IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

OMNI MEDSCI, INC., *Plaintiff*, v. SAMSUNG ELECTRONICS, CO. LTD., SAMSUNG ELECTRONICS AMERICA, INC., FOSSIL GROUP, INC., FOSSIL STORES I, INC., FOSSIL PARTNERS, L.P., ONEPLUS TECHNOLOGY (SHENZHEN) CO., LTD., and ŌURA HEALTH OY, *Defendants*.	Civil No. 2:24-cv-01070-JRG-RSP JURY TRIAL DEMANDED

DEFENDANTS' INVALIDITY AND
SUBJECT MATTER ELIGIBILITY CONTENTIONS

Pursuant to Patent Rules 3-3 and 3-4 and the Docket Control Order entered by the Court (Dkt. 46), Defendants Samsung Electronics, Co. Ltd., Samsung Electronics America, Inc. (collectively "Samsung"), Fossil Group, Inc., Fossil Stores I, Inc., Fossil Partners, L.P. (collectively "Fossil"), and Ōura Health Oy ("Oura") (collectively "Defendants") hereby provide their Invalidity Contentions to Omni MedSci, Inc. ("Omni" or "Plaintiff").

Defendants' Invalidity Contentions include the accompanying claim charts concerning U.S. Patent Nos. 9,055,868 ("the '868 Patent"); 9,651,533 ("the '533 Patent"); 10,517,484 ("the '484 Patent"); 10,874,304 ("the '304 Patent"); 11,160,455 ("the '455 Patent"); 12,193,790 ("the '790 Patent") (collectively the "Asserted Patents").[1]

Defendants also submit their Subject Matter Eligibility Contentions concerning the

[1] The '484, '455, and '790 Patents are asserted against only Samsung and Fossil, not Oura.

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Asserted Patents in accordance with the Court's July 25, 2019, Standing Order Regarding Subject Matter Eligibility Contentions Applicable to All Patent Infringement Cases Assigned to Chief District Judge Rodney Gilstrap ("Standing Order") and the Docket Control Order.

I. Introduction

As disclosed in its respective P. R. 3-1 Infringement Contentions served on Defendants, Plaintiff asserts the following patents and claims:

Patent	Asserted Claims[2]	Omni's Alleged Priority Date	Chart Prefix
'868 Patent	Samsung: 7, 9 Fossil: 7-9 Oura: 7, 9	September 3, 2002	A
'533 Patent	Samsung: 11, 12 Fossil: 12 Oura: 11, 12	December 31, 2012	B
'484 Patent	Samsung: 8-10 Fossil: 8-9 Oura: n/a	December 31, 2012	C
'304 Patent	Samsung: 11, 14-16, 19-22 Fossil: 11, 14, 19-20 Oura: 11-14, 19-20	December 31, 2012	D
'455 Patent	Samsung: 1-3, 8-10, 15 Fossil: 1, 8 Oura: n/a	December 31, 2012	E
'790 Patent	Samsung: 7 Fossil: 7 Oura: n/a	December 31, 2012	F

The claims identified above are referenced as "the Asserted Claims" unless reference is made specifically with respect to particularly identified one or more of the Asserted Patents and/or one or more of the Asserted Claims. By identifying Omni's alleged priority date for the Asserted Claims of each patent above, Defendants do not concede that Omni's claims of priority are correct.

[2] *See* n.1.

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Further, the citation of prior art herein and the accompanying exhibits are not intended to reflect Defendants' claim construction contentions, which will be disclosed in due course in accordance with the Docket Control Order. Instead, Defendants' Invalidity Contentions and Subject Matter Eligibility Contentions as set forth herein and in the accompanying exhibits may reflect Plaintiff's apparent claim constructions based on its Infringement Contentions, with which Defendants disagree.

As further detailed in and supported by these Invalidity Contentions, Defendants contend that each of the Asserted Claims is invalid under at least 35 U.S.C. §§ 101, 102, 103, and/or 112.[3] Defendants reserve the right to prove the invalidity of the Asserted Claims on bases other than those required to be disclosed in these disclosures pursuant to P.R. 3-3.

II. Amendment / Supplementation

Defendants' Invalidity Contentions and Subject Matter Eligibility Contentions pertain to the Asserted Claims as identified in Plaintiff's Infringement Contentions. To the extent the Court later allows Plaintiff to amend its infringement contentions and/or assert one or more claims other than the Asserted Claims, Defendants reserve the right to modify, amend, or supplement these Invalidity Contentions and Subject Matter Eligibility Contentions accordingly—for example, to show the invalidity and/or ineligibility of any such newly Asserted Claims.

These Invalidity Contentions and Subject Matter Eligibility Contentions are based on Defendants' current understanding of the Asserted Claims and Plaintiff's apparent view of the scope of those claims as shown, for example, in Plaintiff's Infringement Contentions. A *Markman*

[3] References to Title 35 of the United States Code are to statutes prior to amendment under the America Invents Act ("AIA"), to the extent that the Asserted Patents have effective filing dates prior to applicable AIA effective dates, and to the current statutory provisions with respect to Asserted Patents having effective filing dates after the applicable AIA effective dates.

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Order in this case has not yet been issued, and in no way should these Invalidity Contentions and Subject Matter Eligibility Contentions be taken as any admission or acquiescence by Defendants as to the proper scope of the Asserted Claims and/or proper claim constructions of terms and phrases recited in those claims. By identifying prior art that anticipates and/or renders obvious the Asserted Claims, Defendants do not admit that the claim limitations are capable of construction, do not admit that any claim limitations are supported with an appropriate written description and enabling disclosure in the applicable patent specifications, and do not adopt Plaintiff's apparent claim constructions or admit the accuracy of any particular claim construction.[4] Defendants reserve all rights to later challenge or oppose any claim constructions advanced by Plaintiff and to present their own claim construction positions as permitted by the Court.

Defendants further reserve the right to revise these Invalidity Contentions and Subject Matter Eligibility Contentions in view of the Court's construction of terms and phrases recited in one or more of the Asserted Claims, additional information obtained during discovery, additional infringement theories put forth by Plaintiff during fact and/or expert discovery, any findings as to the priority date(s) of the Asserted Claims, and/or positions that Plaintiff, its fact witnesses, or its expert witness(es) may take concerning claim construction, infringement, and/or invalidity issues, as permitted by the Court. Defendants further reserve the right to supplement their accompanying P.R. 3-4(b) document productions should they later discover additional prior art documents, information, testimony, prior art systems and related documentation, and/or software or hardware

[4] Defendants do not concede that Plaintiff's apparent interpretation of the claims is correct, but rather assert the well-established principle that whatever infringes a claim if later in time anticipates if earlier in time. *Bristol-Myers Squibb Co. v. Ben Venue Labs., Inc.*, 246 F.3d 1368, 1378 (Fed. Cir. 2001). Thus, where Plaintiff for purposes of its infringement case alleges that a feature of an accused product meets a particular limitation recited in one or more of the Asserted Claims, then that feature, should it be found in the prior art, would also cause that limitation to be met for invalidity purposes.

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code, including information provided by third parties after the date of service of these Invalidity Contention and Subject Matter Eligibility Contentions.

Additionally, Plaintiff has not identified in its contentions regarding the level of ordinary skill in the art for any of the Asserted Patents. Thus, Defendants have based their Invalidity and Subject Matter Eligibility Contentions on the level of skill in the art apparent from the face of the asserted patents. For the avoidance of doubt, Defendants contend that the asserted claims are invalid for the reasons set forth in their Invalidity and Subject Matter Eligibility contentions under any plausible definition of the level of ordinary skill for each of the Asserted Patents. Nevertheless, Defendants reserve the right to revise these Invalidity Contentions and Subject Matter Eligibility Contentions in response to any position taken by Plaintiff on the level of ordinary skill in the art applicable to a given Asserted Patent.

Defendants may further rely on inventor admissions concerning the scope or state of the prior art relevant to the Asserted Claims, the patent prosecution histories of the Asserted Patents, related patents and/or patent applications, any deposition or trial testimony of the named inventors on the Asserted Patents, and the papers filed and any evidence produced or submitted by Plaintiff in connection with these cases or other related litigation. Defendants reserve the right to contend that one or more of the Asserted Claims are invalid under 35 U.S.C. § 102(f) in the event Defendants obtain evidence that one or more of the named inventors did not invent the subject matter in the Asserted Claims.

Prior art not included in these Invalidity Contentions and Subject Matter Eligibility Contentions, whether known or not known to Defendants, may become relevant. Defendants are currently unaware of the extent, if any, to which Plaintiff will contend that limitations of the Asserted Claims are not disclosed in the prior art identified in these Invalidity Contentions and

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Subject Matter Eligibility Contentions. Accordingly, Defendants reserve the right to identify other references that would disclose the allegedly missing limitation(s) of the claimed method, device, or system.

The references identified in these Invalidity Contentions and Subject Matter Eligibility Contentions, which include the attached claim charts, may disclose the elements of the Asserted Claims explicitly and/or inherently, render those elements alone or in combination obvious to those of ordinary skill in the art even absent an explicit or inherent disclosure, and/or they may be relied upon to show the state of the art in the relevant time frame. References identified in these Invalidity Contentions and Subject Matter Eligibility Contentions, as well as the "References Cited" on the face of the Asserted Patents and the patents cited within the body of the Asserted Patents, may be used to illustrate, but not limit the scope of, the state of the art to which the Asserted Patents pertain (i.e., at a time prior to the date of alleged inventions of the Asserted Claims of the Asserted Patents). Moreover, Defendants reserve the ability to rely on later-identified sources of information, including but not limited to witness testimony and other discovery, to establish the state of the art in the relevant time frame pertaining to the Asserted Patents.

Because discovery has just recently begun, Defendants anticipate that additional prior art and invalidity bases may be found. Defendants' investigation and analysis of the prior art is continuing, and thus Defendants reserve the right to supplement, amend, and/or revise the information provided herein as Defendants conduct further investigation and/or analysis, including identifying, charting, and relying on additional references.

Additionally, in view of likely third-party discovery that will be taken, Defendants reserve the right to present additional items of prior art under 35 U.S.C. §§ 102(a), (b), (e), and/or (g) and/or § 103 located during discovery or further investigation, and to assert contentions of

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invalidity under 35 U.S.C. §§ 102(c), (d), or (f). For example, Defendants expect to issue subpoenas to third parties believed to have knowledge, documents, and/or other evidence concerning invalidity of one or more of the Asserted Claims.

In addition to the positions and prior art identified in these Invalidity Contentions and Subject Matter Eligibility Contentions (including the accompanying claim charts), Defendants also incorporate by reference all invalidity contentions and subject matter eligibility contentions, prior art,[5] and invalidity claim charts (including, without limitation, all anticipation positions, obviousness positions [including all prior art combinations and motivations to combine], indefiniteness positions, written description positions, and non-enablement positions) concerning one or more of the Asserted Patents, as disclosed at any time. This includes without limitation disclosures in previous or related litigation, in United States Patent & Trademark Office ("USPTO") proceedings, by the Plaintiff, by any other parties accused of patent infringement by the Plaintiff, or by the named inventors or any individuals associated with the prosecution and/or any form of post-grant review or reexamination of the Asserted Patents.

Specifically, for example, Defendants identify, as prior art upon which they may rely to show the invalidity of the Asserted Claims, the prior art references disclosed by parties in any other litigation (including inter partes review and/or reexamination proceedings) involving one or more of the Asserted Patents, any patent related to any of the Asserted Patents, and/or any other patent allegedly assigned to Plaintiff claiming priority to the Asserted Patents (collectively, "Other Omni Proceedings").

Plaintiff has a present and ongoing duty to produce to Defendants all relevant documents

[5] Prior art appearing in the file histories of the Asserted Patents is not required to be separately produced by Defendants under P. R. 3-4(b).

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from any Other Omni Proceedings, including but not limited to all prior art, invalidity contentions, and expert reports on invalidity (among other relevant items).

Defendants reserve the right to supplement or otherwise amend these Invalidity Contentions and Subject Matter Eligibility Contentions in response to any relevant discovery provided by third parties, Plaintiff, opening or rebuttal expert reports, fact or expert depositions, or in response to any claim construction ruling(s) issued by this Court (regardless of how and when such ruling is made). Defendants also reserve the right to supplement or otherwise amend these Invalidity Contentions and Subject Matter Eligibility Contentions in response to any rebuttal evidence disclosed by Plaintiff or as otherwise may be necessary or appropriate under the circumstances.

III. P. R. 3-3(a) – Identification of Prior Art

Pursuant to P.R. 3-3(a), and subject to Defendants' reservations of rights, Defendants identify each item of prior art that anticipates or renders obvious the Asserted Claims below.[6]

A. U.S. Patent No. 9,055,868

Invalidity claim charts identifying disclosures in the references identified in the tables below as to the Asserted Claims of the '868 Patent are provided in attached Exhibits A1 through A10.

[6] Defendants' disclosure of prior art is premised on the alleged priority dates of the Asserted Patents as identified in Plaintiff's Infringement Contentions. Defendants contend Plaintiff is not entitled to the alleged priority dates and reserve the right to modify, amend, or supplement their invalidity contentions with additional prior art references if any Asserted Claim is shown to not be entitled to the respective alleged priority date or if Plaintiff alleges any other priority date for any of the Asserted Claims. Notwithstanding that reservation of rights, Defendants also reserve the right to argue that they have been unduly prejudiced should Plaintiff allege a different priority date for any of the Asserted Claims, and that accordingly Plaintiff should not be allowed to do so.

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Table 1-A: Prior Art Patents and Printed Publications for the ’868 Patent

Patent No. or Title (Primary Inventor/Author)	**Date of Issue/ Publication**	**Filing Date**
US 2003/0208113 (“Mault”) [Ex. A1]	Nov. 6, 2003	July 18, 2001
US 6,067,463 (“Jeng”) [Ex. A2]	May 23, 2000	Jan. 5, 1999
US 5,891,022 (“Pologe”) [Ex. A3]	April 6, 1999	Sept. 25, 1996
US 2002/0198473 (“Kumar”) [Ex. A4]	Dec. 26, 2002	March 28, 2002
US 2004/0002634 (“Nihtila”) [Ex. A5]	Jan. 1, 2004	June 28, 2002
JP 2000-74829 (“Shigeki”) [Ex. A6]	Sept. 2, 1999	March 14, 2000
US 6,168,563 (“Brown”) [Ex. A7]	Jan. 2, 2001	March 17, 1999
US 2002/0049389 (“Abreu”) [Ex. A8]	April 25, 2002	Feb. 23, 2001
US 6,602,191 (“Quy”) [Ex. A9]	Aug. 5, 2003	Dec. 15, 2000
US 5,830,137 (“Scharf”) [Ex. A10]	Nov. 3, 1998	Nov. 18, 1996

Table 2-A: Prior Art Systems and Inventions for the ’868 Patent

Name of System or Invention	**Date of Sale / Offer for Sale / Public Use / Known by Others**
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by ChoiceMMed, including but not limited to ChoiceMMed MD300C318T, and its accessories (e.g., sensor probe)	At least as early as 2011-05-20
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Criticare Systems, Inc., including but not limited to Criticare 504, and its accessories (e.g., sensor probe)	At least as early as 1988
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by GE Marquette Medical Systems, Inc., including but not limited to Dash 2000 Patient Monitor, and its accessories (e.g., sensor probe)	At least as early as 1999
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Masimo Corp., including but not limited to Rad-5 and Rad-5v Signal Extraction Pulse Oximeters, Radical, Rad-57™, SET® Pulse Oximetry Devices and Rainbow SET™ Devices, and their accessories (e.g., sensor probe)	At least as early as 2004 (Rad-5/ Rad-5v), 2007 (Radical), 2008 (Rad-57™), 2009 (SET®/Rainbow SET™).
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Mindray DS USA, Inc, including but not limited to Accutorr V, and its accessories (e.g., sensor probe)	At least as early as 2008

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Name of System or Invention	Date of Sale / Offer for Sale / Public Use / Known by Others
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Covidien AG / Nellcor Puritan Bennett Inc., including but not limited to Nellcor OxiMax Pulse Oximeters, Nellcor N-595 Pulse Oximter, Nellcor OxiMax N-600X Pulse Oximeter, and their accessories (e.g., sensor probe)	At least as early as 2002 (OxiMax Pulse Oximeters and OmniMax N-595), 2011 (OxiMax N-600X)
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Nonin Medical, Inc., including but not limited to Onyx, PalmSAT™, and Nonin® Model 7500 Digital Pulse Oximeter, Nonin Onyx® 9500, and their accessories (e.g., sensor probe)	At least as early as 1988 (Onyx), 2007 (PalmSAT™), 2007 (Nonin Onyx® 9500), and 2008 (Nonin® Model 7500)
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Novametrix Medical Systems Inc., including but not limited to Novametrix Model 513 and Model 2001, and their accessories (e.g., sensor probe)	At least as early as 1999 (Model 513) and 2007 (Model 2001)
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Respironics, Inc., including but not limited to Models 920, 920M and 920M PLUS Pulse Oximeter, and their accessories (e.g., sensor probe)	At least as early as 1999 (Model 920 and 920M) and 2007 (Model 920M PLUS)
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Smiths Medical, including but not limited to BCI 3304 Oximeter, and its accessories (e.g., sensor probe)	At least as early as 2008
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Utech Co., Ltd., including but not limited to UT100 Handheld Pulse Oximeter, and its accessories (e.g., sensor probe)	At least as early as 2010
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Welch Allyn, including but not limited to Propaq® CS Vital Signs Monitor and Propaq® Encore Vital Signs Monitor, and their accessories (e.g., sensor probe)	At least as early as 2011 (Propaq® Encore Vital Signs Monitor) and 2012 (Propaq® CS Vital Signs Monitor)
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Philips Medical Systems, including but not limited to M4529A DigitalHandheld Pulse Oximeter, and its accessories (e.g., sensor probe)	At least as early as 2007
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Palco Labs Inc, including but not limited to Model 120 Mini Pulse Oximeter, and its accessories (e.g., sensor probe)	At least as early as 2007

Name of System or Invention	Date of Sale / Offer for Sale / Public Use / Known by Others
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by BCI Inc., including but not limited to Capnocheck® Sleep Capnograph/Oximeter, and its accessories (e.g., sensor probe)	At least as early as 2007
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Datex-Ohmeda, including but not limited to TuffSat, and its accessories (e.g., sensor probe)	At least as early as 2007

For each of the prior art devices identified above, Defendants have listed and produced documents as evidence of the relevant features and functionality to the extent that they are presently available and have been located. Defendants have obtained or are in the process of attempting to obtain the identified devices and will make them available for inspection to the extent they are obtained. To the extent that one or more documents (*e.g.*, user manual) may be used to describe aspects of a particular device, that device is a single reference for prior art purposes under 35 U.S.C. § 102. Some or all of the corroborating references may also separately qualify as prior art publications under 35 U.S.C. § 102 and may be used as invalidating references under 35 U.S.C. §§ 102 and/or 103.

Further, Defendants are actively searching for information regarding at least the systems, devices, and/or inventions listed above in Table 2-A.

Discovery is ongoing, and Defendants may serve third parties with document subpoenas. One or more of these devices, along with related documentation, may be invalidating, and Defendants reserve the right to supplement these contentions accordingly. Defendants continue to investigate each of the identified devices, including through potential discovery needed to be obtained via third party subpoenas, and reserve the right to supplement these contentions and accompanying claim charts after further investigation.

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Defendants' reference to a particular product, device, or software program in these contentions should be interpreted as a reference to the system itself as well as to any corresponding patents, publications, or product literature relating to the cited system. Upon information and belief, the systems were publicly disclosed, used, sold, or offered for sale in the United States before the alleged priority date of the Asserted Claims of the '868 Patent. Defendants' investigation of such prior art systems is still ongoing, and discovery has not yet been received from third parties who may have information concerning such prior art systems. Accordingly, subsequent discovery may reveal information that affects the disclosures and contentions herein. For example, subsequent discovery may provide additional information regarding whether any of the third-party prior art systems anticipate or render obvious the Asserted Claims of the '868 Patent. As such, Defendants reserve all rights to supplement their invalidity contentions.

Many of the inventive, research, design, and development activities concerning these systems and technologies occurred in the United States before the alleged priority date of the Asserted Claims of the '868 Patent. Defendants have obtained, and are in the process of obtaining, additional information regarding the dates by which the cited products and services were publicly disclosed, used, sold, or offered for sale, the circumstances under which the research, design, and development activities were conducted, and the identities of the individuals involved in such activities through publicly available patents, publications, and product literature. The actual dates, circumstances, and identities of individuals will be the subject of third-party discovery during this lawsuit, which Defendants reserve the right to rely upon to corroborate the prior art status of the prior art identified herein. Defendants reserve the right to modify, amend, or supplement these contentions if additional information becomes available during the course of this lawsuit. Furthermore, Defendants will make all such devices, software programs, or other products in

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Defendants' possession, custody, or control available for inspection by Plaintiff.

Consequently, Defendants reserve the right to amend, modify, or supplement these Invalidity Contentions should additional information become available to them through discovery.

In addition, Defendants identify, responsive to Plaintiff's Infringement Contentions, the patents, publications, and/or systems listed in Tables 1-A and 2-A as evidence of the state of the art as it relates to physiological monitoring devices / systems.

Each of these references show that the concept of "physiological monitoring" is not novel and was well-known for many years before the alleged priority date of the '868 Patent, as discussed in more detail in Section IV.B (obviousness). In light of the references discussed herein, the Asserted Claims of the '868 Patent cannot be valid.

Each prior art patent, publication, or product identified above was either effectively filed or issued (for patents), published (for publications) or known, used, offered for sale or sold (for products) before either the earliest claimed priority date of the '868 Patent to which it is applied for invalidity, and none appears to have been abandoned, suppressed, or concealed, so each such reference also constitutes evidence of prior invention pursuant to 35 U.S.C. § 102(g), if it is in the U.S. The persons or entities involved with each such invention include the named inventors on the above-identified patents, the authors listed on the above-identified publications, and the entities and individuals identified in connection with the above-identified products.

Because Defendants have not yet completed discovery in this case, including taking depositions of the named inventors, and otherwise obtaining discovery from Plaintiff and third parties, Defendants reserve the right to supplement these contentions with facts, documents, or other information learned at a later point through discovery or further investigation.

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B. U.S. Patent No. 9,651,533

Invalidity claim charts identifying disclosures in the references identified in the tables below as to the Asserted Claims of the '533 Patent are provided in attached Exhibits B1 through B8.

Table 1-B: Prior Art Patents and Printed Publications for the '533 Patent

Patent No. or Title (Primary Inventor/Author)	Date of Issue/ Publication	Filing Date
US 2011/0028802 ("Addison") [Ex. B1]	February 3, 2011	July 31, 2009
US 2015/0057511[7] ("Basu") [Ex. B2]	February 26, 2015	March 27, 2013
US 2005/0049468 ("Carslon") [Ex. B3]	March 3, 2005	September 3, 2003
US 2012/0197093 ("LeBoeuf") [Ex. B4]	August 2, 2012	January 25, 2012
US 9,241,676 ("Lisogurski") [Ex. B5]	January 26, 2016	May 31, 2012
US 9,596,990 ("Park") [Ex. B6]	March 21, 2017	November 6, 2013
US 8,923,918 ("Kreger") [Ex. B7]	December 30, 2014	December 18, 2010
US 7,507,207 ("Sakai") [Ex. B8]	March 24, 2009	October 5, 2004

Table 2-B: Prior Art Systems and Inventions for the '533 Patent

Name of System or Invention	Date of Sale / Offer for Sale / Public Use / Known by Others
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by ChoiceMMed, including but not limited to ChoiceMMed MD300C318T, and its accessories (e.g., sensor probe)	At least as early as 2011-05-20
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Criticare Systems, Inc., including but not limited to Criticare 504, and its accessories (e.g., sensor probe)	At least as early as 1988
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by GE Marquette Medical Systems, Inc., including but not limited to Dash 2000 Patient Monitor, and its accessories (e.g., sensor probe)	At least as early as 1999
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Masimo Corp., including but not limited to Rad-5 and Rad-5v Signal	At least as early as 2004 (Rad-5/ Rad-5v), 2007 (Radical), 2008 (Rad-

[7] Invalidity contentions relying on this reference herein will make reference to the Provisional Application No. 61/616524, which is incorporated by reference into Basu.

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Name of System or Invention	Date of Sale / Offer for Sale / Public Use / Known by Others
Extraction Pulse Oximeters, Radical, Rad-57™, SET® Pulse Oximetry Devices and Rainbow SET™ Devices, and their accessories (e.g., sensor probe)	57™), 2009 (SET®/Rainbow SET™).
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Mindray DS USA, Inc, including but not limited to Accutorr V, and its accessories (e.g., sensor probe)	At least as early as 2008
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Covidien AG / Nellcor Puritan Bennett Inc., including but not limited to Nellcor OxiMax Pulse Oximeters, Nellcor N-595 Pulse Oximter, Nellcor OxiMax N-600X Pulse Oximeter, and their accessories (e.g., sensor probe)	At least as early as 2002 (OxiMax Pulse Oximeters and OmniMax N-595), 2011 (OxiMax N-600X)
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Nonin Medical, Inc., including but not limited to Onyx, PalmSAT™, and Nonin® Model 7500 Digital Pulse Oximeter, Nonin Onyx® 9500, and their accessories (e.g., sensor probe)	At least as early as 1988 (Onyx), 2007 (PalmSAT™), 2007 (Nonin Onyx® 9500), and 2008 (Nonin® Model 7500)
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Novametrix Medical Systems Inc., including but not limited to Novametrix Model 513 and Model 2001, and their accessories (e.g., sensor probe)	At least as early as 1999 (Model 513) and 2007 (Model 2001)
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Respironics, Inc., including but not limited to Models 920, 920M and 920M PLUS Pulse Oximeter, and their accessories (e.g., sensor probe)	At least as early as 1999 (Model 920 and 920M) and 2007 (Model 920M PLUS)
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Smiths Medical, including but not limited to BCI 3304 Oximeter, and its accessories (e.g., sensor probe)	At least as early as 2008
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Utech Co., Ltd., including but not limited to UT100 Handheld Pulse Oximeter, and its accessories (e.g., sensor probe)	At least as early as 2010
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Welch Allyn, including but not limited to Propaq® CS Vital Signs Monitor and Propaq® Encore Vital Signs Monitor, and their accessories (e.g., sensor probe)	At least as early as 2011 (Propaq® Encore Vital Signs Monitor) and 2012 (Propaq® CS Vital Signs Monitor)
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Philips Medical	At least as early as 2007

Name of System or Invention	Date of Sale / Offer for Sale / Public Use / Known by Others
Systems, including but not limited to M4529A DigitalHandheld Pulse Oximeter, and its accessories (e.g., sensor probe)	
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Palco Labs Inc, including but not limited to Model 120 Mini Pulse Oximeter, and its accessories (e.g., sensor probe)	At least as early as 2007
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by BCI Inc., including but not limited to Capnocheck® Sleep Capnograph/Oximeter, and its accessories (e.g., sensor probe)	At least as early as 2007
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Datex-Ohmeda, including but not limited to TuffSat, and its accessories (e.g., sensor probe)	At least as early as 2007

For each of the prior art devices identified above, Defendants have listed and produced documents as evidence of the relevant features and functionality to the extent that they are presently available and have been located. Defendants have obtained or are in the process of attempting to obtain the identified devices and will make them available for inspection to the extent they are obtained. To the extent that one or more documents (*e.g.*, user manual) may be used to describe aspects of a particular device, that device is a single reference for prior art purposes under 35 U.S.C. § 102. Some or all of the corroborating references may also separately qualify as prior art publications under 35 U.S.C. § 102 and may be used as invalidating references under 35 U.S.C. §§ 102 and/or 103.

Further, Defendants are actively searching for information regarding at least the systems, devices, and/or inventions listed above in Table 2-B.

Discovery is ongoing, and Defendants may serve third parties with document subpoenas. One or more of these devices, along with related documentation, may be invalidating, and

Defendants reserve the right to supplement these contentions accordingly. Defendants continue to investigate each of the identified devices, including through potential discovery needed to be obtained via third party subpoenas, and reserve the right to supplement these contentions and accompanying claim charts after further investigation.

Defendants' reference to a particular product, device, or software program in these contentions should be interpreted as a reference to the system itself as well as to any corresponding patents, publications, or product literature relating to the cited system. Upon information and belief, the systems were publicly disclosed, used, sold, or offered for sale in the United States before the alleged priority date of the Asserted Claims of the '533 Patent. Defendants' investigation of such prior art systems is still ongoing, and discovery has not yet been received from third parties who may have information concerning such prior art systems. Accordingly, subsequent discovery may reveal information that affects the disclosures and contentions herein. For example, subsequent discovery may provide additional information regarding whether any of the third-party prior art systems anticipate or render obvious the Asserted Claims of the '533 Patent. As such, Defendants reserve all rights to supplement their invalidity contentions.

Many of the inventive, research, design, and development activities concerning these systems and technologies occurred in the United States before the alleged priority date of the Asserted Claims of the '533 Patent. Defendants have obtained, and are in the process of obtaining, additional information regarding the dates by which the cited products and services were publicly disclosed, used, sold, or offered for sale, the circumstances under which the research, design, and development activities were conducted, and the identities of the individuals involved in such activities through publicly available patents, publications, and product literature. The actual dates, circumstances, and identities of individuals will be the subject of third-party discovery during this

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lawsuit, which Defendants reserve the right to rely upon to corroborate the prior art status of the prior art identified herein. Defendants reserve the right to modify, amend, or supplement these contentions if additional information becomes available during the course of this lawsuit. Furthermore, Defendants will make all such devices, software programs, or other products in Defendants' possession, custody, or control available for inspection by Plaintiff.

Consequently, Defendants reserve the right to amend, modify, or supplement these Invalidity Contentions should additional information become available to them through discovery.

In addition, Defendants identify, responsive to Plaintiff's Infringement Contentions, the patents, publications, and/or systems listed in Tables 1-B and 2-B as evidence of the state of the art as it relates to physiological monitoring devices / systems.

Each of these references show that the concept of "physiological monitoring" is not novel and was well-known for many years before the alleged priority date of the '533 Patent, as discussed in more detail in Section IV.B (obviousness). In light of the references discussed herein, the Asserted Claims of the '533 Patent cannot be valid.

Each prior art patent, publication, or product identified above was either effectively filed or issued (for patents), published (for publications) or known, used, offered for sale or sold (for products) before either the earliest claimed priority date of the '533 Patent to which it is applied for invalidity, and none appears to have been abandoned, suppressed, or concealed, so each such reference also constitutes evidence of prior invention pursuant to 35 U.S.C. § 102(g), if it is in the U.S. The persons or entities involved with each such invention include the named inventors on the above-identified patents, the authors listed on the above-identified publications, and the entities and individuals identified in connection with the above-identified products.

Because Defendants have not yet completed discovery in this case, including taking

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depositions of the named inventors, and otherwise obtaining discovery from Plaintiff and third parties, Defendants reserve the right to supplement these contentions with facts, documents, or other information learned at a later point through discovery or further investigation.

C. U.S. Patent No. 10,517,484

Invalidity claim charts identifying disclosures in the references identified in the tables below as to the Asserted Claims of the '484 Patent are provided in attached Exhibits C1 through C14.

Table 1-C: Prior Art Patents and Printed Publications for the '484 Patent

Patent No. or Title (Primary Inventor/Author)	**Date of Issue/ Publication**	**Filing Date**
US 9,241,676 ("Lisogurski") [Ex. C1]	Jan. 26, 2016	May 31, 2012
US 2015/0057511 ("Basu") [Ex. C2]	Feb. 26, 2015	Mar. 27, 2013
US 6,616,613 ("Goodman") [Ex. C3]	Sep. 9, 2003	Apr. 29, 2000
WO 2012/099536 ("Kassim") [Ex. C4]	Jul. 26, 2012	Jan. 20, 2011
US 9,095,291 ("Soller") [Ex. C5]	Aug. 4, 2015	Aug. 7, 2009
US 11,638,532 ("Poeze") [Ex. C6]	May 2, 2023	Jul. 1, 2010
US 2012/0150047 ("Terumoto") [Ex. C7]	June 14, 2012	Nov. 14, 2011
US 8,172,761 ("Rulkov") [Ex. C8]	May 8, 2012	Oct. 4, 2011
US 2011/0066050 ("Moon") [Ex. C9]	Mar. 17, 2011	Sep. 15, 2009
US 2005/0049468 ("Carlson") [Ex. C10]	Mar. 3, 2005	Sep. 3, 2003
US 8,108,036 ("Tran") [Ex. C11]	Jan. 31, 2012	Jun. 18, 2009
Plug-and-Play, Single-Chip Photoplethysmography ("Chandrasekar") [Ex. C12]	Sep. 2012	N/A
US 8,923,918 ("Kreger") [Ex. C13]	Dec. 30, 2014	Dec. 18, 2010
US 7,507,207 ("Sakai") [Ex. C14]	Mar. 24, 2009	Oct. 5, 2004

Table 2-C: Prior Art Systems and Inventions for the '484 Patent

Name of System or Invention	**Date of Sale / Offer for Sale / Public Use / Known by Others**
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by ChoiceMMed, including but not limited to ChoiceMMed MD300C318T, and its accessories (e.g., sensor probe)	At least as early as 2011-05-20
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Criticare Systems,	At least as early as 1988

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Name of System or Invention	Date of Sale / Offer for Sale / Public Use / Known by Others
Inc., including but not limited to Criticare 504, and its accessories (e.g., sensor probe)	
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by GE Marquette Medical Systems, Inc., including but not limited to Dash 2000 Patient Monitor, and its accessories (e.g., sensor probe)	At least as early as 1999
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Masimo Corp., including but not limited to Rad-5 and Rad-5v Signal Extraction Pulse Oximeters, Radical, Rad-57™, SET® Pulse Oximetry Devices and Rainbow SET™ Devices, and their accessories (e.g., sensor probe)	At least as early as 2004 (Rad-5/ Rad-5v), 2007 (Radical), 2008 (Rad-57™), 2009 (SET®/Rainbow SET™).
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Mindray DS USA, Inc, including but not limited to Accutorr V, and its accessories (e.g., sensor probe)	At least as early as 2008
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Covidien AG / Nellcor Puritan Bennett Inc., including but not limited to Nellcor OxiMax Pulse Oximeters, Nellcor N-595 Pulse Oximter, Nellcor OxiMax N-600X Pulse Oximeter, and their accessories (e.g., sensor probe)	At least as early as 2002 (OxiMax Pulse Oximeters and OmniMax N-595), 2011 (OxiMax N-600X)
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Nonin Medical, Inc., including but not limited to Onyx, PalmSAT™, and Nonin® Model 7500 Digital Pulse Oximeter, Nonin Onyx® 9500, and their accessories (e.g., sensor probe)	At least as early as 1988 (Onyx), 2007 (PalmSAT™), 2007 (Nonin Onyx® 9500), and 2008 (Nonin® Model 7500)
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Novametrix Medical Systems Inc., including but not limited to Novametrix Model 513 and Model 2001, and their accessories (e.g., sensor probe)	At least as early as 1999 (Model 513) and 2007 (Model 2001)
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Respironics, Inc., including but not limited to Models 920, 920M and 920M PLUS Pulse Oximeter, and their accessories (e.g., sensor probe)	At least as early as 1999 (Model 920 and 920M) and 2007 (Model 920M PLUS)
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Smiths Medical, including but not limited to BCI 3304 Oximeter, and its accessories (e.g., sensor probe)	At least as early as 2008

Name of System or Invention	Date of Sale / Offer for Sale / Public Use / Known by Others
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Utech Co., Ltd., including but not limited to UT100 Handheld Pulse Oximeter, and its accessories (e.g., sensor probe)	At least as early as 2010
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Welch Allyn, including but not limited to Propaq® CS Vital Signs Monitor and Propaq® Encore Vital Signs Monitor, and their accessories (e.g., sensor probe)	At least as early as 2011 (Propaq® Encore Vital Signs Monitor) and 2012 (Propaq® CS Vital Signs Monitor)
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Philips Medical Systems, including but not limited to M4529A DigitalHandheld Pulse Oximeter, and its accessories (e.g., sensor probe)	At least as early as 2007
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Palco Labs Inc, including but not limited to Model 120 Mini Pulse Oximeter, and its accessories (e.g., sensor probe)	At least as early as 2007
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by BCI Inc., including but not limited to Capnocheck® Sleep Capnograph/Oximeter, and its accessories (e.g., sensor probe)	At least as early as 2007
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Datex-Ohmeda, including but not limited to TuffSat, and its accessories (e.g., sensor probe)	At least as early as 2007

For each of the prior art devices identified above, Defendants have listed and produced documents as evidence of the relevant features and functionality to the extent that they are presently available and have been located. Defendants have obtained or are in the process of attempting to obtain the identified devices and will make them available for inspection to the extent they are obtained. To the extent that one or more documents (*e.g.*, user manual) may be used to describe aspects of a particular device, that device is a single reference for prior art purposes under 35 U.S.C. § 102. Some or all of the corroborating references may also separately qualify as prior art publications under 35 U.S.C. § 102 and may be used as invalidating references under 35

U.S.C. §§ 102 and/or 103.

Further, Defendants are actively searching for information regarding at least the systems, devices, and/or inventions listed above in Table 2-C.

Discovery is ongoing, and Defendants may serve third parties with document subpoenas. One or more of these devices, along with related documentation, may be invalidating, and Defendants reserve the right to supplement these contentions accordingly. Defendants continue to investigate each of the identified devices, including through potential discovery needed to be obtained via third party subpoenas, and reserve the right to supplement these contentions and accompanying claim charts after further investigation.

Defendants' reference to a particular product, device, or software program in these contentions should be interpreted as a reference to the system itself as well as to any corresponding patents, publications, or product literature relating to the cited system. Upon information and belief, the systems were publicly disclosed, used, sold, or offered for sale in the United States before the alleged priority date of the Asserted Claims of the '484 Patent. Defendants' investigation of such prior art systems is still ongoing, and discovery has not yet been received from third parties who may have information concerning such prior art systems. Accordingly, subsequent discovery may reveal information that affects the disclosures and contentions herein. For example, subsequent discovery may provide additional information regarding whether any of the third-party prior art systems anticipate or render obvious the Asserted Claims of the '484 Patent. As such, Defendants reserve all rights to supplement their invalidity contentions.

Many of the inventive, research, design, and development activities concerning these systems and technologies occurred in the United States before the alleged priority date of the Asserted Claims of the '484 Patent. Defendants have obtained, and are in the process of obtaining,

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additional information regarding the dates by which the cited products and services were publicly disclosed, used, sold, or offered for sale, the circumstances under which the research, design, and development activities were conducted, and the identities of the individuals involved in such activities through publicly available patents, publications, and product literature. The actual dates, circumstances, and identities of individuals will be the subject of third-party discovery during this lawsuit, which Defendants reserve the right to rely upon to corroborate the prior art status of the prior art identified herein. Defendants reserve the right to modify, amend, or supplement these contentions if additional information becomes available during the course of this lawsuit. Furthermore, Defendants will make all such devices, software programs, or other products in Defendants' possession, custody, or control available for inspection by Plaintiff.

Consequently, Defendants reserve the right to amend, modify, or supplement these Invalidity Contentions should additional information become available to them through discovery.

In addition, Defendants identify, responsive to Plaintiff's Infringement Contentions, the patents, publications, and/or systems listed in Tables 1-C and 2-C as evidence of the state of the art as it relates to physiological monitoring devices / systems.

Each of these references show that the concept of "physiological monitoring" is not novel and was well-known for many years before the alleged priority date of the '484 Patent, as discussed in more detail in Section IV.B (obviousness). In light of the references discussed herein, the Asserted Claims of the '484 Patent cannot be valid.

Each prior art patent, publication, or product identified above was either effectively filed or issued (for patents), published (for publications) or known, used, offered for sale or sold (for products) before either the earliest claimed priority date of the '484 Patent to which it is applied for invalidity, and none appears to have been abandoned, suppressed, or concealed, so each such

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reference also constitutes evidence of prior invention pursuant to 35 U.S.C. § 102(g), if it is in the U.S. The persons or entities involved with each such invention include the named inventors on the above-identified patents, the authors listed on the above-identified publications, and the entities and individuals identified in connection with the above-identified products.

Because Defendants have not yet completed discovery in this case, including taking depositions of the named inventors, and otherwise obtaining discovery from Plaintiff and third parties, Defendants reserve the right to supplement these contentions with facts, documents, or other information learned at a later point through discovery or further investigation.

D. U.S. Patent No. 10,874,304

Invalidity claim charts identifying disclosures in the references identified in the tables below as to the Asserted Claims of the '304 Patent are provided in attached Exhibits D1 through D19.

Table 1-D: Prior Art Patents and Printed Publications for the '304 Patent

Patent No. or Title (Primary Inventor/Author)	**Date of Issue/ Publication**	**Filing Date**
US 2015/0057511A1 ("Basu") [Ex. D1]	2/26/2015	3/27/2013
US 2005/0049468A1 ("Carlson") [Ex. D2]	3/3/2005	9/3/2003
US 6,616,613 ("Goodman") [Ex. D3]	9/9/2003	4/27/2000
US 6,519,037B2 ("Jung") [Ex. D4]	2/11/2003	6/1/2001
WO 2012/99536 ("Kassim") [Ex. D5]	7/26/2012	1/20/2011
US 2011/0237911A1 ("Lamego") [Ex. D6]	9/29/2011	3/28/2011
US 2010/0217102A1 ("LeBoeuf") [Ex. D7]	8/26/2010	1/21/2010
US 9,241,676 ("Lisogurski") [Ex. D8]	1/26/2016	5/31/2012
US 5,746,206 ("Mannheimer") [Ex. D9]	5/5/1998	6/10/1996
US 2003/0208113A1 ("Mault") [Ex. D10]	11/6/2003	7/18/2001
US 2011/0082711A1 ("Poeze") [Ex. D11]	4/7/2011	10/5/2010
US 5,891,022 ("Pologe") [Ex. D12]	4/6/1999	9/25/1996
US 8,108,036 ("Tran") [Ex. D13]	1/31/2012	6/18/2009
US 2012/0197093A1 ("Valencell") [Ex. D14]	8/2/2012	1/25/2012

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Patent No. or Title (Primary Inventor/Author)	Date of Issue/ Publication	Filing Date
D. Chandrasekar, et al., "Plug-and-Play, Single-Chip Photoplethysmography" ("Chandrasekar2012") [Ex. D15]	8/28/2012 - 9/1/2012	received 3/29/12
US 7,507,207 ("Sakai") [Ex. D16]	3/24/2009	10/5/2004
US 8,923,918 ("Kreger") [Ex. D17]	12/30/2014	12/18/2010
US 2006/0184040 ("Keller") [Ex. D18]	8/17/2006	12/7/2005
US 7,139,076 ("Marbach") [Ex. D19]	11/21/2006	8/8/2003

Table 2-D: Prior Art Systems and Inventions for the '304 Patent

Name of System or Invention	Date of Sale / Offer for Sale / Public Use / Known by Others
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by ChoiceMMed, including but not limited to ChoiceMMed MD300C318T, and its accessories (e.g., sensor probe)	At least as early as 2011-05-20
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Criticare Systems, Inc., including but not limited to Criticare 504, and its accessories (e.g., sensor probe)	At least as early as 1988
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by GE Marquette Medical Systems, Inc., including but not limited to Dash 2000 Patient Monitor, and its accessories (e.g., sensor probe)	At least as early as 1999
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Masimo Corp., including but not limited to Rad-5 and Rad-5v Signal Extraction Pulse Oximeters, Radical, Rad-57™, SET® Pulse Oximetry Devices and Rainbow SET™ Devices, and their accessories (e.g., sensor probe)	At least as early as 2004 (Rad-5/ Rad-5v), 2007 (Radical), 2008 (Rad-57™), 2009 (SET®/Rainbow SET™).
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Mindray DS USA, Inc, including but not limited to Accutorr V, and its accessories (e.g., sensor probe)	At least as early as 2008
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Covidien AG / Nellcor Puritan Bennett Inc., including but not limited to Nellcor OxiMax Pulse Oximeters, Nellcor	At least as early as 2002 (OxiMax Pulse Oximeters and OmniMax N-595), 2011 (OxiMax N-600X)

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Name of System or Invention	Date of Sale / Offer for Sale / Public Use / Known by Others
N-595 Pulse Oximter, Nellcor OxiMax N-600X Pulse Oximeter, and their accessories (e.g., sensor probe)	
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Nonin Medical, Inc., including but not limited to Onyx, PalmSAT™, and Nonin® Model 7500 Digital Pulse Oximeter, Nonin Onyx® 9500, and their accessories (e.g., sensor probe)	At least as early as 1988 (Onyx), 2007 (PalmSAT™), 2007 (Nonin Onyx® 9500), and 2008 (Nonin® Model 7500)
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Novametrix Medical Systems Inc., including but not limited to Novametrix Model 513 and Model 2001, and their accessories (e.g., sensor probe)	At least as early as 1999 (Model 513) and 2007 (Model 2001)
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Respironics, Inc., including but not limited to Models 920, 920M and 920M PLUS Pulse Oximeter, and their accessories (e.g., sensor probe)	At least as early as 1999 (Model 920 and 920M) and 2007 (Model 920M PLUS)
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Smiths Medical, including but not limited to BCI 3304 Oximeter, and its accessories (e.g., sensor probe)	At least as early as 2008
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Utech Co., Ltd., including but not limited to UT100 Handheld Pulse Oximeter, and its accessories (e.g., sensor probe)	At least as early as 2010
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Welch Allyn, including but not limited to Propaq® CS Vital Signs Monitor and Propaq® Encore Vital Signs Monitor, and their accessories (e.g., sensor probe)	At least as early as 2011 (Propaq® Encore Vital Signs Monitor) and 2012 (Propaq® CS Vital Signs Monitor)
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Philips Medical Systems, including but not limited to M4529A DigitalHandheld Pulse Oximeter, and its accessories (e.g., sensor probe)	At least as early as 2007
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Palco Labs Inc, including but not limited to Model 120 Mini Pulse Oximeter, and its accessories (e.g., sensor probe)	At least as early as 2007

Name of System or Invention	Date of Sale / Offer for Sale / Public Use / Known by Others
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by BCI Inc., including but not limited to Capnocheck® Sleep Capnograph/Oximeter, and its accessories (e.g., sensor probe)	At least as early as 2007
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Datex-Ohmeda, including but not limited to TuffSat, and its accessories (e.g., sensor probe)	At least as early as 2007

For each of the prior art devices identified above, Defendants have listed and produced documents as evidence of the relevant features and functionality to the extent that they are presently available and have been located. Defendants have obtained or are in the process of attempting to obtain the identified devices and will make them available for inspection to the extent they are obtained. To the extent that one or more documents (*e.g.*, user manual) may be used to describe aspects of a particular device, that device is a single reference for prior art purposes under 35 U.S.C. § 102. Some or all of the corroborating references may also separately qualify as prior art publications under 35 U.S.C. § 102 and may be used as invalidating references under 35 U.S.C. §§ 102 and/or 103.

Further, Defendants are actively searching for information regarding at least the systems, devices, and/or inventions listed above in Table 2-D.

Discovery is ongoing, and Defendants may serve third parties with document subpoenas. One or more of these devices, along with related documentation, may be invalidating, and Defendants reserve the right to supplement these contentions accordingly. Defendants continue to investigate each of the identified devices, including through potential discovery needed to be obtained via third party subpoenas, and reserve the right to supplement these contentions and accompanying claim charts after further investigation.

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Defendants' reference to a particular product, device, or software program in these contentions should be interpreted as a reference to the system itself as well as to any corresponding patents, publications, or product literature relating to the cited system. Upon information and belief, the systems were publicly disclosed, used, sold, or offered for sale in the United States before the alleged priority date of the Asserted Claims of the '304 Patent. Defendants' investigation of such prior art systems is still ongoing, and discovery has not yet been received from third parties who may have information concerning such prior art systems. Accordingly, subsequent discovery may reveal information that affects the disclosures and contentions herein. For example, subsequent discovery may provide additional information regarding whether any of the third-party prior art systems anticipate or render obvious the Asserted Claims of the '304 Patent. As such, Defendants reserve all rights to supplement their invalidity contentions.

Many of the inventive, research, design, and development activities concerning these systems and technologies occurred in the United States before the alleged priority date of the Asserted Claims of the '304 Patent. Defendants have obtained, and are in the process of obtaining, additional information regarding the dates by which the cited products and services were publicly disclosed, used, sold, or offered for sale, the circumstances under which the research, design, and development activities were conducted, and the identities of the individuals involved in such activities through publicly available patents, publications, and product literature. The actual dates, circumstances, and identities of individuals will be the subject of third-party discovery during this lawsuit, which Defendants reserve the right to rely upon to corroborate the prior art status of the prior art identified herein. Defendants reserve the right to modify, amend, or supplement these contentions if additional information becomes available during the course of this lawsuit. Furthermore, Defendants will make all such devices, software programs, or other products in

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Defendants' possession, custody, or control available for inspection by Plaintiff.

Consequently, Defendants reserve the right to amend, modify, or supplement these Invalidity Contentions should additional information become available to them through discovery.

In addition, Defendants identify, responsive to Plaintiff's Infringement Contentions, the patents, publications, and/or systems listed in Tables 1-D and 2-D as evidence of the state of the art as it relates to physiological monitoring device/system.

Each of these references show that the concept of "physiological monitoring" is not novel and was well-known for many years before the alleged priority date of the '304 Patent, as discussed in more detail in Section IV.B (obviousness). In light of the references discussed herein, the Asserted Claims of the '304 Patent cannot be valid.

Each prior art patent, publication, or product identified above was either effectively filed or issued (for patents), published (for publications) or known, used, offered for sale or sold (for products) before either the earliest claimed priority date of the '304 Patent to which it is applied for invalidity, and none appears to have been abandoned, suppressed, or concealed, so each such reference also constitutes evidence of prior invention pursuant to 35 U.S.C. § 102(g), if it is in the U.S. The persons or entities involved with each such invention include the named inventors on the above-identified patents, the authors listed on the above-identified publications, and the entities and individuals identified in connection with the above-identified products.

Because Defendants have not yet completed discovery in this case, including taking depositions of the named inventors, and otherwise obtaining discovery from Plaintiff and third parties, Defendants reserve the right to supplement these contentions with facts, documents, or other information learned at a later point through discovery or further investigation.

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E. U.S. Patent No. 11,160,455

Invalidity claim charts identifying disclosures in the references identified in the tables below as to the Asserted Claims of the ’455 Patent are provided in attached Exhibits E1 through E18.

Table 1-E: Prior Art Patents and Printed Publications for the ’455 Patent

Patent No. or Title (Primary Inventor/Author)	**Date of Issue/ Publication**	**Filing Date**
US 2015/0057511A1 (“Basu”) [Ex. E1]	2/26/2015	3/27/2013
US 2005/0049468A1 (“Carlson”) [Ex. E2]	3/3/2005	9/3/2003
US 6,616,613 (“Goodman”) [Ex. E3]	9/9/2003	4/27/2000
US 6,519,037B2 ("Jung") [Ex. E4]	2/11/2003	6/1/2001
WO 2012/99536 (“Kassim”) [Ex. E5]	7/26/2012	1/20/2011
US 2011/0237911A1 (“Lamego”) [Ex. E6]	9/29/2011	3/28/2011
US 2010/0217102A1 (“LeBoeuf”) [Ex. E7]	8/26/2010	1/21/2010
US 9,241,676 (“Lisogurski”) [Ex. E8]	1/26/2016	5/31/2012
US 5,746,206 (“Mannheimer”) [Ex. E9]	5/5/1998	6/10/1996
US 2003/0208113A1 (“Mault”) [Ex. E10]	11/6/2003	7/18/2001
US 2011/0082711A1 (“Poeze”) [Ex. E11]	4/7/2011	10/5/2010
US 5,891,022 (“Pologe”) [Ex. E12]	4/6/1999	9/25/1996
US 8,108,036 (“Tran”) [Ex. E13]	1/31/2012	6/18/2009
US 2012/0197093A1 (“Valencell”) [Ex. E14]	8/2/2012	1/25/2012
D. Chandrasekar, et al., “Plug-and-Play, Single-Chip Photoplethysmography” (“Chandrasekar2012”) [Ex. E15]	8/28/2012 - 9/1/2012	received 3/29/12
US 7,507,207 ("Sakai") [Ex. E16]	3/24/2009	10/5/2004
US 8,923,918 ("Kreger") [Ex. E17]	12/30/2014	12/18/2010
US 8,725,226 (“Isaacson”) [Ex. E18]	5/13/2014	11/13/2009

Table 2-E: Prior Art Systems and Inventions for the ’455 Patent

Name of System or Invention	**Date of Sale / Offer for Sale / Public Use / Known by Others**
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by ChoiceMMed, including but not limited to ChoiceMMed MD300C318T, and its accessories (e.g., sensor probe)	At least as early as 2011-05-20
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Criticare Systems,	At least as early as 1988

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Name of System or Invention	Date of Sale / Offer for Sale / Public Use / Known by Others
Inc., including but not limited to Criticare 504, and its accessories (e.g., sensor probe)	
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by GE Marquette Medical Systems, Inc., including but not limited to Dash 2000 Patient Monitor, and its accessories (e.g., sensor probe)	At least as early as 1999
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Masimo Corp., including but not limited to Rad-5 and Rad-5v Signal Extraction Pulse Oximeters, Radical, Rad-57™, SET® Pulse Oximetry Devices and Rainbow SET™ Devices, and their accessories (e.g., sensor probe)	At least as early as 2004 (Rad-5/ Rad-5v), 2007 (Radical), 2008 (Rad-57™), 2009 (SET®/Rainbow SET™).
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Mindray DS USA, Inc, including but not limited to Accutorr V, and its accessories (e.g., sensor probe)	At least as early as 2008
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Covidien AG / Nellcor Puritan Bennett Inc., including but not limited to Nellcor OxiMax Pulse Oximeters, Nellcor N-595 Pulse Oximter, Nellcor OxiMax N-600X Pulse Oximeter, and their accessories (e.g., sensor probe)	At least as early as 2002 (OxiMax Pulse Oximeters and OmniMax N-595), 2011 (OxiMax N-600X)
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Nonin Medical, Inc., including but not limited to Onyx, PalmSAT™, and Nonin® Model 7500 Digital Pulse Oximeter, Nonin Onyx® 9500, and their accessories (e.g., sensor probe)	At least as early as 1988 (Onyx), 2007 (PalmSAT™), 2007 (Nonin Onyx® 9500), and 2008 (Nonin® Model 7500)
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Novametrix Medical Systems Inc., including but not limited to Novametrix Model 513 and Model 2001, and their accessories (e.g., sensor probe)	At least as early as 1999 (Model 513) and 2007 (Model 2001)
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Respironics, Inc., including but not limited to Models 920, 920M and 920M PLUS Pulse Oximeter, and their accessories (e.g., sensor probe)	At least as early as 1999 (Model 920 and 920M) and 2007 (Model 920M PLUS)
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Smiths Medical, including but not limited to BCI 3304 Oximeter, and its accessories (e.g., sensor probe)	At least as early as 2008

Name of System or Invention	Date of Sale / Offer for Sale / Public Use / Known by Others
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Utech Co., Ltd., including but not limited to UT100 Handheld Pulse Oximeter, and its accessories (e.g., sensor probe)	At least as early as 2010
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Welch Allyn, including but not limited to Propaq® CS Vital Signs Monitor and Propaq® Encore Vital Signs Monitor, and their accessories (e.g., sensor probe)	At least as early as 2011 (Propaq® Encore Vital Signs Monitor) and 2012 (Propaq® CS Vital Signs Monitor)
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Philips Medical Systems, including but not limited to M4529A DigitalHandheld Pulse Oximeter, and its accessories (e.g., sensor probe)	At least as early as 2007
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Palco Labs Inc, including but not limited to Model 120 Mini Pulse Oximeter, and its accessories (e.g., sensor probe)	At least as early as 2007
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by BCI Inc., including but not limited to Capnocheck® Sleep Capnograph/Oximeter, and its accessories (e.g., sensor probe)	At least as early as 2007
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Datex-Ohmeda, including but not limited to TuffSat, and its accessories (e.g., sensor probe)	At least as early as 2007

For each of the prior art devices identified above, Defendants have listed and produced documents as evidence of the relevant features and functionality to the extent that they are presently available and have been located. Defendants have obtained or are in the process of attempting to obtain the identified devices and will make them available for inspection to the extent they are obtained. To the extent that one or more documents (*e.g.*, user manual) may be used to describe aspects of a particular device, that device is a single reference for prior art purposes under 35 U.S.C. § 102. Some or all of the corroborating references may also separately qualify as prior art publications under 35 U.S.C. § 102 and may be used as invalidating references under 35

U.S.C. §§ 102 and/or 103.

Further, Defendants are actively searching for information regarding at least the systems, devices, and/or inventions listed above in Table 2-E.

Discovery is ongoing, and Defendants may serve third parties with document subpoenas. One or more of these devices, along with related documentation, may be invalidating, and Defendants reserve the right to supplement these contentions accordingly. Defendants continue to investigate each of the identified devices, including through potential discovery needed to be obtained via third party subpoenas, and reserve the right to supplement these contentions and accompanying claim charts after further investigation.

Defendants' reference to a particular product, device, or software program in these contentions should be interpreted as a reference to the system itself as well as to any corresponding patents, publications, or product literature relating to the cited system. Upon information and belief, the systems were publicly disclosed, used, sold, or offered for sale in the United States before the alleged priority date of the Asserted Claims of the '455 Patent. Defendants' investigation of such prior art systems is still ongoing and discovery has not yet been received from third parties who may have information concerning such prior art systems. Accordingly, subsequent discovery may reveal information that affects the disclosures and contentions herein. For example, subsequent discovery may provide additional information regarding whether or not any of the third-party prior art systems anticipate or render obvious the Asserted Claims of the '455 Patent. As such, Defendants reserve all rights to supplement their invalidity contentions.

Many of the inventive, research, design, and development activities concerning these systems and technologies occurred in the United States before the alleged priority date of the Asserted Claims of the '455 Patent. Defendants have obtained, and are in the process of obtaining,

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additional information regarding the dates by which the cited products and services were publicly disclosed, used, sold, or offered for sale, the circumstances under which the research, design, and development activities were conducted, and the identities of the particular individuals involved in such activities through publicly available patents, publications, and product literature. The actual dates, circumstances, and identities of individuals will be the subject of third party discovery during this lawsuit, which Defendants reserve the right to rely upon to corroborate the prior art status of the prior art identified herein. Defendants reserve the right to modify, amend, or supplement these contentions if additional information becomes available during the course of this lawsuit. Furthermore, Defendants will make all such devices, software programs, or other products in Defendants' possession, custody, or control available for inspection by Plaintiff.

Consequently, Defendants reserve the right to amend, modify, or supplement these Invalidity Contentions should additional information become available to them through discovery.

In addition, Defendants identify, responsive to Plaintiff's Infringement Contentions, the patents, publications, and/or systems listed in Tables 1-E and 2-E as evidence of the state of the art as it relates to physiological monitoring devices / systems.

Each of these references show that the concept of "physiological monitoring" is not novel and was well-known for many years before the alleged priority date of the '455 Patent, as discussed in more detail in Section IV.B (obviousness). In light of the references discussed herein, the Asserted Claims of the '455 Patent cannot be valid.

Each prior art patent, publication, or product identified above was either effectively filed or issued (for patents), published (for publications) or known, used, offered for sale or sold (for products) before either the earliest claimed priority date of the '455 Patent to which it is applied for invalidity, and none appears to have been abandoned, suppressed, or concealed, so each such

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reference also constitutes evidence of prior invention pursuant to 35 U.S.C. § 102(g), if it is in the U.S. The persons or entities involved with each such invention include the named inventors on the above-identified patents, the authors listed on the above-identified publications, and the entities and individuals identified in connection with the above-identified products.

Because Defendants have not yet completed discovery in this case, including taking depositions of the named inventors, and otherwise obtaining discovery from Plaintiff and third parties, Defendants reserve the right to supplement these contentions with facts, documents, or other information learned at a later point through discovery or further investigation.

F. U.S. Patent No. 12,193,790

Invalidity claim charts identifying disclosures in the references identified in the tables below as to the Asserted Claims of the '790 Patent are provided in attached Exhibits F1 through F14.

Table 1-F: Prior Art Patents and Printed Publications for the '790 Patent

Patent No. or Title (Primary Inventor/Author)	**Date of Issue/ Publication**	**Filing Date**
US 9,241,676 ("Lisogurski") [Ex. F1]	Jan. 26, 2016	May 31, 2012
US 2015/0057511 ("Basu") [Ex. F2]	Feb. 26, 2015	Mar. 27, 2013
US 6,616,613 ("Goodman") [Ex. F3]	Sep. 9, 2003	Apr. 29, 2000
WO 2012/099536 ("Kassim") [Ex. F4]	Jul. 26, 2012	Jan. 20, 2011
US 9,095,291 ("Soller") [Ex. F5]	Aug. 4, 2015	Aug. 7, 2009
US 11,638,532 ("Poeze") [Ex. F6]	May 2, 2023	Jul. 1, 2010
US 2012/0150047 ("Terumoto") [Ex. F7]	June 14, 2012	Nov. 14, 2011
US 8,172,761 ("Rulkov") [Ex. F8]	May 8, 2012	Oct. 4, 2011
US 2011/0066050 ("Moon") [Ex. F9]	Mar. 17, 2011	Sep. 15, 2009
US 2005/0049468 ("Carlson") [Ex. F10]	Mar. 3, 2005	Sep. 3, 2003
US 2008/0242958 ("Al-Ali") [Ex. F11]	Oct. 2, 2008	Mar. 26, 2008
Plug-and-Play, Single-Chip Photoplethysmography ("Chandrasekar") [Ex. F12]	September 2012	N/A
US 8,923,918 ("Kreger") [Ex. F13]	Dec. 30, 2014	Dec. 18, 2010
US 7,507,207 ("Sakai") [Ex. F14]	Mar. 24, 2009	Oct. 5, 2004

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Table 2-F: Prior Art Systems and Inventions for the '790 Patent

Name of System or Invention	Date of Sale / Offer for Sale / Public Use / Known by Others
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by ChoiceMMed, including but not limited to ChoiceMMed MD300C318T, and its accessories (e.g., sensor probe)	At least as early as 2011-05-20
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Criticare Systems, Inc., including but not limited to Criticare 504, and its accessories (e.g., sensor probe)	At least as early as 1988
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by GE Marquette Medical Systems, Inc., including but not limited to Dash 2000 Patient Monitor, and its accessories (e.g., sensor probe)	At least as early as 1999
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Masimo Corp., including but not limited to Rad-5 and Rad-5v Signal Extraction Pulse Oximeters, Radical, Rad-57™, SET® Pulse Oximetry Devices and Rainbow SET™ Devices, and their accessories (e.g., sensor probe)	At least as early as 2004 (Rad-5/ Rad-5v), 2007 (Radical), 2008 (Rad-57™), 2009 (SET®/Rainbow SET™).
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Mindray DS USA, Inc, including but not limited to Accutorr V, and its accessories (e.g., sensor probe)	At least as early as 2008
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Covidien AG / Nellcor Puritan Bennett Inc., including but not limited to Nellcor OxiMax Pulse Oximeters, Nellcor N-595 Pulse Oximter, Nellcor OxiMax N-600X Pulse Oximeter, and their accessories (e.g., sensor probe)	At least as early as 2002 (OxiMax Pulse Oximeters and OmniMax N-595), 2011 (OxiMax N-600X)
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Nonin Medical, Inc., including but not limited to Onyx, PalmSAT™, and Nonin® Model 7500 Digital Pulse Oximeter, Nonin Onyx® 9500, and their accessories (e.g., sensor probe)	At least as early as 1988 (Onyx), 2007 (PalmSAT™), 2007 (Nonin Onyx® 9500), and 2008 (Nonin® Model 7500)
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Novametrix Medical Systems Inc., including but not limited to Novametrix Model 513 and Model 2001, and their accessories (e.g., sensor probe)	At least as early as 1999 (Model 513) and 2007 (Model 2001)

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Name of System or Invention	Date of Sale / Offer for Sale / Public Use / Known by Others
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Respironics, Inc., including but not limited to Models 920, 920M and 920M PLUS Pulse Oximeter, and their accessories (e.g., sensor probe)	At least as early as 1999 (Model 920 and 920M) and 2007 (Model 920M PLUS)
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Smiths Medical, including but not limited to BCI 3304 Oximeter, and its accessories (e.g., sensor probe)	At least as early as 2008
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Utech Co., Ltd., including but not limited to UT100 Handheld Pulse Oximeter, and its accessories (e.g., sensor probe)	At least as early as 2010
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Welch Allyn, including but not limited to Propaq® CS Vital Signs Monitor and Propaq® Encore Vital Signs Monitor, and their accessories (e.g., sensor probe)	At least as early as 2011 (Propaq® Encore Vital Signs Monitor) and 2012 (Propaq® CS Vital Signs Monitor)
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Philips Medical Systems, including but not limited to M4529A DigitalHandheld Pulse Oximeter, and its accessories (e.g., sensor probe)	At least as early as 2007
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Palco Labs Inc, including but not limited to Model 120 Mini Pulse Oximeter, and its accessories (e.g., sensor probe)	At least as early as 2007
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by BCI Inc., including but not limited to Capnocheck® Sleep Capnograph/Oximeter, and its accessories (e.g., sensor probe)	At least as early as 2007
Pulse oximeters or similar products publicly disclosed, used, sold, or offered for sale by Datex-Ohmeda, including but not limited to TuffSat, and its accessories (e.g., sensor probe)	At least as early as 2007

For each of the prior art devices identified above, Defendants have listed and produced documents as evidence of the relevant features and functionality to the extent that they are presently available and have been located. Defendants have obtained or are in the process of

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attempting to obtain the identified devices and will make them available for inspection to the extent they are obtained. To the extent that one or more documents (*e.g.*, user manual) may be used to describe aspects of a particular device, that device is a single reference for prior art purposes under 35 U.S.C. § 102. Some or all of the corroborating references may also separately qualify as prior art publications under 35 U.S.C. § 102 and may be used as invalidating references under 35 U.S.C. §§ 102 and/or 103.

Further, Defendants are actively searching for information regarding at least the systems, devices, and/or inventions listed above in Table 2-F.

Discovery is ongoing, and Defendants may serve third parties with document subpoenas. One or more of these devices, along with related documentation, may be invalidating, and Defendants reserve the right to supplement these contentions accordingly. Defendants continue to investigate each of the identified devices, including through potential discovery needed to be obtained via third party subpoenas, and reserve the right to supplement these contentions and accompanying claim charts after further investigation.

Defendants' reference to a particular product, device, or software program in these contentions should be interpreted as a reference to the system itself as well as to any corresponding patents, publications, or product literature relating to the cited system. Upon information and belief, the systems were publicly disclosed, used, sold, or offered for sale in the United States before the alleged priority date of the Asserted Claims of the '790 Patent. Defendants' investigation of such prior art systems is still ongoing, and discovery has not yet been received from third parties who may have information concerning such prior art systems. Accordingly, subsequent discovery may reveal information that affects the disclosures and contentions herein. For example, subsequent discovery may provide additional information regarding whether any of the third-party

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prior art systems anticipate or render obvious the Asserted Claims of the '790 Patent. As such, Defendants reserve all rights to supplement their invalidity contentions.

Many of the inventive, research, design, and development activities concerning these systems and technologies occurred in the United States before the alleged priority date of the Asserted Claims of the '790 Patent. Defendants have obtained, and are in the process of obtaining, additional information regarding the dates by which the cited products and services were publicly disclosed, used, sold, or offered for sale, the circumstances under which the research, design, and development activities were conducted, and the identities of the individuals involved in such activities through publicly available patents, publications, and product literature. The actual dates, circumstances, and identities of individuals will be the subject of third-party discovery during this lawsuit, which Defendants reserve the right to rely upon to corroborate the prior art status of the prior art identified herein. Defendants reserve the right to modify, amend, or supplement these contentions if additional information becomes available during the course of this lawsuit. Furthermore, Defendants will make all such devices, software programs, or other products in Defendants' possession, custody, or control available for inspection by Plaintiff.

Consequently, Defendants reserve the right to amend, modify, or supplement these Invalidity Contentions should additional information become available to them through discovery.

In addition, Defendants identify, responsive to Plaintiff's Infringement Contentions, the patents, publications, and/or systems listed in Tables 1-F and 2-F as evidence of the state of the art as it relates to physiological monitoring devices / systems.

Each of these references show that the concept of "physiological monitoring" is not novel and was well-known for many years before the alleged priority date of the '790 Patent, as discussed in more detail in Section IV.B (obviousness). In light of the references discussed herein, the

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Asserted Claims of the ’790 Patent cannot be valid.

Each prior art patent, publication, or product identified above was either effectively filed or issued (for patents), published (for publications) or known, used, offered for sale or sold (for products) before either the earliest claimed priority date of the ’790 Patent to which it is applied for invalidity, and none appears to have been abandoned, suppressed, or concealed, so each such reference also constitutes evidence of prior invention pursuant to 35 U.S.C. § 102(g), if it is in the U.S. The persons or entities involved with each such invention include the named inventors on the above-identified patents, the authors listed on the above-identified publications, and the entities and individuals identified in connection with the above-identified products.

Because Defendants have not yet completed discovery in this case, including taking depositions of the named inventors, and otherwise obtaining discovery from Plaintiff and third parties, Defendants reserve the right to supplement these contentions with facts, documents, or other information learned at a later point through discovery or further investigation.

G. State of the Art

Defendants identify, responsive to Plaintiff’s infringement contentions, the references listed in Tables 1-A through 1-F, Tables 2-A through 2-F, and the following patents, publications, and systems as evidence of the state of the art as it relates to each of the Asserted Patents:

- U.S. Patent No. 3,514,538
- U.S. Patent No. 3,789,601
- U.S. Patent No. 4,015,595
- U.S. Patent No. 4,589,078
- U.S. Patent No. 4,591,659
- U.S. Patent No. 4,941,236
- U.S. Patent No. 5,028,787
- U.S. Patent No. 5,222,496,
- U.S. Patent No. 5,254,388
- U.S. Patent No. 5,259,381
- U.S. Patent No. 5,267,152
- U.S. Patent No. 5,334,916

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- U.S. Patent No. 5,348,002
- U.S. Patent No. 5,370,114
- U.S. Patent No. 5,527,261
- U.S. Patent No. 5,555,882
- U.S. Patent No. 5,590,652
- U.S. Patent No. 5,632,272
- U.S. Patent No. 5,638,818
- U.S. Patent No. 5,687,721
- U.S. Patent No. 5,746,206
- U.S. Patent No. 5,795,300
- U.S. Patent No. 5,807,261
- U.S. Patent No. 5,830,137
- U.S. Patent No. 5,879,294
- U.S. Patent No. 5,924,069
- U.S. Patent No. 6,018,673
- U.S. Patent No. 6,064,898
- U.S. Patent No. 6,067,463
- U.S. Patent No. 6,081,782
- U.S. Patent No. 6,108,634
- U.S. Patent No. 6,120,460
- U.S. Patent No. 6,126,595
- U.S. Patent No. 6,152,876
- U.S. Patent No. 6,158,245
- U.S. Patent No. 6,168,563
- U.S. Patent No. 6,171,237
- U.S. Patent No. 6,172,743
- U.S. Patent No. 6,174,291
- U.S. Patent No. 6,178,343
- U.S. Patent No. 6,278,975
- U.S. Patent No. 6,285,454
- U.S. Patent No. 6,293,915
- U.S. Patent No. 6,336,900
- U.S. Patent No. 6,343,223
- U.S. Patent No. 6,393,311
- U.S. Patent No. 6,483,976
- U.S. Patent No. 6,505,133
- U.S. Patent No. 6,553,242
- U.S. Patent No. 6,584,336
- U.S. Patent No. 6,591,239
- U.S. Patent No. 6,591,239
- U.S. Patent No. 6,602,191
- U.S. Patent No. 6,605,038
- U.S. Patent No. 6,608,562
- U.S. Patent No. 6,648,820

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- U.S. Patent No. 6,705,990
- U.S. Patent No. 6,705,991
- U.S. Patent No. 6,801,799
- U.S. Patent No. 6,816,266
- U.S. Patent No. 6,886,964
- U.S. Patent No. 6,912,413
- U.S. Patent No. 6,937,885
- U.S. Patent No. 6,961,599
- U.S. Patent No. 6,990,365
- U.S. Patent No. 7,031,728
- U.S. Patent No. 7,236,811
- U.S. Patent No. 7,346,174
- U.S. Patent No. 7,403,804
- U.S. Patent No. 7,507,207
- U.S. Patent No. 7,624,028
- U.S. Patent No. 7,658,613
- U.S. Patent No. 7,899,506
- U.S. Patent No. 8,095,195
- U.S. Patent No. 8,108,036
- U.S. Patent No. 8,125,331
- U.S. Patent No. 8,172,761
- U.S. Patent No. 8,326,390
- U.S. Patent No. 8,537,343
- U.S. Patent No. 8,670,819
- U.S. Patent No. 8,725,226
- U.S. Patent No. 8,764,651
- U.S. Patent No. 8,923,918
- U.S. Patent No. 9,055,868
- U.S. Patent No. 9,241,676
- U.S. Patent No. 9,392,946
- U.S. Patent No. 9,596,990
- U.S. Patent No. 9,651,633
- U.S. Patent No. 9,820,658
- U.S. Patent No. 10,517,484
- U.S. Patent No. 10,729,335
- U.S. Patent No. 10,729,335
- U.S. Patent No. 10,874,304
- U.S. Patent No. 11,160,455
- U.S. Patent No. 11,242,072
- U.S. Patent No. 11,330,993
- U.S. Patent No. 11,342,072
- U.S. Patent No. 12,193,790
- “Plug-and-Play, Single-Chip Photoplethysmography”, by D. Chandrasekar, B. Arnetz, P. Levy, A. Basu

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- "Supercontinuum generation from ~1.9 to 4:5 μm in ZBLAN fiber with high average power generation beyond 3:8 μm using a thulium-doped fiber amplifier" by O. Kulkarni, V. Alexander, M. Kumar, M.Freeman, M. N. Islam, F. Terry, Jr., M. Neelakandan, and A. Chan
- "Supercontinuum Generation in Silica Fibers by Amplified Nanosecond Laser Diode Pulses" by C. Xia, M. Kumar, M. Cheng, O. Kulkarni, M. Islam, A. Galvanauskas, F. Terry, Jr., M. Freeman, D. Nolan, and W. Wood
- "Towards a Wearable Non-invasive Blood Glucose Monitoring Device" by J. Anders, J. Solanki, O. Choudhary, S. Chouksey, N. Malvia, P. Chaturvedi, and P. Sen
- "Open Data Kit Sensors: Mobile Data Collection with Wired and Wireless Sensors" by R. Chaudhri, W. Brunette, M. Goel, R. Sodt, J. VanORden, M. Falcone, G. Borriello
- "Android Based Body Area Network for the Evaluation of Medical Parameters" by M. Wagner, B. Kuch, C. Cabrera, P. Enoksson, A. Sieber
- "Noninvasice Cardiac Output Estimation Using a Novel Photoplethsymogram Index" by L. Wang, E. Pickwell-MacPherson, Y.P. Liang, Y.T. Zhang
- "Towards a Wearable Non-invasive Blood Glucose Monitoring Device" by J. Andrews, J. Solanki, O. Choudhary, S. Chouksey, N. Malvia, P. Chaturvedi, P. Sen

IV. P. R. 3-3(b) – Invalidity Grounds

Pursuant to P.R. 3-3(b), Defendants contend that certain prior art references below anticipate one or more Asserted Claims and that to the extent the identified prior art references do not anticipate the Asserted Claims, those claims are invalid as obvious under 35 U.S.C. §103. Each anticipatory prior art reference, either alone or in combination with other prior art, also renders the Asserted Claims invalid as obvious. In particular, each anticipatory prior art reference may be combined with (1) information generally known to persons skilled in the art at the time of the alleged invention, and/or (2) any of the other identified prior art references. To the extent that Plaintiff contends that any of the anticipatory prior art fails to disclose one or more limitations of the Asserted Claims, Defendants contend that any difference between the reference and the corresponding patent claims would have been obvious to one of ordinary skill in the art. Thus, all anticipation charts should be interpreted as both reflecting anticipation by the reference as well as invalidity due to single reference obviousness, to the extent that Plaintiff contends that any limitation is missing.

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A. Anticipation

As stated above, Defendants incorporate by reference all other invalidity contentions related to the Asserted Patents served on or otherwise provided to Plaintiff, whether past or future. In accordance with P.R. 3-3(a), prior art references anticipating the Asserted Claims are provided below. The prior art listed below anticipates the Asserted Claims under the proper construction of the claims and/or under Plaintiff's apparent interpretation of the claims reflected by Plaintiff's Complaint and Infringement Contentions.

1. U.S. Patent No. 9,055,868

The Asserted Claims of the '868 Patent are anticipated and/or rendered obvious by prior art. Pursuant to P.R. 3-3(a), Defendants identify the prior art references that anticipate or render obvious the '868 Patent Asserted Claims in the claim charts of Exhibits A1 through A10 (collectively "Appendix A") which are hereby incorporated by reference as if fully set forth herein. The claim charts of Appendix A show how these prior art references teach or suggest each and every element of the '868 Patent Asserted Claims. For each reference or combination of references suggested by each chart and/or herein, Defendants indicate whether the prior art renders the claim anticipated and/or obvious pursuant to P.R. 3-3(b).

In addition to contending that the '868 Patent Asserted Claims are invalid in view of the prior art references cited in the claim charts of Appendix A, Defendants further contend that the '868 Patent Asserted Claims are invalid as anticipated and/or obvious under U.S.C. §§ 102(a), 102(b), and/or 103 in view of public knowledge and uses and/or offers for sale of products and services related to the subject matter of the cited references. As discovery is ongoing, Defendants continue to investigate these items and to reserve the right to amend or supplement these contentions to include additional information or documents regarding such products and/or systems. In addition to contending that the '868 Patent Asserted Claims are invalid in view of the

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explicit disclosures of the prior art references cited in the claim charts of Appendix A, Defendants further contend that the knowledge of skill evidenced by those references render those claims invalid. Defendants further contend that, even if a prior art reference does not expressly disclose all limitations as arranged or combined in the same manner as an asserted claim, a skilled artisan reading the reference would at once envisage the claimed arrangement or combination. *See, e.g.*, *Kennametal Inc. v. Ingersoll Cutting Tool Co.*, 780 F.3d 1376 (Fed. Cir. 2015).

Defendants' reference to particular components, circuits, software programs, devices, or products in the claim charts of Appendix A should be interpreted alternatively as both as a reference to the product itself and to any corresponding patents, publications, or product literature cited in Appendix A that relates to the cited component, circuit, software program, device, or product. In addition, Defendants may rely on other documents or things that have not yet been located to support its contentions regarding such prior art component(s), circuit(s), software program(s), device(s) or product(s) that are referenced in the charts.

Defendants incorporate by reference, as if set forth fully herein, all prior art cited during the prosecution of the '868 Patent, all prior art cited during reexamination proceedings of the '868 Patent, all prior art as described in any future *inter partes* review proceedings of the '868 Patent, and all prior art disclosed during previous litigation proceedings.

Defendants further identify and hereby incorporate by reference as if set forth fully herein the prior art references and invalidity contentions as described in any Other Omni Proceedings wherein invalidity contentions have been, or will be, provided regarding the '868 Patent, its foreign counterparts, or any parent or child patent of the '868 Patent. Defendants reserve the right to use any and all portions of the publication, related publications, commercial embodiments of the publication, and other evidence that is discovered in these lawsuits to demonstrate and/or evidence

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the components, functionality, and capabilities of the devices and systems disclosed in the references charted.

Where Defendants identify a particular figure in a prior art reference, the identification should be understood to encompass the caption and description of the figure, as well as any text relating to the figure in addition to the figure itself. Similarly, where an identified portion of text refers to a figure, embodiment, or other material, the identification should be understood to include the referenced figure, embodiment, or other material as well. Consistent with P.R. 3-3(c), Defendants' citations to specific statements, figures, or disclosures in a prior art reference are sufficient to put Plaintiff on notice where each element of each asserted claim is found in the prior art. However, it should be recognized that a person of ordinary skill in the art would generally read a prior art reference as a whole and in the context of other publications, literature, and general knowledge in the field. To understand and interpret any specific statement or disclosure in a prior art reference, a person of ordinary skill in the art would rely upon other information including other publications and general scientific or engineering knowledge. Defendants therefore reserve the right to rely upon other unidentified portions of the prior art references and on other publications and expert testimony to provide context and to aid understanding and interpretation of the identified portions.

Defendants also reserve the right to rely upon other portions of the prior art references, other publications, and the testimony of experts to establish that the alleged inventions would have been obvious to a person of ordinary skill in the art, including the basis of modifying or combining certain cited references. To the extent any limitation is deemed not to be exactly met by an item of prior art, then any purported differences are such that the claimed subject matter as a whole would have been obvious to one skilled in the art at the time of the alleged invention, in view of

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the state of the art and knowledge of those skilled in the art. To the extent that an element of an Asserted Claim is not anticipated, the claim is rendered obvious by combination with one or more other prior art references identified in Appendix A.

2. U.S. Patent No. 9,651,533

The Asserted Claims of the '533 Patent are anticipated and/or rendered obvious by prior art. Pursuant to P.R. 3-3(a), Defendants identify the prior art references that anticipate or render obvious the '533 Patent Asserted Claims in the claim charts of Exhibits B1 through B8 (collectively "Appendix B") which are hereby incorporated by reference as if fully set forth herein. The claim charts of Appendix B show how these prior art references teach or suggest each and every element of the '533 Patent Asserted Claims. For each reference or combination of references suggested by each chart and/or herein, Defendants indicate whether the prior art renders the claim anticipated and/or obvious pursuant to P.R. 3-3(b).

In addition to contending that the '533 Patent Asserted Claims are invalid in view of the prior art references cited in the claim charts of Appendix B, Defendants further contend that the '533 Patent Asserted Claims are invalid as anticipated and/or obvious under U.S.C. §§ 102(a), 102(b), and/or 103 in view of public knowledge and uses and/or offers for sale of products and services related to the subject matter of the cited references. As discovery is ongoing, Defendants continue to investigate these items and to reserve the right to amend or supplement these contentions to include additional information or documents regarding such products and/or systems. In addition to contending that the '533 Patent Asserted Claims are invalid in view of the explicit disclosures of the prior art references cited in the claim charts of Appendix B, Defendants further contend that the knowledge of skill evidenced by those references render those claims invalid. Defendants further contend that, even if a prior art reference does not expressly disclose all limitations as arranged or combined in the same manner as an asserted claim, a skilled artisan

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reading the reference would at once envisage the claimed arrangement or combination. *See, e.g.*, *Kennametal Inc. v. Ingersoll Cutting Tool Co.*, 780 F.3d 1376 (Fed. Cir. 2015).

Defendants' reference to particular components, circuits, software programs, devices, or products in the claim charts of Appendix B should be interpreted alternatively as both as a reference to the product itself and to any corresponding patents, publications, or product literature cited in Appendix B that relates to the cited component, circuit, software program, device, or product. In addition, Defendants may rely on other documents or things that have not yet been located to support its contentions regarding such prior art component(s), circuit(s), software program(s), device(s) or product(s) that are referenced in the charts.

Defendants incorporate by reference, as if set forth fully herein, all prior art cited during the prosecution of the '533 Patent, all prior art cited during reexamination proceedings of the '533 Patent, all prior art as described in any future *inter partes* review proceedings of the '533 Patent, and all prior art disclosed during previous litigation proceedings.

Defendants further identify and hereby incorporate by reference as if set forth fully herein the prior art references and invalidity contentions as described in any Other Omni Proceedings wherein invalidity contentions have been, or will be, provided regarding the '533 Patent, its foreign counterparts, or any parent or child patent of the '533 Patent. Defendants reserve the right to use any and all portions of the publication, related publications, commercial embodiments of the publication, and other evidence that is discovered in these lawsuits to demonstrate and/or evidence the components, functionality, and capabilities of the devices and systems disclosed in the references charted.

Where Defendants identify a particular figure in a prior art reference, the identification should be understood to encompass the caption and description of the figure, as well as any text

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relating to the figure in addition to the figure itself. Similarly, where an identified portion of text refers to a figure, embodiment, or other material, the identification should be understood to include the referenced figure, embodiment, or other material as well. Consistent with P.R. 3-3(c), Defendants' citations to specific statements, figures, or disclosures in a prior art reference are sufficient to put Plaintiff on notice where each element of each asserted claim is found in the prior art. However, it should be recognized that a person of ordinary skill in the art would generally read a prior art reference as a whole and in the context of other publications, literature, and general knowledge in the field. To understand and interpret any specific statement or disclosure in a prior art reference, a person of ordinary skill in the art would rely upon other information including other publications and general scientific or engineering knowledge. Defendants therefore reserve the right to rely upon other unidentified portions of the prior art references and on other publications and expert testimony to provide context and to aid understanding and interpretation of the identified portions.

Defendants also reserve the right to rely upon other portions of the prior art references, other publications, and the testimony of experts to establish that the alleged inventions would have been obvious to a person of ordinary skill in the art, including the basis of modifying or combining certain cited references. To the extent any limitation is deemed not to be exactly met by an item of prior art, then any purported differences are such that the claimed subject matter as a whole would have been obvious to one skilled in the art at the time of the alleged invention, in view of the state of the art and knowledge of those skilled in the art. To the extent that an element of an Asserted Claim is not anticipated, the claim is rendered obvious by combination with one or more other prior art references identified in Appendix B.

3. U.S. Patent No. 10,517,484

The Asserted Claims of the '484 Patent are anticipated and/or rendered obvious by prior

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art. Pursuant to P.R. 3-3(a), Defendants identify the prior art references that anticipate or render obvious the '484 Patent Asserted Claims in the claim charts of Exhibits C1 through C14 (collectively "Appendix C") which are hereby incorporated by reference as if fully set forth herein. The claim charts of Appendix C show how these prior art references teach or suggest each and every element of the '484 Patent Asserted Claims. For each reference or combination of references suggested by each chart and/or herein, Defendants indicate whether the prior art renders the claim anticipated and/or obvious pursuant to P.R. 3-3(b).

In addition to contending that the '484 Patent Asserted Claims are invalid in view of the prior art references cited in the claim charts of Appendix C, Defendants further contend that the '484 Patent Asserted Claims are invalid as anticipated and/or obvious under U.S.C. §§ 102(a), 102(b), and/or 103 in view of public knowledge and uses and/or offers for sale of products and services related to the subject matter of the cited references. As discovery is ongoing, Defendants continue to investigate these items and to reserve the right to amend or supplement these contentions to include additional information or documents regarding such products and/or systems. In addition to contending that the '484 Patent Asserted Claims are invalid in view of the explicit disclosures of the prior art references cited in the claim charts of Appendix C, Defendants further contend that the knowledge of skill evidenced by those references render those claims invalid. Defendants further contend that, even if a prior art reference does not expressly disclose all limitations as arranged or combined in the same manner as an asserted claim, a skilled artisan reading the reference would at once envisage the claimed arrangement or combination. *See, e.g.*, *Kennametal Inc. v. Ingersoll Cutting Tool Co.*, 780 F.3d 1376 (Fed. Cir. 2015).

Defendants' reference to particular components, circuits, software programs, devices, or products in the claim charts of Appendix C should be interpreted alternatively as both as a

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reference to the product itself and to any corresponding patents, publications, or product literature cited in Appendix C that relates to the cited component, circuit, software program, device, or product. In addition, Defendants may rely on other documents or things that have not yet been located to support its contentions regarding such prior art component(s), circuit(s), software program(s), device(s) or product(s) that are referenced in the charts.

Defendants incorporate by reference, as if set forth fully herein, all prior art cited during the prosecution of the '484 Patent, all prior art cited during reexamination proceedings of the '484 Patent, all prior art as described in any future *inter partes* review proceedings of the '484 Patent, and all prior art disclosed during previous litigation proceedings.

Defendants further identify and hereby incorporate by reference as if set forth fully herein the prior art references and invalidity contentions as described in any Other Omni Proceedings wherein invalidity contentions have been, or will be, provided regarding the '484 Patent, its foreign counterparts, or any parent or child patent of the '484 Patent. Defendants reserve the right to use any and all portions of the publication, related publications, commercial embodiments of the publication, and other evidence that is discovered in these lawsuits to demonstrate and/or evidence the components, functionality, and capabilities of the devices and systems disclosed in the references charted.

Where Defendants identify a particular figure in a prior art reference, the identification should be understood to encompass the caption and description of the figure, as well as any text relating to the figure in addition to the figure itself. Similarly, where an identified portion of text refers to a figure, embodiment, or other material, the identification should be understood to include the referenced figure, embodiment, or other material as well. Consistent with P.R. 3-3(c), Defendants' citations to specific statements, figures, or disclosures in a prior art reference are

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sufficient to put Plaintiff on notice where each element of each asserted claim is found in the prior art. However, it should be recognized that a person of ordinary skill in the art would generally read a prior art reference as a whole and in the context of other publications, literature, and general knowledge in the field. To understand and interpret any specific statement or disclosure in a prior art reference, a person of ordinary skill in the art would rely upon other information including other publications and general scientific or engineering knowledge. Defendants therefore reserve the right to rely upon other unidentified portions of the prior art references and on other publications and expert testimony to provide context and to aid understanding and interpretation of the identified portions.

Defendants also reserve the right to rely upon other portions of the prior art references, other publications, and the testimony of experts to establish that the alleged inventions would have been obvious to a person of ordinary skill in the art, including the basis of modifying or combining certain cited references. To the extent any limitation is deemed not to be exactly met by an item of prior art, then any purported differences are such that the claimed subject matter as a whole would have been obvious to one skilled in the art at the time of the alleged invention, in view of the state of the art and knowledge of those skilled in the art. To the extent that an element of an Asserted Claim is not anticipated, the claim is rendered obvious by combination with one or more other prior art references identified in Appendix C.

4. U.S. Patent No. 10,874,304

The Asserted Claims of the ’304 Patent are anticipated and/or rendered obvious by prior art. Pursuant to P.R. 3-3(a), Defendants identify the prior art references that anticipate or render obvious the ’304 Patent Asserted Claims in the claim charts of Exhibits D1 through D19 (collectively “Appendix D”) which are hereby incorporated by reference as if fully set forth herein. The claim charts of Appendix D show how these prior art references teach or suggest each and

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every element of the ’304 Patent Asserted Claims. For each reference or combination of references suggested by each chart and/or herein, Defendants indicate whether the prior art renders the claim anticipated and/or obvious pursuant to P.R. 3-3(b).

In addition to contending that the ’304 Patent Asserted Claims are invalid in view of the prior art references cited in the claim charts of Appendix D, Defendants further contend that the ’304 Patent Asserted Claims are invalid as anticipated and/or obvious under U.S.C. §§ 102(a), 102(b), and/or 103 in view of public knowledge and uses and/or offers for sale of products and services related to the subject matter of the cited references. As discovery is ongoing, Defendants continue to investigate these items and to reserve the right to amend or supplement these contentions to include additional information or documents regarding such products and/or systems. In addition to contending that the ’304 Patent Asserted Claims are invalid in view of the explicit disclosures of the prior art references cited in the claim charts of Appendix D, Defendants further contend that the knowledge of skill evidenced by those references render those claims invalid. Defendants further contend that, even if a prior art reference does not expressly disclose all limitations as arranged or combined in the same manner as an asserted claim, a skilled artisan reading the reference would at once envisage the claimed arrangement or combination. *See, e.g.*, *Kennametal Inc. v. Ingersoll Cutting Tool Co.*, 780 F.3d 1376 (Fed. Cir. 2015).

Defendants’ reference to particular components, circuits, software programs, devices, or products in the claim charts of Appendix D should be interpreted alternatively as both as a reference to the product itself and to any corresponding patents, publications, or product literature cited in Appendix D that relates to the cited component, circuit, software program, device, or product. In addition, Defendants may rely on other documents or things that have not yet been located to support its contentions regarding such prior art component(s), circuit(s), software

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program(s), device(s), or product(s) that are referenced in the charts.

Defendants incorporate by reference, as if set forth fully herein, all prior art cited during the prosecution of the '304 Patent, all prior art cited during reexamination proceedings of the '304 Patent, all prior art as described in any *inter partes* review proceedings of the '304 Patent, and all prior art disclosed during previous litigation proceedings.

Defendants further identify and hereby incorporate by reference as if set forth fully herein the prior art references and invalidity contentions as described in any Other Omni Proceedings wherein invalidity contentions have been, or will be, provided regarding the '304 Patent, its foreign counterparts, or any parent or child patent of the '304 Patent. Defendants reserve the right to use any and all portions of the publication, related publications, commercial embodiments of the publication, and other evidence that is discovered in these lawsuits to demonstrate and/or evidence the components, functionality, and capabilities of the devices and systems disclosed in the references charted.

Where Defendants identify a particular figure in a prior art reference, the identification should be understood to encompass the caption and description of the figure, as well as any text relating to the figure in addition to the figure itself. Similarly, where an identified portion of text refers to a figure, embodiment, or other material, the identification should be understood to include the referenced figure, embodiment, or other material as well. Consistent with P.R. 3-3(c), Defendants' citations to specific statements, figures, or disclosures in a prior art reference are sufficient to put Plaintiff on notice where each element of each asserted claim is found in the prior art. However, it should be recognized that a person of ordinary skill in the art would generally read a prior art reference as a whole and in the context of other publications, literature, and general knowledge in the field. To understand and interpret any specific statement or disclosure in a prior

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art reference, a person of ordinary skill in the art would rely upon other information including other publications and general scientific or engineering knowledge. Defendants therefore reserve the right to rely upon other unidentified portions of the prior art references and on other publications and expert testimony to provide context and to aid understanding and interpretation of the identified portions.

Defendants also reserve the right to rely upon other portions of the prior art references, other publications, and the testimony of experts to establish that the alleged inventions would have been obvious to a person of ordinary skill in the art, including the basis of modifying or combining certain cited references. To the extent any limitation is deemed not to be exactly met by an item of prior art, then any purported differences are such that the claimed subject matter as a whole would have been obvious to one skilled in the art at the time of the alleged invention, in view of the state of the art and knowledge of those skilled in the art. To the extent that an element of an Asserted Claim is not anticipated, the claim is rendered obvious by combination with one or more other prior art references identified in Appendix D.

5. U.S. Patent No. 11,160,455

The Asserted Claims of the ’455 Patent are anticipated and/or rendered obvious by prior art. Pursuant to P.R. 3-3(a), Defendants identify the prior art references that anticipate or render obvious the ’455 Patent Asserted Claims in the claim charts of Exhibits E1 through E18 (collectively “Appendix E”) which are hereby incorporated by reference as if fully set forth herein. The claim charts of Appendix E show how these prior art references teach or suggest each and every element of the ’455 Patent Asserted Claims. For each reference or combination of references suggested by each chart and/or herein, Defendants indicate whether the prior art renders the claim anticipated and/or obvious pursuant to P.R. 3-3(b).

In addition to contending that the ’455 Patent Asserted Claims are invalid in view of the

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prior art references cited in the claim charts of Appendix E, Defendants further contend that the '455 Patent Asserted Claims are invalid as anticipated and/or obvious under U.S.C. §§ 102(a), 102(b), and/or 103 in view of public knowledge and uses and/or offers for sale of products and services related to the subject matter of the cited references. As discovery is ongoing, Defendants continue to investigate these items and to reserve the right to amend or supplement these contentions to include additional information or documents regarding such products and/or systems. In addition to contending that the '455 Patent Asserted Claims are invalid in view of the explicit disclosures of the prior art references cited in the claim charts of Appendix E, Defendants further contend that the knowledge of skill evidenced by those references render those claims invalid. Defendants further contend that, even if a prior art reference does not expressly disclose all limitations as arranged or combined in the same manner as an asserted claim, a skilled artisan reading the reference would at once envisage the claimed arrangement or combination. *See, e.g.*, *Kennametal Inc. v. Ingersoll Cutting Tool Co.*, 780 F.3d 1376 (Fed. Cir. 2015).

Defendants' reference to particular components, circuits, software programs, devices, or products in the claim charts of Appendix E should be interpreted alternatively as both as a reference to the product itself and to any corresponding patents, publications, or product literature cited in Appendix E that relates to the cited component, circuit, software program, device, or product. In addition, Defendants may rely on other documents or things that have not yet been located to support its contentions regarding such prior art component(s), circuit(s), software program(s), device(s) or product(s) that are referenced in the charts.

Defendants incorporate by reference, as if set forth fully herein, all prior art cited during the prosecution of the '455 Patent, all prior art cited during reexamination proceedings of the '455 Patent, all prior art as described in any future *inter partes* review proceedings of the '455 Patent,

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and all prior art disclosed during previous litigation proceedings.

Defendants further identify and hereby incorporate by reference as if set forth fully herein the prior art references and invalidity contentions as described in any Other Omni Proceedings wherein invalidity contentions have been, or will be, provided regarding the '455 Patent, its foreign counterparts, or any parent or child patent of the '455 Patent. Defendants reserve the right to use any and all portions of the publication, related publications, commercial embodiments of the publication, and other evidence that is discovered in these lawsuits to demonstrate and/or evidence the components, functionality, and capabilities of the devices and systems disclosed in the references charted.

Where Defendants identify a particular figure in a prior art reference, the identification should be understood to encompass the caption and description of the figure, as well as any text relating to the figure in addition to the figure itself. Similarly, where an identified portion of text refers to a figure, embodiment, or other material, the identification should be understood to include the referenced figure, embodiment, or other material as well. Consistent with P.R. 3-3(c), Defendants' citations to specific statements, figures, or disclosures in a prior art reference are sufficient to put Plaintiff on notice where each element of each asserted claim is found in the prior art. However, it should be recognized that a person of ordinary skill in the art would generally read a prior art reference as a whole and in the context of other publications, literature, and general knowledge in the field. To understand and interpret any specific statement or disclosure in a prior art reference, a person of ordinary skill in the art would rely upon other information including other publications and general scientific or engineering knowledge. Defendants therefore reserve the right to rely upon other unidentified portions of the prior art references and on other publications and expert testimony to provide context and to aid understanding and interpretation of the

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identified portions.

Defendants also reserve the right to rely upon other portions of the prior art references, other publications, and the testimony of experts to establish that the alleged inventions would have been obvious to a person of ordinary skill in the art, including the basis of modifying or combining certain cited references. To the extent any limitation is deemed not to be exactly met by an item of prior art, then any purported differences are such that the claimed subject matter as a whole would have been obvious to one skilled in the art at the time of the alleged invention, in view of the state of the art and knowledge of those skilled in the art. To the extent that an element of an Asserted Claim is not anticipated, the claim is rendered obvious by combination with one or more other prior art references identified in Appendix E.

6. U.S. Patent No. 12,193,790

The Asserted Claims of the '790 Patent are anticipated and/or rendered obvious by prior art. Pursuant to P.R. 3-3(a), Defendants identify the prior art references that anticipate or render obvious the '790 Patent Asserted Claims in the claim charts of Exhibits F1 through F14 (collectively "Appendix F") which are hereby incorporated by reference as if fully set forth herein. The claim charts of Appendix F show how these prior art references teach or suggest each and every element of the '790 Patent Asserted Claims. For each reference or combination of references suggested by each chart and/or herein, Defendants indicate whether the prior art renders the claim anticipated and/or obvious pursuant to P.R. 3-3(b).

In addition to contending that the '790 Patent Asserted Claims are invalid in view of the prior art references cited in the claim charts of Appendix F, Defendants further contend that the '790 Patent Asserted Claims are invalid as anticipated and/or obvious under U.S.C. §§ 102(a), 102(b), and/or 103 in view of public knowledge and uses and/or offers for sale of products and services related to the subject matter of the cited references. As discovery is ongoing, Defendants

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continue to investigate these items and to reserve the right to amend or supplement these contentions to include additional information or documents regarding such products and/or systems. In addition to contending that the '790 Patent Asserted Claims are invalid in view of the explicit disclosures of the prior art references cited in the claim charts of Appendix F, Defendants further contend that the knowledge of skill evidenced by those references render those claims invalid. Defendants further contend that, even if a prior art reference does not expressly disclose all limitations as arranged or combined in the same manner as an asserted claim, a skilled artisan reading the reference would at once envisage the claimed arrangement or combination. *See, e.g.*, *Kennametal Inc. v. Ingersoll Cutting Tool Co.*, 780 F.3d 1376 (Fed. Cir. 2015).

Defendants' reference to particular components, circuits, software programs, devices, or products in the claim charts of Appendix F should be interpreted alternatively as both as a reference to the product itself and to any corresponding patents, publications, or product literature cited in Appendix F that relates to the cited component, circuit, software program, device, or product. In addition, Defendants may rely on other documents or things that have not yet been located to support its contentions regarding such prior art component(s), circuit(s), software program(s), device(s) or product(s) that are referenced in the charts.

Defendants incorporate by reference, as if set forth fully herein, all prior art cited during the prosecution of the '790 Patent, all prior art cited during reexamination proceedings of the '790 Patent, all prior art as described in any future *inter partes* review proceedings of the '790 Patent, and all prior art disclosed during previous litigation proceedings.

Defendants further identify and hereby incorporate by reference as if set forth fully herein the prior art references and invalidity contentions as described in any Other Omni Proceedings wherein invalidity contentions have been, or will be, provided regarding the '790 Patent, its foreign

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counterparts, or any parent or child patent of the '790 Patent. Defendants reserve the right to use any and all portions of the publication, related publications, commercial embodiments of the publication, and other evidence that is discovered in these lawsuits to demonstrate and/or evidence the components, functionality, and capabilities of the devices and systems disclosed in the references charted.

Where Defendants identify a particular figure in a prior art reference, the identification should be understood to encompass the caption and description of the figure, as well as any text relating to the figure in addition to the figure itself. Similarly, where an identified portion of text refers to a figure, embodiment, or other material, the identification should be understood to include the referenced figure, embodiment, or other material as well. Consistent with P.R. 3-3(c), Defendants' citations to specific statements, figures, or disclosures in a prior art reference are sufficient to put Plaintiff on notice where each element of each asserted claim is found in the prior art. However, it should be recognized that a person of ordinary skill in the art would generally read a prior art reference as a whole and in the context of other publications, literature, and general knowledge in the field. To understand and interpret any specific statement or disclosure in a prior art reference, a person of ordinary skill in the art would rely upon other information including other publications and general scientific or engineering knowledge. Defendants therefore reserve the right to rely upon other unidentified portions of the prior art references and on other publications and expert testimony to provide context and to aid understanding and interpretation of the identified portions.

Defendants also reserve the right to rely upon other portions of the prior art references, other publications, and the testimony of experts to establish that the alleged inventions would have been obvious to a person of ordinary skill in the art, including the basis of modifying or combining

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certain cited references. To the extent any limitation is deemed not to be exactly met by an item of prior art, then any purported differences are such that the claimed subject matter as a whole would have been obvious to one skilled in the art at the time of the alleged invention, in view of the state of the art and knowledge of those skilled in the art. To the extent that an element of an Asserted Claim is not anticipated, the claim is rendered obvious by combination with one or more other prior art references identified in Appendix F.

B. Obviousness

As stated above, Defendants incorporate by reference all other invalidity contentions related to the Asserted Patents served on or otherwise provided to Plaintiff, whether past or in the future. In addition to certain claims being anticipated at least under Plaintiff's apparent claim constructions as indicated above, the Asserted Claims are also invalid as obvious over the same teachings identified for anticipation. Further, the Asserted Claims are obvious over various combinations of the references shown in the claim charts accompanying or incorporated by reference into this disclosure. No Asserted Claim goes beyond combining known elements to achieve predictable results or does more than choose between clear alternatives known to those of skill in the art. Thus, to the extent that an Asserted Claim is not anticipated, it is nevertheless invalid as obvious. Specifically, Defendants assert that any charted or incorporated reference in combination with one or more other charted or incorporated references renders the Asserted Claims obvious.

In *KSR International Co. v. Teleflex, Inc.*, the United States Supreme Court held that, among other things, "[t]he combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results." 550 U.S. 398, 416 (2007); *see also id.* at 417 ("[A] court must ask whether the improvement is more than the predictable use of

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prior art elements according to their established functions."). A patent is obvious where "the content of the prior art, the scope of the patent claim, and the level of ordinary skill are not in material dispute, and the obviousness of the claim is apparent in light of these factors." *Id.* at 427. The Supreme Court found that "if a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill." *Id.* at 417.

Moreover, the Supreme Court recognizes that market pressures will motivate a person of ordinary skill to survey known art for solutions to problems. *Id.* at 421 ("When there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill in the art has good reason to pursue the known options within his or her technical grasp."). When a person of ordinary skill uses an identified, predictable solution to solve a problem, "it is likely the product not of innovation but of ordinary skill and common sense." *Id.* In addition, when a work is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or a different one. *Id.* at 417. If a person of ordinary skill can implement a predictable variation, U.S.C. § 103 bars its patentability. *Id.*

"'[A]ny need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed.'" *Intel Corp. v. PACT XPP Schweiz AG,* 61 F.4th 1373, 1379 (Fed. Cir. 2023) (quoting *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 420 (2007)). "Additionally, 'universal' motivations known in a particular field to improve technology provide 'a motivation to combine prior art references ***even absent any hint of suggestion*** in the references themselves.'" *Id.* (quoting *Intel Corp. v. Qualcomm Inc.*, 21 F.4th 784, 797-99 (Fed. Cir. 2021)) (original emphasis). Thus, motivations to

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combine, as well as the general state of the art, may be found in a variety of places including, but not limited to, in the references defined above, and the specification of the Asserted Patents. For example, each piece of prior art relates to systems and methods for physiological monitoring devices / systems. A person of ordinary skill in the art at the time of the alleged invention would have been motivated to combine any one piece of identified prior art with any other identified piece of prior art. For at least this reason, it would have been obvious to a person of skill in the art at the time of the alleged invention of the Asserted Claims to combine the various references cited herein so as to practice the Asserted Claims and there is a motivation in the art to make such a combination. Further reasons to combine the references identified in these charts include the nature of the problem being solved, the express, implied, and/or inherent teachings of the prior art, the knowledge of persons of ordinary skill in the art, the fact that the prior art is generally directed towards methods and systems for physiological monitoring, that such combinations would have yielded predictable results, and that such combinations would have represented known alternatives to a person of ordinary skill in the art.

The law does not require evidence of a specific motivation to combine prior art where the combiation would yield expected results and at most simply represents a known alternative or design choice to one of skill in the art. *See Apple Inc. v. Samsung Elecs. Co*., 839 F.3d 1034, 1058 (Fed. Cir. 2016); *Intercontinental Great Brands LLC v. Kellogg N. Am. Co*., 869 F.3d 1336, 1344 (Fed. Cir. 2017); *KSR Int'l Co. v. Teleflex, Inc*., 127 S. Ct. 1727, 1739-40 (2007) (rejecting the Federal Circuit's "rigid" application of the teaching, suggestion, or motivation to combine test, and instead applying an "expansive and flexible" approach). Indeed, the Supreme Court held that a POSITA is "a person of ordinary creativity, not an automaton" and "in many cases a person of ordinary skill in the art will be able to fit the teachings of multiple patents together like pieces of

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a puzzle." *KSR*, 550 U.S. at 420-21.

Nevertheless, in addition to the information contained immediately above and elsewhere in these contentions, Defendants identify additional motivations and reasons to combine. For example, in addition to the specific motivations identified herein, motivation to modify a particular reference or to combine any two or more of the identified references comes from (a) the nature of the problem being solved, (b) the teachings of the prior art, (c) the knowledge of persons of ordinary skill in the art, (d) the fact that all of the references teach systems, apparatuses, and methods related to the subject matter and address the same technical issues described in the Asserted Patents, and (e) one would be motivated by considerations of efficiency, effectiveness, convenience, cost-savings, and accessibility, to combine the various teachings of the references. Additionally, one would be motivated to address the alleged problems or achieve the purported objectives identified in the Background sections of the Asserted Patents, of the references cited on the face of the Asserted Patents, and of the other references cited herein.

In sum, motivations to modify or combine the identified references including the references listed above can be found via, for example, discussions in the cited references, the state of the art discussed in the references, and the knowledge of one of ordinary skill in the art. One of ordinary skill in the art would have been motivated to combine these references, because these references relate to common objectives and subject matter. The references share commonalities in terms of their general subject matter as well as the types of equipment, products, systems, and/or methods used. Further, certain prior art references explicitly or implicitly reference other prior art references, share common authors or inventors, were published in the same journals, were compiled by a common author of a compilation or reference book, were presented at the same conferences, and/or were developed at common companies, schools, or organizations, which

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would motivate one of ordinary skill in the art to combine them. These references are within the field of the Asserted Patents and are directed to similar subject matter within the field. Additionally, the references, and any products, devices, or processes described in the references, existed and/or were invented in the same time period providing further motivation for combination. These disclosures were provided without prejudice to any arguments or objections concerning the relevance of motivation to combine in connection with any invalidity contentions.

Defendants reserve the right to further specify the motivations to combine the prior art in response to positions that Plaintiff may take later in this case and as discovery, including third party discovery, proceeds. Defendants may rely on any and all portions of the prior art, other documents, and expert testimony to establish that a person of ordinary skill in the art would have been motivated to modify or combine the prior art so as to render the claims invalid as obvious. Moreover, Defendants reserve the right to rely on later identified sources of information, including but not limited to witness testimony and other discovery, to establish the state of the art in the relevant time frame pertaining to the Asserted Patents.

Additionally, Defendants note that Plaintiff has neither provided any contention that secondary considerations of non-obviousness exist for any Asserted Patent nor provided any evidence of such secondary considerations. Defendants are not aware of any evidence supporting the existence of any such secondary considerations. This lack of evidence further renders the Asserted Claims obvious. Proving any such secondary considerations is Omni's burden. *See, e.g.*, *ZUP, LLC v. Nach Mfg., Inc.*, 896 F.3d 1365, 1373 (Fed. Cir. 2018) ("[A] patentee bears the burden of production with respect to evidence of secondary considerations of nonobviousness."). To the extent Omni is permitted to introduce contentions and/or evidence concerning secondary considerations in the future, Defendants reserve all rights to rebut those contentions if and when

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Omni identifies them. In the meantime, Defendants note the complete lack of any such evidence in the record. Moreover, Defendants further contend that, in any event, the evidence of obviousness for each asserted claim is so overwhelming that secondary considerations are necessarily insufficient to rebut Defendants' showing. *See, e.g.*, *Ohio Willow Wood Co. v. Alps South, LLC*, 735 F.3d 1333, 1344 (Fed. Cir. 2013) ("[W]here a claimed invention represents no more than the predictable use of prior art elements according to established functions, as here, evidence of secondary indicia are frequently deemed inadequate to establish non-obviousness.").

While Defendants reserve the right to rely on any combination of the references reflected in their charts or incorporated herein by reference, Defendants provide the following exemplary and non-exhaustive references and/or combinations evidencing invalidity of the claims of the Asserted Patents. The combinations of prior art listed below render obvious the Asserted Claims under the proper construction of the claims and/or under Plaintiff's apparent interpretation of the claims as set forth by Plaintiff in its Complaint and Infringement Contentions.

1. U.S. Patent No. 9,055,868

Pursuant to P.R. 3-3(a) and (b), Defendants identify in Appendix A the prior art references that render obvious the Asserted Claims of the '868 Patent and include below exemplary combinations showing the obviousness of the '868 Patent Asserted Claims in view of the prior art. To the extent Plaintiff contends that an element is not disclosed in any one of the anticipatory references described in Appendix A, the limitation would have been obvious in light of the disclosures within the reference and the knowledge of one of ordinary skill in the art at the time of the '868 Patent. Moreover, to the extent Plaintiff contends that an element is not disclosed in any one of the anticipatory references described in Appendix A, such reference may be combined with any other references listed in Appendix A for such element, thereby rendering the claims invalid for obviousness. To the extent a finder of fact determines that a limitation of any of the '868 Patent

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Asserted Claims is not disclosed by one of the references identified above pursuant to P.R. 3-3(a), the claim is nevertheless unpatentable as obvious because they contain nothing that constitutes a patentable innovation. To the extent a finder of fact determines that a limitation of the '868 Patent Asserted Claims is not anticipated, it does not go beyond combining familiar elements according to known methods to achieve predictable results or does more than choose between clear alternatives known to those of ordinary skill in the art.

a. Obviousness Rationale and Motivations to Combine

Obviousness: For at least the reasons described in these contentions, it would have been obvious to one of ordinary skill in the art to combine any of a number of prior art references, including any combination of those prior art references identified in Appendix A along with the knowledge of one of ordinary skill in the art to meet the limitations of the '868 Patent Asserted Claims. As a result, the references identified herein render one or more Asserted Claims of the '868 Patent obvious when the references are read in combination with each other, and/or when read in view of the state of the art and knowledge of those skilled in the art. Each and every reference identified is also relevant to the state of the art at the time of the alleged invention. Any of the references disclosed above may be combined with one another to render obvious (and therefore invalid) each of Omni's Asserted Claims. Defendants may rely upon a subset of the identified references or all of the references identified herein, including all references in Appendix A, for purposes of obviousness depending on the Court's claim construction, positions taken by Omni during this litigation, and further investigation and discovery.

Reservation of Rights: Moreover, as mentioned above, Defendants have not yet completed their search or discovery concerning additional prior art. As such, Defendants' inclusion of exemplary combinations does not preclude them from identifying other invalidating

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combinations as appropriate, and Defendants reserve the right to identify additional specific combinations as well as to detail and explain such combinations.

No More Than Ordinary Variations of Prior Art; No Unexpected Results: To the extent not anticipated, the '868 Patent Asserted Claims represent no more than the result of ordinary variations of the prior art. Defendants further believe that no showing of a specific motivation to combine prior art is required to combine the references disclosed above and in the attached charts, as each combination of art would have no unexpected results, and at most would simply represent a known alternative to one of ordinary skill in the art. *See KSR Int'l Co. v. Teleflex, Inc.*, 550 U.S. 398, 415-16 (2007) (rejecting the Federal Circuit's "rigid" application of the teaching, suggestion, or motivation to combine test, instead espousing an "expansive and flexible" approach); *Apple Inc. v. Samsung Elecs. Co.*, 839 F.3d 1034, 1058 (Fed. Cir. 2016); *Intercontinental Great Brands LLC v. Kellogg N. Am. Co.*, 869 F.3d 1336, 1344 (Fed. Cir. 2017). Indeed, the Supreme Court held that a person of ordinary skill in the art is "a person of ordinary creativity, not an automaton" and "in many cases a person of ordinary skill in the art will be able to fit the teachings of multiple patents together like pieces of a puzzle." *Id.* at 420-21. Nevertheless, in addition to the information contained elsewhere in these contentions, Defendants identify motivation and reason to combine the cited art.

Predictable Results; Obvious to Try: One or more combinations of the prior art references identified in Appendix A would have been obvious because these references would have been combined using: known methods to yield predictable results; known techniques in the same way; a simple substitution of one known, equivalent element for another to obtain predictable results; and/or a teaching, suggestion, or motivation in the prior art generally. In addition, it would have been obvious to try combining the prior art references identified above because there were

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only a finite number of predictable solutions and/or because known work in one field of endeavor prompted variations based on predictable design incentives and/or market forces either in the same field or a different one. Further, the combinations of the prior art references identified in Appendix A would have been obvious because the combinations represent known potential options with a reasonable expectation of success.

Interrelated Teachings: Additional evidence that there would have been a motivation to combine the prior art references identified above includes the interrelated teachings of multiple prior art references; common authorship; the effects of demands known to the design community or present in the marketplace; the existence of a known problem for which there was an obvious solution encompassed by the '868 Patent Asserted Claims; the existence of a known need or problem in the field of the endeavor at the time of the alleged invention(s); and the background knowledge that would have been possessed by a person having ordinary skill in the art.

Summary of Motivations to Combine: Thus, the motivation to combine the teachings of the prior art references disclosed in Appendix A is found in the references themselves and also in: (1) the nature of the problem being solved; (2) the express, implied and inherent teachings of the prior art; (3) the knowledge of persons of ordinary skill in the art; (4) the predictable results obtained in combining the different elements of the prior art; (5) the predictable results obtained in simple substitution of one known element for another; (6) the use of a known technique to improve similar devices, methods, or products in the same way; (7) the predictable results obtained in applying a known technique to a known device, method, or product ready for improvement; (8) the finite number of identified predictable solutions that had a reasonable expectation of success; and (9) known work in various technological fields that could be applied to the same or different technological fields based on design incentives or other market forces.

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Same Area of Technology: Additionally, it would be obvious to one of ordinary skill in the art to consult and/or combine any of the prior art listed in Appendix A because all of these references relate to the same area of technology and/or are from analogous art. The '868 Patent Asserted Claims are directed to a diagnostic system comprising a light source, a software application capable of operating on a control system, and a host. '868 Patent at Abstract. The '868 Patent Asserted Claims merely unite old elements, well known in the field, with no change in their respective function or result. Given the interrelated teachings of the prior art, the effects of demands known to the design community or present in the marketplace, and the background knowledge possessed by a person having ordinary skill in the art, it would have been obvious for one of ordinary skill in the art to combine these familiar elements, disclosed and/or embodied in the prior art listed above to practice the '868 Patent Asserted Claims.

Same Technical Issues: A person of ordinary skill would have been motivated to combine the above prior art based on his/her knowledge, the nature of the problem to be solved, and the teachings of the prior art. The identified prior art addresses the same or similar technical issues and suggests the same or similar solutions to those issues. Moreover, some of the prior art refer to or discuss other prior art, illustrating the close technical relationship among the prior art. For the '868 Patent, one of ordinary skill in the art would have been motivated to combine known prior art solutions described in these references relating to wirelessly collecting and processing physiological information using a light source and related features.

Demand and Market Forces: For example, market forces suggested a demand for wirelessly collecting and processing physiological information using a light source, and thus one of skill in the art would have thought to combine or modify references that described known methods that one of skill in the art would have recognized as offering improvements to solutions

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of that time.

Known Elements; Obvious to Try: Moreover, many of the claim elements were already known as admitted by the applicant in the patent specification. These elements represented design choices available to a person of ordinary skill. When there is a design need or market pressure to solve a problem such as identified previously and/or described in the '868 Patent, and there are a finite number of identified, predictable solutions, a person of ordinary skill would be motivated to combine the known options that are within his or her technical grasp. For the '868 Patent, there are a finite number of approaches for wirelessly collecting and processing physiological information using a light source. For example, as of the priority date of the '868 Patent, a POSITA would have been very familiar with basic elements of the '868 Patent's claims such as devices using light passing through a user's body, including blood, to measure physiological information; semiconductor diodes; software; the wireless transmission of data, including via mobile phones and the internet; tracking location of a remote device; differing inputs to a computing system, including voice commands, touchscreens, keypads, etc. Such elements were within the knowledge of a POSITA, whether or not disclosed in any particular reference, and the inclusion of such elements in the '868 Patent's claims does not render them novel or non-obvious.

There are significant similarities in subject matter and objectives for each of many references used in these contentions for the '868 Patent.

Wireless Physiological Monitoring References: For example, charted reference Mault, as well as numerous other references such as Kumar, Nihtila, Brown, and Quy all include teachings related to wirelessly collecting and analyzing physiological data, including data known to be collected using spectroscopy. These references provide numerous methods for collecting physiological data, as well as different methods for wirelessly transmitting and processing the data.

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For example, Mault teaches "a system embodiment comprising an electronic device 10, a blood glucose sensor 12, a physical activity monitor 14, an insulin pump 16, a communications network 20, and a remote computer system 22." Mault at [0069]. Mault further teaches that "[e]lectronic device 10 can be carried by the person, for example a portable computer, personal digital assistant (PDA), wireless phone with computational functionality, visor-mounted device, or other device" and "[s]ensor 12 can be carried by the person and provides blood glucose measurements at intervals." Mault at [0069]-[0070]. Mault teaches that "using a non-invasive spectroscopic technique, the PDA/module combination may be placed against part of the body to obtain a blood glucose reading." Mault at [0073]. Kumar teaches "system architecture 100 for network-based monitoring of data from a patient-side physiological collecting device . . . includ[ing] one or more patient-side devices 102 for collecting data from a patient/client, one or more provider-side devices 104, and an engine implemented on a central server 106." Kumar at [0067]. Kumar further teaches that "[t]he system may be adapted to include web-enabled spirometers and oximeters, allowing healthcare practitioners to perform remote spirometry and oximetry tests." Kumar at [0072]. Kumar also teaches that "[t]he patient-side device may then be connected via a computing device 110, such as a computer, handheld devices such as personal digital assistants (PDAs) and pocket PCs . . . ." Kumar at [0072]. Nihtila teaches "a system for acquiring physiological data from a user and communicating the physiological data via a mobile terminal to a network server for integration into a virtual physiological model established for the user in accordance with an embodiment of the present invention." Nihtila at [0035]. Nihtila further teaches that "[t]he physiological data communicated from the mobile terminal 122 to the network 124 is routed to a server 126 which is configured to accept and process this data. . . . and executes processing software that, in general, operates on the physiological data received from each of a number of users." Nihtila at [0038].

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Brown teaches "blood glucose monitor 16 operates in conjunction with data management unit 10 and handheld microprocessor unit 12 to: (a) perform a test or calibration sequence in which tests are performed to confirm that the system is operating properly; and, (b) perform the blood glucose test sequence in which blood glucose meter 16 senses the user's blood glucose level. Brown at 20:28-67. Brown further teaches that "each apparatus may be placed in communication with server 2018 via wireless communication networks, cellular networks, telephone networks, or any other network which allows each apparatus to exchange data with server 2018." Brown at 25:12-25. Quy is titled "Method and Apparatus for Health and Disease Management Combining Patient Data Monitoring with Wireless Internet Connectivity." Quy at Title. Quy teaches "[t]he system includes a wireless health-monitoring apparatus ('WHMA') 10 . . . [which] is linked in a wireless fashion to a wireless connection point of presence ("POP") 19, the same including at least a base station antenna 15 coupled to a server 17." Quy at 6:29-32. Quy teaches "[s]erver 17 is in turn connected to the wired, or even a wireless (not shown) Internet 21, which may include the World Wide Web." Quy at 6:33-35.

A person of skill in the art would understand that the functionality taught in these references could be added to other methods and systems that collect and transmit physiological data. These methods are known to be effective in collecting and transmitting data. Moreover, to the extent that any of these references includes a feature not expressly disclosed in one or more other references, a POSITA would have naturally looked to, and been motivated to combine, any one of these references with one or more of the other references in order to better achieve their common goals of collecting and transmitting physiological data.

Physiological Monitoring Using Spectroscopy References: For example, charted

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reference Mault, as well as numerous other references such as Jeng[8], Pologe, Shigeki, Kumar, Nihtila, Quy, Abreu, and Scharf. all include teachings related to physiological monitoring using spectroscopy. These references provide numerous methods for measuring physiological information, such as blood glucose levels and blood oxygenation, using measurements of light. For example, Mault teaches "sensor 12 may use spectroscopic detection of a glucose oxidase reaction . . . and may also use in-vivo spectroscopy techniques to measure blood glucose." Mault at [0073]. Jeng discloses "a method and apparatus for measuring the concentration of an analyte of interest, e.g. glucose, in blood non-invasively, i.e., without penetrating the skin or obtaining a biological sample from the body of a patient." Jeng at 4:28-39. Jeng further discloses that "[l]ight passing through the body part 'B' is transmitted through an aperture 49 and then through a lens system 50 to deliver light to a dispersive element 52." Jeng at 6:57-7:4. Pologe discloses "a system for performing photoplethysmographic measurements using wavelength division multiplexing." Pologe at 4:20-32. Pologe further discloses that "[t]he received light pulses may then be delivered back to the main test unit 12, via probe cable 16, where they are processed to determine the level of one or more blood analytes in the person's arterial blood." Pologe at 4:33-54. Shigeki discloses a "glucose sensor" that "measures the blood glucose concentration of blood flowing through the microvessels in the earlobe 4 of the human body." Shigeki at [0009]. Shigeki further discloses that "[t]he volume of blood flow is measured using the Doppler effect, so infrared light, which has good transmissibility through biological tissue, is used to minimize the attenuation of light reflected by hemoglobin." Shigeki at [0009]. Kumar discloses that "[t]he patient-side device is located with a patient and can be any device that gathers physiological data from the patient."

[8] Mault incorporates Jeng by reference (*see* Mault at [0011], [0073]), thus, references to Jeng should be understood to be references to Mault and/or Jeng.

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Kumar at [0071]. Kumar further discloses that "[t]he system may be adapted to include web-enabled spirometers and oximeters, allowing healthcare practitioners to perform remote spirometry and oximetry tests." Kumar at [0203]. Nihtila discloses "systems and methods for using mobile communication techniques to enhance an understanding of the physiological state of an individual based on physiological information acquired from the individual in real-time." Nihtila at [0024]. Nihtila firther discloses that "a physiological data acquisition system of the present invention can include a blood sensing device 211 . . . [which] can be used to measure a number of blood related parameters," including "oxygen saturation, oxygen consumption, blood chemistry, and blood pressure, for example." Nihtila at [0054]. Quy teaches "while various types of medical devices have been mentioned, numerous other types may also be used in the embodiments of the invention, including pulse oximeters, syringe drivers, infusion pumps, spirometers, ventilators, anesthesia monitors, and so on." Quy at 12:51-13:22. Abreu teaches "FIG. 100(C) shows a schematic block diagram of one preferred far-infrared spectroscopy measuring apparatus of the present invention." Abreu at [1159]. Abreu further teaches "[b]esides near-infrared spectroscopy, the present invention provides superior results and higher signal to noise ratio when using any other form of electromagnetic radiation such as for example mid-infrared radiation, radio wave impedance, photoacoustic spectroscopy, Raman spectroscopy, visible spectroscopy, ultraviolet spectroscopy, fluorescent spectroscopy, scattering spectroscopy, and optical rotation of polarized light as well as other techniques such as fluorescent (including Maillard reaction, light induced fluorescence, and induction of glucose fluorescence by ultraviolet light), colorimetric, refractive index, light reflection, thermal gradient, Attenuated Total Internal Reflection, molecular imprinting, and the like. Abreu at [0276]. Scharf teaches "[a] reflectance pulse oximeter that determines oxygen saturation of hemoglobin using two sources of electromagnetic radiation in the green optical

region, which provides the maximum reflectance pulsation spectrum." Scharf at Abstract. Scharf further teaches "[t]he oximeter 10 of the present invention comprises two emitters of green light 12, 14 that illuminate a volume of intravascular blood 4." Scharf at 4:8-22.

A person of skill in the art would understand that the functionality taught in these references could be added to other methods and systems that measure physiological information, such as blood glucose levels and blood oxygenation, using measurements of light. These methods use light to measure physiological information. Moreover, to the extent that any of these references includes a feature not expressly disclosed in one or more other references, a POSITA would have naturally looked to, and been motivated to combine, any one of these references with one or more of the other references in order to better achieve their common goals of measuring physiological information, such as blood glucose levels and blood oxygenation, using measurements of light.

Physiological Monitoring with Lenses References: For example, charted reference Jeng, as well as numerous other references such as Pologe, Shigeki, and Scharf all include teachings related to using light with lens systems to collect physiological data. These references provide numerous methods for collecting physiological data using spectroscopy, including using systems with lenses. For example, Jeng teaches that "[t]he body part, e.g., a finger, earlobe, is positioned at the place where the beam from the source of light is focused. Light passing through the body part is transmitted through an aperture 24 and then through a lens system 25 to deliver light to the detector 20." Jeng at 6:31-44. Jeng further discloses that "Light passing through the body part 'B' is transmitted through an aperture 49 and then through a lens system 50 to deliver light to a dispersive element 52." Jeng at 6:57-7:4. Pologue discloses that "the WDM coupler can include any of a number of coupler types, such as those using lenses, prisms, interference filters, diffraction gratings, or butt coupling." Pologe at 3:43-55. Shigeki discloses that "[t]he wavelength of the light

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outputted from the first semiconductor laser 1 is 1.55 μm, which is within the glucose absorption wavelength band." Shigeki at [0009]. Shigeki further discloses that the light "passes through the earlobe 4 and is received by the first photodetector 20." Shigeki at [0009]. Abreu teaches "[t]he light radiation 2302 can be directly emitted from a light source 2300 and directly collected by a photodetector 2318, or the light radiation 2302 can be delivered and collected using optic fiber cables." Abreu at [1086]. Abreu further teaches "[a]n interface lens system can be used to convert the rays to spatial parallel rays, such as from an incident divergent beam to a spatially parallel beam." Abreu at [1086]. Scharf teaches "[s]uitable optical filters include custom-made molded acrylic aspheric lens/filters having peak wavelengths of 560 nm and 580 nm, respectively, and which have bandwidths of less than 5 nm, which are available from Innovations In Optics, Inc., address 38 Montvale Avenue, Suite 215, Storeham, Mass. 02180, (716) 279-0806." Scharf at 4:22-37. Scharf further teaches "Although shown as flat surfaces, face pieces 16, 18, and 91 can alternatively be shaped to form discrete lenses (not shown) to focus the radiant energy from the LEDs 13a-13d and 15a-15d onto the skin 2 and into the blood 4 and from the skin 2 onto the photodiode 26, 62." Scharf at 8:59-65.

A person of skill in the art would understand that the functionality taught in these references could be added to other methods and systems that measure physiological information using light with a lens system. These methods use light with a lens system to measure physiological information. Moreover, to the extent that any of these references includes a feature not expressly disclosed in one or more other references, a POSITA would have naturally looked to, and been motivated to combine, any one of these references with one or more of the other references in order to better achieve their common goals of measuring physiological information using light with a lens system.

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Wavelength Division Multiplexing References: For example, charted reference Pologe, as well as numerous other references such as Jeng, Abreu, and Scharf all include teachings related to using wavelength division multiplexing to measure physiological information. These references provide numerous methods for using wavelength division multiplexing to measure physiological information, particularly relating to blood measurements. For example, Pologe teaches "the present invention relates to a system for performing photoplethysmographic measurements using wavelength division multiplexing." Pologe at 4:20-32. Pologe further discloses "the WDM coupler is capable of producing a wavelength multiplexed pulse on the single light guide that includes the spectral contents of all of the multiple light pulses. In this regard, the WDM coupler can include any of a number of coupler types, such as those using lenses, prisms, interference filters, diffraction gratings, or butt coupling. In addition, active WDM couplers can also be used." Pologe at 3:43-55. Jeng discloses that "[t]he band-pass filter set 14 selects one desired wavelength at a time by rotating the set to place a given filter in the path of the beam." Jeng at 6:11-30. Jeng further discloses that "[a] lens system 47 is used to focus the light from the beam splitter onto the detector 48." Jeng at 6:45-56. Jeng discloses that "[l]ight passing through the body part 'B' is transmitted through an aperture 49 and then through a lens system 50 to deliver light to a dispersive element 52." Jeng at 6:57-7:4. Abreu teaches "[a] variety of radiation sources 2300 can be used in the present invention including LEDs with or without a spectral filter, a variety of lasers including diode lasers, halogen lights and white light sources having maximum output power in the near infrared region with or without a filter, and the like . . . ." Abreu at [1085]. Abreu further teaches "[t]he contact device filter system allowed passage of the glucose band which is used as a reference measuring point while simultaneously measuring thermal energy absorption outside the glucose band." Abreu at [1166]. Scharf teaches "[d]epending on the particular green light sources chosen, green optical

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filters 16, 18 might be needed. For example, if the Toshiba Ltd. part nos. TLGA183P and TLPGA-183P are used as green LEDs 13, 15 then narrow-band optical filters 16, 18 need to be used." Scharf at 4:22-37.

A person of skill in the art would understand that the functionality taught in these references could be added to other methods and systems that use wavelength division multiplexing to measure physiological information. These methods use principles of wavelength division multiplexing to measure physiological information. Moreover, to the extent that any of these references includes a feature not expressly disclosed in one or more other references, a POSITA would have naturally looked to, and been motivated to combine, any one of these references with one or more of the other references in order to better achieve their common goals of using wavelength division multiplexing to measure physiological information.

Semiconductor Diode References: For example, charted reference Jeng, as well as numerous other references such as Pologe, Shigeki, Abreu, and Scharf all include teachings related to using semiconductor diodes to measure physiological information. These references provide numerous methods for using semiconductor diodes to measure physiological information, particularly information related to a subject's blood. For example, Jeng teaches that "[t]he light sources are either laser diodes or light emitting diodes." Jeng at 15:1-27. Pologe teaches that "[t]he plurality of separate emitters includes multiple separate light sources, such as light emitting diodes (LEDs) and laser diodes." Pologe at 3:1-17. Shigeki teaches that "[t]he wavelength of the light outputted from the first semiconductor laser 1 is 1.55 μm, which is within the glucose absorption wavelength band" Shigeki at [0009]. Abreu teaches "[a] variety of radiation sources 2300 can be used in the present invention including LEDs with or without a spectral filter, a variety of lasers including diode lasers, halogen lights and white light sources having maximum output power in

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the near infrared region with or without a filter, and the like . . . ." Abreu at [1085]. Scharf teaches "The green light sources 12, 14 are shown schematically as including light emitting diodes (LEDs) 13, 15 in FIG. 1; however, other green light sources can be used, such as laser diodes, filtered white light sources, filtered broad-band LEDs, etc. Suitable LEDs 13, 15 include part. nos. TLGA-183P (peak wavelength 574 nm) and TLPGA-183P (peak wavelength 562 nm) from Toshiba Ltd. through various sources, such as Marktech International, 5 Hemlock Street, Latham, N.Y. 12110, (518) 786-6591." Scharf at 4:8-22.

A person of skill in the art would understand that the functionality taught in these references could be added to other methods and systems that use semiconductor diodes to measure physiological information. These methods use semiconductor diodes to measure physiological information. Moreover, to the extent that any of these references includes a feature not expressly disclosed in one or more other references, a POSITA would have naturally looked to, and been motivated to combine, any one of these references with one or more of the other references in order to better achieve their common goals of measuring physiological information.

Software Application References: For example, charted reference Mault, as well as numerous other references such as Jeng, Pologe, Shigeki, Kumar, Nihtila, Brown, Quy, Abreu, and Scharf all include teachings related to using software to analyze the collected physiological data. These references provide numerous methods for using software to analyze the collected physiological data, including generating a status of a user based on the physiological data. For example, Mault teaches that "FIG. 19 shows a flowchart representing a software program running on a computing device." Mault at [0187]. Mault further teaches that "Box 516 corresponds to performing a blood test at intervals, and providing the data to a glycemic response algorithm." Mault at [0187]. Mault teaches that "[t]he PDA has a software program, such as a calorie

management program, having a glycemic response algorithm for the subject." Mault at [0109]. Jeng teaches that "[t]he computer controls the software operation for collecting data and storing measurement readings as a data file." Jeng at 6:31-44. Pologe teaches that "The received light pulses may then be delivered back to the main test unit 12, via probe cable 16, where they are processed to determine the level of one or more blood analytes in the person's arterial blood." Pologe at 4:33-54. Pologe further teaches that "[p]rocessing methods to determine the blood analyte levels are known and, therefore, will not be discussed further." Pologe at 4:33-54. Shigeki teaches that "[i]n the arithmetic control circuit 8, calculations are performed to calculate the amount of glucose using the relationship between glucose concentration values previously written to the EEPROM and the photodetector output values, and the relationship between glucose solution temperatures and the photodetector output values." Shigeki at [0012]. Kumar teaches that "[t]he present invention may be implemented on a program or code that can be stored in a computer-readable (or electronically-readable) medium." Kumar at [0087]. Kumar further teaches that "[t]he data interpretation and analysis module 114 is used to interpret the data stream from the client-side device, perform mathematical analysis on the data using FFT, DFT, etc., and generate statistics." Kumar at [0075]. Nihtila teaches that "The processing software integrates currently or recently acquired physiological data into the user's virtual physiological model (i.e., avatar)." Nihtila at [0038]. Nihtila further teaches that "The processing software further computes fitness data (FD) of various types, including, textual, graphical, animation, audio, video, or other form of fitness data." Nihtila at [0040]. Brown teaches that "[w]hen inserted in the handheld microprocessor unit, the program cartridge provides the software necessary (program instructions) to program the handheld microprocessor unit for operation with the microprocessor-based data management unit." Brown at 6:18-45. Brown further teaches that "Remotely Programmable

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Patient Apparatus 320 comprises a Patient Interaction Unit 322, which is connected through a patient communication network 324 to a Patient Data Management Unit 326." Brown at 35:50-36:8. Quy teaches "[a]pplication 62 may include an algorithm 63 for analyzing data from the HMD, and either application 62 or algorithm 63 may optionally access data from an external data source 74 and may further consult an artificial intelligence system 76." Quy at 8:9-14. Quy further teaches "wireless application 70 may correspondingly send a large amount of health data to server application 62." Quy at 8:47-62. Abreu teaches "[s]uitable analyzers include modified Fourier Transform Infrared (FTIR) spectrometers with chemometric software packages. Those are available from the PerkinElmer Corporation (Wellesley, Mass.) and Thermo Nicolet Company (Madison, Wis.)." Abreu at [1103]. Abreu further teaches "[p]rocessor 2324 can contain or be connected to a memory unit 2326 which can store data related to calibration, patient's measurement data, reference data, suitable algorithms, and the like." Abreu at [1083]. Scharf teaches "[a] reflectance pulse oximeter that determines oxygen saturation of hemoglobin using two sources of electromagnetic radiation in the green optical region, which provides the maximum reflectance pulsation spectrum." Scharf at Abstract. Scharf further teaches "the processor 30 collects data in the form of a digitized signal, calculates a coefficient for the oxygen saturation value from the digitized signal, determines the final saturation value by reading the saturation value for the calculated coefficient from a look-up table stored in memory, and then causes the display(s) 38, 40 to display a visual image corresponding to the final saturation value or other oximetry data." Scharf at 11:5-14.

A person of skill in the art would understand that the functionality taught in these references could be added to other methods and systems that use software to analyze the collected physiological data. These methods use software to analyze the collected physiological data,

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including generating a status of a user based on the physiological data. Moreover, to the extent that any of these references includes a feature not expressly disclosed in one or more other references, a POSITA would have naturally looked to, and been motivated to combine, any one of these references with one or more of the other references in order to better achieve their common goals of using software to analyze the collected physiological data.

Touch Screen, Voice, and Manual Inputs References: For example, charted reference Mault as well as numerous other references such as Pologe, Kumar, Nihtila, Brown, and Quy all include teachings related to receiving touch screen, voice, or manual input to the system for measuring physiological data. These references provide numerous methods for receiving various inputs to systems that measure physiological data. For example, Mault teaches that "Other data entry mechanisms can be used, such as a stylus, touch pad, tracker device, biofeedback system, roller-jog dial, voice recognition, and the like." Mault at [0109]. Mault also teaches that "[t]he computer [which can be a PDA] can have a display, a microprocessor, memory (in the form of RAM, ROM, and a data storage device), and data entry mechanisms such as a keyboard, buttons, stylus, voice entry, roller-jog dial, track ball, finger tracking device, and the like." Mault at [0121]. Pologe discloses that "[t]he main test unit 12 includes: . . . and an input device 34, such as a keypad or a touch screen, for allowing the user to input commands and other information to the processor unit 28." Pologe at 4:63, 5:9. Kumar teaches that "the system allows for the real-time streaming of raw, interpreted, and processed physiological data as well as textual/audio/video data from a patient/client to a health care provider." Kumar at [0010]. Nihtila teaches that "the user can input weight, height, age, gender, and other physical and personal information to the user's virtual physiological model via the mobile terminal's user interface 216." Nihtila at [0046]. Brown teaches that "the user input buttons may be replaced by switches, keys, a touch sensitive display screen, or

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any other data input device." Brown at 26:1-8. Brown further teaches "the patient interaction unit is a palm-top computer, the display means being provided by a display screen of the palm top computer, and the patient interaction unit input device is a palm-top computer input device such as a touch screen." Brown at claim 2. Brown teaches "the user interface includes a speech synthesizer for audibly communicating the queries and a speech recognizer for receiving spoken responses to the queries." Brown at 9:47-52. Quy teaches "[t]he deployment of voice processing technology may be used to enable an even more convenient user interface: i.e., one to which patients can talk." Quy at 4:62-65. Quy further teaches "[t]hese applications may accept as inputs data from a sensor 24 as well as from a manual input 36." Quy at 7:61-8:8.

A person of skill in the art would understand that the functionality taught in these references could be added to other methods and systems that receiving touch screen, voice, or manual input to the system for measuring physiological data. These methods allow the systems to receive touch screen, voice, or manual input to the system. Moreover, to the extent that any of these references includes a feature not expressly disclosed in one or more other references, a POSITA would have naturally looked to, and been motivated to combine, any one of these references with one or more of the other references in order to better achieve their common goals of receiving touch screen, voice, or manual input to the system for measuring physiological data.

Remote Server with Storage References: For example, charted reference Mault as well as numerous other references such as Kumar, Nihtila, Brown, Quy, Abreu, and Scharf all include teachings related to using remote systems, such as servers, to store and/or process physiological information. These references provide numerous methods for using remote systems, such as servers, to store and/or process physiological information. For example, Mault teaches "[t]he portable computing device 30 is in linked to a communications network 52, allowing

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communication a remote computer system 54, which may be located at the person's home, doctor's office, or other remote location." Mault at [0079]. Mault teaches that "[a] remote server system 56 is also accessible through the communications network 52, and can be used to store a database of physiological parameters, activity, and diet relating to the person, for medical, nutritional, or computer expert system analysis." Mault at [0079]. Mault teaches that "[a] global positioning system (GPS) may also be added to the PDA, to facilitate medical rescue in an emergency." Mault at [0077]. Kumar teaches "the system includes one or more patient-side devices 102 for collecting data from a patient/client, one or more provider-side devices 104, and an engine implemented on a central server 106." Kumar at [0067]. Kumar teaches "the data may be stored in a secured storage device at the central server for later access, replay, and/or analysis." Kumar at [0083]. Nihtila teaches that "there is illustrated a system for acquiring physiological data from a user and communicating the physiological data via a mobile terminal to a network server for integration into a virtual physiological model established for the user in accordance with an embodiment of the present invention." Nihtila at [0035]. Nihtila teaches "the mobile terminal 122 operates effectively as a modem to facilitated the transfer of acquired physiological data between the physiological sensor device, mobile terminal 122, network 124, and server 126 in real-time." Nihtila at [0044]. Brown teaches "[m]onitoring application 2048 is a controlling software application executed by server 2018 to perform the various functions described below." Brown at 27:11-14. Quy teaches "[s]erver 22 has a base server application 62 with which the same calculates or provides a response based at least in part on data from WHMA 10." Quy at 8:9-14. Quy further teaches "[i]t should also be noted that each of application 62, algorithm 63, external data source 74, or AI system 76, may physically reside on more than one server, e.g., on an array of servers for, e.g., storage or multiple processing purposes." Quy at 8:40-46. Abreu teaches "[t]he signal can

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be communicated by wires or radio telemetered to an externally placed receiver. The signal can then be processed, analyzed and stored." Abreu at Abstract; *see also* Abreu at [0099]. Scharf teaches "[t]he processor 30 and the remote display 40 are placed in circuit communication via a transmitter 42 and receiver 44." Scharf at 7:48-67. Scharf further teaches "the processor 30 is also in circuit communication with a remote display 40 to display a second visual image corresponding to the oximetry data." Scharf at 7:38-47.

A person of skill in the art would understand that the functionality taught in these references could be added to other methods and systems that use remote systems, such as servers, to store and/or process physiological information. These methods use remote systems, such as servers, to store and/or process physiological information Moreover, to the extent that any of these references includes a feature not expressly disclosed in one or more other references, a POSITA would have naturally looked to, and been motivated to combine, any one of these references with one or more of the other references in order to better achieve their common goals of using remote systems, such as servers, to store and/or process physiological information.

b. Combinations

For at least the reasons described above, it would have been obvious to one of ordinary skill in the art to combine each prior art reference listed in Appendix A with any other reference or references listed in Appendix A along with the knowledge of one of ordinary skill in the art to arrive at the inventions claims in the '868 Patent.

For example, and without limitation, the Asserted Claims of the '868 Patent would have been obvious to one of ordinary skill in the art in view of the following combinations:

(i) <u>Mault Combined with Jeng, Pologe, Shigeki, Abreu and/or Scharf</u>

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A POSITA would have had reason to combine Mault with any one of Jeng, Pologe, Shigeki, Abreu and/or Scharf all of which relate to systems and methods for obtaining physiological measurements of a user. Each of Mault, Jeng, Pologe, Shigeki, Abreu, and Scharf relate to obtaining physiological measurements of a user, including blood measurements obtained by using light. Indeed, such components and/or processes were conventional as of the time these references were known. Each of Jeng, Pologe, Shigeki, Abreu, and Scharf provide means—not necessarily expressly present in all other references—for measuring physiological data of a user using light. A POSITA would have understood that the systems and methods for Jeng, Pologe, Shigeki, Abreu, and Scharf were intended to be incorporated into wearable measurement devices. A POSITA would understand that systems and methods for Jeng, Pologe, Shigeki, Abreu, and Scharf provide improvements such as advances in measuring physiological data of a user using light. A POSITA would further understand that in order to implement a wearable measurement device, the systems and methods for measuring physiological data of a user using light would commonly be combined with a wireless, wearable system, and thus a POSITA would have been motivated to combine the teachings of these references. The combination would apply known techniques for measuring physiological data of a user using light, to wearable measurement devices that were ready for improvement, in order to yield predictable results. The combination would further be "obvious to try," because it would involve simple design choices from a finite number of identified, predictable solutions, with a reasonable expectation of success.

(ii) Kumar Combined with Jeng, Pologe, Shigeki, Abreu, and/or Scharf

A POSITA would have had reason to combine Kumar with any one of Jeng, Pologe, Shigeki, Abreu and/or Scharf all of which relate to systems and methods for obtaining

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physiological measurements of a user. Each of Kumar, Jeng, Pologe, Shigeki, Abreu, and Scharf relate to obtaining physiological measurements of a user, including blood measurements obtained by using light. Indeed, such components and/or processes were conventional as of the time these references were known. Each of Jeng, Pologe, Shigeki, Abreu, and Scharf provide means—not necessarily expressly present in all other references—for measuring physiological data of a user using light. A POSITA would have understood that the systems and methods for Jeng, Pologe, Shigeki, Abreu, and Scharf were intended to be incorporated into wearable measurement devices. A POSITA would understand that systems and methods for Jeng, Pologe, Shigeki, Abreu, and Scharf provide improvements such as advances in measuring physiological data of a user using light. A POSITA would further understand that in order to implement a wearable measurement device, the systems and methods for measuring physiological data of a user using light would commonly be combined with a wireless, wearable system, and thus a POSITA would have been motivated to combine the teachings of these references. The combination would apply known techniques for measuring physiological data of a user using light, to wearable measurement devices that were ready for improvement, in order to yield predictable results. The combination would further be "obvious to try," because it would involve simple design choices from a finite number of identified, predictable solutions, with a reasonable expectation of success.

(iii) Nihtila Combined with Jeng, Pologe, Shigeki, Abreu, and/or Scharf

A POSITA would have had reason to combine Nihtila with any one of Jeng, Pologe, Shigeki, Abreu and/or Scharf all of which relate to systems and methods for obtaining physiological measurements of a user. Each of Nihtila, Jeng, Pologe, Shigeki, Abreu, and Scharf relate to obtaining physiological measurements of a user, including blood measurements

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obtained by using light. Indeed, such components and/or processes were conventional as of the time these references were known. Each of Jeng, Pologe, Shigeki, Abreu, and Scharf provide means—not necessarily expressly present in all other references—for measuring physiological data of a user using light. A POSITA would have understood that the systems and methods for Jeng, Pologe, Shigeki, Abreu, and Scharf were intended to be incorporated into wearable measurement devices. A POSITA would understand that systems and methods for Jeng, Pologe, Shigeki, Abreu, and Scharf provide improvements such as advances in measuring physiological data of a user using light. A POSITA would further understand that in order to implement a wearable measurement device, the systems and methods for measuring physiological data of a user using light would commonly be combined with a wireless, wearable system, and thus a POSITA would have been motivated to combine the teachings of these references. The combination would apply known techniques for measuring physiological data of a user using light, to wearable measurement devices that were ready for improvement, in order to yield predictable results. The combination would further be "obvious to try," because it would involve simple design choices from a finite number of identified, predictable solutions, with a reasonable expectation of success.

(iv) Mault, Kumar, Nihtila, Brown, and/or Quy, Combined with any of the References Disclosing Remaining Features

A POSITA would have had reason to combine references Mault, Kumar, Nihtila, Brown, and/or Quy with any one of the references disclosing physiological monitoring using spectroscopy; physiological monitoring with lenses; wavelength division multiplexing; the use of semiconductor diodes; software applications; touch screen, voice, and manual inputs; and remote servers with storage (collectively, the "remaining features") all of which relate to systems and methods for obtaining physiological measurements of a user, including blood measurements.

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Each of the references teaching the remaining features relate to obtaining physiological measurements of a user, including blood measurements, using light. Indeed, such components and/or processes were conventional as of the time these references were known. Each of the references teaching the remaining features provide means—not necessarily expressly present in all other references—for obtaining physiological measurements of a user, including blood measurements, using light. A POSITA would have understood that the systems and methods for the references teaching the remaining features were intended to be incorporated into wearable measurement devices. A POSITA would understand that systems and methods for the references teaching the remaining features provide improvements such as specific methods and systems for obtaining physiological measurements using light. A POSITA would further understand that in order to implement a wearable measurement device, the systems and methods for a wireless system for collecting and processing physiological data would commonly be combined with obtaining physiological measurements (for example, blood glucose levels and blood oxygenation) using light, and thus a POSITA would have been motivated to combine the teachings of these references. Two non-limiting examples of such combinations, which are provided for illustrative purposes only, include Brown in view of Jeng, Pologe, Shigeki, Abreu, and/or Scharf and Quy in view of Jeng, Pologe, Shigeki, Abreu, and/or Scharf. The combinations would apply known techniques for obtaining physiological measurements using light, to wearable measurement devices that were ready for improvement, in order to yield predictable results. The combinations would further be "obvious to try," because they would involve simple design choices from a finite number of identified, predictable solutions, with a reasonable expectation of success.

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Furthermore, to the extent any limitation of an Asserted Claim is deemed not to be exactly disclosed by an item of prior art, then the claim is rendered obvious by combination of the prior art in Exhibits A1 through A10 standing alone, in combination with the reference(s) in any other claim chart, in combination with any system art identified in Table 2-A, in combination with Applicant's Admitted Prior Art, in view of the knowledge of a person of ordinary skill in the art, and/or in view of the wireless physiological monitoring references; the physiological monitoring using spectroscopy references; the physiological monitoring with lenses references; the wavelength division multiplexing references; the semiconductor diode references; the software application references; the touch screen, voice, and manual inputs references; the remote server with storage references, for the reasons discussed above.

2. U.S. Patent No. 9,651,533

Pursuant to P.R. 3-3(a) and (b), Defendants identify in Appendix B the prior art references that render obvious the Asserted Claims of the '533 Patent and include below exemplary combinations showing the obviousness of the '533 Patent Asserted Claims in view of the prior art. To the extent Plaintiff contends that an element is not disclosed in any one of the anticipatory references described in Appendix B, the limitation would have been obvious in light of the disclosures within the reference and the knowledge of one of ordinary skill in the art at the time of the '533 Patent. Moreover, to the extent Plaintiff contends that an element is not disclosed in any one of the anticipatory references described in Appendix B, such reference may be combined with any other references listed in Appendix B for such element, thereby rendering the claims invalid for obviousness. To the extent a finder of fact determines that a limitation of any of the '533 Patent Asserted Claims is not disclosed by one of the references identified above pursuant to P.R. 3-3(a), the claim is nevertheless unpatentable as obvious because they contain nothing that constitutes a patentable innovation. To the extent a finder of fact determines that a limitation of the '533 Patent

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Asserted Claims is not anticipated, it does not go beyond combining familiar elements according to known methods to achieve predictable results or does more than choose between clear alternatives known to those of ordinary skill in the art.

a. Obviousness Rationale and Motivations to Combine

Obviousness: For at least the reasons described in these contentions, it would have been obvious to one of ordinary skill in the art to combine any of a number of prior art references, including any combination of those prior art references identified in Appendix B along with the knowledge of one of ordinary skill in the art to meet the limitations of the '533 Patent Asserted Claims. As a result, the references identified herein render one or more Asserted Claims of the '533 Patent obvious when the references are read in combination with each other, and/or when read in view of the state of the art and knowledge of those skilled in the art. Each and every reference identified is also relevant to the state of the art at the time of the alleged invention. Any of the references disclosed above may be combined with one another to render obvious (and therefore invalid) each of Omni's Asserted Claims. Defendants may rely upon a subset of the identified references or all of the references identified herein, including all references in Appendix B, for purposes of obviousness depending on the Court's claim construction, positions taken by Omni during this litigation, and further investigation and discovery.

Reservation of Rights: Moreover, as mentioned above, Defendants have not yet completed their search or discovery concerning additional prior art. As such, Defendants' inclusion of exemplary combinations does not preclude them from identifying other invalidating combinations as appropriate, and Defendants reserve the right to identify additional specific combinations as well as to detail and explain such combinations.

No More Than Ordinary Variations of Prior Art; No Unexpected Results: To the

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extent not anticipated, the ’533 Patent Asserted Claims represent no more than the result of ordinary variations of the prior art. Defendants further believe that no showing of a specific motivation to combine prior art is required to combine the references disclosed above and in the attached charts, as each combination of art would have no unexpected results, and at most would simply represent a known alternative to one of ordinary skill in the art. *See KSR Int’l Co. v. Teleflex, Inc.*, 550 U.S. 398, 415-16 (2007) (rejecting the Federal Circuit’s “rigid” application of the teaching, suggestion, or motivation to combine test, instead espousing an “expansive and flexible” approach); *Apple Inc. v. Samsung Elecs. Co*., 839 F.3d 1034, 1058 (Fed. Cir. 2016); *Intercontinental Great Brands LLC v. Kellogg N. Am. Co*., 869 F.3d 1336, 1344 (Fed. Cir. 2017). Indeed, the Supreme Court held that a person of ordinary skill in the art is “a person of ordinary creativity, not an automaton” and “in many cases a person of ordinary skill in the art will be able to fit the teachings of multiple patents together like pieces of a puzzle.” *Id.* at 420-21. Nevertheless, in addition to the information contained elsewhere in these contentions, Defendants identify motivation and reason to combine the cited art.

Predictable Results; Obvious to Try: One or more combinations of the prior art references identified in Appendix B would have been obvious because these references would have been combined using: known methods to yield predictable results; known techniques in the same way; a simple substitution of one known, equivalent element for another to obtain predictable results; and/or a teaching, suggestion, or motivation in the prior art generally. In addition, it would have been obvious to try combining the prior art references identified above because there were only a finite number of predictable solutions and/or because known work in one field of endeavor prompted variations based on predictable design incentives and/or market forces either in the same field or a different one. Further, the combinations of the prior art references identified in Appendix

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B would have been obvious because the combinations represent known potential options with a reasonable expectation of success.

Interrelated Teachings: Additional evidence that there would have been a motivation to combine the prior art references identified above includes the interrelated teachings of multiple prior art references; common authorship; the effects of demands known to the design community or present in the marketplace; the existence of a known problem for which there was an obvious solution encompassed by the '533 Patent Asserted Claims; the existence of a known need or problem in the field of the endeavor at the time of the alleged invention(s); and the background knowledge that would have been possessed by a person having ordinary skill in the art.

Summary of Motivations to Combine: Thus, the motivation to combine the teachings of the prior art references disclosed in Appendix B is found in the references themselves and also in: (1) the nature of the problem being solved; (2) the express, implied and inherent teachings of the prior art; (3) the knowledge of persons of ordinary skill in the art; (4) the predictable results obtained in combining the different elements of the prior art; (5) the predictable results obtained in simple substitution of one known element for another; (6) the use of a known technique to improve similar devices, methods, or products in the same way; (7) the predictable results obtained in applying a known technique to a known device, method, or product ready for improvement; (8) the finite number of identified predictable solutions that had a reasonable expectation of success; and (9) known work in various technological fields that could be applied to the same or different technological fields based on design incentives or other market forces.

Same Area of Technology: Additionally, it would be obvious to one of ordinary skill in the art to consult and/or combine any of the prior art listed in Appendix B because all of these references relate to the same area of technology and/or are from analogous art. The '533 Patent

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Asserted Claims are directed to an optical measurement system with a personal device and a remote device. '533 Patent at Claim 5. The '533 Patent Asserted Claims merely unite old elements, well known in the field, with no change in their respective function or result. Given the interrelated teachings of the prior art, the effects of demands known to the design community or present in the marketplace, and the background knowledge possessed by a person having ordinary skill in the art, it would have been obvious for one of ordinary skill in the art to combine these familiar elements, disclosed and/or embodied in the prior art listed above to practice the '533 Patent Asserted Claims.

Same Technical Issues: A person of ordinary skill would have been motivated to combine the above prior art based on his/her knowledge, the nature of the problem to be solved, and the teachings of the prior art. The identified prior art addresses the same or similar technical issues and suggests the same or similar solutions to those issues. Moreover, some of the prior art refer to or discuss other prior art, illustrating the close technical relationship among the prior art. For the '533 Patent, one of ordinary skill in the art would have been motivated to combine known prior art solutions described in these references concerning features related to known techniques for increasing the signal-to-noise ratio and known components and functionalities of personal devices and remote devices.

Demand and Market Forces: For example, market forces suggested a demand for improving signal-to-noise ratio and wirelessly transmitting information from optical measurement systems to devices such as personal devices and remote devices, and thus one of skill in the art would have thought to combine or modify references that described known methods that one of skill in the art would have recognized as offering improvements to solutions of that time.

Known Elements; Obvious to Try: Moreover, many of the claim elements were already

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known as admitted by the applicant in the patent specification. These elements represented design choices available to a person of ordinary skill. When there is a design need or market pressure to solve a problem such as identified previously and/or described in the ’533 Patent, and there are a finite number of identified, predictable solutions, a person of ordinary skill would be motivated to combine the known options that are within his or her technical grasp. For the ’533 Patent, there are a finite number of approaches for increasing signal-to-noise ratio and communicating information to other devices. For example, as of the priority date of the ’533 Patent, a POSITA would have been very familiar with basic elements of the ’533 Patent’s claims such as increasing a light intensity, increasing a pulse rate, using a plurality of lenses to direct an output optical beam, and communicating information with a personal device and a remote device. Such elements were within the knowledge of a POSITA, whether or not disclosed in any particular reference, and the inclusion of such elements in the ’533 Patent’s claims does not render them novel or non-obvious.

There are significant similarities in subject matter and objectives for each of many references used in these contentions for the ’533 Patent.

References disclosing techniques for increasing signal-to-noise ratio: For example, charted reference Basu, as well as numerous other references such as Lisogurski, Carlson, LeBoeuf, and Park all include teachings related to increasing the signal-to-noise ratio of optical measurement systems by increasing a light intensity and increasing a pulse rate of an LED. These references provide numerous methods for increasing a light intensity and increasing a pulse rate of an LED. For example, Basu teaches that “[t]o maximize the signal-to-noise ratio in photoplethysmography, the LED intensity should be made as large as possible without saturating the detector. In the OPS 10, the LED intensity and modulation frequencies are programmable through the serial interface. In the case of the Vishay VCNL4000, the intensity is programmable

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from 10-200 mA in 10 mA increments." Basu at [0048]. Lisogurski teaches "that modulation of the light drive signal . . . may include modulation of parameters including drive current or light brightness, duty cycle, firing rate, modulation parameters, other suitable parameters, or any combination thereof" and that "[t]he system may increase the brightness of the light sources in response to the noise to improve the signal-to-noise ratio." Lisogurski at 27:44-55, 9:46-60. Carlson teaches that the "frequency is chosen in such a way that it is outside the frequency spectrum of sunlight and of ambient light which, according to FIG. 7 b, is in the range of above approximately 1000 Hz. Thus, the pulsoximeter signals are readily discriminated from electronic and parasitic contributions of environmental optical radiation outside the frequency fc+/−5 Hz increasing significantly the Signal-to-Noise and Signal-to-Background ratio." Carlson at [0069]. LeBoeuf teaches that "the intensity of the optical emitter 102 may be increased to increase the ratio of physiological optical scatter 111 from blood vessels with respect to unwanted sunlight" and that "it is important to consider the emitter pulsing frequency and sampling approach" because "choosing a frequency that is too low may result in unsatisfactory subtraction." LeBoeuf at [0123], [0139]. Park teaches that "the light source intensity may be increased to maintain the output signal from the light detector within a desired range of output values." Park at 16:8-20.

A person of skill in the art would understand that the functionality taught in these references could be added to other methods and systems that are concerned with improving signal-to-noise ratio in optical measurement systems. These methods are known to be effective in improving the signal-to-noise ratio for such systems, and merely modulate the functioning of the existing LEDs in each system. Moreover, to the extent that any of these references includes a feature not expressly disclosed in one or more other references, a POSITA would have naturally looked to, and been motivated to combine, any one of these references with one or more of the other

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references in order to better achieve their common goals of improving signal-to-noise ratio.

References disclosing lenses: For example, charted reference Basu, as well as numerous other references such as Carlson, LeBoeuf, Park, and Sakai all include teachings related to using a plurality of lenses configured to receive a portion of the output optical beam and to deliver an analysis output beam to a sample. These references provide numerous methods for using lenses to direct an optical output beam. For example, Basu teaches that "[e]ach of the LEDs is separated from the photo detector by an optical barrier." Basu at [0087]. Carlson teaches "a beam-shaping element, such as e.g. diffractive or refractive lenses, to direct the emitted optical radiation of, e.g., the LED light source into the human or animal tissue and the photon detecting element in order to increase the optical signal power, detected by the pulsoximeter sensor, and thus increasing the Signal/Noise—and signal/Background ratio" Carlson at [0014]. LeBoeuf teaches that "the at least one sensor module include a lens positioned above at least one of the optical emitter and filter. The lens may include respective first and second portions configured to matingly engage respective first and second apertures in the light-opaque material." LeBoeuf at [0022]. Park teaches that "the transmissive structures may employ a material and/or optical design to facilitate low light loss (for example, a lens) thereby improving SNR of the photo detector and/or reducing power consumption of the light emitter(s) and/or light detector(s)." Park at 11:32-57. Sakai teaches that "[i]nfrared light or green light is emitted to the human body via a light transmitting plate 2029." Sakai at 28:01-32.

A person of skill in the art would understand that the functionality taught in these references could be added to other methods and systems that are concerned with using lenses to direct an optical output beam. These methods are known to be effective in directing an optical output beam using known lens structures. Moreover, to the extent that any of these references includes a feature

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not expressly disclosed in one or more other references, a POSITA would have naturally looked to, and been motivated to combine, any one of these references with one or more of the other references in order to better achieve their common goals of directing an optical output beam.

References disclosing a personal device: For example, charted reference Basu, as well as numerous other references such as Addison, LeBoeuf, Park, and Kreger all include teachings related to a personal device. These references provide numerous methods for incorporating a personal device into an optical measurement system. For example, Basu teaches "a wireless ring which combines the sensor with a Bluetooth transmitter linked to an Android application running on the user's cell phone." Basu at [0057]. Addison teaches that "[o]utput 414 may be any suitable output device such as, for example, . . . one or more display devices (e.g., monitor, PDA, mobile phone, any other suitable display device, or any combination thereof), one or more audio devices, . . . or any combination thereof." Addison at [0069]. LeBoeuf teaches that "headsets configured to monitor an individual's physiology and/or environment may be wired to a device that stores and/or processes data or there may be a combination of wired and wireless communications." LeBoeuf at [0106]. Park teaches that a "secondary device may be equipped with a display to output data obtained by the secondary device or data transferred to it by the biometric monitoring device, the external service, or a combination of data from the biometric monitoring device, the secondary device, and/or the external service." Park at 9:17-40. Kreger teaches "sensor data and measurements may be transmitted to remote medical personnel, internet servers, and others using WiFi transceiver 68, Bluetooth transceiver 72 or other RF transmitter such as for a cellular phone network. As well, the signals and measurements on the mobile 12 may be transferred via a cable connected to USB connector 28 c or docking connector 28 b to another computer storage device, over a computer network, to a personal computer, and so forth." Kreger at 7:39-46.

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A person of skill in the art would understand that the functionality taught in these references could be added to other methods and systems that are concerned with incorporating a personal device into optical measurement systems. These methods are known to be effective in incorporating a personal device into such systems. Moreover, to the extent that any of these references includes a feature not expressly disclosed in one or more other references, a POSITA would have naturally looked to, and been motivated to combine, any one of these references with one or more of the other references in order to better achieve their common goals of communicating with a personal device.

References disclosing a remote device: For example, charted reference Basu, as well as numerous other references such as Addison, LeBoeuf, Park, and Kreger all include teachings related to a remote device. These references provide numerous methods for incorporating a remote device into an optical measurement system. For example, Basu teaches that "[a] 'cloud-based' RPM infrastructure can actively manage cardiovascular health (Fig. 1). Using OPS technology, cardiovascular parameters can be monitored on a 24-hour ambulatory basis using wearable biosensors, with wireless transmission of relevant data to the patient's electronic medical record." Basu at [0055]. Carlson teaches that "health problems could be detected and an alarm signal could be generated which can be transmitted to a respective person, to a medical doctor, to a hospital, etc. so that help can be organised." Carlson at [0078]. LeBoeuf teaches that "the processed energy response signal is transmitted to a remote device, for example wirelessly transmitted." LeBoeuf at [0035]. Park teaches that "the secondary device may communicate with an external service such as www.fitbit.com or server (e.g., personal computer). Communication may be achieved through wired (e.g., Ethernet, USB) or wireless (e.g., WLAN, Bluetooth, RFID, NFC, cellular) circuitry and protocols to transfer data to and/or from the secondary device." Park at 8:53-9:16. Kreger

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teaches “sensor data and measurements may be transmitted to remote medical personnel, internet servers, and others using WiFi transceiver 68, Bluetooth transceiver 72 or other RF transmitter such as for a cellular phone network. As well, the signals and measurements on the mobile 12 may be transferred via a cable connected to USB connector 28 c or docking connector 28 b to another computer storage device, over a computer network, to a personal computer, and so forth.” Kreger at 7:39-46.

A person of skill in the art would understand that the functionality taught in these references could be added to other methods and systems that are concerned with incorporating a remote device into optical measurement systems. These methods are known to be effective in incorporating a remote device into such systems. Moreover, to the extent that any of these references includes a feature not expressly disclosed in one or more other references, a POSITA would have naturally looked to, and been motivated to combine, any one of these references with one or more of the other references in order to better achieve their common goals of communicating with a remote device.

b. Combinations

For at least the reasons described above, it would have been obvious to one of ordinary skill in the art to combine each prior art reference listed in Appendix B with any other reference or references listed in Appendix B along with the knowledge of one of ordinary skill in the art to arrive at the inventions claims in the ’533 Patent.

For example, and without limitation, the Asserted Claims of the ’533 Patent would have been obvious to one of ordinary skill in the art in view of the following combinations:

(i) Basu Combined with Lisogurski, Carlson, LeBoeuf, Park, Kreger, and/or Sakai

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A POSITA would have had reason to combine Basu with any one of Lisogurski, Carlson, LeBoeuf, and Park all of which relate to systems and methods for optical measurement. Each of Lisogurski, Carlson, LeBoeuf, and Park relate to increasing signal-to-noise ratio in optical measurement systems. Indeed, such components and/or processes were conventional as of the time these references were known. Each of Lisogurski, Carlson, LeBoeuf, and Park provide means—not necessarily expressly present in all other references—for increasing signal-to-noise ratio. A POSITA would have understood that the systems and methods for increasing signal-to-noise ratio were intended to be incorporated into wearable measurement devices. A POSITA would understand that systems and methods for increasing intensity and pulse rate, and those using filters, provide improvements such as increasing signal-to-noise ratio. A POSITA would further understand that in order to implement a wearable measurement device, the systems and methods for increasing signal-to-noise ratio would commonly be combined with increasing intensity and pulse rate, and thus a POSITA would have been motivated to combine the teachings of these references. The combination would apply known techniques for increasing signal-to-noise ratio, to wearable measurement devices that were ready for improvement, in order to yield predictable results. The combination would further be "obvious to try," because it would involve simple design choices from a finite number of identified, predictable solutions, with a reasonable expectation of success.

(ii) Basu Combined with Addison and/or Kreger

A POSITA would have had reason to combine Basu with Addison, which relates to systems and methods for optical measurement. Addison and Kreger relate to incorporating personal and remote devices into systems for optical measurement. Indeed, such components and/or processes were conventional as of the time these references were known. Addison and Kreger provide means—not necessarily expressly present in all other references—for incorporating personal and

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remote devices into systems for optical measurement. A POSITA would have understood that the systems and methods for incorporating personal and remote devices into systems for optical measurement were intended to be incorporated into wearable measurement devices. A POSITA would understand that systems and methods for incorporating personal and remote devices into systems for optical measurement provide improvements such as improved mobility and remote medical monitoring. A POSITA would further understand that in order to implement a wearable measurement device, the systems and methods for optical measurement would commonly be combined with personal and remote devices, and thus a POSITA would have been motivated to combine the teachings of these references. The combination would apply known techniques for incorporating personal and remote devices into systems for optical measurement, to wearable measurement devices that were ready for improvement, in order to yield predictable results. The combination would further be "obvious to try," because it would involve simple design choices from a finite number of identified, predictable solutions, with a reasonable expectation of success.

(iii) Addison, Carslon, LeBoeuf, Lisogurski, Park, Kreger, Sakai, Combined with any of the References Disclosing Remaining Features

A POSITA would have had reason to combine references Addison, Carslon, LeBoeuf, Lisogurski, Park, Kreger, or Sakai with any one of the references disclosing increasing signal-to-noise ratio, lenses, a personal device, a remote device (collectively, the "remaining features") all of which relate to systems and methods for obtaining and processing physiological measurements of a user. Each of the references teaching the remaining features relate to obtaining and processing physiological measurements of a user using light. Indeed, such components and/or processes were conventional as of the time these references were known. Each of the references teaching the remaining features provide means—not necessarily expressly present in all other references—for obtaining and processing physiological measurements of a user. A POSITA would have

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understood that the systems and methods for the references teaching the remaining features were intended to be incorporated into wearable measurement devices. A POSITA would understand that systems and methods for the references teaching the remaining features provide improvements such as specific methods and systems for obtaining and processing physiological measurements using light. A POSITA would further understand that in order to implement a wearable measurement device, the systems and methods for a wireless system for collecting and processing physiological data would commonly be combined with obtaining physiological measurements (for example, blood glucose levels and blood oxygenation) using light, and thus a POSITA would have been motivated to combine the teachings of these references. The combinations would apply known techniques for obtaining physiological measurements using light, to wearable measurement devices that were ready for improvement, in order to yield predictable results. The combinations would further be "obvious to try," because they would involve simple design choices from a finite number of identified, predictable solutions, with a reasonable expectation of success.

Furthermore, to the extent any limitation of an Asserted Claim is deemed not to be exactly disclosed by an item of prior art, then the claim is rendered obvious by combination of the prior art in Exhibits B1 through B8 standing alone, in combination with the reference(s) in any other claim chart, in combination with any system art identified in Table 2-B, in combination with Applicant's Admitted Prior Art, in view of the knowledge of a person of ordinary skill in the art, and/or in view of the References disclosing techniques for increasing signal-to-noise ratio, References disclosing lenses, References disclosing a personal device, and References disclosing a remote device, for the reasons discussed above.

3. U.S. Patent No. 10,517,484

Pursuant to P.R. 3-3(a) and (b), Defendants identify in Appendix C the prior art references that render obvious the Asserted Claims of the '484 Patent and include below exemplary

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combinations showing the obviousness of the ’484 Patent Asserted Claims in view of the prior art. To the extent Plaintiff contends that an element is not disclosed in any one of the anticipatory references described in Appendix C, the limitation would have been obvious in light of the disclosures within the reference and the knowledge of one of ordinary skill in the art at the time of the ’484 Patent. Moreover, to the extent Plaintiff contends that an element is not disclosed in any one of the anticipatory references described in Appendix C, such reference may be combined with any other references listed in Appendix C for such element, thereby rendering the claims invalid for obviousness. To the extent a finder of fact determines that a limitation of any of the ’484 Patent Asserted Claims is not disclosed by one of the references identified above pursuant to P.R. 3-3(a), the claim is nevertheless unpatentable as obvious because they contain nothing that constitutes a patentable innovation. To the extent a finder of fact determines that a limitation of the ’484 Patent Asserted Claims is not anticipated, it does not go beyond combining familiar elements according to known methods to achieve predictable results or does more than choose between clear alternatives known to those of ordinary skill in the art.

a. Obviousness Rationale and Motivations to Combine

Obviousness: For at least the reasons described in these contentions, it would have been obvious to one of ordinary skill in the art to combine any of a number of prior art references, including any combination of those prior art references identified in Appendix C along with the knowledge of one of ordinary skill in the art to meet the limitations of the ’484 Patent Asserted Claims. As a result, the references identified herein render one or more Asserted Claims of the ’484 Patent obvious when the references are read in combination with each other, and/or when read in view of the state of the art and knowledge of those skilled in the art. Each and every reference identified is also relevant to the state of the art at the time of the alleged invention. Any

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of the references disclosed above may be combined with one another to render obvious (and therefore invalid) each of Omni's Asserted Claims. Defendants may rely upon a subset of the identified references or all of the references identified herein, including all references in Appendix C, for purposes of obviousness depending on the Court's claim construction, positions taken by Omni during this litigation, and further investigation and discovery.

Reservation of Rights: Moreover, as mentioned above, Defendants have not yet completed their search or discovery concerning additional prior art. As such, Defendants' inclusion of exemplary combinations does not preclude them from identifying other invalidating combinations as appropriate, and Defendants reserve the right to identify additional specific combinations as well as to detail and explain such combinations.

No More Than Ordinary Variations of Prior Art; No Unexpected Results: To the extent not anticipated, the '484 Patent Asserted Claims represent no more than the result of ordinary variations of the prior art. Defendants further believe that no showing of a specific motivation to combine prior art is required to combine the references disclosed above and in the attached charts, as each combination of art would have no unexpected results, and at most would simply represent a known alternative to one of ordinary skill in the art. *See KSR Int'l Co. v. Teleflex, Inc.*, 550 U.S. 398, 415-16 (2007) (rejecting the Federal Circuit's "rigid" application of the teaching, suggestion, or motivation to combine test, instead espousing an "expansive and flexible" approach); *Apple Inc. v. Samsung Elecs. Co.*, 839 F.3d 1034, 1058 (Fed. Cir. 2016); *Intercontinental Great Brands LLC v. Kellogg N. Am. Co.*, 869 F.3d 1336, 1344 (Fed. Cir. 2017). Indeed, the Supreme Court held that a person of ordinary skill in the art is "a person of ordinary creativity, not an automaton" and "in many cases a person of ordinary skill in the art will be able to fit the teachings of multiple patents together like pieces of a puzzle." *Id.* at 420-21.

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Nevertheless, in addition to the information contained elsewhere in these contentions, Defendants identify motivation and reason to combine the cited art.

Predictable Results; Obvious to Try: One or more combinations of the prior art references identified in Appendix C would have been obvious because these references would have been combined using: known methods to yield predictable results; known techniques in the same way; a simple substitution of one known, equivalent element for another to obtain predictable results; and/or a teaching, suggestion, or motivation in the prior art generally. In addition, it would have been obvious to try combining the prior art references identified above because there were only a finite number of predictable solutions and/or because known work in one field of endeavor prompted variations based on predictable design incentives and/or market forces either in the same field or a different one. Further, the combinations of the prior art references identified in Appendix C would have been obvious because the combinations represent known potential options with a reasonable expectation of success.

Interrelated Teachings: Additional evidence that there would have been a motivation to combine the prior art references identified above includes the interrelated teachings of multiple prior art references; common authorship; the effects of demands known to the design community or present in the marketplace; the existence of a known problem for which there was an obvious solution encompassed by the '484 Patent Asserted Claims; the existence of a known need or problem in the field of the endeavor at the time of the alleged invention(s); and the background knowledge that would have been possessed by a person having ordinary skill in the art.

Summary of Motivations to Combine: Thus, the motivation to combine the teachings of the prior art references disclosed in Appendix C is found in the references themselves and also in: (1) the nature of the problem being solved; (2) the express, implied and inherent teachings of the

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prior art; (3) the knowledge of persons of ordinary skill in the art; (4) the predictable results obtained in combining the different elements of the prior art; (5) the predictable results obtained in simple substitution of one known element for another; (6) the use of a known technique to improve similar devices, methods, or products in the same way; (7) the predictable results obtained in applying a known technique to a known device, method, or product ready for improvement; (8) the finite number of identified predictable solutions that had a reasonable expectation of success; and (9) known work in various technological fields that could be applied to the same or different technological fields based on design incentives or other market forces.

Same Area of Technology: Additionally, it would be obvious to one of ordinary skill in the art to consult and/or combine any of the prior art listed in Appendix C because all of these references relate to the same area of technology and/or are from analogous art. The '484 Patent Asserted Claims are directed to "A wearable device includes a measurement device to measure a physiological parameter adapted to be placed on a wrist or an ear of a user." '484 Patent at Abstract. The '484 Patent Asserted Claims merely unite old elements, well known in the field, with no change in their respective function or result. Given the interrelated teachings of the prior art, the effects of demands known to the design community or present in the marketplace, and the background knowledge possessed by a person having ordinary skill in the art, it would have been obvious for one of ordinary skill in the art to combine these familiar elements, disclosed and/or embodied in the prior art listed above to practice the '484 Patent Asserted Claims.

Same Technical Issues: A person of ordinary skill would have been motivated to combine the above prior art based on his/her knowledge, the nature of the problem to be solved, and the teachings of the prior art. The identified prior art addresses the same or similar technical issues and suggests the same or similar solutions to those issues. Moreover, some of the prior art refer

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to or discuss other prior art, illustrating the close technical relationship among the prior art. For the ’484 Patent, one of ordinary skill in the art would have been motivated to combine known prior art solutions described in these references relating to wearable devices measuring physiological parameters.

Demand and Market Forces: For example, market forces suggested a demand for wearable devices for measuring physiological parameters, and thus one of skill in the art would have thought to combine or modify references that described known methods that one of skill in the art would have recognized as offering improvements to solutions of that time.

Known Elements; Obvious to Try: Moreover, many of the claim elements were already known as admitted by the applicant in the patent specification. These elements represented design choices available to a person of ordinary skill. When there is a design need or market pressure to solve a problem such as identified previously and/or described in the ’484 Patent, and there are a finite number of identified, predictable solutions, a person of ordinary skill would be motivated to combine the known options that are within his or her technical grasp. For the ’484 Patent, there are a finite number of approaches for providing a wearable device for measuring physiological parameters. For example, as of the priority date of the ’484 Patent, a POSITA would have been very familiar with basic elements of the ’484 Patent’s claims such as semiconductors, optical wavelengths, lenses, signal-to-noise ratio, detectors, analog to digital convertors, smart phones, tablets, cloud, and artificial intelligence. Such elements were within the knowledge of a POSITA, whether or not disclosed in any particular reference, and the inclusion of such elements in the ’484 Patent’s claims does not render them novel or non-obvious.

There are significant similarities in subject matter and objectives for each of many references used in these contentions for the ’484 Patent.

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References disclosing smart phone or tablet: For example, charted reference Basu, Rulkov, Goodman, Kassim, Poeze, Terumoto, Moon, Tran, and Kreger, as well as other references such as Mault, all include teachings related to incorporating a smart phone or tablet into an optical measurement system. For example, Rulkov discloses "a device such as a personal digital assistant, laptop computer, mobile telephone, exercise equipment, or the like for display and even processing of the user's real-time vital signs information." Rulkov at 5:48-64. Basu discloses that "[i]n smart phones, for example, OPS detect when a phone is placed in a pocket, triggering touch-screen locking." Basu at [0035]. Goodman discloses "FIG. 5 shows another possible configuration of system 10 wherein processing device 14 is a PDA (e.g. Palm Pilot™) having PPG sensor 12 interfaced therein." Goodman at 13:26-42. Kassim discloses "the feedback unit may be a portable device, such as a mobile phone, smartphone, personal digital assistant (PDA), tablet, netbook or laptop, although this list is not exhaustive by any means." Kassim at 12:12-19. Poeze discloses "the patient monitor may include a display device, a network interface communicating with any one or combination of a computer network, a handheld computing device, a mobile phone, the Internet, or the like." Poeze at 2:47-60. Terumoto discloses "the wireless communication circuit 33 transmits the measurement data acquired at the measurement unit 10 (i.e., the raw data provided from the amplifier circuit 14, the processed data various processes has performed provided from the processing circuit 15, or the stored data provided from the memory 32) to the external personal computer or a cell phone." Terumoto at [0130]. Moon discloses, "FIG. 14 indicates how the wrist-worn transceiver 72 can communicate wirelessly with either a networked computer 198 (e.g. a tablet computer located at a central nursing station) or a hand-held computer 199 (e.g. a cell phone or PDA, typically carried by the medical professional)." Moon at [0107]. Tran teaches that while a patient with a wearable device is outside a mesh network range, "the wearable appliance

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communicates with the cell phone and provides information to the server 200 using the cellular connection." Tran, 34:4-30. Kreger discloses "In other embodiments, the mobile communications device can be any of a number of mobile phones such as an iPhone® or an Android® phone, a personal digital assistant (PDA) such as a Blackberry®, a portable audio playback device such as an MP3 player, a portable media playback device such as an iPod®, or a handheld tablet such as an iPad®." Kreger at 5:48-53. Mault teaches a blood glucose monitoring system including an electronic device that "can be a portable electronic device or system carried by the person, or a device or system combining multiple functionalities, such as:…a portable computer; any portable Internet access device; [or] a wireless phone…." Mault [0069]-[0070].

A person of skill in the art would understand that the functionality taught in these references could be added to other methods and systems that are concerned with incorporating a smart phone or tablet into optical measurement systems. These methods are known to be effective in incorporating a smart phone or tablet into such systems. Moreover, to the extent that any of these references includes a feature not expressly disclosed in one or more other references, a POSITA would have naturally looked to, and been motivated to combine, any one of these references with one or more of the other references in order to better achieve their common goals of communicating with a smart phone or tablet.

References disclosing lenses: For example, charted reference Carlson, Poeze, and Soller, as well as numerous other references such as LeBoeuf and Park, all include teachings related to using one or more lenses configured to receive a portion of at least one of the output optical lights and to direct a lens output light to tissue. These references provide numerous methods for using lenses to direct an optical output beam. For example, Carlson teaches "us[ing] a beam-shaping element, such as e.g. diffractive or refractive lenses, to direct the emitted optical radiation of, e.g.,

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the LED light source into the human or animal tissue and the photon detecting element in order to increase the optical signal power, detected by the pulsoximeter sensor, and thus increasing the Signal/Noise—and signal/Background ratio. The increase of the S/B ratio is estimated e.g. to a factor 5." Carlson at [0014]. Poeze teaches "[using] a lens which collects attenuated light exiting the measurement site and focuses onto one or more detectors. The protrusion can advantageously include plastic, including a hard opaque plastic, such as a black or other colored plastic, helpful in reducing light noise." Poeze at 7:52-8:7. Soller teaches "a variety of different collimating elements 56 can be used in sensor 10. Exemplary collimating elements include fiber faceplates (e.g., fiber optic windows), collimating hole devices, gradient index (GRIN) lenses, fiber bundles, lens arrays, optical windows (including shaped optical windows), and other similar devices." Soller at 18:37-56.

A person of skill in the art would understand that the functionality taught in these references could be added to other methods and systems that are concerned with using lenses to direct an optical output beam. These methods are known to be effective in directing an optical output beam using known lens structures. Moreover, to the extent that any of these references includes a feature not expressly disclosed in one or more other references, a POSITA would have naturally looked to, and been motivated to combine, any one of these references with one or more of the other references in order to better achieve their common goals of directing an optical output beam.

References disclosing techniques for increasing signal-to-noise ratio: For example, charted reference Basu, Lisogurski, and Carlson, as well as numerous other references such as LeBoeuf and Park, all include teachings related to increasing the signal-to-noise ratio of optical measurement systems by increasing a light intensity and increasing a pulse rate of an LED. These references provide numerous methods for increasing a light intensity and increasing a pulse rate

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of an LED. For example, Basu teaches that "[t]o maximize the signal-to-noise ratio in photoplethysmography, the LED intensity should be made as large as possible without saturating the detector. In the OPS 10, the LED intensity and modulation frequencies are programmable through the serial interface. In the case of the Vishay VCNL4000, the intensity is programmable from 10-200 mA in 10 mA increments." Basu at [0058]. Lisogurski teaches "that modulation of the light drive signal . . . may include modulation of parameters including drive current or light brightness, duty cycle, firing rate, modulation parameters, other suitable parameters, or any combination thereof" and that "[t]he system may increase the brightness of the light sources in response to the noise to improve the signal-to-noise ratio." Lisogurski at 27:44-55, 9:46-60. Carlson teaches that the "frequency is chosen in such a way that it is outside the frequency spectrum of sunlight and of ambient light which, according to FIG. 7b, is in the range of above approximately 1000 Hz. Thus, the pulsoximeter signals are readily discriminated from electronic and parasitic contributions of environmental optical radiation outside the frequency fc+/−5 Hz increasing significantly the Signal-to-Noise and Signal-to-Background ratio." Carlson at [0069]. LeBoeuf teaches that "the intensity of the optical emitter 102 may be increased to increase the ratio of physiological optical scatter 111 from blood vessels with respect to unwanted sunlight" and that "it is important to consider the emitter pulsing frequency and sampling approach" because "choosing a frequency that is too low may result in unsatisfactory subtraction." LeBoeuf at [0123], [0139]. Park teaches that "the light source intensity may be increased to maintain the output signal from the light detector within a desired range of output values." Park at 16:8-20.

A person of skill in the art would understand that the functionality taught in these references could be added to other methods and systems that are concerned with improving signal-to-noise ratio in optical measurement systems. These methods are known to be effective in improving the

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signal-to-noise ratio for such systems, and merely modulate the functioning of the existing LEDs in each system. Moreover, to the extent that any of these references includes a feature not expressly disclosed in one or more other references, a POSITA would have naturally looked to, and been motivated to combine, any one of these references with one or more of the other references in order to better achieve their common goals of improving signal-to-noise ratio.

References disclosing an analog to digital converter: For example, charted reference Basu, Goodman, Lisogurski, Rulkov, Moon, Poeze, Chandrasekar, Kreger, and Sakai all include teachings related to an analog to digital converter. These references provide numerous methods for using an analog to digital converter coupled to a detector. For example, Basu discloses "a digital interface for communication with a microcontroller." Basu at [0007]. Goodman discloses "On board analog-to-digital converter A/D 44 (10 bit, 5 channel input) is used to convert the conditioned PPG signals at B and B′ into time sampled digital signals which are then provided to processing device 14. Goodman at 11:66-12:21. Lisogurski discloses a "[f]ront end processing circuitry 150 may perform various analog and digital processing of the detector signal." Lisogurski at 12:42-51. Rulkov discloses that "The microprocessor741 has a LED control715 connected to DAC702 for controlling the intensity of the LEDs737. The signal from the photodetector736 is transmitted to a high pass filter (HPF) 703 which sends it to an analog to digital converter704, and the signal from the photodetector737 is also sent directly to a second analog to digital converter704." Rulkov at 11:39-60. Moon discloses that "[a] filter removes any high-frequency noise (e.g. 60 Hz electrical noise) that is not related to the PPG waveform, and yields a preliminary waveform that is digitized with an analog-to-digital converter 176, and processed as described above to generate a DC portion of the PPG." Moon at [0091]. Poeze discloses "[f]ront-end interfaces 108 may be implemented using transimpedance amplifiers that are coupled to analog to

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digital converters in a sigma delta converter." Poeze at 40:15-27. Chandrasekar discloses "In principle, PPGs are considered simple devices; however, in practice, implementation requires a careful design involving optics (multiple paths, alignments, leakage barriers) and mixed signal electronics (transimpedance amplifiers, analog digital conversion, drivers, modulators, filters)." Chandrasekar at 1. Kreger discloses "Biosensor signals may also be received by one or more RF receivers in the dock 246 (not shown) and communicated to the mobile 212 via wired electrical connector 246, for example, to allow the wireless sensor to utilize the features of the wired audio input's anti-alias filters and analog to digital converter as will be explained in detail below." Kreger at 10:14-28. Sakai discloses "A/D converter 2013 d which converts a voltage value of analog signal into 10-bit digital value."

A person of skill in the art would understand that the functionality taught in these references could be added to other methods and systems that are concerned with incorporating an analog to digital converter into optical measurement systems. These methods are known to be effective in incorporating an analog to digital converter into such systems. Moreover, to the extent that any of these references includes a feature not expressly disclosed in one or more other references, a POSITA would have naturally looked to, and been motivated to combine, any one of these references with one or more of the other references in order to better achieve their common goals of signal processing.

References disclosing a cloud: For example, charted references Basu and Kassim, as well as numerous other references such as Mault and US2011/0082711A1, include teachings related to using a cloud. These references provide numerous methods for communicating with a cloud. For example, Basu teaches that "a "cloud-based" RPM infrastructure can actively manage cardiovascular health. Using OPS technology, cardiovascular parameters can be monitored on a

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24-hour ambulatory basis using wearable biosensors, with wireless transmission of relevant data to the patient's electronic medical record." Basu at [0064]. Kassim teaches that "[t]he computer platform may further be connected to network resources 2006 which connect to the Internet or other components of a local public or private network. The network resources 2006 may provide instructions and data to the computer platform from a remote location on a network 2007." Kassim, 33:34-34:19. Mault teaches "[t]he PDA can access the communications network, such as the Internet, using a wireless connection. Data can be transferred to the remote system over the communications network 20." Mault, [0077]. US 2011/0082711A1 teaches "the camera is paired with an optical character recognition module so that scanned medical forms can be converted into data that can be uploaded for synchronization at a server in a network (e.g. a cloud computing network) or stored on the personal health organizer device." At [0048].

A person of skill in the art would understand that the functionality taught in this reference could be added to other methods and systems for measuring physiological parameters. These methods provide communication with a cloud which allows for remote storage and computation on the cloud. Moreover, to the extent that any of these references includes a feature not expressly disclosed in one or more other references, a POSITA would have naturally looked to, and been motivated to combine, any one of these references with one or more of the other references in order to better achieve their common goals of measuring physiological parameters.

References disclosing artificial intelligence: For example, charted reference Tran, as well as other references such as Quy, include teachings related to using artificial inteligence. For example, Tran teaches "Various mathematical techniques and Artificial Intelligence (AI) analyzer can be applied. … AI approaches towards signal recognition include Artificial Neural Networks (ANN), dynamic recurrent neural networks (DRNN), fuzzy logic system, Genetic Algorithm (GA),

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and Hidden Markov Model (HMM)." Tran at 94:49-65. Quy teaches "[a]pplication 62 may include an algorithm 63 for analyzing data from the HMD, and either application 62 or algorithm 63 may optionally access data from an external data source 74 and may further consult an artificial intelligence system 76." Quy at 8:9-14.

A person of skill in the art would understand that the functionality taught in these references could be added to other methods and systems for measuring physiological parameters. These methods provide using artificial intelligence. Moreover, to the extent that any of these references includes a feature not expressly disclosed in one or more other references, a POSITA would have naturally looked to, and been motivated to combine, any one of these references with one or more of the other references in order to better achieve their common goals of measuring physiological parameters.

References disclosing spatially separated detectors: For example, charted references Lisogurski, Poeze, Soller, Terumoto, and Tran, all include teachings related to using detectors that are spatially separated. These references provide numerous methods for using light detectors. For example, Lisogurski teaches that "[o]ne or more detector 318 may also be provided in sensor unit 312 for detecting the light that is reflected by or has traveled through the subject's tissue. Any suitable configuration of light source 316 and detector 318 may be used. In an embodiment, sensor unit 312 may include multiple light sources and detectors, which may be spaced apart." Lisogurski at 17:35-45. Poeze discloses that "multiple detectors are employed and arranged in a spatial geometry. This spatial geometry provides a diversity of path lengths among at least some of the detectors and allows for multiple bulk and pulsatile measurements that are robust." Poeze at 9:18-27. Soller discloses "a plurality of spectral detectors attached to the circuit board, each spectral detector being configured to analyze radiation derived from the radiation source" and depicts the

detectors as spatially separated. Soller at 3:16-27; Fig. 34. Terumoto discloses "[t]he light sensor portions 101-1 to 101-n are located equally spaced from one another and to go round the armlet type housing 107 same as the fourth to sixth implementations." Terumoto at [0152]. Tran discloses "[t]he electrode array sensor can be a geometric array of discrete electrodes having an equally-spaced geometry of multiple nodes that are capable of functioning as sense and reference electrodes. In a typical tomography application the electrodes are equally-spaced in a circular configuration. Alternatively, the electrodes can have non-equal spacing and/or can be in rectangular or other configurations in one circuit or multiple circuits." Tran at 50:61-51:8.

A person of skill in the art would understand that the functionality taught in these references could be added to other methods and systems that detect light. These methods provide using detectors that are spatially separated. Moreover, to the extent that any of these references includes a feature not expressly disclosed in one or more other references, a POSITA would have naturally looked to, and been motivated to combine, any one of these references with one or more of the other references in order to better achieve their common goals of measuring physiological parameters.

References disclosing detection system is synchronized to the light source: For example, charted reference Lisogurski, Carlson, Poeze, Kreger, and Sakai all include teachings related to detection system is synchronized to the light source. These references provide numerous methods for synchronizing detection system with the light source. For example, Lisogurski discloses "he front end processing circuitry 150 may use the timing control signals to operate synchronously with light drive circuitry 120. For example, front end processing circuitry 150 may synchronize the operation of an analog-to-digital converter and a demultiplexer with the light drive signal based on the timing control signals." Lisogurski at 11:33-49. Carlson discloses "[t]he basic

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idea of using AC-Coupling or Lock-In Amplification (synchronous detection), is to temporarily modulate the optical radiation of the LED at the carrier frequency fc in order to shift the power spectrum of the pulsoximeter signals into a higher frequency range where environmental optical radiation is unlikely and electronic band pass filtering is technologically less stringent. AC-Coupling or Lock-In Amplification is well known out of the state of the art and is described in literature 3." Carlson at [0065]. Poeze teaches that "[a] control signal can be useful in order to synchronize, minimize, or reduce jitter in the timing of pulses emitted from the emitter 104. Accordingly, this control signal can be useful in order to cause optical radiation pulses emitted from the emitter 104 to follow a precise timing and consistent pattern." Poeze at 15:27-48. Kreger discloses "Thus, it is another object to provide compatible signals to the mobile's electrical connectors which may involve transforming the biosensor signals to match requisite impedance and signal levels, eliminate noise, cancel DC noise and drift, demultiplex or multiplex multiple measurements, provide electrical isolation, serialization, synchronization, and so forth." Kreger at 3:17-23. Sakai discloses "he A/D converter 14 operates in synchronization with the light emission timing of the driver 12, to thereby convert the pulse wave detection signal detected upon light emission from the green LED 11 a and the body motion detection signal detected upon light emission from the infrared LED 11 b into digital data, and provides these digital data, as biological information, to the information processor 20." Sakai at 5:66-6:9.

A person of skill in the art would understand that the functionality taught in these references could be added to other methods and systems that are concerned with measuring physiological parameters. These methods are known to be effective in incorporating synchronizing detection system with the light source. Moreover, to the extent that any of these references includes a feature not expressly disclosed in one or more other references, a POSITA would have naturally looked

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to, and been motivated to combine, any one of these references with one or more of the other references in order to better achieve their common goals of signal processing.

b. Combinations

For at least the reasons described above, it would have been obvious to one of ordinary skill in the art to combine each prior art reference listed in Appendix C with any other reference or references listed in Appendix C along with the knowledge of one of ordinary skill in the art to arrive at the inventions claims in the ’484 Patent.

For example, and without limitation, the Asserted Claims of the ’484 Patent would have been obvious to one of ordinary skill in the art in view of the following combinations:

(i) Carlson, Lisgurski, Chandersekar, Soller, Tran, and Sakai combined with References disclosing smart phone or tablet

A POSITA would have had reason to combine references Carlson, Lisgurski, Moon, Soller, and Sakai with any one of References disclosing smart phone or tablet, all of which relate to systems and methods for incorporating a smart phone or tablet into an optical measurement system. Indeed, such components and/or processes were conventional as of the time these references were known. Each of References disclosing smart phone or tablet provide means—not necessarily expressly present in all other references—for incorporating a smart phone or tablet into an optical measurement system. A POSITA would have understood that the systems and methods for References disclosing smart phone or tablet were intended to be incorporated into wearable measurement devices. A POSITA would understand that systems and methods for using smart phone or tablet into an optical measurement system provide improvements such as the ability to coomunicate with smart phone or tablet and/or increased processing capabilities. A POSITA would further understand that in order to implement a wearable measurement device, the systems and methods for using smart phone or tablet would commonly be combined with

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optical measurement system, and thus a POSITA would have been motivated to combine the teachings of these references. The combination would apply known techniques for using smart phone or tablet, to wearable measurement devices that were ready for improvement, in order to yield predictable results. The combination would further be "obvious to try," because it would involve simple design choices from a finite number of identified, predictable solutions, with a reasonable expectation of success.

(ii) Rulkov, Basu, Goodman, Chandersekar, Kassim, Lisogurski, Moon, Terumoto, Tran, Kreger, and Sakai combined with References disclosing lenses

A POSITA would have had reason to combine references Rulkov, Basu, Goodman, Kassim, Lisogurski, Moon, Terumoto, Tran, Kreger, and Sakai with any one of References disclosing lenses, all of which relate to systems and methods for using lenses to direct an optical output beam. Each of References disclosing lenses relate to using one or more lenses configured to receive a portion of at least one of the output optical lights and to direct a lens output light to tissue. Indeed, such components and/or processes were conventional as of the time these references were known. Each of References disclosing lenses provide means—not necessarily expressly present in all other references—for using lenses to direct an optical output beam. A POSITA would have understood that the systems and methods for References disclosing lenses were intended to be incorporated into wearable measurement devices. A POSITA would understand that systems and methods for using lenses provide improvements such as disrecting the light to tissue. A POSITA would further understand that in order to implement a wearable measurement device, the systems and methods for using lenses to direct an optical output beam would commonly be combined with optical measurement systems, and thus a POSITA would have been motivated to combine the teachings of these references. The combination would apply known techniques for using lenses to direct an optical output beam, to wearable

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measurement devices that were ready for improvement, in order to yield predictable results. The combination would further be "obvious to try," because it would involve simple design choices from a finite number of identified, predictable solutions, with a reasonable expectation of success.

(iii) Kassim, Rulkov, Goodman, Moon, Chandersekar, Poeze, Soller, Terumoto, Tran, Kreger, and Sakai combined with References disclosing techniques for increasing signal-to-noise ratio

A POSITA would have had reason to combine Kassim, Rulkov, Goodman, Moon, Poeze, Soller, Terumoto, Tran, Kreger, and Sakai with any one of References disclosing techniques for increasing signal-to-noise ratio, all of which relate to systems and methods for increasing a light intensity and increasing a pulse rate of an LED. Each of References disclosing techniques for increasing signal-to-noise ratio relate to increasing the signal-to-noise ratio of optical measurement systems by increasing a light intensity and increasing a pulse rate of an LED. Indeed, such components and/or processes were conventional as of the time these references were known. Each of References disclosing techniques for increasing signal-to-noise ratio provide means—not necessarily expressly present in all other references—for increasing signal-to-noise ratio relate to increasing the signal-to-noise ratio of optical measurement systems by increasing a light intensity and increasing a pulse rate of an LED. A POSITA would have understood that the systems and methods for References disclosing techniques for increasing signal-to-noise ratio were intended to be incorporated into wearable measurement devices. A POSITA would understand that systems and methods for increasing a light intensity and increasing a pulse rate of an LED provide improvements such as increasing signal-to-noise ratio. A POSITA would further understand that in order to implement a wearable measurement device, the systems and methods for increasing signal-to-noise ratio would commonly be combined with

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optical measurement systems, and thus a POSITA would have been motivated to combine the teachings of these references. The combination would apply known techniques for increasing signal-to-noise ratio, to wearable measurement devices that were ready for improvement, in order to yield predictable results. The combination would further be "obvious to try," because it would involve simple design choices from a finite number of identified, predictable solutions, with a reasonable expectation of success.

(iv) Carlson, Kassim, Soller, Chandersekar, Terumoto, and Tran combined with References disclosing an analog to digital converter

A POSITA would have had reason to combine references Carlson, Kassim, Soller, Terumoto, and Tran with any one of References disclosing an analog to digital converter, all of which relate to systems and methods for using an analog to digital converter coupled to a detector. Indeed, such components and/or processes were conventional as of the time these references were known. Each of References disclosing an analog to digital converter provide means—not necessarily expressly present in all other references—for using an analog to digital converter coupled to a detector. A POSITA would have understood that the systems and methods for References disclosing an analog to digital converter were intended to be incorporated into wearable measurement devices. A POSITA would understand that systems and methods for using an analog to digital converter provide improvements such as ability to process a signal digitally. A POSITA would further understand that in order to implement a wearable measurement device, the systems and methods for using an analog to digital converter would commonly be combined with optical measurement systems, and thus a POSITA would have been motivated to combine the teachings of these references. The combination would apply known techniques for using an analog to digital converter, to wearable measurement devices that were ready for improvement, in order to yield predictable results. The combination

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would further be "obvious to try," because it would involve simple design choices from a finite number of identified, predictable solutions, with a reasonable expectation of success.

(v) Carlson, Rulkov, Chandersekar, Goodman, Kassim, Lisogurski, Moon, Poeze, Soller, Terumoto, Tran, Kreger, and Sakai combined with References disclosing a cloud

A POSITA would have had reason to combine references Carlson, Rulkov, Chandersekar, Goodman, Kassim, Lisogurski, Moon, Poeze, Soller, Terumoto, Tran, Kreger, and Sakai with any one of References disclosing a cloud, all of which relate to systems and methods for using a cloud. Indeed, such components and/or processes were conventional as of the time these references were known. Each of References disclosing a cloud provide means—not necessarily expressly present in all other references—for using a cloud. A POSITA would have understood that the systems and methods for using a cloud were intended to be incorporated into wearable measurement devices. A POSITA would understand that systems and methods for using a cloud provide improvements such as remote storage and computing. A POSITA would further understand that in order to implement a wearable measurement device, the systems and methods for measuring physiological parameters would commonly be combined with a cloud, and thus a POSITA would have been motivated to combine the teachings of these references. The combination would apply known techniques for using a cloud, to wearable measurement devices that were ready for improvement, in order to yield predictable results. The combination would further be "obvious to try," because it would involve simple design choices from a finite number of identified, predictable solutions, with a reasonable expectation of success.

(vi) Carlson, Rulkov, Chandersekar, Basu, Goodman, Kassim, Lisogurski, Moon, Poeze, Soller, Terumoto, Kreger, and Sakai combined with References disclosing artificial intelligence

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A POSITA would have had reason to combine references Carlson, Rulkov, Chandersekar, Basu, Goodman, Kassim, Lisogurski, Moon, Poeze, Soller, Terumoto, Kreger, and Sakai with any one of References disclosing artificial intelligence, all of which relate to systems and methods for using artificial intelligence. Indeed, such components and/or processes were conventional as of the time these references were known. Each of References disclosing artificial intelligence provide means—not necessarily expressly present in all other references—for using artificial intelligence. A POSITA would have understood that the systems and methods for References disclosing artificial intelligence were intended to be incorporated into wearable measurement devices. A POSITA would understand that systems and methods for using artificial intelligence provide improvements such as automation and improved processing power. A POSITA would further understand that in order to implement a wearable measurement device, the systems and methods for measuring physiological parameters would commonly be combined with artificial intelligence, and thus a POSITA would have been motivated to combine the teachings of these references. The combination would apply known techniques for artificial intelligence, to wearable measurement devices that were ready for improvement, in order to yield predictable results. The combination would further be "obvious to try," because it would involve simple design choices from a finite number of identified, predictable solutions, with a reasonable expectation of success.

(vii) Carlson, Rulkov, Chandersekar, Basu, Goodman, Kassim, Moon, Kreger, and Sakai combined with References disclosing spatially separated detectors

A POSITA would have had reason to combine references Carlson, Rulkov, Chandersekar, Basu, Goodman, Kassim, Moon, Kreger, and Sakai with any one of References disclosing spatially separated detectors all of which relate to systems and methods for using spatially separated detectors. Indeed, such components and/or processes were conventional as of

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the time these references were known. Each of References disclosing spatially separated detectors provide means—not necessarily expressly present in all other references—for using spatially separated detectors. A POSITA would have understood that the systems and methods for References disclosing spatially separated detectors were intended to be incorporated into wearable measurement devices. A POSITA would understand that systems and methods for spatially separated detectors provide improvements such as improved detection quality. A POSITA would further understand that in order to implement a wearable measurement device, the systems and methods for measuring physiological parameters would commonly be combined with spatially separated detectors, and thus a POSITA would have been motivated to combine the teachings of these references. The combination would apply known techniques for using spatially separated detectors, to wearable measurement devices that were ready for improvement, in order to yield predictable results. The combination would further be "obvious to try," because it would involve simple design choices from a finite number of identified, predictable solutions, with a reasonable expectation of success.

(viii) Rulkov, Chandersekar, Basu, Goodman, Kassim, Moon, Soller, Terumoto, and Tran combined with References disclosing detection system is synchronized to the light source

A POSITA would have had reason to combine references Rulkov, Chandersekar, Basu, Goodman, Kassim, Moon, Soller, Terumoto, and Tran with any one of References disclosing detection system is synchronized to the light source, all of which relate to systems and methods for synchronizing a detection system with a light source. Indeed, such components and/or processes were conventional as of the time these references were known. Each of References disclosing detection system is synchronized to the light source provide means—not necessarily expressly present in all other references—for synchronizing a detection system with a light

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source. A POSITA would have understood that the systems and methods for References disclosing detection system is synchronized to the light source were intended to be incorporated into wearable measurement devices. A POSITA would understand that systems and methods for synchronizing a detection system with a light source provide improvements such as improved detection. A POSITA would further understand that in order to implement a wearable measurement device, the systems and methods for measuring physiological parameters would commonly be combined with techniques for synchronizing a detection system with a light source, and thus a POSITA would have been motivated to combine the teachings of these references. The combination would apply known techniques for synchronizing a detection system with a light source, to wearable measurement devices that were ready for improvement, in order to yield predictable results. The combination would further be "obvious to try," because it would involve simple design choices from a finite number of identified, predictable solutions, with a reasonable expectation of success.

Furthermore, to the extent any limitation of an Asserted Claim is deemed not to be exactly disclosed by an item of prior art, then the claim is rendered obvious by combination of the prior art in Exhibits C1 through C14 standing alone, in combination with the reference(s) in any other claim chart, in combination with any system art identified in Table 2-C, in combination with Applicant's Admitted Prior Art, in view of the knowledge of a person of ordinary skill in the art, and/or in view of the References disclosing smart phone or tablet, References disclosing lenses, References disclosing techniques for increasing signal-to-noise ratio, References disclosing an analog to digital converter, References disclosing a cloud, References disclosing artificial intelligence, References disclosing spatially separated detectors, References disclosing detection system is synchronized to the light source, for the reasons discussed above.

4. U.S. Patent No. 10,874,304

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Pursuant to P.R. 3-3(a) and (b), Defendants identify in Appendix D the prior art references that render obvious the Asserted Claims of the ’304 Patent and include below exemplary combinations showing the obviousness of the ’304 Patent Asserted Claims in view of the prior art. To the extent Plaintiff contends that an element is not disclosed in any one of the anticipatory references described in Appendix D, the limitation would have been obvious in light of the disclosures within the reference and the knowledge of one of ordinary skill in the art at the time of the ’304 Patent. Moreover, to the extent Plaintiff contends that an element is not disclosed in any one of the anticipatory references described in Appendix D, such reference may be combined with any other references listed in Appendix D for such element, thereby rendering the claims invalid for obviousness. To the extent a finder of fact determines that a limitation of any of the ’304 Patent Asserted Claims is not disclosed by one of the references identified above pursuant to P.R. 3-3(a), the claim is nevertheless unpatentable as obvious because they contain nothing that constitutes a patentable innovation. To the extent a finder of fact determines that a limitation of the ’304 Patent Asserted Claims is not anticipated, it does not go beyond combining familiar elements according to known methods to achieve predictable results or does more than choose between clear alternatives known to those of ordinary skill in the art.

a. Obviousness Rationale and Motivations to Combine

Obviousness: For at least the reasons described in these contentions, it would have been obvious to one of ordinary skill in the art to combine any of a number of prior art references, including any combination of those prior art references identified in Appendix D along with the knowledge of one of ordinary skill in the art to meet the limitations of the ’304 Patent Asserted Claims. As a result, the references identified herein render one or more Asserted Claims of the ’304 Patent obvious when the references are read in combination with each other, and/or when

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read in view of the state of the art and knowledge of those skilled in the art. Each and every reference identified is also relevant to the state of the art at the time of the alleged invention. Any of the references disclosed above may be combined with one another to render obvious (and therefore invalid) each of Omni's Asserted Claims. Defendants may rely upon a subset of the identified references or all of the references identified herein, including all references in Appendix D, for purposes of obviousness depending on the Court's claim construction, positions taken by Omni during this litigation, and further investigation and discovery.

Reservation of Rights: Moreover, as mentioned above, Defendants have not yet completed their search or discovery concerning additional prior art, including prior art systems that may anticipate and/or render obvious the Asserted Claims (e.g., System Art).. As such, Defendants' inclusion of exemplary combinations does not preclude them from identifying other invalidating combinations as appropriate, and Defendants reserve the right to identify additional specific combinations as well as to detail and explain such combinations.

No More Than Ordinary Variations of Prior Art; No Unexpected Results: To the extent not anticipated, the '304 Patent Asserted Claims represent no more than the result of ordinary variations of the prior art. Defendants further believe that no showing of a specific motivation to combine prior art is required to combine the references disclosed above and in the attached charts, as each combination of art would have no unexpected results, and at most would simply represent a known alternative to one of ordinary skill in the art. *See KSR Int'l Co. v. Teleflex, Inc.*, 550 U.S. 398, 415-16 (2007) (rejecting the Federal Circuit's "rigid" application of the teaching, suggestion, or motivation to combine test, instead espousing an "expansive and flexible" approach); *Apple Inc. v. Samsung Elecs. Co.*, 839 F.3d 1034, 1058 (Fed. Cir. 2016); *Intercontinental Great Brands LLC v. Kellogg N. Am. Co.*, 869 F.3d 1336, 1344 (Fed. Cir. 2017).

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Indeed, the Supreme Court held that a person of ordinary skill in the art is "a person of ordinary creativity, not an automaton" and "in many cases a person of ordinary skill in the art will be able to fit the teachings of multiple patents together like pieces of a puzzle." *Id.* at 420-21. Nevertheless, in addition to the information contained elsewhere in these contentions, Defendants identify motivation and reason to combine the cited art.

Predictable Results; Obvious to Try: One or more combinations of the prior art references identified in Appendix D would have been obvious because these references would have been combined using: known methods to yield predictable results; known techniques in the same way; a simple substitution of one known, equivalent element for another to obtain predictable results; and/or a teaching, suggestion, or motivation in the prior art generally. In addition, it would have been obvious to try combining the prior art references identified above because there were only a finite number of predictable solutions and/or because known work in one field of endeavor prompted variations based on predictable design incentives and/or market forces either in the same field or a different one. Further, the combinations of the prior art references identified in Appendix D would have been obvious because the combinations represent known potential options with a reasonable expectation of success.

Interrelated Teachings: Additional evidence that there would have been a motivation to combine the prior art references identified above includes the interrelated teachings of multiple prior art references; common authorship; the effects of demands known to the design community or present in the marketplace; the existence of a known problem for which there was an obvious solution encompassed by the '304 Patent Asserted Claims; the existence of a known need or problem in the field of the endeavor at the time of the alleged invention(s); and the background knowledge that would have been possessed by a person having ordinary skill in the art.

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Summary of Motivations to Combine: Thus, the motivation to combine the teachings of the prior art references disclosed in Appendix D is found in the references themselves and also in: (1) the nature of the problem being solved; (2) the express, implied and inherent teachings of the prior art; (3) the knowledge of persons of ordinary skill in the art; (4) the predictable results obtained in combining the different elements of the prior art; (5) the predictable results obtained in simple substitution of one known element for another; (6) the use of a known technique to improve similar devices, methods, or products in the same way; (7) the predictable results obtained in applying a known technique to a known device, method, or product ready for improvement; (8) the finite number of identified predictable solutions that had a reasonable expectation of success; and (9) known work in various technological fields that could be applied to the same or different technological fields based on design incentives or other market forces.

Same Area of Technology: Additionally, it would be obvious to one of ordinary skill in the art to consult and/or combine any of the prior art listed in Appendix D because all of these references relate to the same area of technology and/or are from analogous art. The ’304 Patent Asserted Claims are directed to a physiological measurement system. ’304 Patent at Abstract. The ’304 Patent Asserted Claims merely unite old elements, well known in the field, with no change in their respective function or result. Given the interrelated teachings of the prior art, the effects of demands known to the design community or present in the marketplace, and the background knowledge possessed by a person having ordinary skill in the art, it would have been obvious for one of ordinary skill in the art to combine these familiar elements, disclosed and/or embodied in the prior art listed above to practice the ’304 Patent Asserted Claims.

Same Technical Issues: A person of ordinary skill would have been motivated to combine the above prior art based on his/her knowledge, the nature of the problem to be solved, and the

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teachings of the prior art. The identified prior art addresses the same or similar technical issues and suggests the same or similar solutions to those issues. Moreover, some of the prior art refer to or discuss other prior art, illustrating the close technical relationship among the prior art. For the '304 Patent, one of ordinary skill in the art would have been motivated to combine known prior art solutions described in these references relating to wearable devices measuring physiological parameters.

Demand and Market Forces: For example, market forces suggested a demand for wearable devices for measuring physiological parameters, and thus one of skill in the art would have thought to combine or modify references that described known methods that one of skill in the art would have recognized as offering improvements to solutions of that time.

Known Elements; Obvious to Try: Moreover, many of the claim elements were already known as admitted by the applicant in the patent specification. These elements represented design choices available to a person of ordinary skill. When there is a design need or market pressure to solve a problem such as identified previously and/or described in the '304 Patent, and there are a finite number of identified, predictable solutions, a person of ordinary skill would be motivated to combine the known options that are within his or her technical grasp. For the '304 Patent, there are a finite number of approaches for providing a wearable device for measuring physiological parameters. For example, as of the priority date of the '304 Patent, a POSITA would have been very familiar with basic elements of the '304 Patent's claims such as semiconductors, optical wavelengths, signal-to-noise ratio, detectors, analog to digital converters, smart phones/tablets, cloud, and their configurations and/or means for the same. Such elements were within the knowledge of a POSITA, whether or not disclosed in any particular reference, and the inclusion of such elements in the '304 Patent's claims does not render them novel or non-obvious.

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There are significant similarities in subject matter and objectives for each of many references used in these contentions for the ’304 Patent.

Reflective Surface References: For example, charted reference **LeBoeuf**, as well as numerous other references such as **Basu** and **Valencell** all include teachings related to physiological measurement systems. These references provide numerous methods for using a reflective surface in a sensor to direct the reflected light from a sample to a detector. For example, **LeBoeuf** teaches using a “cover 18” with a “cladding material 21 [which] may be reflective material” to “serve[] as a light guide that… collects light external to the earbud housing 16 and delivers the collected light to the optical detector 26”. LeBoeuf, [0103], [0107], [0115]. **Basu** teaches “[t]he battery 32 may additionally be arranged to provide a reflective surface for the light emitted by the LED 14 toward the photodiode 16.” Basu, [0088]. **Valencell** teaches “The light guiding region 2306 helps direct light to and/or from the sensor module …. In some embodiments, the light guiding region 2306 may be a reflector.” Valencell, [0152].

A person of skill in the art would understand that the functionality taught in these references could be added to other methods and systems for physiological measurements. These methods provide the benefit of improved delivery of the light reflected from tissue to the detectors in the sensor. Moreover, to the extent that any of these references includes a feature not expressly disclosed in one or more other references, a POSITA would have naturally looked to, and been motivated to combine, any one of these references with one or more of the other references in order to better achieve their common goals of more accurate and efficient physiological monitoring.

SNR Techniques: For example, charted reference **Kassim**, as well as numerous other references such as **Carlson, Basu, Lisogurski, Marbach**, and **LeBoeuf** all include teachings related to physiological measurement systems. These references provide numerous methods for

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improving signal-to-noise ratio through various methods, including increasing light intensity, increasing pulse rate, differencing detected signals, and applying multivariate techniques. For example, **Kassim** teaches "a maximum of the true Red PPG signal (devoid of ambient noise) can simply be obtained by subtracting the obtained maximum value of the Red PPG signal, obtained when the Red LED is turned on, with the obtained maximum value of the ambient PPG signal." Kassim, 22:27-23:3. **Carlson** teaches that "shift[ing] [the] spectrum of signal" can result in "increasing significantly the Signal-to-Noise and Signal-to-Background ratio" when the "frequency is chosen in such a way that it is outside the frequency spectrum of sunlight and of ambient light." Carlson, [0069]. **Basu** teaches "[t]o maximize the signal-to-noise ratio in photoplethysmography, the LED intensity should be made as large as possible without saturating the detector." Basu, [0058]. **Lisogurski** teaches "dark subtractor 162 may subtract dark values from the Red and IR components to generate adjusted Red and IR signals. For example, dark subtractor 162 may determine a subtraction amount from the dark signal portion of the detection signal and subtract it from the peak portion of the detection signal in order to reduce the effect of the dark signal on the peak. Lisogurski, 13:60-67. **Marbach** teaches "The LEDs are preferably pulse-modulated with a pulse frequency on the order of several kHz. Low power, quasi-continuous operation is possible by measuring intermittently, e.g., one measurement lasting 10 seconds every 5 minutes. …depending on the sampling rate and SNR requirements," and performing "measurement algorithms" on "multivariate input data" of measurement signals in order to "better the measurement accuracy a.k.a. SNR." Marbach, 17:1-7, 12:19-27. **LeBoeuf** teaches "Channel A refers to inputs from sensors that collect physiological information plus noise information, and Channel B refers to inputs from sensors that collect primarily … noise information. … The filter 203 properties are updated to minimize the difference between Channel A and the post-processed

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Channel B, denoted as B. In this way, noise is removed from Channel A and Channel C contains predominantly physiological information." LeBoeuf, [0143].

A person of skill in the art would understand that the functionality taught in these references could be added to other methods and systems for physiological measurements. These methods and systems provide the benefit of increasing a signal-to-noise ratio of the measure signal. Moreover, to the extent that any of these references includes a feature not expressly disclosed in one or more other references, a POSITA would have naturally looked to, and been motivated to combine, any one of these references with one or more of the other references in order to better achieve their common goals of more accurate and efficient physiological monitoring.

Smartphone/Tablet References: For example, charted reference **Basu**, as well as numerous other references such as **Kassim**, **Kreger**, **Lisogurski**, **Tran**, all include teachings related to physiological measurement systems. These references provide numerous means for a physiological monitoring system to be configured for use with a smart phone or tablet. For example, **Basu** teaches "health ring 44 which can monitor heart rate on a 24 hour basis," and that "combines the sensor with a…wireless transmitter linked to an application running on the user's cell phone." Basu, [0065]-[0066]. For example, **Kassim** teaches "[t]he optical measurement device 300 further comprises a coupling member 316 that can provide coupling between the measurement device 300 to a personal mobile processing device/feedback unit (not shown) in a cableless configuration," and that "the feedback unit may be a portable device, such as a mobile phone, smartphone, personal digital assistant (PDA), tablet, netbook or laptop, although this list is not exhaustive by any means." Kassim, 12:5-14. For example, **Kreger** teaches a "biosensor interface apparatus for use with a mobile communication device 10," that "can be any of a number of mobile phones such as an iPhone® or an Android® phone, a personal digital assistant (PDA)

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such as a Blackberry®, a portable audio playback device such as an MP3 player, a portable media playback device such as an iPod®, or a handheld tablet such as an iPad®." Kreger, 5:40-53; *see also* Kreger, 7:39-46. For example, **Lisogurski** teaches a "monitor [that] may be powered by a battery" with a "[u]ser interface [which] may include user input 182, display 184, and speaker 186. User input 182 may include any type of user input device such as a keyboard, a mouse, a touch screen, buttons, switches, a microphone, a joy stick, a touch pad, or any other suitable input device." Lisogurski, 15:19-23, 18:65-67. For example, **Mault** teaches a blood glucose monitoring system including an electronic device that "can be a portable electronic device or system carried by the person, or a device or system combining multiple functionalities, such as:…a portable computer; any portable Internet access device; [or] a wireless phone…." Mault [0069]-[0070]. For example, **Poeze** teaches "a personal health organizer software module 132 executed on a general purpose computing device 126, with the computing device 126 coupled with the health data collection device 112 via a communications link 128," where the "personal health organizer module 132 can be an executable program on an operating system of a device such as a mobile phone, a personal digital assistant, a portable music player, an electronic book reader, a netbook, a TV media center, and a laptop or desktop computer. For example, the personal health organizer module 132 can be an application that is executed on the operating system of a mobile phone such as the iPhone manufactured by Apple, Inc., a Blackberry device manufactured by Research In Motion, Inc., the Pre manufactured by Palm, Inc, or a mobile device manufactured by HTC, Nokia, or Motorola, etc." Poeze, [0034]; *see also* Poeze [0010]. **Tran** teaches that while a patient with a wearable device is outside a mesh network range, "the wearable appliance communicates with the cell phone," such as a "smart phone[]" and "provides information to the server 200 using the cellular connection." Tran, 34:4-30.

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A person of skill in the art would understand that the functionality taught in these references could be added to other methods and systems that concern physiological monitoring. These methods and systems provide the benefit of more processing power and more convenient means to flag emergency situations. Moreover, to the extent that any of these references includes a feature not expressly disclosed in one or more other references, a POSITA would have naturally looked to, and been motivated to combine, any one of these references with one or more of the other references in order to better achieve their common goals of more accurate and efficient physiological monitoring.

Cloud References: For example, charted reference **Kassim**, as well as numerous other references such as **Mault, Basu, Lisogurski**, and **Poeze** all include teachings related to physiological measurement systems. These references provide numerous means for a physiological monitoring system to be configured for use a with cloud. For example, **Kassim** teaches that "[t]he computer platform may further be connected to network resources 2006 which connect to the Internet or other components of a local public or private network. The network resources 2006 may provide instructions and data to the computer platform from a remote location on a network 2007." Kassim, 33:34-34:19. **Mault** teaches "[t]he PDA can access the communications network, such as the Internet, using a wireless connection. Data can be transferred to the remote system over the communications network 20." Mault, [0077]. **Basu** teaches "a cloud-based health monitoring and mentoring framework which integrates remote patient monitoring (RPM) with an online community involving medical caregivers and a social network of the patient's peers." Basu, [0081]. **Lisogurski** teaches "monitor 314 and/or multi-parameter physiological monitor 326 may be coupled to a network to enable the sharing of information with servers or other work-stations." Lisogurski, 18:62-65. **Poeze** teaches "the camera is paired with an

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opti cal character recognition module so that scanned medical forms can be converted into data that can be uploaded for synchronization at a server in a network (e.g. a cloud computing network) or stored on the personal health organizer device." Poeze, [0048].

A person of skill in the art would understand that the functionality taught in these references could be added to other methods and systems for physiological measurements. These methods improving the analysis capabilities of measurement systems due to the increased processing and storage power of a cloud. Moreover, to the extent that any of these references includes a feature not expressly disclosed in one or more other references, a POSITA would have naturally looked to, and been motivated to combine, any one of these references with one or more of the other references in order to better achieve their common goals of more accurate and efficient physiological monitoring.

Optical Detection Techniques References: For example, charted reference **Keller**, as well as numerous other references such as **Mault**, **Carlson, Lisogurski, Basu**, **Jung**, and **Marbach** all include teachings related to physiological measurement systems. These references provide numerous means for effective optical detection through various methods, including synchronizing light sources and detectors and modulating the light source. For example, **Keller** teaches that "[t]he light source 102 may also be pulsed or flashed, in order, for example, to synchronize with the imaging devices 305, 504 (see, FIGS. 3 and 5, respectively) of the invention." Keller, [0088]. **Mault** teaches "electrical modulation of a single device may be used to obtain multiple wavelength emission" Mault, [0020]. **Carlson** teaches "us[ing] a light source modulation to temporarily modulate the optical radiation of the LED … in order to shift the power spectrum of the pulsometer signals into a higher frequency range." Carlson, [0063]-[0065]. **Lisogurski** teaches "front end processing circuitry 150 may use the timing control signals to operate

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synchronously with light drive circuitry 120." Lisogurski, 11:41-43. **Basu** teaches "[t]he LED 14 is modulated at 1 KHz frequency or higher. The received PD signal oscillates at the same frequency." Basu, [0037]. **Jung** teaches "[t]he three monochrome sources, however, are turned on and off rapidly, synchronous with the spectral measurements being taken." Jung, 68:26-30. **Lamego** teaches a "digital-to-analog conversion circuit 338" that includes "a synchronizing latch 323" which "accepts the synchronizing pulses which maintain synchronization between the activation of emitters 302 and the analog to digital conversion circuit 332." Lamego, [0044]-[0045]. **Marbach** teaches "The LEDs are preferably pulse-modulated with a pulse frequency on the order of several kHz. Low power, quasi-continuous operation is possible by measuring intermittently, e.g., one measurement lasting 10 seconds every 5 minutes." Marbach, 17:1-5.

A person of skill in the art would understand that the functionality taught in these references could be added to other methods and systems for physiological measurements. These methods and systems provide increased accuracy for monitoring physiological parameters. Moreover, to the extent that any of these references includes a feature not expressly disclosed in one or more other references, a POSITA would have naturally looked to, and been motivated to combine, any one of these references with one or more of the other references in order to better achieve their common goals of more accurate and efficient physiological monitoring.

Artificial Intelligence / Multivariate Techniques References: For example, charted reference **Tran**, as well as numerous other references such as **Mault** and **Marbach** all include teachings related to physiological measurement systems. These references provide numerous means for using artificial intelligence and multivariate techniques to make decisions and improve signal-to-noise ratios. For example, **Tran** teaches that "feed forward artificial neural networks (NNs) are used to classify valve-related heart disorders." Tran, 74:45-62. **Mault** teaches that

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"[f]eedback, generated by a specialist or computer expert system, may be transmitted to the PDA from the remote computer over the communications network." Mault, [0077]. **Marbach** teaches performing "measurement algorithms" on "multivariate input data" of measurement signals in order to "better the measurement accuracy a.k.a. SNR." Marbach, 12:19-27.

A person of skill in the art would understand that the functionality taught in these references could be added to other methods and systems for physiological measurements. These methods and systems provide increased decision-making capabilities and minimize noise interference. Moreover, to the extent that any of these references includes a feature not expressly disclosed in one or more other references, a POSITA would have naturally looked to, and been motivated to combine, any one of these references with one or more of the other references in order to better achieve their common goals of more accurate and efficient physiological monitoring.

Arc References: For example, charted reference **Isaacson**, as well as numerous other references such as **Jung**, and **LeBoeuf** all include teachings related to physiological measurement systems. These references provide numerous methods for utilizing a plurality of semiconductor sources and the plurality of spatially separated detectors are located on one or more arcs. For example, **Isaacson** teaches emitters 10, 20 and detectors 12, 22 disposed on an arc. Isaacson, 4:64-5:9, Fig. 1. For example, **Jung** teaches "a fiber optic arrangement presented at the forward end of probe tip 1" which "utilizes a single central light source fiber optic…and a plurality of perimeter light receiver fiber optics, denoted as light receivers R1, R2 and R3." Jung, 11:21-50, Fig. 2; *see also* Jung 24:39-48, 24:39-62, 32:66-33:9, 39:41-40:14, Figs. 9, 10A-B, 20, 28A-B. For example, **LeBoeuf** teaches optical emitters 24 and optical detectors 26 configured in an arc. LeBoeuf, [0123]-[1024], Fig. 8B

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A person of skill in the art would understand that the functionality taught in these references could be added to other methods and systems that concern physiological monitoring. These methods provide the benefit of better acquisition of signals from the samples. Moreover, to the extent that any of these references includes a feature not expressly disclosed in one or more other references, a POSITA would have naturally looked to, and been motivated to combine, any one of these references with one or more of the other references in order to better achieve their common goals of more accurate and efficient physiological monitoring.

b. Combinations

For at least the reasons described above, it would have been obvious to one of ordinary skill in the art to combine each prior art reference listed in Appendix D with any other reference or references listed in Appendix D along with the knowledge of one of ordinary skill in the art to arrive at the inventions claims in the ’304 Patent.

For example, and without limitation, the Asserted Claims of the ’304 Patent would have been obvious to one of ordinary skill in the art in view of the following combinations:

(i) Lisogurski, Kassim, Chandrasekar2012, Valencell, Mault, and Basu Combined with Reflective Surface References

A POSITA would have had reason to combine references **Lisogurski**, **Kassim**, **Chandrasekar2012**, **Valencell**, **Mault**, or **Basu**, or any of the references in Appendix D, with any one of the Reflective Surface References all of which relate to systems and methods for physiological monitoring. Each of references **LeBoeuf, Basu** and **Valencell** relate to physiological monitoring systems which use a reflective surface to direct the reflected light from a sample to a detector. Indeed, such components and/or processes were conventional as of the time these references were known. Each of the Reflective Surface References provide means—

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not necessarily expressly present in all other references—for using a reflective surface in a sensor to direct the reflected light from a sample to a detector. A POSITA would have understood that the systems and methods for the Reflective Surface References were intended to be incorporated into wearable measurement devices. A POSITA would understand that systems and methods for incorporating reflective surfaces into sensors to direct the reflected light from a sample to a detector provide improvements such as enhancing the efficiency of the delivery of the light reflected from or transmitted through the tissue to the detectors in the sensor, minimizing loss of light intensity due to scattering. *E.g.*, LeBoeuf, [0125] ("An advantage of this configuration is … this configuration may reduce unwanted optical signals from regions that may not be relevant to the physiological activity of interest.") A POSITA would further understand that in order to implement a wearable measurement device, the systems and methods for optical measurement systems would commonly be combined with reflective surfaces, and thus a POSITA would have been motivated to combine the teachings of these references. The combination would apply known techniques of including basic optical components, to wearable measurement devices that were ready for improvement, in order to yield predictable results. The combination would further be "obvious to try," because it would involve simple design choices from a finite number of identified, predictable solutions, with a reasonable expectation of success.

(ii) Lisogurski, Kassim, Chandrasekar2012, Valencell, Mault, and Basu Combined with SNR Techniques References

A POSITA would have had reason to combine references **Lisogurski**, **Kassim, Chandrasekar2012**, **Valencell**, **Mault**, or **Basu**, or any of the references in Appendix D, with any one of the SNR Techniques References all of which relate to systems and methods for physiological monitoring. Each of references **Kassim, Carlson, Basu, Lisogurski, Marbach**, and **LeBoeuf** relate to physiological monitoring systems which use various methods for improving

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signal-to-noise ratio. Indeed, such components and/or processes were conventional as of the time these references were known. Each of the SNR Techniques References provide means—not necessarily expressly present in all other references—for various methods, including increasing light intensity, increasing pulse rate, and differencing detected signals to improve the SNR of a detected signal. A POSITA would have understood that the systems and methods for the SNR Techniques References were intended to be incorporated into wearable measurement devices. A POSITA would understand that systems and methods for incorporating the usage of various SNR techniques into physiological measurement systems provide improvements such as reducing the effects of background noise or ambient light on the measurement signal and improving the accuracy of the measurement. *E.g.*, Kassim, 22:28-22:30 ("The inventors have recognized that by identifying and utilizing only significant information for Sp02 calculation, an efficient and accurate calculation can be carried out"). A POSITA would further understand that in order to implement a wearable measurement device, the systems and methods for optical measurement systems would commonly be combined with SNR improvement techniques, and thus a POSITA would have been motivated to combine the teachings of these references. The combination would apply known techniques of using known noise reduction and signal enhancement methods, to wearable measurement devices that were ready for improvement, in order to yield predictable results. The combination would further be "obvious to try," because it would involve simple design choices from a finite number of identified, predictable solutions, with a reasonable expectation of success.

(iii) Lisogurski, Kassim, Chandrasekar2012, Valencell, Mault, and Basu Combined with Smartphone/Tablet References

A POSITA would have had reason to combine references **Lisogurski**, **Kassim**, **Chandrasekar2012**, **Valencell**, **Mault**, or **Basu**, or any of the references in Appendix E, with any

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one of Smartphone/Tablet References all of which relate to systems and methods for physiological monitoring. Each of references **Basu**, **Kassim**, **Kreger**, **Lisogurski**, **Mault**, **Poeze**, and **Tran** relate to physiological monitoring systems for use with a smartphone or tablet. Indeed, such components and/or processes were conventional as of the time these references were known. Each of Smartphone/Tablet References provide means—not necessarily expressly present in all other references—for a physiological monitoring system to communicate with a smartphone or tablet. A POSITA would have understood that the systems and methods for Smartphone/Tablet References were intended to be incorporated into wearable measurement devices. A POSITA would understand that systems and methods for connectivity to smartphones or tablets provide improvements improving the analysis capabilities of measurement systems due to the increased processing power of smartphones and tablets and the additional resources provided by their ability to connect to wireless and cell networks. *E.g.*, Basu, [0066] (physiological monitoring system "combines the sensor with a…wireless transmitter linked to an application running on the user's cell phone."); Kreger, 13:1-3 ("Mobile device smart phone 444 may derive measurements, display plots, transmit medical records of biosensor data, and so forth."); Tran, 34:4-40 ("If the wearable appliance detects a cellphone that is mesh network compatible, the wearable appliance communicates with the cell phone," such as a "smart phone" and "provides information to the server 200 using the cellular connection."). A POSITA would further understand that in order to implement a wearable measurement device, the systems and methods for optical physiological measurement would commonly be combined with smartphone and personal computing technology and thus a POSITA would have been motivated to combine the teachings of these references. The combination would apply known techniques of providing for connectivity to smartphone or personal computing devices in wearable measurement devices that were ready for improvement,

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in order to yield predictable results. The combination would further be "obvious to try," because it would involve simple design choices from a finite number of identified, predictable solutions, with a reasonable expectation of success.

(iv) Lisogurski, Kassim, Chandrasekar2012, Valencell, Mault, and Basu Combined with Cloud References

A POSITA would have had reason to combine references **Lisogurski**, **Kassim**, **Chandrasekar2012**, **Valencell**, **Mault**, or **Basu**, or any of the references in Appendix D, with any one of the Cloud References all of which relate to systems and methods for physiological monitoring. Each of references **Kassim**, **Mault, Basu, Lisogurski**, and **Poeze** relate to connecting the physiological monitoring system with a cloud. Indeed, such components and/or processes were conventional as of the time these references were known. Each of the Cloud References provide means—not necessarily expressly present in all other references—for a physiological monitoring system to communicate with a cloud. A POSITA would have understood that the systems and methods for the Cloud References were intended to be incorporated into wearable measurement devices. A POSITA would understand that systems and methods for connectivity to a cloud provide improvements improving the analysis capabilities of measurement systems due to the increased processing and storage power of a cloud and the additional resources provided by their ability to connect to the internet and other remote networks. *E.g.*, Kassim, 34:14-16 ("The network resources may include 15 storage devices for storing data and executable instructions at a location separate from the computer platform 2001"). *E.g.*, Mault, [0077] ("Data can be transferred to the remote system over the communications network 20, allowing examination by a dietician, physician, other specialist"). A POSITA would further understand that in order to implement a wearable measurement device, the systems and methods for optical physiological measurement would commonly be combined with cloud connectivity and thus a POSITA would have been

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motivated to combine the teachings of these references. The combination would apply known techniques of providing for connectivity to smartphone or personal computing devices in wearable measurement devices that were ready for improvement, in order to yield predictable results. The combination would further be "obvious to try," because it would involve simple design choices from a finite number of identified, predictable solutions, with a reasonable expectation of success.

(v) Lisogurski, Kassim, Chandrasekar2012, Valencell, Mault, and Basu Combined with Optical Detection Techniques References

A POSITA would have had reason to combine references **Lisogurski**, **Kassim**, **Chandrasekar2012**, **Valencell**, **Mault**, or **Basu**, or any of the references in Appendix D, with any one of the Optical Detection Techniques References all of which relate to systems and methods for physiological monitoring. Each of references **Keller, Mault**, **Carlson, Lisogurski, Basu**, **Jung**, and **Marbach** relate to physiological monitoring systems which use various methods for effective optical detection. Indeed, such components and/or processes were conventional as of the time these references were known. Each of the Optical Detection References provide means—not necessarily expressly present in all other references—for various methods, including synchronizing light sources and detectors and modulating the light source for effective optical detection of a sample. A POSITA would have understood that the systems and methods for the Optical Detection References were intended to be incorporated into wearable measurement devices. A POSITA would understand that systems and methods for incorporating the usage of various optical detection techniques into physiological measurement systems provide improvements such as improving the system's ability to effectively detect and measure samples of interest. *E.g.*, Carlson , [0065] ("AC-Coupling or Lock-In Amplification (synchronous detection), is to temporarily modulate the optical radiation of the LED at the carrier frequency fc in order to shift the power spectrum of the pulsoximeter signals into a higher frequency range where

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environmental optical radiation is unlikely and electronic band pass filtering is technologically less stringent."); Lamego, [0045] ("[D]river circuit," including "synchronizing latch 323 [that] accepts the synchronizing pulses which maintain synchronization between the activation of emitters 302 and the analog to digital conversion circuit 332" "is designed to minimize the noise from the emitters 302."). A POSITA would further understand that in order to implement a wearable measurement device, the systems and methods for optical measurement systems would commonly be combined with optical detection techniques, and thus a POSITA would have been motivated to combine the teachings of these references. The combination would apply known techniques of using known optical detection methods, to wearable measurement devices that were ready for improvement, in order to yield predictable results. The combination would further be "obvious to try," because it would involve simple design choices from a finite number of identified, predictable solutions, with a reasonable expectation of success.

(vi) Lisogurski, Kassim, Chandrasekar2012, Valencell, Mault, and Basu Combined with Artificial Intelligence / Multivariate Techniques References

A POSITA would have had reason to combine references **Lisogurski**, **Kassim**, **Chandrasekar2012**, **Valencell**, **Mault**, or **Basu**, or any of the references in Appendix D, with any one of the Artificial Intelligence / Multivariate Techniques References all of which relate to systems and methods for physiological monitoring. Each of references **Tran, Mault,** and **Marbach** relate to physiological monitoring systems which use artificial intelligence or multivariate techniques to improve their measurements. Indeed, such components and/or processes were conventional as of the time these references were known. Each of the Artificial Intelligence / Multivariate Techniques References provide means—not necessarily expressly present in all other references—for improving a system's decision-making and the SNR of a measured signal. A POSITA would have understood that the systems and methods for the

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Artificial Intelligence / Multivariate Techniques References were intended to be incorporated into wearable measurement devices. A POSITA would understand that systems and methods for incorporating the usage artificial intelligence and multivariate techniques into physiological measurement systems provide improvements such as improving the system's ability to effectively make decisions and make accurate measurements with minimal noise interference. *E.g.*, Tran, 5:57-65 ("For example, the system can perform patient behavior analysis such as eating/drinking/smoke habits and medication compliance, among others"). A POSITA would further understand that in order to implement a wearable measurement device, the systems and methods for optical measurement systems would commonly be combined with artificial intelligence and multivariate techniques, and thus a POSITA would have been motivated to combine the teachings of these references. The combination would apply known techniques of using known artificial intelligence models and multivariate calculation methods, to wearable measurement devices that were ready for improvement, in order to yield predictable results. The combination would further be "obvious to try," because it would involve simple design choices from a finite number of identified, predictable solutions, with a reasonable expectation of success.

(vii) Lisogurski, Kassim, Chandrasekar2012, Valencell, Mault, and Basu Combined with Arc References

A POSITA would have had reason to combine references **Lisogurski**, **Kassim**, **Chandrasekar2012**, **Valencell**, **Mault**, or **Basu**, or any of the references in Appendix D, with any one of Arc References all of which relate to systems and methods for physiological monitoring. Each of references **Isaacson**, **Jung**, and **LeBoeuf** relate to physiological monitoring systems with their light sources and/or detectors configured in an arc. Indeed, such components and/or processes were conventional as of the time these references were known. Each of Arc References provide means—not necessarily expressly present in all other references—for configuring the

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detectors and/or emitters of a physiological measurement system in an arc formation. A POSITA would have understood that the systems and methods for Arc References were intended to be incorporated into wearable measurement devices. A POSITA would understand that systems and methods for configuring optical detectors and emitters in an arc formation would provide improvements such as increased measurement accuracy due to lessening the negative effects of light scattering and accounting for the contours of the tissue sample that is being measured. A POSITA would further understand that in order to implement a wearable measurement device, the systems and methods for optical measurement would commonly be combined detectors and emitters in an arc formation, and thus a POSITA would have been motivated to combine the teachings of these references. The combination would apply known techniques for varying the spatial configurations of emitters and detectors in wearable measurement devices that were ready for improvement, in order to yield predictable results. The combination would further be "obvious to try," because it would involve simple design choices from a finite number of identified, predictable solutions, with a reasonable expectation of success.

Furthermore, to the extent any limitation of an Asserted Claim is deemed not to be exactly disclosed by an item of prior art, then the claim is rendered obvious by combination of the prior art in Exhibits D1 through D19 standing alone, in combination with the reference(s) in any other claim chart, in combination with any system art identified in Table 2-D, in combination with Applicant's Admitted Prior Art, in view of the knowledge of a person of ordinary skill in the art, and/or in view of the Lens References, Light Intensity References, Three Wavelength References, Six LED References, Smartphone/Tablet References, Synchronize Light Source/Detector References, and/or Arc References for the reasons discussed above.

5. U.S. Patent No. 11,160,455

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Pursuant to P.R. 3-3(a) and (b), Defendants identify in Appendix E the prior art references that render obvious the Asserted Claims of the ’455 Patent and include below exemplary combinations showing the obviousness of the ’455 Patent Asserted Claims in view of the prior art. To the extent Plaintiff contends that an element is not disclosed in any one of the anticipatory references described in Appendix E, the limitation would have been obvious in light of the disclosures within the reference and the knowledge of one of ordinary skill in the art at the time of the ’455 Patent. Moreover, to the extent Plaintiff contends that an element is not disclosed in any one of the anticipatory references described in Appendix E, such reference may be combined with any other references listed in Appendix E for such element, thereby rendering the claims invalid for obviousness. To the extent a finder of fact determines that a limitation of any of the ’455 Patent Asserted Claims is not disclosed by one of the references identified above pursuant to P.R. 3-3(a), the claim is nevertheless unpatentable as obvious because they contain nothing that constitutes a patentable innovation. To the extent a finder of fact determines that a limitation of the ’455 Patent Asserted Claims is not anticipated, it does not go beyond combining familiar elements according to known methods to achieve predictable results or does more than choose between clear alternatives known to those of ordinary skill in the art.

a. Obviousness Rationale and Motivations to Combine

Obviousness: For at least the reasons described in these contentions, it would have been obvious to one of ordinary skill in the art to combine any of a number of prior art references, including any combination of those prior art references identified in Appendix E along with the knowledge of one of ordinary skill in the art to meet the limitations of the ’455 Patent Asserted Claims. As a result, the references identified herein render one or more Asserted Claims of the ’455 Patent obvious when the references are read in combination with each other, and/or when

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read in view of the state of the art and knowledge of those skilled in the art. Each and every reference identified is also relevant to the state of the art at the time of the alleged invention. Any of the references disclosed above may be combined with one another to render obvious (and therefore invalid) each of Omni's Asserted Claims. Defendants may rely upon a subset of the identified references or all of the references identified herein, including all references in Appendix E, for purposes of obviousness depending on the Court's claim construction, positions taken by Omni during this litigation, and further investigation and discovery.

Reservation of Rights: Moreover, as mentioned above, Defendants have not yet completed their search or discovery concerning additional prior art, including prior art systems that may anticipate and/or render obvious the Asserted Claims (e.g., System Art). As such, Defendants' inclusion of exemplary combinations does not preclude them from identifying other invalidating combinations as appropriate, and Defendants reserve the right to identify additional specific combinations as well as to detail and explain such combinations.

No More Than Ordinary Variations of Prior Art; No Unexpected Results: To the extent not anticipated, the '455 Patent Asserted Claims represent no more than the result of ordinary variations of the prior art. Defendants further believe that no showing of a specific motivation to combine prior art is required to combine the references disclosed above and in the attached charts, as each combination of art would have no unexpected results, and at most would simply represent a known alternative to one of ordinary skill in the art. *See KSR Int'l Co. v. Teleflex, Inc.*, 550 U.S. 398, 415-16 (2007) (rejecting the Federal Circuit's "rigid" application of the teaching, suggestion, or motivation to combine test, instead espousing an "expansive and flexible" approach); *Apple Inc. v. Samsung Elecs. Co.*, 839 F.3d 1034, 1058 (Fed. Cir. 2016); *Intercontinental Great Brands LLC v. Kellogg N. Am. Co.*, 869 F.3d 1336, 1344 (Fed. Cir. 2017).

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Indeed, the Supreme Court held that a person of ordinary skill in the art is "a person of ordinary creativity, not an automaton" and "in many cases a person of ordinary skill in the art will be able to fit the teachings of multiple patents together like pieces of a puzzle." *Id.* at 420-21. Nevertheless, in addition to the information contained elsewhere in these contentions, Defendants identify motivation and reason to combine the cited art.

Predictable Results; Obvious to Try: One or more combinations of the prior art references identified in Appendix E would have been obvious because these references would have been combined using: known methods to yield predictable results; known techniques in the same way; a simple substitution of one known, equivalent element for another to obtain predictable results; and/or a teaching, suggestion, or motivation in the prior art generally. In addition, it would have been obvious to try combining the prior art references identified above because there were only a finite number of predictable solutions and/or because known work in one field of endeavor prompted variations based on predictable design incentives and/or market forces either in the same field or a different one. Further, the combinations of the prior art references identified in Appendix E would have been obvious because the combinations represent known potential options with a reasonable expectation of success.

Interrelated Teachings: Additional evidence that there would have been a motivation to combine the prior art references identified above includes the interrelated teachings of multiple prior art references; common authorship; the effects of demands known to the design community or present in the marketplace; the existence of a known problem for which there was an obvious solution encompassed by the '455 Patent Asserted Claims; the existence of a known need or problem in the field of the endeavor at the time of the alleged invention(s); and the background knowledge that would have been possessed by a person having ordinary skill in the art.

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Summary of Motivations to Combine: Thus, the motivation to combine the teachings of the prior art references disclosed in Appendix E is found in the references themselves and also in: (1) the nature of the problem being solved; (2) the express, implied and inherent teachings of the prior art; (3) the knowledge of persons of ordinary skill in the art; (4) the predictable results obtained in combining the different elements of the prior art; (5) the predictable results obtained in simple substitution of one known element for another; (6) the use of a known technique to improve similar devices, methods, or products in the same way; (7) the predictable results obtained in applying a known technique to a known device, method, or product ready for improvement; (8) the finite number of identified predictable solutions that had a reasonable expectation of success; and (9) known work in various technological fields that could be applied to the same or different technological fields based on design incentives or other market forces.

Same Area of Technology: Additionally, it would be obvious to one of ordinary skill in the art to consult and/or combine any of the prior art listed in Appendix E because all of these references relate to the same area of technology and/or are from analogous art. The ’455 Patent Asserted Claims are directed to a physiological measurement system. ’455 Patent at Abstract. The ’455 Patent Asserted Claims merely unite old elements, well known in the field, with no change in their respective function or result. Given the interrelated teachings of the prior art, the effects of demands known to the design community or present in the marketplace, and the background knowledge possessed by a person having ordinary skill in the art, it would have been obvious for one of ordinary skill in the art to combine these familiar elements, disclosed and/or embodied in the prior art listed above to practice the ’455 Patent Asserted Claims.

Same Technical Issues: A person of ordinary skill would have been motivated to combine the above prior art based on his/her knowledge, the nature of the problem to be solved, and the

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teachings of the prior art. The identified prior art addresses the same or similar technical issues and suggests the same or similar solutions to those issues. Moreover, some of the prior art refer to or discuss other prior art, illustrating the close technical relationship among the prior art. For the ’455 Patent, one of ordinary skill in the art would have been motivated to combine known prior art solutions described in these references relating to wearable devices measuring physiological parameters.

Demand and Market Forces: For example, market forces suggested a demand for wearable devices for measuring physiological parameters, and thus one of skill in the art would have thought to combine or modify references that described known methods that one of skill in the art would have recognized as offering improvements to solutions of that time.

Known Elements; Obvious to Try: Moreover, many of the claim elements were already known as admitted by the applicant in the patent specification. These elements represented design choices available to a person of ordinary skill. When there is a design need or market pressure to solve a problem such as identified previously and/or described in the ’455 Patent, and there are a finite number of identified, predictable solutions, a person of ordinary skill would be motivated to combine the known options that are within his or her technical grasp. For the ’455 Patent, there are a finite number of approaches for providing a wearable device for measuring physiological parameters. For example, as of the priority date of the ’455 Patent, a POSITA would have been very familiar with basic elements of the ’455 Patent’s claims such as semiconductors, optical wavelengths, lenses, signal-to-noise ratio, detectors, analog to digital converters, smart phones/tablets, cloud, and their configurations and/or means for the same. Such elements were within the knowledge of a POSITA, whether or not disclosed in any particular reference, and the inclusion of such elements in the ’455 Patent’s claims does not render them novel or non-obvious.

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There are significant similarities in subject matter and objectives for each of many references used in these contentions for the ’455 Patent.

Lens References: For example, charted reference **Carlson**, as well as numerous other references such as **LeBoeuf**, **Poeze**, **Pologe**, and **Valencell** all include teachings related to physiological measurement systems. These references provide numerous means and methods for using lenses to receive at least a portion of the output optical light and to deliver a lens output light to tissue, which were already well known in the art. For example, **Carlson** teaches using “a beam-shaping element, such as e.g. diffractive or refractive lenses, to direct the emitted optical radiation of, e.g., the LED light Source into the human or animal tissue and the photon detecting element in order to increase the optical signal power, detected by the pulsoximeter sensor, and thus increasing the Signal/Noise-and signal/Background ratio.” Carlson, [0014]; *see also* Carlson, [0024]; [0041], [0062], FIG. 6c. Fore example, **LeBoeuf** teaches “lenses 29L [] configured to focus inspection light 111 onto a particular region of the ear.” LeBoeuf, [0114]; *see also* LeBoeuf, [0011], [0019], [0031], [0036], [0097], [0114], [0116] [0117], [0135], [0138], [0161], [0168]. For example, **Poeze** teaches “the device 112 includes an optional tissue thickness adjuster or tissue shaper 522, which can include one or more…lenses….” Poeze, [0102]. **Pologe** further teaches a “wavelength division multiplexing (WDM) coupler[]” using a lens to combine light signals from emitters into a “single multiplexed light signal on output cable 24.” Pologe, 5:16-51. For example, **Valencell** teaches “optical lenses 715 [that] may be designed for the desired optical coupling between the skin/blood vessel region and the emitter 102 or detector 103.” Valencell, [0118]; *see also* Valencell, [0016]-[0017], [0022]-[0023], [0038], [0119], [0121], [0124]-[0125], [0128]-[0131].

A person of skill in the art would understand that the functionality taught in these references could be added to other methods and systems that concern physiological monitoring. These

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methods provide the benefit of increasing the light intensity to increase signal-to-noise ratio, without increasing power usage. Moreover, to the extent that any of these references includes a feature not expressly disclosed in one or more other references, a POSITA would have naturally looked to, and been motivated to combine, any one of these references with one or more of the other references in order to better achieve their common goals of more accurate and efficient physiological monitoring.

Light Intensity References: For example, charted reference **Basu**, as well as numerous other references such as **Kassim**, **Lisogurski**, and **Valencell** all include teachings related physiological measurement systems. These references provide numerous methods for increasing the signal-to-noise ratio by increasing light intensity of at least one of the semiconductor sources from an initial light intensity. For example, **Basu** teaches "[t]o maximize the signal-to-noise ratio in photoplethysmography, the LED intensity should be made as large as possible without saturating the detector." Basu, [0058]. For example, **Kassim** teaches "the effects of ambient light signals 30 can be reduced as much as possible by tuning the intensities of the IR and Red LEDs to be maximized as long as the detection assembly has not reached saturation." Kassim, 16:27-35. For example, **Lisogurski** discloses the "system may increase the brightness of the light sources in response to the noise to improve the signal-to-noise ratio." Lisogurski, 9:46-60. For example, **Valencell** teaches "the intensity of the optical emitter 102 may be increased to increase the ratio of physiological optical scatter 111 from blood vessels with respect to unwanted sunlight." Valencell, [0123].

A person of skill in the art would understand that the functionality taught in these references could be added to other methods and systems that concern physiological monitoring. These methods and systems provide the benefit of increasing a signal-to-noise ratio of the measure signal.

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Moreover, to the extent that any of these references includes a feature not expressly disclosed in one or more other references, a POSITA would have naturally looked to, and been motivated to combine, any one of these references with one or more of the other references in order to better achieve their common goals of more accurate and efficient physiological monitoring.

Three Wavelength References: For example, charted reference **Basu**, as well as numerous other references such as **Lisogurski**, **Lamego**, **LeBoeuf**, **Poeze**, and **Valencell** all include teachings related to physiological measurement systems. These references provide numerous methods for using three optical wavelengths for measuring at least a portion of the one or more of the physiological parameters and using one of said wavelengths to improve measurement of at least one of the one or more physiological parameters using the output signal corresponding to the other two optical wavelengths. For example, **Lisogurski** discloses that its light source "emit photonic signals having one or more wavelength of light" and "include any number of light sources with any suitable characteristics." Lisogurski, 10:48-60, 10:65-11:6, 17:17-39. For example, **Basu** teaches "three LEDs 14, 14′, and 15 may all emit different wavelengths. LEDs 15, and 14, for example, may emit light in the red and IR spectrum, respectively, while LED 14′ may emit light at a wavelength at which the presence of falsifying components can be detected." Basu, [0109]. For example, **Lamego** teaches a multiwavelength physiological monitor "utiliz[ing] at least three different wavelengths of light . . . to determine blood oxygen saturation," and that "adding wave lengths sensitive to additional significant absorbers can help the system compensate for the additional significant absorbers and enable more accurate calculation of the concentration of each absorber and the blood oxygen saturation." Lamego, [0033], [0035]; *see also* Lamego [0034], [0036]-[0037], [0041]. For example, **LeBoeuf** teaches"[t]he optical detectors 26 and emitters 24 may be of multiple wavelengths, with the goal

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of providing specialized physiological information for each wavelength. Referring to FIG. 19, for example, violet or UV light may be used to measure motion-related aspects of the ear, as violet and UV light may not penetrate greatly through the skin of the ear. Green, red, and IR wavelengths may have deeper penetration and provide information on the blood vessels and blood analyte levels. Blue wavelengths may be particularly useful for gauging changes in the size of the blood vessels." LeBoeuf, [0153]; *see also* LeBouef, [0163]. For example, **Poeze** teaches "the emitter 504 of the data collection device 112 can emit, in certain embodiments, combinations of optical radiation in various bands of interest. For example, in some embodiments, for analytes like glucose, the emitter 504 can emit optical radiation at three (3) or more wavelengths between about 1600 nm to about 1700 nm. In particular, the emitter 504 can emit optical radiation at or about 1610 nm, about 1640 nm, and about 1665 nm. In some circumstances, the use of three wavelengths within about 1600 nm to about 1700 nm enable sufficient SNRs of about 100 dB, which can result in a measurement accuracy of about 20 mg/dL or better for analytes like glucose." Poeze, [0109]; *see also* Poeze, [0108], [0110]-[0116]. For example, **Valencell** teaches "collecting light at different wavelengths, and processing these signals collectively, can be used to generate assessments of blood gas levels, such as blood oxygen (SpO2) and carbon dioxide (SpCO2), blood hemoglobin types and levels, or other blood constituents and their respective concentration levels. Multiple wavelengths may be generated by a signal multiwavelength optical emitter, multiple optical emitters, optically filtered optical emitters, or the like. In such case, multiple optical emitters 102 may be located between the two optical filters 715." Valencell, [0130].

A person of skill in the art would understand that the functionality taught in these references could be added to other methods and systems that concern physiological monitoring. These methods and systems provide the benefit of increased accuracy in measuring physiological

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parameters. Moreover, to the extent that any of these references includes a feature not expressly disclosed in one or more other references, a POSITA would have naturally looked to, and been motivated to combine, any one of these references with one or more of the other references in order to better achieve their common goals of more accurate and efficient physiological monitoring.

Six LED References: For example, charted reference **Lamego**, as well as numerous other references such as **LeBoeuf**, **Lisogurski**, and **Pologe** all include teachings related to physiological measurement systems. These references provide numerous means for utilizing a plurality of semiconductor sources comprising six light emitting diodes. For example, **Lamego** teaches a multiwavelength physiological monitor "includ[ing] . . . six . . . LEDs of different wavelengths," and that "adding wave lengths sensitive to additional significant absorbers can help the system compensate for the additional significant absorbers and enable more accurate calculation of the concentration of each absorber and the blood oxygen saturation." Lamego, [0041], [0035]; *see also* Lamego [0033]-[0034], [0036]-[0037]. For example, **LeBoeuf** teaches utilizing "multiple light emitters… of different wavelengths." LeBoeuf, [0163]. For example, **Lisogurski** teaches "that light source 130 may include any number of light sources with any suitable characteristics," and that light source 130 ma include LEDs. Lisogurski, 10:42-11:8. For example, **Pologe** teaches a "main test unit 12 includes: an emitter module 18 having a plurality of emitters 20," and that the "emitters 20 may include…light emitting diodes (LEDs)." Pologe, 4:63-65, 5:16-20.

A person of skill in the art would understand that the functionality taught in these references could be added to other methods and systems that concern physiological monitoring. These methods and systems provide the benefit of increased accuracy in measuring physiological parameters. Moreover, to the extent that any of these references includes a feature not expressly disclosed in one or more other references, a POSITA would have naturally looked to, and been

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motivated to combine, any one of these references with one or more of the other references in order to better achieve their common goals of more accurate and efficient physiological monitoring.

Smartphone/Tablet References: For example, charted reference **Basu**, as well as numerous other references such as **Kassim**, **Kreger**, **Lisogurski**, **Tran**, all include teachings related to physiological measurement systems. These references provide numerous means for a physiological monitoring system to be configured for use with a smart phone or tablet. For example, **Basu** teaches "health ring 44 which can monitor heart rate on a 24 hour basis," and that "combines the sensor with a…wireless transmitter linked to an application running on the user's cell phone." Basu, [0065]-[0066]. For example, **Kassim** teaches "[t]he optical measurement device 300 further comprises a coupling member 316 that can provide coupling between the measurement device 300 to a personal mobile processing device/feedback unit (not shown) in a cableless configuration," and that "the feedback unit may be a portable device, such as a mobile phone, smartphone, personal digital assistant (PDA), tablet, netbook or laptop, although this list is not exhaustive by any means." Kassim, 12:5-14. For example, **Kreger** teaches a "biosensor interface apparatus for use with a mobile communication device 10," that "can be any of a number of mobile phones such as an iPhone® or an Android® phone, a personal digital assistant (PDA) such as a Blackberry®, a portable audio playback device such as an MP3 player, a portable media playback device such as an iPod®, or a handheld tablet such as an iPad®." Kreger, 5:40-53; *see also* Kreger, 7:39-46. For example, **Lisogurski** teaches a "monitor [that] may be powered by a battery" with a "[u]ser interface [which] may include user input 182, display 184, and speaker 186. User input 182 may include any type of user input device such as a keyboard, a mouse, a touch screen, buttons, switches, a microphone, a joy stick, a touch pad, or any other suitable input device." Lisogurski, 15:19-23, 18:65-67. For example, **Mault** teaches a blood glucose monitoring

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system including an electronic device that "can be a portable electronic device or system carried by the person, or a device or system combining multiple functionalities, such as:…a portable computer; any portable Internet access device; [or] a wireless phone…." Mault [0069]-[0070]. For example, **Poeze** teaches "a personal health organizer software module 132 executed on a general purpose computing device 126, with the computing device 126 coupled with the health data collection device 112 via a communications link 128," where the "personal health organizer module 132 can be an executable program on an operating system of a device such as a mobile phone, a personal digital assistant, a portable music player, an electronic book reader, a netbook, a TV media center, and a laptop or desktop computer. For example, the personal health organizer module 132 can be an application that is executed on the operating system of a mobile phone such as the iPhone manufactured by Apple, Inc., a Blackberry device manufactured by Research In Motion, Inc., the Pre manufactured by Palm, Inc, or a mobile device manufactured by HTC, Nokia, or Motorola, etc." Poeze, [0034]; *see also* Poeze [0010]. **Tran** teaches that while a patient with a wearable device is outside a mesh network range, "the wearable appliance communicates with the cell phone and provides information to the server 200 using the cellular connection." Tran, 34:4-30.

A person of skill in the art would understand that the functionality taught in these references could be added to other methods and systems that concern physiological monitoring. These methods and systems provide the benefit of more processing power and more convenient means to flag emergency situations. Moreover, to the extent that any of these references includes a feature not expressly disclosed in one or more other references, a POSITA would have naturally looked to, and been motivated to combine, any one of these references with one or more of the other

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references in order to better achieve their common goals of more accurate and efficient physiological monitoring.

Synchronize Light Source/Detector References: For example, charted reference **Carlson**, as well as numerous other references such as **Jung**, **Lamego**, **Lisogurski**, and **Poeze** all include teachings related to physiological measurement systems. These references provide numerous methods for utilizing a detection system that is configured to be synchronized to the light source. For example, **Carlson** teaches using "AC-Coupling or Lock-In Amplification (synchronous detection), is to temporarily modulate the optical radiation of the LED at the carrier frequency fc in order to shift the power spectrum of the pulsoximeter signals into a higher frequency range where environmental optical radiation is unlikely and electronic band pass filtering is technologically less stringent." Carlson, [0064]-[0065]; *see also* Carlson, [0011]-[0020], [0018]-[0020], [0027]. For example, **Jung** discloses a spectrometer system were "three monochrome sources, however, are turned on and off rapidly, synchronous with the spectral measurements being taken at, for example, a rate of 1000 Hz." Jung, 68:13-33. For example, **Lamego** teaches a "digital-to-analog conversion circuit 338" that includes "a synchronizing latch 323" which "accepts the synchronizing pulses which maintain synchronization between the activation of emitters 302 and the analog to digital conversion circuit 332." Lamego, [0044]-[0045]; *see also* Lamego [0050]-[0051], [0069]. For example, **Lisogurski** teaches "light drive circuitry 120 may generate a light drive signal, which may be used to turn on and off the light source 130, based on the timing control signals. The front end processing circuitry 150 may use the timing control signals to operate synchronously with light drive circuitry 120." Lisogurski, 11:41-12:9; *see also* Lisogurski, 12:52-13:6 9 ("The peaks of detector current waveform 214 may be synchronous with light 'on' periods driving one or more emitters of a light source, such as light

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Source 130 of FIG. 1."). For example, **Poeze** teaches a "data collection device 112" including "a driver 520 that drives the emitter 504," wherein "[t]he driver 520 can be synchronized with other parts of the sensor 116 and can minimize or reduce jitter in the timing of pulses of optical radiation emitted from the emitter 504." Poeze, [0116]-[0117].

A person of skill in the art would understand that the functionality taught in these references could be added to other methods and systems that concern physiological monitoring. These methods and systems provide increased accuracy for monitoring physiological parameters. Moreover, to the extent that any of these references includes a feature not expressly disclosed in one or more other references, a POSITA would have naturally looked to, and been motivated to combine, any one of these references with one or more of the other references in order to better achieve their common goals of more accurate and efficient physiological monitoring.

Arc References: For example, charted reference **Isaacson**, as well as numerous other references such as **Jung**, and **LeBoeuf** all include teachings related to physiological measurement systems. These references provide numerous methods for utilizing a plurality of semiconductor sources and the plurality of spatially separated detectors are located on one or more arcs. For example, **Isaacson** teaches emitters 10, 20 and detectors 12, 22 disposed on an arc. Isaacson, 4:64-5:9, Fig. 1. For example, **Jung** teaches "a fiber optic arrangement presented at the forward end of probe tip 1" which "utilizes a single central light source fiber optic…and a plurality of perimeter light receiver fiber optics, denoted as light receivers R1, R2 and R3." Jung, 11:21-50, Fig. 2; *see also* Jung 24:39-48, 24:39-62, 32:66-33:9, 39:41-40:14, Figs. 9, 10A-B, 20, 28A-B. For example, **LeBoeuf** teaches optical emitters 24 and optical detectors 26 configured in an arc. LeBoeuf, [0123]-[1024], Fig. 8B

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A person of skill in the art would understand that the functionality taught in these references could be added to other methods and systems that concern physiological monitoring. These methods provide the benefit of better acquisition of signals from the samples. Moreover, to the extent that any of these references includes a feature not expressly disclosed in one or more other references, a POSITA would have naturally looked to, and been motivated to combine, any one of these references with one or more of the other references in order to better achieve their common goals of more accurate and efficient physiological monitoring.

b. Combinations

For at least the reasons described above, it would have been obvious to one of ordinary skill in the art to combine each prior art reference listed in Appendix E with any other reference or references listed in Appendix E along with the knowledge of one of ordinary skill in the art to arrive at the inventions claims in the ’455 Patent.

For example, and without limitation, the Asserted Claims of the ’455 Patent would have been obvious to one of ordinary skill in the art in view of the following combinations:

(i) Lisogurski, Kassim, Chandrasekar2012, Valencell, Mault, and Basu Combined with Lens References

A POSITA would have had reason to combine references **Lisogurski**, **Kassim**, **Chandrasekar2012**, **Valencell**, **Mault**, or **Basu**, or any of the references in Appendix E, with any one of Lens References all of which relate to systems and methods for physiological monitoring. Each of references **Carlson**, **LeBoeuf**, **Poeze**, **Pologe**, and **Valencell** relate to physiological monitoring systems utilizing lenses. Indeed, such components and/or processes were conventional as of the time these references were known. Each of Lens References provide means—not necessarily expressly present in all other references—for a wearable device comprising one or more lenses configured to receive at least a portion of the output optical light and to deliver a lens

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output light to tissue. A POSITA would have understood that the systems and methods for Lens References were intended to be incorporated into wearable measurement devices. A POSITA would understand that systems and methods for wearable device comprising one or more lenses configured to receive at least a portion of the output optical light and to deliver a lens output light to tissue provide improvements such as focusing output optical light to increase the intensity of the light transmitted to the wearer's tissue thereby reducing the light source's power consumption, reducing the detrimental effects of ambient light, reducing the loss of energy due to scattered light, and increasing signal-to-noise ratio. *E.g.*, Carlson, [0014] (lens system "increase[s] the optical signal power, detected by the pulsoximeter sensor, and thus increase[s] the Signal/Noise-and signal/Background ratio."); LeBoeuf, [0114] ("Lenses 29L are configured to focus inspection light 111 onto a particular region of the ear."). Valencell, [0017] ("The first lens focuses light emitted by the optical emitter…."). A POSITA would further understand that in order to implement a wearable measurement device, the systems and methods for optical measurement systems would commonly be combined with lens systems, and thus a POSITA would have been motivated to combine the teachings of these references. The combination would apply known techniques of including basic optical components, to wearable measurement devices that were ready for improvement, in order to yield predictable results. The combination would further be "obvious to try," because it would involve simple design choices from a finite number of identified, predictable solutions, with a reasonable expectation of success.

(ii) Lisogurski, Kassim, Chandrasekar2012, Valencell, Mault, and Basu Combined with Light Intensity References

A POSITA would have had reason to combine references **Lisogurski**, **Kassim**, **Chandrasekar2012**, **Valencell**, **Mault**, or **Basu**, or any of the references in Appendix E, with any one of Light Intensity References all of which relate to systems and methods for physiological

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monitoring. Each of references **Basu, Kassim**, **Lisogurski**, and **Valencell** relate to physiological monitoring systems that utilize increased light intensity of their emitters to increase signal-to-noise ratio of their detection signal. Indeed, such components and/or processes were conventional as of the time these references were known. Each of Light Intensity References provide means—not necessarily expressly present in all other references—for improving signal-to-noise ratio by increasing the intensity of light sources. A POSITA would have understood that the systems and methods for Light Intensity References were intended to be incorporated into wearable measurement devices. A POSITA would understand that systems and methods for improving signal-to-noise ratio by increasing the intensity of light sources provide improvements such as increasing the accuracy of measured physiological parameters. *E.g.*, Basu, [0058] ("To maximize the signal-to-noise ratio in photoplethysmography, the LED intensity should be made as large as possible without saturating the detector."); Kassim, 16:27-35 ("[T]he effects of ambient light signals 30 can be reduced as much as possible by tuning the intensities of the IR and Red LEDs to be maximized as long as the detection assembly has not reached saturation."), Lisogurski 9:46-60 ("[S]ystem may increase the brightness of the light sources in response to the noise to improve the signal-to-noise ratio."); Valencell, [0123] ("[T]he intensity of the optical emitter 102 may be increased to increase the ratio of physiological optical scatter 111 from blood vessels with respect to unwanted sunlight."). A POSITA would further understand that in order to implement a wearable measurement device, the systems and methods for optical measurements systems would commonly be combined with circuity coupled to light sources that allow for the control of the light source's parameters, such as light intensity, and thus a POSITA would have been motivated to combine the teachings of these references. The combination would apply known techniques of allowing for the variability of light source parameters to wearable measurement devices that were

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ready for improvement, in order to yield predictable results. The combination would further be "obvious to try," because it would involve simple design choices from a finite number of identified, predictable solutions, with a reasonable expectation of success.

(iii) Lisogurski, Kassim, Chandrasekar2012, Valencell, Mault, and Basu Combined with Three Wavelength References

A POSITA would have had reason to combine references **Lisogurski**, **Kassim**, **Chandrasekar2012**, **Valencell**, **Mault**, or **Basu**, or any of the references in Appendix E, with any one of Three Wavelength References all of which relate to systems and methods for physiological monitoring. Each of references **Basu**, **Lamego**, **LeBoeuf**, **Poeze**, and **Valencell** relate to physiological monitoring systems utilizing three wavelengths and using one of said wavelengths to improve measurement of at least one of the one or more physiological parameters using the output signal corresponding to the other two optical wavelengths. Indeed, such components and/or processes were conventional as of the time these references were known. Each of Three Wavelength References provide means—not necessarily expressly present in all other references—for using three optical wavelengths for measuring at least a portion of the one or more of the physiological parameters or using one of said wavelengths to improve measurement of at least one of the one or more physiological parameters using the output signal corresponding to the other two optical wavelengths. A POSITA would have understood that the systems and methods for Three Wavelength References were intended to be incorporated into wearable measurement devices. A POSITA would understand that systems and methods for utilizing three optical wavelengths provide improvements such as the ability to target different physiological absorbers according to their wavelength sensitivity and therefore providing for more accurate measurements. *E.g.*, Basu, [0109] ("It is known that certain factors may render pulse oximetry unreliable because the presence of other components (e.g. methemoglobin or carboxyhemoglobin) in the blood may

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mimic the absorption of oxyhemoglobin at the IR LED frequency so that the reading is falsified. Such errors can be minimized by adding a third LED emitting light of a wavelength at which the component shows a different behavior than oxyhemoglobin and reduced hemoglobin."); Lamego, [0035] ("[A]dding wave lengths sensitive to additional significant absorbers can help the system compensate for the additional significant absorbers and enable more accurate calculation of the concentration of each absorber and the blood oxygen saturation."); Poeze, [0109] ("[T]he use of three wavelengths within about 1600 nm to about 1700 nm enable sufficient SNRs of about 100 dB, which can result in a measurement accuracy of about 20 mg/dL or better for analytes like glucose."). A POSITA would further understand that in order to implement a wearable measurement device, the systems and methods for multiwavelength emitters would commonly be combined with optical measurement systems, and thus a POSITA would have been motivated to combine the teachings of these references. The combination would apply known techniques of the variability of light source parameters, to wearable measurement devices that were ready for improvement, in order to yield predictable results. The combination would further be "obvious to try," because it would involve simple design choices from a finite number of identified, predictable solutions, with a reasonable expectation of success.

(iv) Lisogurski, Kassim, Chandrasekar2012, Valencell, Mault, and Basu Combined with Six LED References

A POSITA would have had reason to combine references **Lisogurski**, **Kassim**, **Chandrasekar2012**, **Valencell**, **Mault**, or **Basu**, or any of the references in Appendix E, with any one of Six LED References all of which relate to systems and methods for physiological monitoring. Each of references **Lamego**, **LeBoeuf**, **Lisogurski**, and **Pologe** relate to physiological monitoring systems using multiple LEDs as emitters. Indeed, such components and/or processes were conventional as of the time these references were known. Each of Six LED References

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provide means—not necessarily expressly present in all other references—for utilizing six LED optical emitters in a light source. A POSITA would have understood that the systems and methods for Six LED References were intended to be incorporated into wearable measurement devices. A POSITA would understand that systems and methods for utilizing six LEDs provide improvements such as the ability to target different physiological absorbers according to their wavelength sensitivity and therefore providing for more accurate measurements, increasing intensity of optical output light, and reducing the detrimental effects on ambient light. *E.g.*, Lamego, [0035] ("[A]dding wave lengths sensitive to additional significant absorbers can help the system compensate for the additional significant absorbers and enable more accurate calculation of the concentration of each absorber and the blood oxygen saturation."). A POSITA would further understand that in order to implement a wearable measurement device, the systems and methods for optical physiological measurement would commonly be combined with multiple LED emitters and thus a POSITA would have been motivated to combine the teachings of these references. The combination would apply known techniques for increasing the number of optical emitters in a light to wearable measurement devices that were ready for improvement, in order to yield predictable results. The combination would further be "obvious to try," because it would involve simple design choices from a finite number of identified, predictable solutions, with a reasonable expectation of success.

(v) Lisogurski, Kassim, Chandrasekar2012, Valencell, Mault, and Basu Combined with Smartphone/Tablet References

A POSITA would have had reason to combine references **Lisogurski**, **Kassim**, **Chandrasekar2012**, **Valencell**, **Mault**, or **Basu**, or any of the references in Appendix E, with any one of Smartphone/Tablet References all of which relate to systems and methods for physiological monitoring. Each of references **Basu**, **Kassim**, **Kreger**, **Lisogurski**, **Mault**, **Poeze**, and **Tran**

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relate to physiological monitoring systems for use with a smartphone or tablet. Indeed, such components and/or processes were conventional as of the time these references were known. Each of Smartphone/Tablet References provide means—not necessarily expressly present in all other references—for a physiological monitoring system to communicate with a smartphone or tablet. A POSITA would have understood that the systems and methods for Smartphone/Tablet References were intended to be incorporated into wearable measurement devices. A POSITA would understand that systems and methods for connectivity to smartphones or tablets provide improvements improving the analysis capabilities of measurement systems due to the increased processing power of smartphones and tablets and the additional resources provided by their ability to connect to wireless and cell networks. *E.g.*, Basu, [0066] (physiological monitoring system "combines the sensor with a…wireless transmitter linked to an application running on the user's cell phone."); Kreger, 13:1-3 ("Mobile device smart phone 444 may derive measurements, display plots, transmit medical records of biosensor data, and so forth."); Tran, 34:4-40 ("If the wearable appliance detects a cellphone that is mesh network compatible, the wearable appliance communicates with the cell phone and provides information to the server 200 using the cellular connection."). A POSITA would further understand that in order to implement a wearable measurement device, the systems and methods for optical physiological measurement would commonly be combined with smartphone and personal computing technology and thus a POSITA would have been motivated to combine the teachings of these references. The combination would apply known techniques of providing for connectivity to smartphone or personal computing devices in wearable measurement devices that were ready for improvement, in order to yield predictable results. The combination would further be "obvious to try," because it would involve

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simple design choices from a finite number of identified, predictable solutions, with a reasonable expectation of success.

References Lisogurski and Basu Combined with Synchronize Light Source/Detector References

A POSITA would have had reason to combine references **Lisogurski** or **Basu**, or any of the references in Appendix E, with any one of Synchronize Light Source/Detector References all of which relate to systems and methods for physiological monitoring. Each of references **Carlson**, **Jung**, **Lamego**, **Lisogurski**, and **Poeze** relate to physiological monitoring systems that synchronize their detection systems to the their light sources. Indeed, such components and/or processes were conventional as of the time these references were known. Each of Synchronize Light Source/Detector References provide means—not necessarily expressly present in all other references—for synchronizing the sampling of a detector to the output of a light source. A POSITA would have understood that the systems and methods for Synchronize Light Source/Detector References were intended to be incorporated into wearable measurement devices. A POSITA would understand that systems and methods for synchronizing the sampling of a detector to the output of a light source provide improvements such as increased measurement accuracy. *E.g.*, Carlson, [0065] ("AC-Coupling or Lock-In Amplification (synchronous detection), is to temporarily modulate the optical radiation of the LED at the carrier frequency fc in order to shift the power spectrum of the pulsoximeter signals into a higher frequency range where environmental optical radiation is unlikely and electronic band pass filtering is technologically less stringent."); Lamego, [0045] ("[D]river circuit," including "synchronizing latch 323 [that] accepts the synchronizing pulses which maintain synchronization between the activation of emitters 302 and the analog to digital conversion circuit 332" "is designed to minimize the noise from the emitters 302."); Poeze, [0117] ("The driver 520 can be synchronized with other parts of the sensor 116 and can minimize or reduce jitter in the timing of pulses of

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optical radiation emitted from the emitter 504."). A POSITA would further understand that in order to implement a wearable measurement device, the systems and methods for optical measurement would commonly be combined with detector and light source synchronization, and thus a POSITA would have been motivated to combine the teachings of these references. The combination would apply known techniques for varying the collection parameters of a detection system and the output parameters of light source in wearable measurement devices that were ready for improvement, in order to yield predictable results. The combination would further be "obvious to try," because it would involve simple design choices from a finite number of identified, predictable solutions, with a reasonable expectation of success.

(vi) Lisogurski, Kassim, Chandrasekar2012, Valencell, Mault, and Basu Combined with Arc References

A POSITA would have had reason to combine references **Lisogurski**, **Kassim**, **Chandrasekar2012**, **Valencell**, **Mault**, or **Basu**, or any of the references in Appendix E, with any one of Arc References all of which relate to systems and methods for physiological monitoring. Each of references **Isaacson**, **Jung**, and **LeBoeuf** relate to physiological monitoring systems with their light sources and/or detectors configured in an arc. Indeed, such components and/or processes were conventional as of the time these references were known. Each of Arc References provide means—not necessarily expressly present in all other references—for configuring the detectors and/or emitters of a physiological measurement system in an arc formation. A POSITA would have understood that the systems and methods for Arc References were intended to be incorporated into wearable measurement devices. A POSITA would understand that systems and methods for configuring optical detectors and emitters in an arc formation would provide improvements such as increased measurement accuracy due to lessening the negative effects of light scattering and accounting for the contours of the tissue sample that is being measured. A

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POSITA would further understand that in order to implement a wearable measurement device, the systems and methods for optical measurement would commonly be combined detectors and emitters in an arc formation, and thus a POSITA would have been motivated to combine the teachings of these references. The combination would apply known techniques for varying the spatial configurations of emitters and detectors in wearable measurement devices that were ready for improvement, in order to yield predictable results. The combination would further be "obvious to try," because it would involve simple design choices from a finite number of identified, predictable solutions, with a reasonable expectation of success.

Furthermore, to the extent any limitation of an Asserted Claim is deemed not to be exactly disclosed by an item of prior art, then the claim is rendered obvious by combination of the prior art in Exhibits E1 through E18 standing alone, in combination with the reference(s) in any other claim chart, in combination with any system art identified in Table 2-E, in combination with Applicant's Admitted Prior Art, in view of the knowledge of a person of ordinary skill in the art, and/or in view of the Lens References, Light Intensity References, Three Wavelength References, Six LED References, Smartphone/Tablet References, Synchronize Light Source/Detector References, and/or Arc References for the reasons discussed above.

6. U.S. Patent No. 12,193,790

Pursuant to P.R. 3-3(a) and (b), Defendants identify in Appendix F the prior art references that render obvious the Asserted Claims of the '790 Patent and include below exemplary combinations showing the obviousness of the '790 Patent Asserted Claims in view of the prior art. To the extent Plaintiff contends that an element is not disclosed in any one of the anticipatory references described in Appendix F, the limitation would have been obvious in light of the disclosures within the reference and the knowledge of one of ordinary skill in the art at the time of the '790 Patent. Moreover, to the extent Plaintiff contends that an element is not disclosed in any

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one of the anticipatory references described in Appendix F, such reference may be combined with any other references listed in Appendix F for such element, thereby rendering the claims invalid for obviousness. To the extent a finder of fact determines that a limitation of any of the '790 Patent Asserted Claims is not disclosed by one of the references identified above pursuant to P.R. 3-3(a), the claim is nevertheless unpatentable as obvious because they contain nothing that constitutes a patentable innovation. To the extent a finder of fact determines that a limitation of the '790 Patent Asserted Claims is not anticipated, it does not go beyond combining familiar elements according to known methods to achieve predictable results or does more than choose between clear alternatives known to those of ordinary skill in the art.

a. Obviousness Rationale and Motivations to Combine

Obviousness: For at least the reasons described in these contentions, it would have been obvious to one of ordinary skill in the art to combine any of a number of prior art references, including any combination of those prior art references identified in Appendix F along with the knowledge of one of ordinary skill in the art to meet the limitations of the '790 Patent Asserted Claims. As a result, the references identified herein render one or more Asserted Claims of the '790 Patent obvious when the references are read in combination with each other, and/or when read in view of the state of the art and knowledge of those skilled in the art. Each and every reference identified is also relevant to the state of the art at the time of the alleged invention. Any of the references disclosed above may be combined with one another to render obvious (and therefore invalid) each of Omni's Asserted Claims. Defendants may rely upon a subset of the identified references or all of the references identified herein, including all references in Appendix F, for purposes of obviousness depending on the Court's claim construction, positions taken by Omni during this litigation, and further investigation and discovery.

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Reservation of Rights: Moreover, as mentioned above, Defendants have not yet completed their search or discovery concerning additional prior art. As such, Defendants' inclusion of exemplary combinations does not preclude them from identifying other invalidating combinations as appropriate, and Defendants reserve the right to identify additional specific combinations as well as to detail and explain such combinations.

No More Than Ordinary Variations of Prior Art; No Unexpected Results: To the extent not anticipated, the '790 Patent Asserted Claims represent no more than the result of ordinary variations of the prior art. Defendants further believe that no showing of a specific motivation to combine prior art is required to combine the references disclosed above and in the attached charts, as each combination of art would have no unexpected results, and at most would simply represent a known alternative to one of ordinary skill in the art. *See KSR Int'l Co. v. Teleflex, Inc.*, 550 U.S. 398, 415-16 (2007) (rejecting the Federal Circuit's "rigid" application of the teaching, suggestion, or motivation to combine test, instead espousing an "expansive and flexible" approach); *Apple Inc. v. Samsung Elecs. Co.*, 839 F.3d 1034, 1058 (Fed. Cir. 2016); *Intercontinental Great Brands LLC v. Kellogg N. Am. Co.*, 869 F.3d 1336, 1344 (Fed. Cir. 2017). Indeed, the Supreme Court held that a person of ordinary skill in the art is "a person of ordinary creativity, not an automaton" and "in many cases a person of ordinary skill in the art will be able to fit the teachings of multiple patents together like pieces of a puzzle." *Id.* at 420-21. Nevertheless, in addition to the information contained elsewhere in these contentions, Defendants identify motivation and reason to combine the cited art.

Predictable Results; Obvious to Try: One or more combinations of the prior art references identified in Appendix F would have been obvious because these references would have been combined using: known methods to yield predictable results; known techniques in the same

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way; a simple substitution of one known, equivalent element for another to obtain predictable results; and/or a teaching, suggestion, or motivation in the prior art generally. In addition, it would have been obvious to try combining the prior art references identified above because there were only a finite number of predictable solutions and/or because known work in one field of endeavor prompted variations based on predictable design incentives and/or market forces either in the same field or a different one. Further, the combinations of the prior art references identified in Appendix F would have been obvious because the combinations represent known potential options with a reasonable expectation of success.

Interrelated Teachings: Additional evidence that there would have been a motivation to combine the prior art references identified above includes the interrelated teachings of multiple prior art references; common authorship; the effects of demands known to the design community or present in the marketplace; the existence of a known problem for which there was an obvious solution encompassed by the '790 Patent Asserted Claims; the existence of a known need or problem in the field of the endeavor at the time of the alleged invention(s); and the background knowledge that would have been possessed by a person having ordinary skill in the art.

Summary of Motivations to Combine: Thus, the motivation to combine the teachings of the prior art references disclosed in Appendix F is found in the references themselves and also in: (1) the nature of the problem being solved; (2) the express, implied and inherent teachings of the prior art; (3) the knowledge of persons of ordinary skill in the art; (4) the predictable results obtained in combining the different elements of the prior art; (5) the predictable results obtained in simple substitution of one known element for another; (6) the use of a known technique to improve similar devices, methods, or products in the same way; (7) the predictable results obtained in applying a known technique to a known device, method, or product ready for improvement; (8)

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the finite number of identified predictable solutions that had a reasonable expectation of success; and (9) known work in various technological fields that could be applied to the same or different technological fields based on design incentives or other market forces.

Same Area of Technology: Additionally, it would be obvious to one of ordinary skill in the art to consult and/or combine any of the prior art listed in Appendix F because all of these references relate to the same area of technology and/or are from analogous art. The '790 Patent Asserted Claims are directed to "An optical system comprises a wearable device for measuring one or more physiological parameters." '790 Patent at Abstract. The '790 Patent Asserted Claims merely unite old elements, well known in the field, with no change in their respective function or result. Given the interrelated teachings of the prior art, the effects of demands known to the design community or present in the marketplace, and the background knowledge possessed by a person having ordinary skill in the art, it would have been obvious for one of ordinary skill in the art to combine these familiar elements, disclosed and/or embodied in the prior art listed above to practice the '790 Patent Asserted Claims.

Same Technical Issues: A person of ordinary skill would have been motivated to combine the above prior art based on his/her knowledge, the nature of the problem to be solved, and the teachings of the prior art. The identified prior art addresses the same or similar technical issues and suggests the same or similar solutions to those issues. Moreover, some of the prior art refer to or discuss other prior art, illustrating the close technical relationship among the prior art. For the '790 Patent, one of ordinary skill in the art would have been motivated to combine known prior art solutions described in these references relating to wearable devices measuring physiological parameters.

Demand and Market Forces: For example, market forces suggested a demand for

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wearable devices measuring physiological parameters, and thus one of skill in the art would have thought to combine or modify references that described known methods that one of skill in the art would have recognized as offering improvements to solutions of that time.

Known Elements; Obvious to Try: Moreover, many of the claim elements were already known as admitted by the applicant in the patent specification. These elements represented design choices available to a person of ordinary skill. When there is a design need or market pressure to solve a problem such as identified previously and/or described in the '790 Patent, and there are a finite number of identified, predictable solutions, a person of ordinary skill would be motivated to combine the known options that are within his or her technical grasp. For the '790 Patent, there are a finite number of approaches for providing a wearable device for measuring physiological parameters. For example, as of the priority date of the '790 Patent, a POSITA would have been very familiar with basic elements of the '790 Patent's claims such as semiconductors diodes, optical wavelengths, lenses, signal-to-noise ratio, detectors, and analog to digital convertors. Such elements were within the knowledge of a POSITA, whether or not disclosed in any particular reference, and the inclusion of such elements in the '790 Patent's claims does not render them novel or non-obvious.

There are significant similarities in subject matter and objectives for each of many references used in these contentions for the '790 Patent.

References disclosing lenses: For example, charted reference Carlson, Poeze, and Soller, as well as numerous other references such as LeBoeuf and Park, all include teachings related to using one or more lenses configured to receive a portion of at least one of the output optical lights and to direct a lens output light to tissue. These references provide numerous methods for using lenses to direct an optical output beam. For example, Carlson teaches "us[ing] a beam-shaping

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element, such as e.g. diffractive or refractive lenses, to direct the emitted optical radiation of, e.g., the LED light source into the human or animal tissue and the photon detecting element in order to increase the optical signal power, detected by the pulsoximeter sensor, and thus increasing the Signal/Noise—and signal/Background ratio. The increase of the S/B ratio is estimated e.g. to a factor 5." Carlson at [0014]. Poeze teaches "[using] a lens which collects attenuated light exiting the measurement site and focuses onto one or more detectors. The protrusion can advantageously include plastic, including a hard opaque plastic, such as a black or other colored plastic, helpful in reducing light noise." Poeze at 7:52-8:7. Soller teaches "a variety of different collimating elements 56 can be used in sensor 10. Exemplary collimating elements include fiber faceplates (e.g., fiber optic windows), collimating hole devices, gradient index (GRIN) lenses, fiber bundles, lens arrays, optical windows (including shaped optical windows), and other similar devices." Soller at 18:37-56.

A person of skill in the art would understand that the functionality taught in these references could be added to other methods and systems that are concerned with using lenses to direct an optical output beam. These methods are known to be effective in directing an optical output beam using known lens structures. Moreover, to the extent that any of these references includes a feature not expressly disclosed in one or more other references, a POSITA would have naturally looked to, and been motivated to combine, any one of these references with one or more of the other references in order to better achieve their common goals of directing an optical output beam.

References disclosing techniques for increasing signal-to-noise ratio: For example, charted reference Basu, Lisogurski, and Carlson, as well as numerous other references such as LeBoeuf and Park, all include teachings related to increasing the signal-to-noise ratio of optical measurement systems by increasing a light intensity and increasing a pulse rate of an LED. These

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references provide numerous methods for increasing a light intensity and increasing a pulse rate of an LED. For example, Basu teaches that "[t]o maximize the signal-to-noise ratio in photoplethysmography, the LED intensity should be made as large as possible without saturating the detector. In the OPS 10, the LED intensity and modulation frequencies are programmable through the serial interface. In the case of the Vishay VCNL4000, the intensity is programmable from 10-200 mA in 10 mA increments." Basu at [0058]. Lisogurski teaches "that modulation of the light drive signal . . . may include modulation of parameters including drive current or light brightness, duty cycle, firing rate, modulation parameters, other suitable parameters, or any combination thereof" and that "[t]he system may increase the brightness of the light sources in response to the noise to improve the signal-to-noise ratio." Lisogurski at 27:44-55, 9:46-60. Carlson teaches that the "frequency is chosen in such a way that it is outside the frequency spectrum of sunlight and of ambient light which, according to FIG. 7b, is in the range of above approximately 1000 Hz. Thus, the pulsoximeter signals are readily discriminated from electronic and parasitic contributions of environmental optical radiation outside the frequency fc+/−5 Hz increasing significantly the Signal-to-Noise and Signal-to-Background ratio." Carlson at [0069]. LeBoeuf teaches that "the intensity of the optical emitter 102 may be increased to increase the ratio of physiological optical scatter 111 from blood vessels with respect to unwanted sunlight" and that "it is important to consider the emitter pulsing frequency and sampling approach" because "choosing a frequency that is too low may result in unsatisfactory subtraction." LeBoeuf at [0123], [0139]. Park teaches that "the light source intensity may be increased to maintain the output signal from the light detector within a desired range of output values." Park at 16:8-20.

A person of skill in the art would understand that the functionality taught in these references could be added to other methods and systems that are concerned with improving signal-to-noise

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ratio in optical measurement systems. These methods are known to be effective in improving the signal-to-noise ratio for such systems, and merely modulate the functioning of the existing LEDs in each system. Moreover, to the extent that any of these references includes a feature not expressly disclosed in one or more other references, a POSITA would have naturally looked to, and been motivated to combine, any one of these references with one or more of the other references in order to better achieve their common goals of improving signal-to-noise ratio.

References disclosing an analog to digital converter: For example, charted reference Basu, Goodman, Lisogurski, Rulkov, Moon, Poeze, Chandrasekar, Al-Ali, Kreger, and Sakai all include teachings related to an analog to digital converter. These references provide numerous methods for using an analog to digital converter coupled to a detector. For example, Basu discloses "a digital interface for communication with a microcontroller." Basu at [0007]. Goodman discloses "On board analog-to-digital converter A/D 44 (10 bit, 5 channel input) is used to convert the conditioned PPG signals at B and B′ into time sampled digital signals which are then provided to processing device 14. Goodman at 11:66-12:21. Lisogurski discloses a "[f]ront end processing circuitry 150 may perform various analog and digital processing of the detector signal." Lisogurski at 12:42-51. Rulkov discloses that "The microprocessor741 has a LED control715 connected to DAC702 for controlling the intensity of the LEDs737. The signal from the photodetector736 is transmitted to a high pass filter (HPF) 703 which sends it to an analog to digital converter704, and the signal from the photodetector737 is also sent directly to a second analog to digital converter704." Rulkov at 11:39-60. Moon discloses that "[a] filter removes any high-frequency noise (e.g. 60 Hz electrical noise) that is not related to the PPG waveform, and yields a preliminary waveform that is digitized with an analog-to-digital converter 176, and processed as described above to generate a DC portion of the PPG." Moon at [0091]. Poeze discloses "[f]ront-end

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interfaces 108 may be implemented using transimpedance amplifiers that are coupled to analog to digital converters in a sigma delta converter." Poeze at 40:15-27. Chandrasekar discloses "In principle, PPGs are considered simple devices; however, in practice, implementation requires a careful design involving optics (multiple paths, alignments, leakage barriers) and mixed signal electronics (transimpedance amplifiers, analog digital conversion, drivers, modulators, filters)." Chandrasekar at 1. Kreger discloses "Biosensor signals may also be received by one or more RF receivers in the dock 246 (not shown) and communicated to the mobile 212 via wired electrical connector 246, for example, to allow the wireless sensor to utilize the features of the wired audio input's anti-alias filters and analog to digital converter as will be explained in detail below." Kreger at 10:14-28. Sakai discloses "A/D converter 2013 d which converts a voltage value of analog signal into 10-bit digital value." Al-Ali discloses "As shown in FIG. 2, the processor board 250 includes a front end signal conditioner 252, an analog-to-digital (A/D) converter 253, a digital signal processor (DSP) 258, a memory reader 256, emitter drivers 254 and digital-to-analog (D/A) converters 255." Al-Ai at [0045].

A person of skill in the art would understand that the functionality taught in these references could be added to other methods and systems that are concerned with incorporating an analog to digital converter into optical measurement systems. These methods are known to be effective in incorporating an analog to digital converter into such systems. Moreover, to the extent that any of these references includes a feature not expressly disclosed in one or more other references, a POSITA would have naturally looked to, and been motivated to combine, any one of these references with one or more of the other references in order to better achieve their common goals of signal processing.

References disclosing spatially separated detectors: For example, charted references

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Lisogurski, Poeze, Soller, and Terumoto, all include teachings related to using detectors that are spatially separated. These references provide numerous methods for using light detectors. For example, Lisogurski teaches that "[o]ne or more detector 318 may also be provided in sensor unit 312 for detecting the light that is reflected by or has traveled through the subject's tissue. Any suitable configuration of light source 316 and detector 318 may be used. In an embodiment, sensor unit 312 may include multiple light sources and detectors, which may be spaced apart." Lisogurski at 17:35-45. Poeze discloses that "multiple detectors are employed and arranged in a spatial geometry. This spatial geometry provides a diversity of path lengths among at least some of the detectors and allows for multiple bulk and pulsatile measurements that are robust." Poeze at 9:18-27. Soller discloses "a plurality of spectral detectors attached to the circuit board, each spectral detector being configured to analyze radiation derived from the radiation source" and depicts the detectors as spatially separated. Soller at 3:16-27; Fig. 34. Terumoto discloses "[t]he light sensor portions 101-1 to 101-n are located equally spaced from one another and to go round the armlet type housing 107 same as the fourth to sixth implementations." Terumoto at [0152].

A person of skill in the art would understand that the functionality taught in these references could be added to other methods and systems that detect light. These methods provide using detectors that are spatially separated. Moreover, to the extent that any of these references includes a feature not expressly disclosed in one or more other references, a POSITA would have naturally looked to, and been motivated to combine, any one of these references with one or more of the other references in order to better achieve their common goals of measuring physiological parameters.

References disclosing detection system is synchronized to the light source: For example, charted reference Lisogurski, Carlson, Poeze, Kreger, and Sakai all include teachings

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related to detection system is synchronized to the light source. These references provide numerous methods for synchronizing detection system with the light source. For example, Lisogurski discloses "he front end processing circuitry 150 may use the timing control signals to operate synchronously with light drive circuitry 120. For example, front end processing circuitry 150 may synchronize the operation of an analog-to-digital converter and a demultiplexer with the light drive signal based on the timing control signals." Lisogurski at 11:33-49. Carlson discloses "[t]he basic idea of using AC-Coupling or Lock-In Amplification (synchronous detection), is to temporarily modulate the optical radiation of the LED at the carrier frequency fc in order to shift the power spectrum of the pulsoximeter signals into a higher frequency range where environmental optical radiation is unlikely and electronic band pass filtering is technologically less stringent. AC-Coupling or Lock-In Amplification is well known out of the state of the art and is described in literature 3." Carlson at [0065]. Poeze teaches that "[a] control signal can be useful in order to synchronize, minimize, or reduce jitter in the timing of pulses emitted from the emitter 104. Accordingly, this control signal can be useful in order to cause optical radiation pulses emitted from the emitter 104 to follow a precise timing and consistent pattern." Poeze at 15:27-48. Kreger discloses "Thus, it is another object to provide compatible signals to the mobile's electrical connectors which may involve transforming the biosensor signals to match requisite impedance and signal levels, eliminate noise, cancel DC noise and drift, demultiplex or multiplex multiple measurements, provide electrical isolation, serialization, synchronization, and so forth." Kreger at 3:17-23. Sakai discloses "he A/D converter 14 operates in synchronization with the light emission timing of the driver 12, to thereby convert the pulse wave detection signal detected upon light emission from the green LED 11 a and the body motion detection signal detected upon light emission from the infrared LED 11 b into digital data, and provides these digital data, as biological

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information, to the information processor 20." Sakai at 5:66-6:9.

A person of skill in the art would understand that the functionality taught in these references could be added to other methods and systems that are concerned with measuring physiological parameters. These methods are known to be effective in incorporating synchronizing detection system with the light source. Moreover, to the extent that any of these references includes a feature not expressly disclosed in one or more other references, a POSITA would have naturally looked to, and been motivated to combine, any one of these references with one or more of the other references in order to better achieve their common goals of signal processing.

b. Combinations

For at least the reasons described above, it would have been obvious to one of ordinary skill in the art to combine each prior art reference listed in Appendix C with any other reference or references listed in Appendix C along with the knowledge of one of ordinary skill in the art to arrive at the inventions claims in the '790 Patent.

For example, and without limitation, the Asserted Claims of the '790 Patent would have been obvious to one of ordinary skill in the art in view of the following combinations:

(i) Rulkov, Basu, Goodman, Chandersekar, Kassim, Lisogurski, Moon, Terumoto, Al-Ali, Kreger, and Sakai combined with References disclosing lenses

A POSITA would have had reason to combine references Rulkov, Basu, Goodman, Kassim, Lisogurski, Moon, Terumoto, Al-Ali, Kreger, and Sakai with any one of References disclosing lenses, all of which relate to systems and methods for using lenses to direct an optical output beam. Each of References disclosing lenses relate to using one or more lenses configured to receive a portion of at least one of the output optical lights and to direct a lens output light to tissue. Indeed, such components and/or processes were conventional as of the time these references were known. Each of References disclosing lenses provide means—not necessarily

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expressly present in all other references—for using lenses to direct an optical output beam. A POSITA would have understood that the systems and methods for References disclosing lenses were intended to be incorporated into wearable measurement devices. A POSITA would understand that systems and methods for using lenses provide improvements such as disrecting the light to tissue. A POSITA would further understand that in order to implement a wearable measurement device, the systems and methods for using lenses to direct an optical output beam would commonly be combined with optical measurement systems, and thus a POSITA would have been motivated to combine the teachings of these references. The combination would apply known techniques for using lenses to direct an optical output beam, to wearable measurement devices that were ready for improvement, in order to yield predictable results. The combination would further be "obvious to try," because it would involve simple design choices from a finite number of identified, predictable solutions, with a reasonable expectation of success.

(ii) Kassim, Rulkov, Goodman, Moon, Chandersekar, Poeze, Soller, Terumoto, Al-Ali, Kreger, and Sakai combined with References disclosing techniques for increasing signal-to-noise ratio

A POSITA would have had reason to combine Kassim, Rulkov, Goodman, Moon, Poeze, Soller, Terumoto, Al-Ali, Kreger, and Sakai with any one of References disclosing techniques for increasing signal-to-noise ratio, all of which relate to systems and methods for increasing a light intensity and increasing a pulse rate of an LED. Each of References disclosing techniques for increasing signal-to-noise ratio relate to increasing the signal-to-noise ratio of optical measurement systems by increasing a light intensity and increasing a pulse rate of an LED. Indeed, such components and/or processes were conventional as of the time these references were known. Each of References disclosing techniques for increasing signal-to-noise ratio

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provide means—not necessarily expressly present in all other references—for increasing signal-to-noise ratio relate to increasing the signal-to-noise ratio of optical measurement systems by increasing a light intensity and increasing a pulse rate of an LED. A POSITA would have understood that the systems and methods for References disclosing techniques for increasing signal-to-noise ratio were intended to be incorporated into wearable measurement devices. A POSITA would understand that systems and methods for increasing a light intensity and increasing a pulse rate of an LED provide improvements such as increasing signal-to-noise ratio. A POSITA would further understand that in order to implement a wearable measurement device, the systems and methods for increasing signal-to-noise ratio would commonly be combined with optical measurement systems, and thus a POSITA would have been motivated to combine the teachings of these references. The combination would apply known techniques for increasing signal-to-noise ratio, to wearable measurement devices that were ready for improvement, in order to yield predictable results. The combination would further be "obvious to try," because it would involve simple design choices from a finite number of identified, predictable solutions, with a reasonable expectation of success.

(iii) Carlson, Kassim, Soller, Chandersekar, and Terumoto combined with References disclosing an analog to digital converter

A POSITA would have had reason to combine references Carlson, Kassim, Soller, and Terumoto with any one of References disclosing an analog to digital converter, all of which relate to systems and methods for using an analog to digital converter coupled to a detector. Indeed, such components and/or processes were conventional as of the time these references were known. Each of References disclosing an analog to digital converter provide means—not necessarily expressly present in all other references—for using an analog to digital converter coupled to a detector. A POSITA would have understood that the systems and methods for

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References disclosing an analog to digital converter were intended to be incorporated into wearable measurement devices. A POSITA would understand that systems and methods for using an analog to digital converter provide improvements such as ability to process a signal digitally. A POSITA would further understand that in order to implement a wearable measurement device, the systems and methods for using an analog to digital converter would commonly be combined with optical measurement systems, and thus a POSITA would have been motivated to combine the teachings of these references. The combination would apply known techniques for using an analog to digital converter, to wearable measurement devices that were ready for improvement, in order to yield predictable results. The combination would further be "obvious to try," because it would involve simple design choices from a finite number of identified, predictable solutions, with a reasonable expectation of success.

(iv) Carlson, Rulkov, Chandersekar, Basu, Goodman, Kassim, Moon, Al-Ali, Kreger, and Sakai combined with References disclosing spatially separated detectors

A POSITA would have had reason to combine references Carlson, Rulkov, Chandersekar, Basu, Goodman, Kassim, Moon, Al-Ali, Kreger, and Sakai with any one of References disclosing spatially separated detectors all of which relate to systems and methods for using spatially separated detectors. Indeed, such components and/or processes were conventional as of the time these references were known. Each of References disclosing spatially separated detectors provide means—not necessarily expressly present in all other references—for using spatially separated detectors. A POSITA would have understood that the systems and methods for References disclosing spatially separated detectors were intended to be incorporated into wearable measurement devices. A POSITA would understand that systems and methods for spatially separated detectors provide improvements such as improved detection quality. A POSITA would further understand that in order to implement a wearable measurement device, the systems and

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methods for measuring physiological parameters would commonly be combined with spatially separated detectors, and thus a POSITA would have been motivated to combine the teachings of these references. The combination would apply known techniques for using spatially separated detectors, to wearable measurement devices that were ready for improvement, in order to yield predictable results. The combination would further be "obvious to try," because it would involve simple design choices from a finite number of identified, predictable solutions, with a reasonable expectation of success.

(v) Rulkov, Chandersekar, Basu, Goodman, Kassim, Moon, Soller, Terumoto, and Al-Ali combined with References disclosing detection system is synchronized to the light source

A POSITA would have had reason to combine references Rulkov, Chandersekar, Basu, Goodman, Kassim, Moon, Soller, Terumoto, and Al-Ali with any one of References disclosing detection system is synchronized to the light source, all of which relate to systems and methods for synchronizing a detection system with a light source. Indeed, such components and/or processes were conventional as of the time these references were known. Each of References disclosing detection system is synchronized to the light source provide means—not necessarily expressly present in all other references—for synchronizing a detection system with a light source. A POSITA would have understood that the systems and methods for References disclosing detection system is synchronized to the light source were intended to be incorporated into wearable measurement devices. A POSITA would understand that systems and methods for synchronizing a detection system with a light source provide improvements such as improved detection. A POSITA would further understand that in order to implement a wearable measurement device, the systems and methods for measuring physiological parameters would commonly be combined with techniques for synchronizing a detection system with a light

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source, and thus a POSITA would have been motivated to combine the teachings of these references. The combination would apply known techniques for synchronizing a detection system with a light source, to wearable measurement devices that were ready for improvement, in order to yield predictable results. The combination would further be "obvious to try," because it would involve simple design choices from a finite number of identified, predictable solutions, with a reasonable expectation of success.

Furthermore, to the extent any limitation of an Asserted Claim is deemed not to be exactly disclosed by an item of prior art, then the claim is rendered obvious by combination of the prior art in Exhibits F1 through F14 standing alone, in combination with the reference(s) in any other claim chart, in combination with any system art identified in Table 2-F, in combination with Applicant's Admitted Prior Art, in view of the knowledge of a person of ordinary skill in the art, and/or in view of the References disclosing lenses, References disclosing techniques for increasing signal-to-noise ratio, References disclosing an analog to digital converter, References disclosing spatially separated detectors, References disclosing detection system is synchronized to the light source, for the reasons discussed above.

V. P.R. 3-3(c) – Claim Charts

Pursuant to Rule 3-3(c), Defendants identify invalidity claim charts identifying disclosures in the references identified in Sections III-IV supra as to the Asserted Claims of the Asserted Patents are provided in attached Appendix A ('868 Patent), Appendix B ('533 Patent), Appendix C ('484 Patent), Appendix D ('304 Patent), Appendix E ('455 Patent), and Appendix F ('790 Patent).

Defendants have identified relevant portions and/or features of the prior art. However, the identified prior art may contain additional descriptions of or alternative support for the claim

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limitations. Defendants may rely on uncited portions or features of the identified prior art, other documents, and expert testimony, to provide context or to aid in understanding the identified prior art and the state of the art. Citations to a particular figure in a reference include the caption and description of the figure and any text relating to the figure. Similarly, citations to particular text referring to a figure include the figure and caption as well. Portions relevant to dependent claims incorporate by reference the citations to the chain of claims from which that dependent claim derives. Likewise, portions related to subsequent limitations that refer to claim elements identified, described, and/or cited to in earlier limitations may rely on the citations related to those portions of the claim chart that identify and/or describe these elements.

Throughout the invalidity claim charts in Appendices A-F, Defendants provide exemplary citations showing where references disclose subject matter recited in preambles of the Asserted Claims, regardless of whether the preambles limit the claims. Defendants reserve the right to argue that the preambles are or are not limitations. Further, where an entry in a claim chart corresponding to a given limitation refers back to the discussion of another claim, the entry incorporates all evidence cited for the other claim.

As noted above, the asserted claims have not yet been construed. Additional portions of the references may become relevant after claim construction. Further, to the extent that any claim term is governed by 35 U.S.C. § 112 ¶ 6, the claim charts identify, by the citations provided, the structure(s), act(s), or material(s) in each reference performing the claimed function for each limitation of the asserted claims. Plaintiffs' claim construction positions, expert analysis and testimony, and additional discovery could all inform which portions of the references disclose a limitation, including under 35 U.S.C. § 112 ¶ 6, and whether any particular limitation is governed by 35 U.S.C. § 112 ¶ 6. Defendants' contentions are based on the information presently available,

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and Defendants reserve all rights to provide their claim construction positions in accordance with the Docket Control Order in this case.

VI. P. R. 3-3(d) – Other Grounds for Invalidity

A. U.S. Patent No. 9,055,868

Pursuant to Rule 3-3(d), Defendants hereby identify grounds of invalidity for the '868 Patent based on lack of written description under 35 U.S.C. § 112, first paragraph; lack of enablement under 35 U.S.C. § 112, first paragraph; indefiniteness under 35 U.S.C. § 112, second paragraph; and indefiniteness under 35 U.S.C. § 112, sixth paragraph. These contentions shall not be construed as an admission that any claim construction advanced by Defendants in this case is in any way inconsistent, flawed, or erroneous. Nor should these contentions prevent Defendants from advancing claim construction and/or non-infringement positions in lieu of, or in addition to, invalidity positions. Further, these contentions shall not be construed as an admission of or acquiescence to Plaintiff's purported construction of the claim language or of other positions advanced by Plaintiff during the course of this litigation. Defendants' invalidity contentions under 35 U.S.C. § 112 may depend, in part, on the Court's claim construction, as well as Plaintiff's alleged scope of the '868 Patent Asserted Claims. Consequently, Defendants only identify the issues under 35 U.S.C. § 112 of which they are presently aware.

1. Lack of Written Description and/or Enablement Under 35 U.S.C. § 112, ¶ 1

The '868 Patent does not provide sufficient written description to establish that the inventors were in possession of the alleged inventions recited in the '868 Patent Asserted Claims at the time the '868 Patent was filed, at least as plaintiff appears to be asserting those limitations. *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010). In other words, the applicants did not describe their purported inventions in a manner that "reasonably conveys to

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those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date." *Id.* One of ordinary skill in the art would not have understood that the inventors were in possession of the full scope of the claimed apparatus and methods, at least as plaintiff appears to be asserting the claims. For example, the claims of the '868 Patent do not provide sufficient written description of the limitations listed below.

The specification of the '868 Patent also does not enable one of ordinary skill in the art to make and/or use certain recited elements of the '868 Patent Asserted Claims without undue experimentation, at least as plaintiff appears to be asserting those limitations. For example, the claims of the '868 Patent fail to sufficiently enable the limtiations listed below.

To the extent the following limitations are definite (under 35 U.S.C. § 112, ¶ 2), the application that became the '868 Patent fails to sufficiently describe or enable them as required by 35 U.S.C. § 112, ¶ 1:[9]

Term	Relevant Claim(s)
"a software application capable of generating data"	7
"a status of the user"	7
"at least a portion of the status or associated information"	7
"a multiplexer capable of combining the plurality of semiconductor diodes"	8

2. Invalidity Under 35 U.S.C. § 112, ¶ 2

"[T]he second paragraph of § 112 contains two requirements: first, the claim must set forth what the applicant regards as his invention, and second, it must do so with sufficient particularity and distinctness, *i.e.*, the claim must be sufficiently definite." *Allen Eng'g Corp. v. Bartell Indus., Inc.*, 299 F.3d 1336, 1348 (Fed. Cir. 2002) (internal quotation marks and alteration omitted).

[9] Listed claims also include all Asserted Claims dependent thereon, even if those claims are not individually listed.

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"Where it would be apparent to one of skill in the art, based on the specification, that the invention set forth in a claim is not what the patentee regarded as his invention," the claim is "invalid under § 112, paragraph 2." *Id.* at 1349. Several of the '868 Patent Asserted Claims are invalid because it would be apparent to one of skill in the art, based on the specification, that the invention set forth in these claims are not what the patentee regarded as his invention, at least as the claims are being asserted by the Plaintiff. *Id.* These claims are invalid under the "applicant regards" prong of § 112 at least because they contain elements that differ from and/or conflict with the '868 Patent's written description of the invention, at least as the claim elements are being asserted by Plaintiff, or because they omit elements that one of skill in the art would understand as part of the '868 Patent's invention based on the specification.

Independently, under § 112, ¶ 2, "a patent is invalid for indefiniteness if its claims, read in light of the specification delineating the patent, and the prosecution history, fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention." *Nautilus, Inc. v. Biosig Instruments, Inc.*, 572 U.S. 898, 901 (2014). Several of the '868 Patent Asserted Claims are also invalid as indefinite under § 112, ¶ 2 because they fail to inform those skilled in the art about the scope of the invention with reasonable certainty and are indefinite.

The following limitations recited in the '868 Patent Asserted Claims are indefinite in whole, in part or in combination:[10]

Term	Relevant Claim(s)
"a part of a user's body comprising blood"	7
"physiological information associated with the user"	7
"wireless data"	7
"voice input signals and manually entered input signals"	7
"at least a portion of the status or associated information"	7

[10] Listed claims also include all Asserted Claims dependent thereon, even if those claims are not individually listed.

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Term	Relevant Claim(s)
"a multiplexer capable of combining the plurality of semiconductor diodes"	8
"generating the input light beam comprising one or more wavelengths"	8
"adapted for use in a diagnostics"	9
"a plurality of associated wavelengths transmitted or reflected from the blood"	9

B. U.S. Patent No. 9,651,533

Pursuant to Rule 3-3(d), Defendants hereby identify grounds of invalidity for the '533 Patent based on lack of written description under 35 U.S.C. § 112, first paragraph; lack of enablement under 35 U.S.C. § 112, first paragraph; indefiniteness under 35 U.S.C. § 112, second paragraph; and indefiniteness under 35 U.S.C. § 112, sixth paragraph. These contentions shall not be construed as an admission that any claim construction advanced by Defendants in this case is in any way inconsistent, flawed, or erroneous. Nor should these contentions prevent Defendants from advancing claim construction and/or non-infringement positions in lieu of, or in addition to, invalidity positions. Further, these contentions shall not be construed as an admission of or acquiescence to Plaintiff's purported construction of the claim language or of other positions advanced by Plaintiff during the course of this litigation. Defendants' invalidity contentions under 35 U.S.C. § 112 may depend, in part, on the Court's claim construction, as well as Plaintiff's alleged scope of the '533 Patent Asserted Claims. Consequently, Defendants only identify the issues under 35 U.S.C. § 112 of which they are presently aware.

1. Lack of Written Description and/or Enablement Under 35 U.S.C. § 112, ¶ 1

The '533 Patent does not provide sufficient written description to establish that the inventors were in possession of the alleged inventions recited in the '533 Patent Asserted Claims at the time the '533 Patent was filed, at least as plaintiff appears to be asserting those limitations.

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Ariad Pharms., Inc. v. Eli Lilly & Co., 598 F.3d 1336, 1351 (Fed. Cir. 2010). In other words, the applicants did not describe their purported inventions in a manner that "reasonably conveys to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date." *Id.* One of ordinary skill in the art would not have understood that the inventors were in possession of the full scope of the claimed apparatus and methods, at least as plaintiff appears to be asserting the claims. For example, the claims of the '533 Patent do not provide sufficient written description of the limitations listed below.

The specification of the '533 Patent also does not enable one of ordinary skill in the art to make and/or use certain recited elements of the '533 Patent Asserted Claims without undue experimentation, at least as plaintiff appears to be asserting those limitations. For example, the claims of the '533 Patent fail to sufficiently enable the limtiations listed below.

To the extent the following limitations are definite (under 35 U.S.C. § 112, ¶ 2), the application that became the '533 Patent fails to sufficiently describe or enable them as required by 35 U.S.C. § 112, ¶ 1:[11]

Term	Relevant Claim(s)
"the light emitting diodes configured to generate an output optical beam with one or more optical wavelengths"	5
"the processed output signal"	5
"one of more detectors"	11
"to select a fraction of the one or more optical wavelengths"	11

2. Invalidity Under 35 U.S.C. § 112, ¶ 2

"[T]he second paragraph of § 112 contains two requirements: first, the claim must set forth what the applicant regards as his invention, and second, it must do so with sufficient particularity and distinctness, *i.e.*, the claim must be sufficiently definite." *Allen Eng'g Corp. v. Bartell Indus.,*

[11] Listed claims also include all Asserted Claims dependent thereon, even if those claims are not individually listed.

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Inc., 299 F.3d 1336, 1348 (Fed. Cir. 2002) (internal quotation marks and alteration omitted). "Where it would be apparent to one of skill in the art, based on the specification, that the invention set forth in a claim is not what the patentee regarded as his invention," the claim is "invalid under § 112, paragraph 2." *Id.* at 1349. Several of the '533 Patent Asserted Claims are invalid because it would be apparent to one of skill in the art, based on the specification, that the invention set forth in these claims are not what the patentee regarded as his invention, at least as the claims are being asserted by the Plaintiff. *Id.* These claims are invalid under the "applicant regards" prong of § 112 at least because they contain elements that differ from and/or conflict with the '533 Patent's written description of the invention, at least as the claim elements are being asserted by Plaintiff, or because they omit elements that one of skill in the art would understand as part of the '533 Patent's invention based on the specification.

Independently, under § 112, ¶ 2, "a patent is invalid for indefiniteness if its claims, read in light of the specification delineating the patent, and the prosecution history, fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention." *Nautilus, Inc. v. Biosig Instruments, Inc.*, 572 U.S. 898, 901 (2014). Several of the '533 Patent Asserted Claims are also invalid as indefinite under § 112, ¶ 2 because they fail to inform those skilled in the art about the scope of the invention with reasonable certainty and are indefinite.

The following limitations recited in the '533 Patent Asserted Claims are indefinite in whole, in part or in combination:[12]

Term	Relevant Claim(s)
"the light emitting diodes configured to generate an output optical beam with one or more optical wavelengths"	5
"the processed output signal"	5
"one of more detectors"	11

[12] Listed claims also include all Asserted Claims dependent thereon, even if those claims are not individually listed.

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Term	Relevant Claim(s)
"to select a fraction of the one or more optical wavelengths"	11

C. U.S. Patent No. 10,517,484

Pursuant to Rule 3-3(d), Defendants hereby identify grounds of invalidity for the '484 Patent based on lack of written description under 35 U.S.C. § 112, first paragraph; lack of enablement under 35 U.S.C. § 112, first paragraph; indefiniteness under 35 U.S.C. § 112, second paragraph; and indefiniteness under 35 U.S.C. § 112, sixth paragraph. These contentions shall not be construed as an admission that any claim construction advanced by Defendants in this case is in any way inconsistent, flawed, or erroneous. Nor should these contentions prevent Defendants from advancing claim construction and/or non-infringement positions in lieu of, or in addition to, invalidity positions. Further, these contentions shall not be construed as an admission of or acquiescence to Plaintiff's purported construction of the claim language or of other positions advanced by Plaintiff during the course of this litigation. Defendants' invalidity contentions under 35 U.S.C. § 112 may depend, in part, on the Court's claim construction, as well as Plaintiff's alleged scope of the '484 Patent Asserted Claims. Consequently, Defendants only identify the issues under 35 U.S.C. § 112 of which they are presently aware.

1. Lack of Written Description and/or Enablement Under 35 U.S.C. § 112, ¶ 1

The '484 Patent does not provide sufficient written description to establish that the inventors were in possession of the alleged inventions recited in the '484 Patent Asserted Claims at the time the '484 Patent was filed, at least as plaintiff appears to be asserting those limitations. *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010). In other words, the applicants did not describe their purported inventions in a manner that "reasonably conveys to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing

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date." *Id.* One of ordinary skill in the art would not have understood that the inventors were in possession of the full scope of the claimed apparatus and methods, at least as plaintiff appears to be asserting the claims. For example, the claims of the '484 Patent do not provide sufficient written description of the limitations listed below.

The specification of the '484 Patent also does not enable one of ordinary skill in the art to make and/or use certain recited elements of the '484 Patent Asserted Claims without undue experimentation, at least as plaintiff appears to be asserting those limitations. For example, the claims of the '484 Patent fail to sufficiently enable the limtiations listed below.

To the extent the following limitations are definite (under 35 U.S.C. § 112, ¶ 2), the application that became the '484 Patent fails to sufficiently describe or enable them as required by 35 U.S.C. § 112, ¶ 1:[13]

Term	Relevant Claim(s)
"wherein the output signal is indicative of one or more of the physiological parameters"	7-10
"increase the signal-to-noise ratio by comparing the first signal and the second signal"	7-10
"a property of at least some of the output signal is compared by at least one of the wearable device, the smart phone or tablet to a threshold"	8-10
"wherein the wearable device is at least in part configured to identify an object"	8-10
"wherein the wearable device is configured to use artificial intelligence to process at least a portion of the output signal"	10

2. Invalidity Under 35 U.S.C. § 112, ¶ 2

"[T]he second paragraph of § 112 contains two requirements: first, the claim must set forth what the applicant regards as his invention, and second, it must do so with sufficient particularity and distinctness, *i.e.*, the claim must be sufficiently definite." *Allen Eng'g Corp. v. Bartell Indus.,*

[13] Listed claims also include all Asserted Claims dependent thereon, even if those claims are not individually listed.

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Inc., 299 F.3d 1336, 1348 (Fed. Cir. 2002) (internal quotation marks and alteration omitted). "Where it would be apparent to one of skill in the art, based on the specification, that the invention set forth in a claim is not what the patentee regarded as his invention," the claim is "invalid under § 112, paragraph 2." *Id.* at 1349. Several of the '484 Patent Asserted Claims are invalid because it would be apparent to one of skill in the art, based on the specification, that the invention set forth in these claims are not what the patentee regarded as his invention, at least as the claims are being asserted by the Plaintiff. *Id.* These claims are invalid under the "applicant regards" prong of § 112 at least because they contain elements that differ from and/or conflict with the '484 Patent's written description of the invention, at least as the claim elements are being asserted by Plaintiff, or because they omit elements that one of skill in the art would understand as part of the '484 Patent's invention based on the specification.

Independently, under § 112, ¶ 2, "a patent is invalid for indefiniteness if its claims, read in light of the specification delineating the patent, and the prosecution history, fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention." *Nautilus, Inc. v. Biosig Instruments, Inc.*, 572 U.S. 898, 901 (2014). Several of the '484 Patent Asserted Claims are also invalid as indefinite under § 112, ¶ 2 because they fail to inform those skilled in the art about the scope of the invention with reasonable certainty and are indefinite.

The following limitations recited in the '484 Patent Asserted Claims are indefinite in whole, in part or in combination:[14]

Term	Relevant Claim(s)
"spatially separated detectors"	7-10
"increase the signal-to-noise ratio by comparing the first signal and the second signal"	7-10

[14] Listed claims also include all Asserted Claims dependent thereon, even if those claims are not individually listed.

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Term	Relevant Claim(s)
"wherein the detection system is configured to be synchronized to the light source"	7-10
"a cloud configured to receive over the wireless transmission link an output status"	7-10
"wherein the wearable device is at least in part configured to identify an object"	8-10
"gain configured to improve detection sensitivity"	9-10
"wherein the wearable device is configured to use artificial intelligence"	10

D. U.S. Patent No. 10,874,304

Pursuant to Rule 3-3(d), Defendants hereby identify grounds of invalidity for the '304 Patent based on lack of written description under 35 U.S.C. § 112, first paragraph; lack of enablement under 35 U.S.C. § 112, first paragraph; indefiniteness under 35 U.S.C. § 112, second paragraph; and indefiniteness under 35 U.S.C. § 112, sixth paragraph. These contentions shall not be construed as an admission that any claim construction advanced by Defendants in this case is in any way inconsistent, flawed, or erroneous. Nor should these contentions prevent Defendants from advancing claim construction and/or non-infringement positions in lieu of, or in addition to, invalidity positions. Further, these contentions shall not be construed as an admission of or acquiescence to Plaintiff's purported construction of the claim language or of other positions advanced by Plaintiff during the course of this litigation. Defendants' invalidity contentions under 35 U.S.C. § 112 may depend, in part, on the Court's claim construction, as well as Plaintiff's alleged scope of the '304 Patent Asserted Claims. Consequently, Defendants only identify the issues under 35 U.S.C. § 112 of which they are presently aware.

1. Lack of Written Description and/or Enablement Under 35 U.S.C. § 112, ¶ 1

The '304 Patent does not provide sufficient written description to establish that the inventors were in possession of the alleged inventions recited in the '304 Patent Asserted Claims

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at the time the '304 Patent was filed, at least as plaintiff appears to be asserting those limitations. *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010). In other words, the applicants did not describe their purported inventions in a manner that "reasonably conveys to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date." *Id.* One of ordinary skill in the art would not have understood that the inventors were in possession of the full scope of the claimed apparatus and methods, at least as plaintiff appears to be asserting the claims. For example, the claims of the '304 Patent do not provide sufficient written description of the limitations listed below.

The specification of the '304 Patent also does not enable one of ordinary skill in the art to make and/or use certain recited elements of the '304 Patent Asserted Claims without undue experimentation, at least as plaintiff appears to be asserting those limitations. For example, the claims of the '304 Patent fail to sufficiently enable the limitations listed below.

To the extent the following limitations are definite (under 35 U.S.C. § 112, ¶ 2), the application that became the '304 Patent fails to sufficiently describe or enable them as required by 35 U.S.C. § 112, ¶ 1:[15]

Term	Relevant Claim(s)
a cloud configured to receive over the wireless transmission link an output status comprising the at least a portion of the processed output signal, to process the received output status to generate processed data and to store the processed data, and wherein the cloud is capable of storing a history of at least a portion of the received output status over a specified period of time.	11
the light source configured to increase signal-to-noise ratio by increasing a light intensity relative to an initial light intensity from at least one of the plurality of semiconductor sources	11
wherein the measurement system is further configured to improve the signal-to-noise ratio by differencing the first signal and the second signal	11

[15] Listed claims also include all Asserted Claims dependent thereon, even if those claims are not individually listed.

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Term	Relevant Claim(s)
wherein the light source is configured to further increase the signal-to-noise ratio by increasing a pulse rate of at least one of the plurality of semiconductor sources from an initial non-zero pulse rate	13
the receiver comprises a plurality of detectors arranged along a first arc, and wherein the plurality of semiconductor sources are arranged along a second arc that is offset from the first arc.	15, 21
wherein the first arc and the second arc are concentric	16, 22
the measurement device further configured to improve a signal-to-noise ratio of the input optical beam reflected from the tissue by: differencing the first signal and the second signal, and increasing the light intensity relative to the initial light intensity from at least one of the semiconductor sources	19
a measurement device including a light source comprising a plurality of semiconductor sources for measuring one or more physiological parameters	19
wherein the light source is configured to further improve the signal-to-noise ratio of the input optical beam reflected from the tissue by increasing a pulse rate of at least one of the plurality of semiconductor sources from an initial non-zero pulse rate	20

2. Invalidity Under 35 U.S.C. § 112, ¶ 2

"[T]he second paragraph of § 112 contains two requirements: first, the claim must set forth what the applicant regards as his invention, and second, it must do so with sufficient particularity and distinctness, *i.e.*, the claim must be sufficiently definite." *Allen Eng'g Corp. v. Bartell Indus., Inc.*, 299 F.3d 1336, 1348 (Fed. Cir. 2002) (internal quotation marks and alteration omitted). "Where it would be apparent to one of skill in the art, based on the specification, that the invention set forth in a claim is not what the patentee regarded as his invention," the claim is "invalid under § 112, paragraph 2." *Id.* at 1349. Several of the '304 Patent Asserted Claims are invalid because it would be apparent to one of skill in the art, based on the specification, that the invention set forth in these claims are not what the patentee regarded as his invention, at least as the claims are being asserted by the Plaintiff. *Id.* These claims are invalid under the "applicant regards" prong of § 112 at least because they contain elements that differ from and/or conflict with the '304 Patent's written description of the invention, at least as the claim elements are being asserted by Plaintiff, or

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because they omit elements that one of skill in the art would understand as part of the '304 Patent's invention based on the specification.

Independently, under § 112, ¶ 2, "a patent is invalid for indefiniteness if its claims, read in light of the specification delineating the patent, and the prosecution history, fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention." *Nautilus, Inc. v. Biosig Instruments, Inc*., 572 U.S. 898, 901 (2014). Several of the '304 Patent Asserted Claims are also invalid as indefinite under § 112, ¶ 2 because they fail to inform those skilled in the art about the scope of the invention with reasonable certainty and are indefinite.

The following limitations recited in the '304 Patent Asserted Claims are indefinite in whole, in part or in combination:[16]

Term	Relevant Claim(s)
a receiver configured to: … synchronize to the light source	11
the light source configured to increase signal-to-noise ratio by increasing a light intensity relative to an initial light intensity from at least one of the plurality of semiconductor sources	11
wherein the measurement system is at least in part configured for selection or identification of an object	12
wherein the measurement system is configured to use artificial intelligence in making decisions	12
wherein the light source is configured to further increase the signal-to-noise ratio by increasing a pulse rate of at least one of the plurality of semiconductor sources from an initial non-zero pulse rate	13
the receiver comprises a plurality of detectors arranged along a first arc, and wherein the plurality of semiconductor sources are arranged along a second arc that is offset from the first arc.	15, 21
wherein the first arc and the second arc are concentric	16, 22
a receiver configured to: … synchronize to the modulation of the at least one of the semiconductor sources	19
the measurement device further configured to improve a signal-to-noise ratio of the input optical beam reflected from the tissue by:	19

[16] Listed claims also include all Asserted Claims dependent thereon, even if those claims are not individually listed.

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Term	Relevant Claim(s)
differencing the first signal and the second signal, and increasing the light intensity relative to the initial light intensity from at least one of the semiconductor sources	
wherein the light source is configured to further improve the signal-to-noise ratio of the input optical beam reflected from the tissue by increasing a pulse rate of at least one of the plurality of semiconductor sources from an initial non-zero pulse rate	20

E. U.S. Patent No. 11,160,455

Pursuant to Rule 3-3(d), Defendants hereby identify grounds of invalidity for the '455 Patent based on lack of written description under 35 U.S.C. § 112, first paragraph; lack of enablement under 35 U.S.C. § 112, first paragraph; indefiniteness under 35 U.S.C. § 112, second paragraph; and indefiniteness under 35 U.S.C. § 112, sixth paragraph. These contentions shall not be construed as an admission that any claim construction advanced by Defendants in this case is in any way inconsistent, flawed, or erroneous. Nor should these contentions prevent Defendants from advancing claim construction and/or non-infringement positions in lieu of, or in addition to, invalidity positions. Further, these contentions shall not be construed as an admission of or acquiescence to Plaintiff's purported construction of the claim language or of other positions advanced by Plaintiff during the course of this litigation. Defendants' invalidity contentions under 35 U.S.C. § 112 may depend, in part, on the Court's claim construction, as well as Plaintiff's alleged scope of the '455 Patent Asserted Claims. Consequently, Defendants only identify the issues under 35 U.S.C. § 112 of which they are presently aware.

1. Lack of Written Description and/or Enablement Under 35 U.S.C. § 112, ¶ 1

The '455 Patent does not provide sufficient written description to establish that the inventors were in possession of the alleged inventions recited in the '455 Patent Asserted Claims at the time the '455 Patent was filed, at least as plaintiff appears to be asserting those limitations.

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Ariad Pharms., Inc. v. Eli Lilly & Co., 598 F.3d 1336, 1351 (Fed. Cir. 2010). In other words, the applicants did not describe their purported inventions in a manner that "reasonably conveys to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date." *Id.* One of ordinary skill in the art would not have understood that the inventors were in possession of the full scope of the claimed apparatus and methods, at least as plaintiff appears to be asserting the claims. For example, the claims of the '455 Patent do not provide sufficient written description of the limitations listed below.

The specification of the '455 Patent also does not enable one of ordinary skill in the art to make and/or use certain recited elements of the '455 Patent Asserted Claims without undue experimentation, at least as plaintiff appears to be asserting those limitations. For example, the claims of the '455 Patent fail to sufficiently enable the limtiations listed below.

To the extent the following limitations are definite (under 35 U.S.C. § 112, ¶ 2), the application that became the '455 Patent fails to sufficiently describe or enable them as required by 35 U.S.C. § 112, ¶ 1:[17]

Term	Relevant Claim(s)
A system for measuring one or more physiological parameters	1, 8, 15
the processed output signal	1, 8, 15
wherein the output signal is indicative of one or more of the physiological parameters	1, 8, 15
the wearable device configured to increase the signal-to-noise ratio by increasing light intensity of at least one of the [plurality of] semiconductor sources from an initial light intensity	1, 8, 15
increase the signal-to-noise ratio by comparing the first signal and the second signal	1, 8, 15
at least a portion of the one or more of the physiological parameters	1, 10
the plurality of semiconductor sources configured to generate an output optical light having a plurality of optical wavelengths	1

[17] Listed claims also include all Asserted Claims dependent thereon, even if those claims are not individually listed.

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Term	Relevant Claim(s)
the plurality of semiconductor sources and the plurality of spatially separated detectors are located on one or more arcs	2, 9, 15
the light emitting diodes configured to generate an output optical light having one or more optical wavelengths	8, 15

2. Invalidity Under 35 U.S.C. § 112, ¶ 2

"[T]he second paragraph of § 112 contains two requirements: first, the claim must set forth what the applicant regards as his invention, and second, it must do so with sufficient particularity and distinctness, *i.e.*, the claim must be sufficiently definite." *Allen Eng'g Corp. v. Bartell Indus., Inc.*, 299 F.3d 1336, 1348 (Fed. Cir. 2002) (internal quotation marks and alteration omitted). "Where it would be apparent to one of skill in the art, based on the specification, that the invention set forth in a claim is not what the patentee regarded as his invention," the claim is "invalid under § 112, paragraph 2." *Id.* at 1349. Several of the '455 Patent Asserted Claims are invalid because it would be apparent to one of skill in the art, based on the specification, that the invention set forth in these claims are not what the patentee regarded as his invention, at least as the claims are being asserted by the Plaintiff. *Id.* These claims are invalid under the "applicant regards" prong of § 112 at least because they contain elements that differ from and/or conflict with the '455 Patent's written description of the invention, at least as the claim elements are being asserted by Plaintiff, or because they omit elements that one of skill in the art would understand as part of the '455 Patent's invention based on the specification.

Independently, under § 112, ¶ 2, "a patent is invalid for indefiniteness if its claims, read in light of the specification delineating the patent, and the prosecution history, fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention." *Nautilus, Inc. v. Biosig Instruments, Inc.*, 572 U.S. 898, 901 (2014). Several of the '455 Patent Asserted Claims are also invalid as indefinite under § 112, ¶ 2 because they fail to inform those skilled in the art

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about the scope of the invention with reasonable certainty and are indefinite.

The following limitations recited in the '455 Patent Asserted Claims are indefinite in whole, in part or in combination:[18]

Term	Relevant Claim(s)
spatially separated detectors	1, 2, 8, 9, 15
a plurality of detectors that are spatially separated from each other	1, 8, 15
wherein the detection system is configured to be synchronized to the light source	1, 8, 15
increase the signal-to-noise ratio by comparing the first signal and the second signal	1, 8, 15
the plurality of semiconductor sources configured to generate an output optical light having a plurality of optical wavelengths	1
the wearable device configured to increase the signal-to-noise ratio by increasing light intensity of at least one of the semiconductor sources from an initial light intensity	1
the plurality of semiconductor sources and the plurality of spatially separated detectors are located on one or more arcs	2, 9, 15
the light emitting diodes configured to generate an output optical light having one or more optical wavelengths	8, 15

F. U.S. Patent No. 12,193,790

Pursuant to Rule 3-3(d), Defendants hereby identify grounds of invalidity for the '790 Patent based on lack of written description under 35 U.S.C. § 112, first paragraph; lack of enablement under 35 U.S.C. § 112, first paragraph; indefiniteness under 35 U.S.C. § 112, second paragraph; and indefiniteness under 35 U.S.C. § 112, sixth paragraph. These contentions shall not be construed as an admission that any claim construction advanced by Defendants in this case is in any way inconsistent, flawed, or erroneous. Nor should these contentions prevent Defendants from advancing claim construction and/or non-infringement positions in lieu of, or in addition to, invalidity positions. Further, these contentions shall not be construed as an admission of or

[18] Listed claims also include all Asserted Claims dependent thereon, even if those claims are not individually listed.

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acquiescence to Plaintiff's purported construction of the claim language or of other positions advanced by Plaintiff during the course of this litigation. Defendants' invalidity contentions under 35 U.S.C. § 112 may depend, in part, on the Court's claim construction, as well as Plaintiff's alleged scope of the '790 Patent Asserted Claims. Consequently, Defendants only identify the issues under 35 U.S.C. § 112 of which they are presently aware.

1. Lack of Written Description and/or Enablement Under 35 U.S.C. § 112, ¶ 1

The '790 Patent does not provide sufficient written description to establish that the inventors were in possession of the alleged inventions recited in the '790 Patent Asserted Claims at the time the '790 Patent was filed, at least as plaintiff appears to be asserting those limitations. *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010). In other words, the applicants did not describe their purported inventions in a manner that "reasonably conveys to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date." *Id.* One of ordinary skill in the art would not have understood that the inventors were in possession of the full scope of the claimed apparatus and methods, at least as plaintiff appears to be asserting the claims. For example, the claims of the '790 Patent do not provide sufficient written description of the limitations listed below.

The specification of the '790 Patent also does not enable one of ordinary skill in the art to make and/or use certain recited elements of the '790 Patent Asserted Claims without undue experimentation, at least as plaintiff appears to be asserting those limitations. For example, the claims of the '790 Patent fail to sufficiently enable the limtiations listed below.

To the extent the following limitations are definite (under 35 U.S.C. § 112, ¶ 2), the application that became the '790 Patent fails to sufficiently describe or enable them as required by

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35 U.S.C. § 112, ¶ 1:[19]

Term	Relevant Claim(s)
"a wearable device for measuring one or more physiological parameters"	7
"signal is indicative of one or more of the physiological parameters"	7
"wherein the wearable device is at least in part configured to identify an object"	7

2. Invalidity Under 35 U.S.C. § 112, ¶ 2

"[T]he second paragraph of § 112 contains two requirements: first, the claim must set forth what the applicant regards as his invention, and second, it must do so with sufficient particularity and distinctness, *i.e.*, the claim must be sufficiently definite." *Allen Eng'g Corp. v. Bartell Indus., Inc.*, 299 F.3d 1336, 1348 (Fed. Cir. 2002) (internal quotation marks and alteration omitted). "Where it would be apparent to one of skill in the art, based on the specification, that the invention set forth in a claim is not what the patentee regarded as his invention," the claim is "invalid under § 112, paragraph 2." *Id.* at 1349. Several of the '790 Patent Asserted Claims are invalid because it would be apparent to one of skill in the art, based on the specification, that the invention set forth in these claims are not what the patentee regarded as his invention, at least as the claims are being asserted by the Plaintiff. *Id.* These claims are invalid under the "applicant regards" prong of § 112 at least because they contain elements that differ from and/or conflict with the '790 Patent's written description of the invention, at least as the claim elements are being asserted by Plaintiff, or because they omit elements that one of skill in the art would understand as part of the '790 Patent's invention based on the specification.

Independently, under § 112, ¶ 2, "a patent is invalid for indefiniteness if its claims, read in

[19] Listed claims also include all Asserted Claims dependent thereon, even if those claims are not individually listed.

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light of the specification delineating the patent, and the prosecution history, fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention." *Nautilus, Inc. v. Biosig Instruments, Inc*., 572 U.S. 898, 901 (2014). Several of the '790 Patent Asserted Claims are also invalid as indefinite under § 112, ¶ 2 because they fail to inform those skilled in the art about the scope of the invention with reasonable certainty and are indefinite.

The following limitations recited in the '790 Patent Asserted Claims are indefinite in whole, in part or in combination:[20]

Term	Relevant Claim(s)
"a plurality of detectors that are spatially separated from each other"	7
"increase the signal-to-noise ratio by comparing the first signal and the second signal"	7
"wherein the wearable device is at least in part configured to identify an object"	7
"wherein the detection system is configured to be synchronized to the light source"	7

VII. Subject Matter Eligibility

Pursuant to the court's Standing Order Regarding Subject Matter Eligibility Contentions Applicable to All Patent Infringement Cases Assigned to Chief District Judge Rodney Gilstrap ("Order Regarding Eligibility"), Samsung provides the following Eligibility Contentions.

As described below, in Appendices A-F, and in Exhibits A101, B101, C101, D101, E101, and F101 (collectively "Appendix 101"), which are hereby incorporated by reference as if fully set forth herein, Defendants contend that the Asserted Claims of the Asserted Patents are drawn to subject matter that is not patentable under 35 U.S.C. § 101. Pursuant to section (a)(1) of the Order Regarding Eligibility, Appendix 101 contains a chart for each Asserted Patent identifying each

[20] Listed claims also include all Asserted Claims dependent thereon, even if those claims are not individually listed.

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exception to eligibility to which each Challenged Claim is directed and the factual and legal basis therefor. Pursuant to section (a)(2)(A) of the Order Regarding Eligibility the charts of Appendix 101, read in conjunction with the discussion herein and in Appendices A-F, and together with the material described, referenced, or cited in the charts, further provide a description of the indsutry, at the relevant time, in which the Challenged Claims are alleged to be well understood, routine, and conventional, and the factual and legal basis therefor. Further, pursuant to sections (a)(2)(B) and (a)(3) of the Order Regarding Eligibility the charts of Appendix 101, read in conjunction with the discussion herein, and together with the material described, referenced, or cited in the charts, further provides: (i) a description of how each element of each Challenged Claim, both individually and in combination with the other elements of that claim, was well understood, routine, and/or conventional in the relevant industry at the relevant time and (ii) an identification of the factual or legal basis for how the Challenged Claims are otherwise ineligible for patent protection.

Additionally, pursuant to section (b) of the Order Regarding Eligibility, Defendants are concurrently producing or making available for inspection and copying the materials on which Defendants presently seek to rely for subject-matter eligibility purposes. These prior art references and other materials are cited herein or in Appendices 101, A-F. For the avoidance of doubt, Defendants may rely on the materials identified in Section III, above. Without concession that expert testimony is necessary to resolve the subject matter eligibility of the Asserted Claims, Defendants reserve the right to further rely on expert testimony to be disclosed in accordance with the Docket Control Order. Defendants' search for prior art references, additional documentation, and/or corroborating evidence concerning prior art systems and devices is ongoing. Accordingly, Defendants reserve the right to supplement their production as Defendants obtain additional prior art references, documentation, and/or corroborating evidence concerning subject matter eligibility

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during the course of discovery.

Defendants reserve the right to supplement their document production pursuant to section (b) of the Order Regarding Eligibility as authorized by the Patent Local Rules, the Order Regarding Eligibility, or any other order of the Court.

A. U.S. Patent No. 9,055,868

Each of the Asserted Claims of the '868 Patent is drawn to subject matter that is not patentable under 35 U.S.C. § 101. The '868 Patent Asserted Claims are unpatentable for failure to recite patent eligible subject matter.

The '868 Patent Asserted Claims are directed to abstract ideas and therefore not eligible subject matter under 35 U.S.C. § 101. *E.g.*, *Alice Corp. Pty. Ltd. v. CLS Bank Intern.*, 573 U.S. 208, 216 (2014). By way of example, the Asserted Claims of the '868 Patent are generally directed to the abstract idea of collecting, processing, and storing light-based physiological data for diagnostics. Although the Asserted Claims recite concrete, tangible components, the specification provides no technical details but instead describes them—both individually and collectively—in generic and functional terms. *See, e.g.*, '868 Patent at Figs. 1, 2, 4, 5 (illustrating exemplary embodiments via generic technology and functional language). This confirms that the recited physical components merely provide a generic environment in which to carry out the abstract idea of collecting, processing, and storing light-based physiological data. Indeed, the patent does not purport to have invented or improved signal generation or processing; data transmission or remote storage; or any sort of diagnostic technique. Thus, under *Alice* Step 1, the Asserted Claims of the '868 Patent are directed to one or more ineligible concepts.

Under *Alice* Step 2, the '868 Patent does not add an inventive step to the general abstract idea. The claimed elements, individually and as an ordered combination, recite only a "handful of

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generic computer components configured to implement" the abstract idea. *See Alice*, 573 U.S. at 226. Semiconductor diodes and the claimed lens system have long been used in optical sensing; touchscreens, location sensors, applications, and wireless transceivers are common in smartphones; and terms like "host," "digital file," and "control logic" represent generic computer components. Optical systems, phone applications, and remote storage are well-known, and their combination follows the general trend toward interconnectivity. *See Chamberlain Grp., Inc. v. Techtronic Indus. Co.*, 935 F.3d 1341, 1347–48 (Fed. Cir. 2019) (noting the ability to "transmit[] data wirelessly" is "not a technological improvement, but rather simply a feature of wireless communication"). The '868 Patent, moreover, does not recite any new or improved algorithm, measurement method, or hardware design. *See Elec. Power Grp., LLC v. Alstom S.A.*, 830 F.3d 1350, 1354 (Fed. Cir. 2016) ("We have repeatedly held that such invocation of computers and networks that are not even arguably inventive are insufficient to pass the test of an inventive concept in the application of an abstract idea." (cleaned up)). Instead, the '868 Patent recites functional, result-oriented language that fails to transform the claimed abstract idea beyond routine and conventional tasks. *See, e.g., Intell. Ventures I LLC v. Cap. Fin. Corp.*, 850 F.3d 1332, 1342 (Fed. Cir. 2017). The law requires more.

Pursuant to section (a)(1) of the Order Regarding Eligibility, Exhibit A101 contains a chart identifying each exception to eligibility to which each Challenged Claim is directed and the factual and legal basis therefor. For avoidance of doubt, and as set forth above and in Exhibit A101 each Challenged Claim of the '868 Patent is directed to one or more abstract ideas and therefore is not directed to patent eligible subject matter. Exhibit A101 also identifies claim 7 as representative of the other Challenged Claims for purposes of the eligibility inquiry. Also, pursuant to section (a)(2)(B) and (a)(3) of the Order regarding Eligibility, Exhibit A101, read in conjunction with the

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preceding paragraphs herein provides: (i) a description of how each element of each Challenged Claim, both individually and in combination with the other elements of that claim, was well understood, routine, and/or conventional in the relevant industry at the relevant time and (ii) an identification of the factual or legal basis for how the Challenged Claims are otherwise ineligible for patent protection.

Finally, pursuant to section (a)(2)(A) of the Order Regarding Eligibility, Defendants provide the following description of the relevant industry at the relevant time. As of the alleged priority date for the '868 Patent, the relevant industry was well-developed. All individual elements disclosed and recited in the '868 Patent were conventional, routine, and well known in the medical device and wearable health tech industries. *See generally* Appendix A. As shown in the accompanying claim charts, none of the claimed concepts were new or merely on the verge of development as of the alleged priority date of the '868 Patent. Instead, these concepts had been known for years and were the subject of many published articles and/or patents from around the world. The '868 Patent contributed nothing beyond what was already conventional, routine, well-known technology as of the relevant time period.

Further detail regarding Defendants' contentions that the Asserted Claims of the '868 Patent do not qualify as patent-eligible subject matter are contained in Exhibit A101.

B. U.S. Patent No. 9,651,533

Each of the Asserted Claims of the '533 Patent is drawn to subject matter that is not patentable under 35 U.S.C. § 101. The '533 Patent Asserted Claims are unpatentable for failure to recite patent eligible subject matter.

The '533 Patent Asserted Claims are directed to abstract ideas and therefore not eligible subject matter under 35 U.S.C. § 101. *E.g.*, *Alice*, 573 U.S. at 216. By way of example, the

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Asserted Claims of the ’533 Patent are generally directed to the abstract idea of collecting, processing, and storing light-based data for analysis. Although the Asserted Claims recite concrete, tangible components, the specification provides no technical details but instead describes them—both individually and collectively—in generic and functional terms. *See, e.g.*, ’533 Patent at 9:34-38, 2:26-29, 26:49-27:2. This confirms that the recited physical components merely provide a generic environment in which to carry out the abstract idea of collecting, processing, and storing light-based data. Indeed, the patent does not purport to have invented or improved signal generation or processing; data transmission or remote storage; or any sort of measurement technique. Thus, under *Alice* Step 1, the Asserted Claims of the ’533 Patent are directed to one or more ineligible concepts.

Under *Alice* Step 2, the ’533 Patent does not add an inventive step to the general abstract idea. The claimed elements, individually and as an ordered combination, recite only a “handful of generic computer components configured to implement” the abstract idea. *See Alice*, 573 U.S. at 226. Semiconductor diodes, filters, and lenses have long been used in optical sensing; touchscreens, receivers, and transmitters are common in smartphones; and a “remote device” represents a conventional computer or storage unit. Optical systems, phone applications, and remote storage are well-known, and their combination follows the general trend toward interconnectivity. *See Chamberlain*, 935 F.3d at 1347–48. The ’533 Patent, moreover, does not recite any new or improved algorithm, measurement method, or hardware design. Instead, the ’533 Patent recites functional, result-oriented language that fails to transform the claimed abstract idea beyond routine and conventional tasks. *See, e.g., Intell. Ventures*, 850 F.3d at 1342. The law requires more.

Pursuant to section (a)(1) of the Order Regarding Eligibility, Exhibit B101 contains a chart

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identifying each exception to eligibility to which each Challenged Claim is directed and the factual and legal basis therefor. For avoidance of doubt, and as set forth above and in Exhibit B101, each Challenged Claim of the ’533 Patent is directed to one or more abstract ideas and therefore is not directed to patent eligible subject matter. Exhibit B101 also identifies claim 11 as representative of the other Challenged Claims for purposes of the eligibility inquiry. Also, pursuant to section (a)(2)(B) and (a)(3) of the Order regarding Eligibility, Exhibit B101, read in conjunction with the preceding paragraphs herein provides: (i) a description of how each element of each Challenged Claim, both individually and in combination with the other elements of that claim, was well understood, routine, and/or conventional in the relevant industry at the relevant time and (ii) an identification of the factual or legal basis for how the Challenged Claims are otherwise ineligible for patent protection.

Finally, pursuant to section (a)(2)(A) of the Order Regarding Eligibility, Defendants provide the following description of the relevant industry at the relevant time. As of the alleged priority date for the ’533 Patent, the relevant industry was well-developed. All individual elements disclosed and recited in the ’533 Patent were conventional, routine, and well known in the optoelectronics and laboratory analytical instrumentation industries. *See generally* Appendix B. As shown in the accompanying claim charts, none of the claimed concepts were new or merely on the verge of development as of the alleged priority date of the ’533 Patent. Instead, these concepts had been known for years and were the subject of many published articles and/or patents from around the world. The ’533 Patent contributed nothing beyond what was already conventional, routine, well-known technology as of the relevant time period.

Further detail regarding Defendants’ contentions that the Asserted Claims of the ’533 Patent do not qualify as patent-eligible subject matter are contained in Exhibit B101.

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C. U.S. Patent No. 10,517,484

Each of the Asserted Claims of the ’484 Patent is drawn to subject matter that is not patentable under 35 U.S.C. § 101. The ’484 Patent Asserted Claims are unpatentable for failure to recite patent eligible subject matter.

The ’484 Patent Asserted Claims are directed to abstract ideas and therefore not eligible subject matter under 35 U.S.C. § 101. *E.g.*, *Alice*, 573 U.S. at 216. By way of example, the Asserted Claims of the ’484 Patent are generally directed to the abstract ideas of collecting, processing, and storing light-based physiological data for analysis. Although the Asserted Claims recite concrete, tangible components, the specification provides no technical details but instead describes them—both individually and collectively—in generic and functional terms. *See, e.g.*, ’484 Patent at 11:3-6, 32:45-65. This confirms that the recited physical components merely provide a generic environment in which to carry out the abstract idea of collecting, processing, and storing light-based data. Indeed, the patent does not purport to have invented or improved signal generation or processing; data transmission or remote storage; or any sort of measurement technique. Thus, under *Alice* Step 1, the Asserted Claims of the ’484 Patent are directed to one or more ineligible concepts.

Under *Alice* Step 2, the ’484 Patent does not add an inventive step to the general abstract idea. The claimed elements, individually and as an ordered combination, recite only a “handful of generic computer components configured to implement” the abstract idea. *See Alice*, 573 U.S. at 226. Semiconductor diodes, detectors, and lenses have long been used in optical sensing; touchscreens, receivers, and transmitters are common in smartphones; and the cloud is ubiquitous with modern computing. Optical systems, phone applications, and remote storage are well-known, and their combination follows the general trend toward interconnectivity. *See Chamberlain*, 935

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F.3d at 1347–48. The ’484 Patent, moreover, does not recite any new or improved algorithm, measurement method, or hardware design. Instead, the ’484 Patent recites functional, result-oriented language that fails to transform the claimed abstract idea beyond routine and conventional tasks. *See, e.g., Intell. Ventures*, 850 F.3d at 1342. The law requires more.

Pursuant to section (a)(1) of the Order Regarding Eligibility, Exhibit C101 contains a chart identifying each exception to eligibility to which each Challenged Claim is directed and the factual and legal basis therefor. For avoidance of doubt, and as set forth above and in Exhibit C101, each Challenged Claim of the ’484 Patent is directed to one or more abstract ideas and therefore is not directed to patent eligible subject matter. Exhibit C101 also identifies claim 8 as representative of the other Challenged Claims for purposes of the eligibility inquiry. Also, pursuant to section (a)(2)(B) and (a)(3) of the Order regarding Eligibility, Exhibit C101, read in conjunction with the preceding paragraphs herein provides: (i) a description of how each element of each Challenged Claim, both individually and in combination with the other elements of that claim, was well understood, routine, and/or conventional in the relevant industry at the relevant time and (ii) an identification of the factual or legal basis for how the Challenged Claims are otherwise ineligible for patent protection.

Finally, pursuant to section (a)(2)(A) of the Order Regarding Eligibility, Defendants provide the following description of the relevant industry at the relevant time. As of the alleged priority date for the ’484 Patent, the relevant industry was well-developed. All individual elements disclosed and recited in the ’484 Patent were conventional, routine, and well known in the medical device and wearable health tech industries. *See generally* Appendix C. As shown in the accompanying claim charts, none of the claimed concepts were new or merely on the verge of development as of the alleged priority date of the ’484 Patent. Instead, these concepts had been

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known for years and were the subject of many published articles and/or patents from around the world. The ’484 Patent contributed nothing beyond what was already conventional, routine, well-known technology as of the relevant time period.

Further detail regarding Defendants’ contentions that the Asserted Claims of the ’484 Patent do not qualify as patent-eligible subject matter are contained in Exhibit C101.

D. U.S. Patent No. 10,874,304

Each of the Asserted Claims of the ’304 Patent is drawn to subject matter that is not patentable under 35 U.S.C. § 101. The ’304 Patent Asserted Claims are unpatentable for failure to recite patent eligible subject matter.

The ’304 Patent Asserted Claims are directed to abstract ideas and therefore not eligible subject matter under 35 U.S.C. § 101. *E.g.*, *Alice*, 573 U.S. at 216. By way of example, the Asserted Claims of the ’304 Patent are generally directed to the abstract ideas of collecting, processing, and storing light-based physiological data for analysis. Although the Asserted Claims recite concrete, tangible components, the specification provides no technical details but instead describes them—both individually and collectively—in generic and functional terms. *See, e.g.*, ’304 Patent at 13:21-25, 33:45-64. This confirms that the recited physical components merely provide a generic environment in which to carry out the abstract idea of collecting, processing, and storing light-based physiological data. Indeed, the patent does not purport to have invented or improved signal generation or processing; data transmission or remote storage; or any sort of measurement technique. Thus, under *Alice* Step 1, the Asserted Claims of the ’304 Patent are directed to one or more ineligible concepts.

Under *Alice* Step 2, the ’304 Patent does not add an inventive step to the general abstract idea. The claimed elements, individually and as an ordered combination, recite only a “handful of

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generic computer components configured to implement" the abstract idea. *See Alice*, 573 U.S. at 226. Semiconductor diodes and receivers have long been used in optical sensing; touchscreens, receivers, and transmitters are common in smartphones; and the cloud is ubiquitous with modern computing. Optical systems, phone applications, and remote storage are well-known, and their combination follows the general trend toward interconnectivity. *See Chamberlain*, 935 F.3d at 1347–48. The '304 Patent, moreover, does not recite any new or improved algorithm, measurement method, or hardware design. Instead, the '484 Patent recites functional, result-oriented language that fails to transform the claimed abstract idea beyond routine and conventional tasks. *See, e.g., Intell. Ventures*, 850 F.3d at 1342. The law requires more.

Pursuant to section (a)(1) of the Order Regarding Eligibility, Exhibit D101 contains a chart identifying each exception to eligibility to which each Challenged Claim is directed and the factual and legal basis therefor. For avoidance of doubt, and as set forth above and in Exhibit D101 each Challenged Claim of the '304 Patent is directed to one or more abstract ideas and therefore is not directed to patent eligible subject matter. Exhibit D101 also identifies claim 11 as representative of the other Challenged Claims for purposes of the eligibility inquiry. Also, pursuant to section (a)(2)(B) and (a)(3) of the Order regarding Eligibility, Exhibit D101, read in conjunction with the preceding paragraphs herein provides: (i) a description of how each element of each Challenged Claim, both individually and in combination with the other elements of that claim, was well understood, routine, and/or conventional in the relevant industry at the relevant time and (ii) an identification of the factual or legal basis for how the Challenged Claims are otherwise ineligible for patent protection.

Finally, pursuant to section (a)(2)(A) of the Order Regarding Eligibility, Defendants provide the following description of the relevant industry at the relevant time. As of the alleged

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priority date for the ’304 Patent, the relevant industry was well-developed. All individual elements disclosed and recited in the ’304 Patent were conventional, routine, and well known in the medical device and wearable health tech industries. *See generally* Appendix D. As shown in the accompanying claim charts, none of the claimed concepts were new or merely on the verge of development as of the alleged priority date of the ’304 Patent. Instead, these concepts had been known for years and were the subject of many published articles and/or patents from around the world. The ’304 Patent contributed nothing beyond what was already conventional, routine, well-known technology as of the relevant time period.

Further detail regarding Defendants’ contentions that the Asserted Claims of the ’304 Patent do not qualify as patent-eligible subject matter are contained in Exhibit D101.

E. U.S. Patent No. 11,160,455

Each of the Asserted Claims of the ’455 Patent is drawn to subject matter that is not patentable under 35 U.S.C. § 101. The ’455 Patent Asserted Claims are unpatentable for failure to recite patent eligible subject matter.

The ’455 Patent Asserted Claims are directed to abstract ideas and therefore not eligible subject matter under 35 U.S.C. § 101. *E.g.*, *Alice*, 573 U.S. at 216. By way of example, the Asserted Claims of the ’455 Patent are generally directed to the abstract ideas of collecting, processing, and storing light-based physiological data for analysis. Although the Asserted Claims recite concrete, tangible components, the specification provides no technical details but instead describes them—both individually and collectively—in generic and functional terms. *See, e.g.*, ’455 Patent at 16:66-17:3, 45:43-62. This confirms that the recited physical components merely provide a generic environment in which to carry out the abstract idea of collecting, processing, and storing light-based physiological data. Indeed, the patent does not purport to have invented or

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improved signal generation or processing; data transmission or remote storage; or any sort of measurement technique. Thus, under *Alice* Step 1, the Asserted Claims of the '455 Patent are directed to one or more ineligible concepts.

Under *Alice* Step 2, the '455 Patent does not add an inventive step to the general abstract idea. The claimed elements, individually and as an ordered combination, recite only a "handful of generic computer components configured to implement" the abstract idea. *See Alice*, 573 U.S. at 226. Semiconductor sources, lenses, and detectors have long been used in optical sensing; touchscreens, receivers, and transmitters are common in smartphones; and the combination of optical systems and smartphones follows the general trend toward interconnectivity. *See Chamberlain*, 935 F.3d at 1347–48. The '455 Patent, moreover, does not recite any new or improved algorithm, measurement method, or hardware design. Instead, the '455 Patent recites functional, result-oriented language that fails to transform the claimed abstract idea beyond routine and conventional tasks. *See, e.g.*, *Intell. Ventures*, 850 F.3d at 1342. The law requires more.

Pursuant to section (a)(1) of the Order Regarding Eligibility, Exhibit E101 contains a chart identifying each exception to eligibility to which each Challenged Claim is directed and the factual and legal basis therefor. For avoidance of doubt, and as set forth above and in Exhibit E101 each Challenged Claim of the '455 Patent is directed to one or more abstract ideas and therefore is not directed to patent eligible subject matter. Exhibit E101 also identifies claim 1 as representative of the other Challenged Claims for purposes of the eligibility inquiry. Also, pursuant to section (a)(2)(B) and (a)(3) of the Order regarding Eligibility, Exhibit E101, read in conjunction with the preceding paragraphs herein provides: (i) a description of how each element of each Challenged Claim, both individually and in combination with the other elements of that claim, was well understood, routine, and/or conventional in the relevant industry at the relevant time and (ii) an

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identification of the factual or legal basis for how the Challenged Claims are otherwise ineligible for patent protection.

Finally, pursuant to section (a)(2)(A) of the Order Regarding Eligibility, Defendants provide the following description of the relevant industry at the relevant time. As of the alleged priority date for the '455 Patent, the relevant industry was well-developed. All individual elements disclosed and recited in the '455 Patent were conventional, routine, and well known in the medical device and wearable health tech industries. *See generally* Appendix E. As shown in the accompanying claim charts, none of the claimed concepts were new or merely on the verge of development as of the alleged priority date of the '455 Patent. Instead, these concepts had been known for years and were the subject of many published articles and/or patents from around the world. The '455 Patent contributed nothing beyond what was already conventional, routine, well-known technology as of the relevant time period.

Further detail regarding Defendants' contentions that the Asserted Claims of the '455 Patent do not qualify as patent-eligible subject matter are contained in Exhibit E101.

F. U.S. Patent No. 12,193,790

The Asserted Claim of the '790 Patent is drawn to subject matter that is not patentable under 35 U.S.C. § 101. The '790 Patent Asserted Claim is unpatentable for failure to recite patent eligible subject matter.

The '790 Patent Asserted Claim is directed to abstract ideas and therefore not eligible subject matter under 35 U.S.C. § 101. *E.g.*, *Alice*, 573 U.S. at 216. By way of example, the Asserted Claim of the '790 Patent is generally directed to the abstract idea of collecting and processing light-based data to determine physiological parameters. Although the Asserted Claim recites concrete, tangible components, the specification provides no technical details but instead

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describes them—both individually and collectively—in generic and functional terms. *See, e.g.*, '790 Patent at 7:50-55, 84:63-67, 32:28-67. This confirms that the recited physical components merely provide a generic environment in which to carry out the abstract idea of collecting and processing natural phenomena. Indeed, the patent does not purport to have invented or improved signal generation or processing; data transmission or remote storage; or any sort of measurement technique. Thus, under *Alice* Step 1, the Asserted Claim of the '790 Patent is directed to one or more ineligible concepts.

Under *Alice* Step 2, the '790 Patent does not add an inventive step to the general abstract idea. The claimed elements, individually and as an ordered combination, recite only a "handful of generic computer components configured to implement" the abstract idea. *See Alice*, 573 U.S. at 226. The claimed light source (e.g., LEDs), semiconductor diodes, lenses, detection system, detectors, and analog-to-digital converters are conventional and perform their ordinary, expected functions. The claimed enhancement of signal-to-noise ratio by increasing light intensity or by subtracting background signal is a well-known technique in signal processing and does not constitute an unconventional arrangement or improvement in technology. The '790 Patent, moreover, does not recite any new or improved algorithm, measurement method, or hardware design. Instead, the '790 Patent recites functional, result-oriented language that fails to transform the claimed abstract idea beyond routine and conventional tasks. *See, e.g.*, *Intell. Ventures*, 850 F.3d at 1342. The law requires more.

Pursuant to section (a)(1) of the Order Regarding Eligibility, Exhibit F101 contains a chart identifying each exception to eligibility to which each Challenged Claim is directed and the factual and legal basis therefor. For avoidance of doubt, and as set forth above and in Exhibit F101 each Challenged Claim of the '790 Patent is directed to one or more abstract ideas and therefore is not

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directed to patent eligible subject matter. Also, pursuant to section (a)(2)(B) and (a)(3) of the Order regarding Eligibility, Exhibit F101, read in conjunction with the preceding paragraphs herein provides: (i) a description of how each element of each Challenged Claim, both individually and in combination with the other elements of that claim, was well understood, routine, and/or conventional in the relevant industry at the relevant time and (ii) an identification of the factual or legal basis for how the Challenged Claims are otherwise ineligible for patent protection.

Finally, pursuant to section (a)(2)(A) of the Order Regarding Eligibility, Defendants provide the following description of the relevant industry at the relevant time. As of the alleged priority date for the '790 Patent, the relevant industry was well-developed. All individual elements disclosed and recited in the '790 Patent were conventional, routine, and well known in the medical device and wearable health tech industries. *See generally* Appendix F. As shown in the accompanying claim charts, none of the claimed concepts were new or merely on the verge of development as of the alleged priority date of the '790 Patent. Instead, these concepts had been known for years and were the subject of many published articles and/or patents from around the world. The '790 Patent contributed nothing beyond what was already conventional, routine, well-known technology as of the relevant time period.

Further detail regarding Defendants' contentions that the Asserted Claims of the '790 Patent do not qualify as patent-eligible subject matter are contained in Exhibit F101.

VIII. P. R. 3-4 – Productions

Pursuant to P.R. 3-4(a), each Defendant is concurrently producing and/or making available for inspection documents and other materials sufficient to show the operation of any aspects or elements of the Accused Products identified by Plaintiff in its P.R. 3-1(c) charts.

Additionally, and pursuant to P.R. 3-4(b), Defendants are concurrently producing a copy

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of each item of prior art identified herein. These prior art references and corroborating evidence are cited in attached invalidity claim charts in Appendices 101, A-F. Defendants will also make available for inspection any prior art systems or devices upon request to the extent Defendants acquire such systems or devices. References that were cited during prosecution of the Asserted Patents may not be contained in Defendants' production as they are not required to be under the local patent rules. Defendants' search for prior art references, additional documentation, and/or corroborating evidence concerning prior art systems and devices is ongoing. Accordingly, Defendants reserve the right to supplement their production as Defendants obtain additional prior art references, documentation, and/or corroborating evidence concerning invalidity during the course of discovery.

Defendants reserve the right to supplement their P. R. 3-4 document production pursuant to the Patent Local Rules and the orders of the Court.

Dated: June 3, 2025 Respectfully Submitted,

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EXHIBIT F101

Preliminary Eligibility Contentions for U.S. Patent No. 12,193,790

Based on Omni's apparent positions, as best they can be deciphered, as to the scope of asserted claims of U.S. Patent No. 12,193,790, the chart below provides Defendants' current contentions regarding the patent ineligibility of each asserted claim.

This disclosure is not an admission that Defendants concede any claim construction implied or suggested by Omni's apparent positions as to the scope of the patent's claims, nor is it an admission by Defendants that any of their products are covered by or infringe the patent's claims, particularly when they are properly construed and applied. Defendants are not taking any claim construction positions through this disclosure, including whether the preamble is a limitation.

Defendants reserve the right to rely on additional citations or sources of evidence that also may be applicable, or that may become applicable in light of claim construction, changes in Omni's infringement contentions, and/or information obtained during discovery as the case progresses. Defendants further reserve the right to amend or supplement this claim chart at a later date as more fully set forth in the Invalidity and Subject Matter Eligibility Contentions.

Claim 7 of the '790 patent, the only asserted claim, is drawn to patent-ineligible subject matter under 35 U.S.C. § 101. Claim 7 is generally directed to the abstract idea of collecting and processing light-based data to determine physiological parameters. And it contains no "'inventive concept' . . . sufficient to ensure that the patent in practice amounts to *significantly more* than a patent upon the ineligible concept itself." *See Alice Corp. Pty. Ltd. v. CLS Bank Int'l*, 573 U.S. 208, 217–18 (2014) (emphasis added).

***Alice* Step One: Claim 7 is generally directed to the abstract idea of collecting and processing light-based data to determine physiological parameters.**

The *Alice* test requires the Court to look at the "focus of the claimed advance over the prior art to determine if the claim's character as a whole is directed to excluded subject matter." *Affinity Labs of Tex., LLC v. DIRECTV, LLC*, 838 F.3d 1253, 1257 (Fed. Cir. 2016) (cleaned up). The '790 patent alleges an unmet need for "non-invasive monitoring of blood constituents or blood analytes," including glucose and HbA1c, with "adequate sensitivity and selectivity, along with repeatability of the results." *See* '790 patent at 3:5, 15:26–37. According to the patent, readings from near-infrared spectroscopy, a common method of non-invasive blood monitoring, are often inaccurate due to either a weak signal or interference (noise). *Id.* at 3:12–30. The '790 patent purports to address this shortcoming in two ways: (1) by adjusting the light intensity to increase signal levels for purposes of data collection and (2) by using "mathematical modeling and signal processing methodologies" to reduce interference. *Id.* at 3:28–38, 21:7–28. This purported "advance" relates to the abstract idea of collecting and processing light-based data to determine physiological parameters through a series of abstract steps, namely collecting and processing signal data.

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Claim 7 is generally directed to the abstract idea of collecting and processing light-based data to determine physiological parameters. *Id.* at cl. 7, 15:26–27; *Ariosa Diagnostics, Inc. v. Sequenom, Inc.*, 788 F.3d 1371, 1376 (Fed. Cir. 2015) (holding that claims "generally directed to detecting the presence of a naturally occurring thing" are abstract). The claimed system is configured to first measure a property of a physiological parameter by observing its relationship to light—specifically, it measures the correlation between two naturally occurring phenomena, an abstract natural law. '790 patent at cl. 7, 15:26–37; *see also Cleveland Clinic Found. v. True Health Diagnostics LLC*, 859 F.3d 1352, 1361 (Fed. Cir. 2017) (holding claims directed to measuring the relationship between naturally occurring phenomena are directed to an abstract natural law). The system then supposedly improves signal-to-noise ratio by providing a stronger signal ("increasing light intensity") and using basic, conventional math to filter out noise ("comparing the first signal and the second signal"). '790 patent at cl. 7.

This amounts to nothing more than a compilation of abstract ideas. Indeed, the patent does not purport to have invented or improved signal generation or processing. The "use of a mathematical calculation, even one that yields different or better results, does not render patent eligible subject matter." *In re Bd. of Trs. of Leland Stanford Junior Univ.*, 991 F.3d 1245, 1251 (Fed. Cir. 2021). Nor does "[a]dding one abstract idea (math) to another abstract idea" (measuring natural phenomena). *See RecogniCorp, LLC v. Nintendo Co., Ltd.*, 855 F.3d 1322, 1327 (Fed. Cir. 2017). And although Claim 7 requires concrete, tangible components such as a "wearable device," a "light source," "semiconductor diodes," "lenses," a "detection system," "detectors," and an "analog to digital converter," "the specification makes clear that the recited physical components merely provide a generic environment in which to carry out the abstract idea" of collecting and processing natural phenomena. *See In re TLI Commc'ns LLC Pat. Litig.*, 823 F.3d 607, 611–12 (Fed. Cir. 2016) (finding claims "directed to the use of conventional or generic technology in a nascent but well-known environment" to be abstract). In fact, the specification provides no technical details for the tangible components, but instead describes them—both individually and collectively—in generic and functional terms. *See infra*, *Alice* Step Two. So instead of providing any new or useful system, Claim 7 recites the abstract idea of measuring natural phenomena through conventional and result-oriented steps. *See In re Gopalan*, 809 F. App'x 942, 945–46 (Fed. Cir. 2020).

***Alice* Step Two: Claim 7 does not contain a transformative inventive concept.**

Claim 7 likewise contains no inventive concept that transforms the abstract idea into patent-eligible subject matter.

The claimed elements, individually and as an ordered combination, recite only a "handful of generic computer components configured to implement" the abstract idea. *See Alice*, 573 U.S. at 226. The claimed light source (e.g., LEDs), semiconductor diodes, lenses, detection system, detectors, and analog-to-digital converters are conventional and perform their ordinary, expected functions. The claimed enhancement of signal-to-noise ratio by increasing light intensity or by subtracting background signal is a well-known

technique in signal processing and does not constitute an unconventional arrangement or improvement in technology. Ex. F1-F14; Cover Pleading at § III.G.

The specification confirms that each of the result-oriented claim elements can be carried out by generic hardware operating in a conventional fashion. *See, e.g.*, '790 patent at 7:50–55 ("[O]ptical instruments tend to be portable and more cost effective as compared to other instrumentation that is conventionally used for medical diagnosis. This can be particularly true, if the mature technologies for telecommunications and fiber optics are exploited."); *id.* at 84:63–67 ("In one embodiment, the 'optical light' and/or 'optical beam' and/or 'light beam' may originate from a fiber, a fiber laser, a laser, a light emitting diodes, a lamp, a pump laser, or a light source."); *id.* at 6:48–51 ("In particular embodiments, the detection system may be a dispersive spectrometer, a Fourier transform infrared spectrometer, or a hyper-spectral imaging detector or camera."); *id.* at 35:28–67 (reciting generic technologies, including "a transmitter," "a processor," "wireless technologies such as Bluetooth," and recognizing that "other devices could be used and are included in the scope of this disclosure"). In other words, the claim does not offer any specific technological solution to improve the functioning of the sensors or hardware, but merely applies conventional signal-processing techniques to achieve the functional goal of enhanced signal quality, without any improvement to the claimed "wearable device," "light source," "semiconductor diodes," "lenses," "detection system," "detectors," or "analog to digital converter."

At bottom, Claim 7 recites functional, result-oriented language that fails to transform the claimed abstract idea beyond routine and conventional tasks. *See, e.g., Intell. Ventures I LLC v. Cap. Fin. Corp.*, 850 F.3d 1332, 1342 (Fed. Cir. 2017) ("[T]he claim language here provides only a result-oriented solution, with insufficient detail for how a computer accomplishes it. Our law demands more.").

'790 Patent – Claim 7	**Subject Matter Eligibility Contentions**
[7pre] An optical system, comprising:	Claim 7 of the '790 is directed to an abstract idea. And it contains no inventive concept sufficient to ensure that the claim amounts to significantly more than the patent-ineligible concept itself. Claim 7 of the '790 patent is generally directed to the abstract idea of collecting and processing light-based data to determine physiological parameters. *See, e.g.*, *AI Visualize, Inc. v. Nuance Commc'ns, Inc.*, 97 F.4th 1371, 1378–79 (Fed. Cir. 2024); *In re*

	TLI Commc'ns LLC Patent Litig., 823 F.3d 607, 611–13 (Fed. Cir. 2016); *Elec. Power Grp., LLC v. Alstom S.A.*, 830 F.3d 1350, 1353–54 (Fed. Cir. 2016); *Intell. Ventures I LLC v. Cap. Fin. Corp.*, 850 F.3d 1332, 1340–41 (Fed. Cir. 2017); *Univ. of Fla. Rsch. Found., Inc. v. Gen. Elec. Co.*, 916 F.3d 1363, 1367–68 (Fed. Cir. 2019); *CardioNet, LLC v. InfoBionic, Inc.*, 816 F. App'x 471, 475–77 (Fed. Cir. 2020); *In re Bd. of Trs. Of Leland Stanford Junior Univ.*, 991 F.3d 1245, 1250–51 (Fed. Cir. 2021); *Audio Evolution Diagnostics, Inc. v. United States*, 160 Fed. Cl. 513, 526–27 (2022), *aff'd*, No. 2023-1096, 2024 WL 2143376 (Fed. Cir. May 14, 2024); *Braemar Mfg., LLC v. ScottCare Corp.*, 816 F. App'x 465, 470 (Fed. Cir. 2020); *Philips N. Am. LLC v. Fitbit LLC*, 626 F. Supp. 3d 292, 306–09 (D. Mass. 2022); *Two-Way Media Ltd. v. Comcast Cable Commc'ns, LLC*, 874 F.3d 1329, 1337–39 (Fed. Cir. 2017); *In re Gopalan*, 809 F. App'x 942, 945–46 (Fed. Cir. 2020); *Ariosa Diagnostics, Inc. v. Sequenom, Inc.*, 788 F.3d 1371, 1376 (Fed. Cir. 2015); *Cleveland Clinic Found. v. True Health Diagnostics LLC*, 859 F.3d 1352, 1361 (Fed. Cir. 2017); *RecogniCorp, LLC v. Nintendo Co., Ltd.*, 855 F.3d 1322, 1327 (Fed. Cir. 2017); *Chamberlain Grp., Inc. v. Techtronic Indus. Co.*, 935 F.3d 1341, 1346–48 (Fed. Cir. 2019); *Content Extraction & Transmission LLC v. Wells Fargo Bank, Nat'l Ass'n*, 776 F.3d 1343, 1347 (Fed. Cir. 2014). Claim 7 also contains no inventive concept. At the time of the alleged invention, the elements of Claim 7 were well-understood, routine, and/or conventional in wearable diagnostics devices. Claim 7 employs well-known components or functionality, as shown for example in Defendants' invalidity contentions, which is not enough to impart patent eligibility. *See,*

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	e.g., Ex. F1-F14 at all disclosures for [7pre]; Cover Pleading at § III.G.
[7a] a wearable device for measuring one or more physiological parameters, the wearable device adapted to be placed on a wrist of a user;	As explained above, Claim 7 is generally directed to the abstract idea of collecting and processing light-based data to determine physiological parameters. At the time of the alleged invention, this element was well-understood, routine, and/or conventional. *See, e.g.*, Ex. F1-F14 at all disclosures for [7a]; Cover Pleading at § III.G; '790 patent at 2:60–8:30 (describing prior art as background).
[7b] the wearable device including a light source comprising a plurality of semiconductor diodes that are configured to generate an output optical light having one or more optical wavelengths, wherein at least a portion of the one or more optical wavelengths is a near-infrared wavelength between 700 nanometers and 2500 nanometers;	As explained above, Claim 7 is generally directed to the abstract idea of collecting and processing light-based data to determine physiological parameters. At the time of the alleged invention, this element was well-understood, routine, and/or conventional. *See, e.g.*, Ex. F1-F14 at all disclosures for [7b]; Cover Pleading at § III.G; '790 patent at 2:60–8:30 (describing prior art as background).
[7c] the wearable device comprising one or more lenses configured to receive at least a portion of the output optical light and to deliver a lens output light to tissue comprising skin;	As explained above, Claim 7 is generally directed to the abstract idea of collecting and processing light-based data to determine physiological parameters. At the time of the alleged invention, this element was well-understood, routine, and/or conventional. *See, e.g.*, Ex. F1-F14 at all disclosures for [7c]; Cover Pleading at § III.G; '790 patent at 2:60–8:30 (describing prior art as background).
[7d] the wearable device further comprising a detection system configured to receive at least a portion of the lens output light reflected from the tissue and to generate an output signal having a signal-to-noise ratio, wherein the detection system is configured to be synchronized to the light source;	As explained above, Claim 7 is generally directed to the abstract idea of collecting and processing light-based data to determine physiological parameters. At the time of the alleged invention, this element was well-understood, routine, and/or conventional. *See, e.g.*, Ex. F1-F14

	at all disclosures for [7d]; Cover Pleading at § III.G; '790 patent at 2:60–8:30 (describing prior art as background).
[7e] wherein the detection system comprises a plurality of detectors that are spatially separated from each other, and wherein at least one analog to digital converter is coupled to at least one of the plurality of detectors;	As explained above, Claim 7 is generally directed to the abstract idea of collecting and processing light-based data to determine physiological parameters. At the time of the alleged invention, this element was well-understood, routine, and/or conventional. *See, e.g.*, Ex. F1-F14 at all disclosures for [7e]; Cover Pleading at § III.G; '790 patent at 2:60–8:30 (describing prior art as background).
[7f] wherein the output signal is indicative of the one or more of the physiological parameters;	As explained above, Claim 7 is generally directed to the abstract idea of collecting and processing light-based data to determine physiological parameters. At the time of the alleged invention, this element was well-understood, routine, and/or conventional. *See, e.g.*, Ex. F1-F14 at all disclosures for [7f]; Cover Pleading at § III.G; '790 patent at 2:60–8:30 (describing prior art as background).
[7g] the wearable device configured to increase the signal-to-noise ratio by increasing light intensity of at least one of the plurality of semiconductor diodes from an initial light intensity; and	As explained above, Claim 7 is generally directed to the abstract idea of collecting and processing light-based data to determine physiological parameters. At the time of the alleged invention, this element was well-understood, routine, and/or conventional. *See, e.g.*, Ex. F1-F14 at all disclosures for [7g]; Cover Pleading at § III.G; '790 patent at 2:60–8:30 (describing prior art as background).
[7h] the detection system further configured to: generate a first signal responsive to light received while the semiconductor diodes are off,	As explained above, Claim 7 is generally directed to the abstract idea of collecting and processing light-based data to determine physiological parameters.

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	At the time of the alleged invention, this element was well-understood, routine, and/or conventional. *See, e.g.*, Ex. F1-F14 at all disclosures for [7h]; Cover Pleading at § III.G; '790 patent at 2:60–8:30 (describing prior art as background).
[7i] generate a second signal responsive to light received while at least one of the semiconductor diodes is on, and	As explained above, Claim 7 is generally directed to the abstract idea of collecting and processing light-based data to determine physiological parameters. At the time of the alleged invention, this element was well-understood, routine, and/or conventional. *See, e.g.*, Ex. F1-F14 at all disclosures for [7i]; Cover Pleading at § III.G; '790 patent at 2:60–8:30 (describing prior art as background).
[7j] increase the signal-to-noise ratio by comparing the first signal and the second signal; and	As explained above, Claim 7 is generally directed to the abstract idea of collecting and processing light-based data to determine physiological parameters. At the time of the alleged invention, this element was well-understood, routine, and/or conventional. *See, e.g.*, Ex. F1-F14 at all disclosures for [7j]; Cover Pleading at § III.G; '790 patent at 2:60–8:30 (describing prior art as background).
[7k] wherein the wearable device is at least in part configured to identify an object.	As explained above, Claim 7 is generally directed to the abstract idea of collecting and processing light-based data to determine physiological parameters. At the time of the alleged invention, this element was well-understood, routine, and/or conventional. *See, e.g.*, Ex. F1-F14 at all disclosures for [7k]; Cover Pleading at § III.G; '790 patent at 2:60–8:30 (describing prior art as background).

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EXHIBIT F1

U.S. Pat. No. 12,193,790 B2 in view of U.S. Patent No. 9,241,676 B2 to Daniel Lisogurski ("Lisogurski")

As described in detail below, Lisogurski (individually or collectively) anticipates and/or renders obvious claim 7 ("Asserted Claim") of U.S. Patent No. 12,193,790 B2 (the "'790 Patent") under 35 U.S.C. §102 and/or §103, either alone in combination with the knowledge of a person of ordinary skill, and/or additional prior art references discussed in discussed in Exhibits F1-F14, the contents of which are hereby incorporated by reference into this chart. One of ordinary skill in the art, as of the priority date of the '790 Patent, would have known to combine the prior art elements disclosed by the foregoing references using known methods, and to use these elements according to their established functions in order to achieve a known and predictable result. This invalidity claim chart is based on Defendants' present understanding of the Asserted Claim and Plaintiff's apparent construction of the Asserted Claim in its Preliminary Infringement Contentions ("Infringement Contentions").

The following invalidity chart includes references to the structure, function, operation, and/or features of the technology described in Lisogurski. The cited portions of Lisogurski are merely illustrative, and Defendants reserve the right to rely on alternative or additional evidence, including uncited portions of Lisogurski. Where a particular figure is cited, the citation should be understood to encompass the caption and description of the figure as well as any text relating to or describing the figure. Conversely, where particular text referring to a figure is cited, the citation should be understood to include the figure as well. Although the documentation collectively evidences prior knowledge, use, or sale, Defendants reserve the right to rely upon individual documents as printed publications. Where the chart below states that Lisogurski "describes" or "provides for" a limitation, such disclosure may be express, inherent, or implicit. To the extent it is found Lisogurski does not expressly disclose certain limitations in the Asserted Claim, such limitations are inherent. Defendants reserve the right to present direct evidence of the structure, function, operation, and/or features of the technology described in Lisogurski (including product samples, source code, and/or witness testimony) and/or its prior art status, and to present alternative or additional documents concerning the same as evidence that the technology described in Lisogurski anticipates and/or renders obvious the Asserted Claim of the '790 Patent

This chart is subject to all reservations, objections, and disclaimers in Defendants' Invalidity Contentions and any amendment, supplement, or modification thereof, which are incorporated herein by reference in their entirety. Nothing stated herein shall be treated as an admission or suggestion that Defendants agree with Plaintiff regarding the scope of the Asserted Claim, Plaintiff's apparent claim constructions, or the accuracy of any particular claim construction. Defendants reserve all rights to challenge any of the claim terms herein under 35 U.S.C. § 112, including by arguing that they are indefinite, are not supported by the written description, and/or are not enabled. Defendants further reserve all rights to amend this invalidity claim chart without leave of court pursuant to the Court's Docket Control Order, or upon a showing of good cause.

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EXHIBIT F1

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Claim 7	
7[pre]. An optical system, comprising:	By providing this disclosure, Defendants do not take a position on whether the preamble is limiting. Lisogurski discloses or renders obvious an optical system. **Systems and methods are provided for** optimizing power consumption in **an optical physiological monitoring system**. The system may vary light drive signal parameters to reduce power consumption or vary power use. The system may vary parameters in a technique correlated to cardiac pulse cycles. In some embodiments, reducing power consumption may allow for increased battery life in portable systems or increased portability. In some embodiments, varying light output during a cardiac cycle may reduce heating effects of the emitters. Parameters that may be varied include light intensity, firing rate, duty cycle, other suitable parameters, or any combination thereof. The generated signals may be used to determined physiological parameters such as blood oxygen saturation, hemoglobin, blood pressure, pulse rate, other suitable parameters, or any combination thereof. Lisogurski at 1:10-25 **A physiological monitoring system may use photonic signals to determine physiological parameters**. The system may vary parameters of a light drive signal used to generate the photonic signal from a light source such that power consumption is reduced or optimized. Parameters may include light intensity, firing rate, duty cycle, other suitable parameters, or any combination thereof. In some embodiments, the system may use information from a first light source to generate a light drive signal for a second light source. In some embodiments, the system may vary parameters in a way substantially synchronous with physiological pulses, for example, cardiac pulses. In some embodiments, the system may vary parameters in response to an external trigger. Lisogurski at Abstract

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	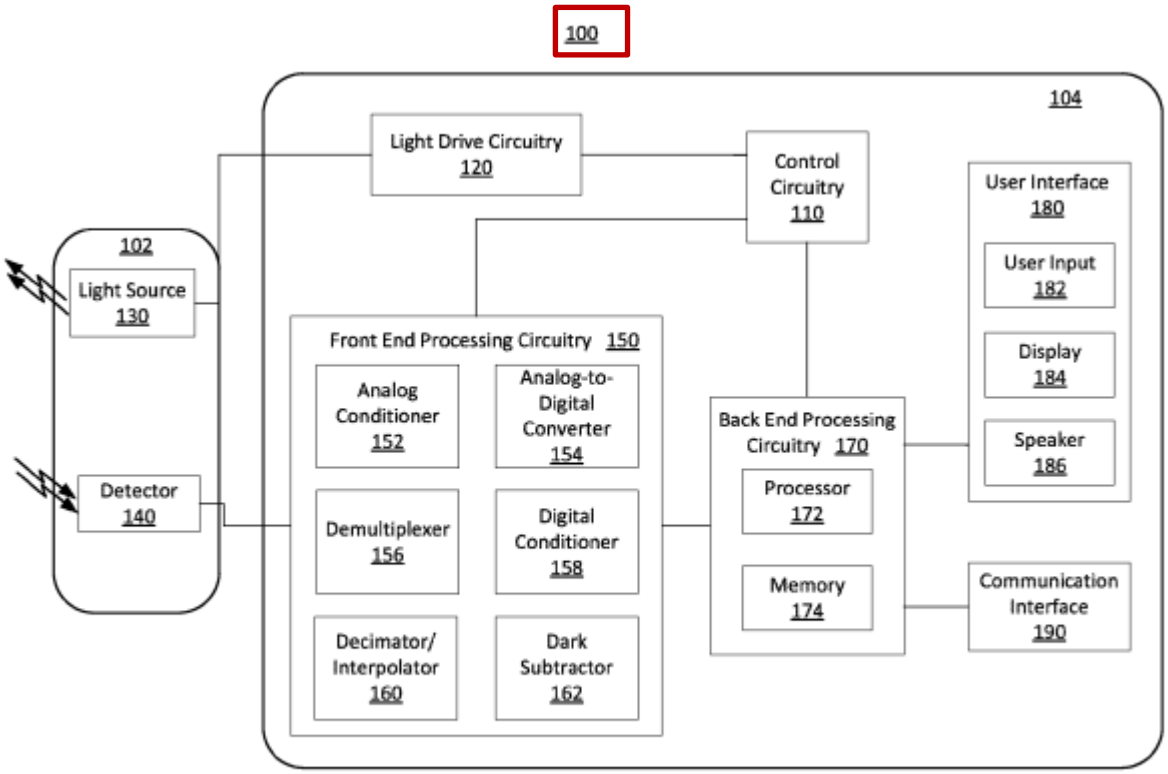 FIG. 1 Lisogurski at Fig. 1 **FIG. 1 is a block diagram of an illustrative physiological monitoring system 100** in accordance with some embodiments of the present disclosure. System 100 may include a sensor 102 and a monitor 104 for generating and processing physiological signals of a subject. In some embodiments, sensor 102 and monitor 104 may be part of an oximeter. Lisogurski at 10:42-47.

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	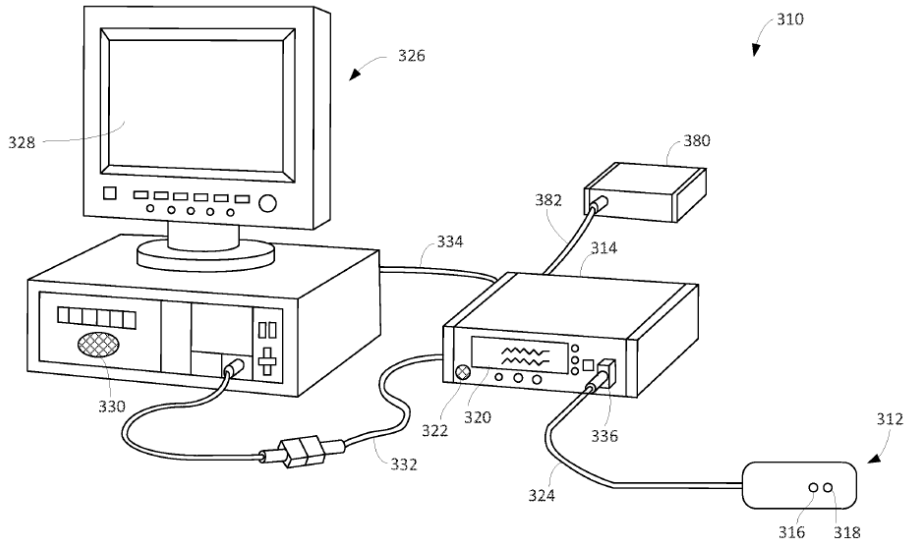 FIG. 3 Lisogurski at Fig. 3 **FIG. 3 is a perspective view of an embodiment of a physiological monitoring system 310** in accordance with some embodiments of the present disclosure. In some embodiments, one or more components of physiological monitoring system 310 may include one or more components of physiological monitoring system 100 of FIG. 1. System 310 may include sensor unit 312 and monitor 314. In some embodiments, sensor unit 312 may be part of an oximeter. Sensor unit 312 may include one or more light source 316 for emitting light at one or more wavelengths into a subject's tissue. One or more detector 318 may also be provided in sensor unit 312 for detecting the light that is reflected by or has traveled through the subject's tissue. Any suitable configuration of light source 316 and detector 318 may be used. In an embodiment, sensor unit 312 may include multiple light sources and detectors, which may be spaced apart. Lisogurski at 17:30-45 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references

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	identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Lisogurski, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Lisogurski, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[a]. a wearable device for measuring one or more physiological parameters, the wearable device adapted to be placed on a wrist of a user;	Lisogurski discloses or renders obvious a wearable device for measuring one or more physiological parameters, the wearable device adapted to be placed on a wrist of a user. **The present disclosure is directed towards** power optimization in **a medical device**. **A physiological monitoring system may monitor one or more physiological parameters of a patient, typically using one or more physiological sensors**. The system may include, for example, a light source and a photosensitive detector. Providing a light drive signal to the light source may account for a significant portion of the system's total power consumption. Thus, it may be desirable to reduce the power consumption of the light source, while still enabling high quality physiological parameters to be determined. The system may reduce the power consumption by modulating parameters associated with the light drive signal in techniques correlated to the cardiac cycle or other cyclical physiological activity. For example, the system may decrease brightness during a particular portion of the cardiac cycle. It may also be desirable to reduce the power consumption by the light drive signal to reduce heating effects caused by an emitter. Lisogurski at 3:43-60 **An oximeter is a medical device that may determine the oxygen saturation of an analyzed tissue**. **One common type of oximeter is a pulse oximeter, which may non-invasively measure the oxygen saturation of a patient's blood (as opposed to measuring oxygen saturation directly by analyzing a blood sample taken from the patient).** Pulse oximeters may be included in patient monitoring systems that measure and display various blood flow characteristics including, but not limited to, the oxygen saturation of hemoglobin in arterial blood. Such patient monitoring systems may also measure and display additional physiological parameters, such as a patient's pulse rate and blood pressure. Lisogurski at 3:61-4:5 **An oximeter may include a light sensor that is placed at a site on a patient**, typically a fingertip, toe, forehead or earlobe, or in the case of a neonate, across a foot. The oximeter may use a light source to pass light through blood perfused tissue and photoelectrically sense the absorption of the light in the

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	tissue. In addition, **locations which are not typically understood to be optimal for pulse oximetry serve as suitable sensor locations for the blood pressure monitoring processes described herein, including any location on the body that has a strong pulsatile arterial flow**. For example, **additional suitable sensor locations include, without limitation,** the neck to monitor carotid artery pulsatile flow, **the wrist to monitor radial artery pulsatile flow**, the inside of a patient's thigh to monitor femoral artery pulsatile flow, the ankle to monitor tibial artery pulsatile flow, and around or in front of the ear. Lisogurski at 4:6-20 **Systems and methods are provided for** optimizing power consumption in **an optical physiological monitoring system**. The system may vary light drive signal parameters to reduce power consumption or vary power use. The system may vary parameters in a technique correlated to cardiac pulse cycles. In some embodiments, reducing power consumption may allow for increased battery life in portable systems or increased portability. In some embodiments, varying light output during a cardiac cycle may reduce heating effects of the emitters. Parameters that may be varied include light intensity, firing rate, duty cycle, other suitable parameters, or any combination thereof. **The generated signals may be used to determined physiological parameters such as blood oxygen saturation, hemoglobin, blood pressure, pulse rate, other suitable parameters, or any combination thereof.** Lisogurski at 1:10-25 Back end processing circuitry 170 may include processor 172 and memory 174. Processor 172 may be adapted to execute software, which may include an operating system and one or more applications, as part of performing the functions described herein. **Processor 172 may receive and process physiological signals received from front end processing circuitry 150. For example, processor 172 may determine one or more physiological parameters based on the received physiological signals**. Lisogurski at 14:56-64 In some embodiments, sensor unit 312 may be connected to monitor 314 as shown. Sensor unit 312 may be powered by an internal power source, e.g., a battery (not shown). Sensor unit 312 may draw power from monitor 314. In another embodiment, the sensor may be wirelessly connected to monitor 314 (not shown). Monitor 314 may be configured to calculate physiological parameters based at least in part on data relating to light emission and acoustic detection received from one or more sensor units such as

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	sensor unit 312. **For example, monitor 314 may be configured to determine pulse rate, blood pressure, blood oxygen saturation (e.g., arterial, venous, or both), hemoglobin concentration (e.g., oxygenated, deoxygenated, and/or total), any other suitable physiological parameters, or any combination thereof**. Lisogurski at 17:54-67 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Lisogurski, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Lisogurski, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[b]. the wearable device including a light source comprising a plurality of semiconductor diodes that are configured to generate an output optical light having one or more optical wavelengths, wherein at least a portion of the one or more optical wavelengths is a near-infrared wavelength between 700 nanometers and 2500 nanometers;	Lisogurski discloses or renders obvious the wearable device including a light source comprising a plurality of semiconductor diodes that are configured to generate an output optical light having one or more optical wavelengths, wherein at least a portion of the one or more optical wavelengths is a near-infrared wavelength between 700 nanometers and 2500 nanometers. The present disclosure is directed towards power optimization in a medical device. **A physiological monitoring system** may monitor one or more physiological parameters of a patient, typically using one or more physiological sensors. **The system may include, for example, a light source** and a photosensitive detector. Providing a light drive signal to the light source may account for a significant portion of the system's total power consumption. Thus, it may be desirable to reduce the power consumption of the light source, while still enabling high quality physiological parameters to be determined. The system may reduce the power consumption by modulating parameters associated with the light drive signal in techniques correlated to the cardiac cycle or other cyclical physiological activity. For example, the system may decrease brightness during a particular portion of the cardiac cycle. It may also be desirable to reduce the power consumption by the light drive signal to reduce heating effects caused by an emitter. Lisogurski at 3:43-60.

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	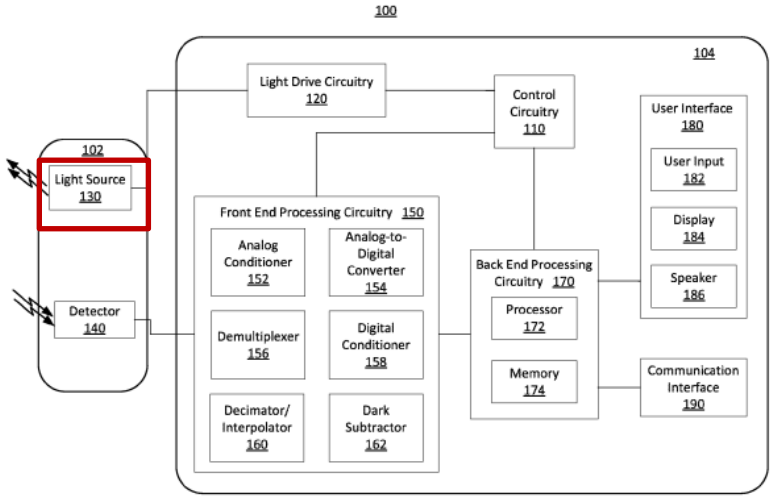 FIG. 1 Lisogurski at Fig. 1 **FIG. 1 is a block diagram of an illustrative physiological monitoring system 100** in accordance with some embodiments of the present disclosure. System 100 may include a sensor 102 and a monitor 104 for generating and processing physiological signals of a subject. In some embodiments, sensor 102 and monitor 104 may be part of an oximeter. Lisogurski at 10:42-47 **Sensor 102 of physiological monitoring system 100 may include light source 130** and detector 140. **Light source 130 may be configured to emit photonic signals having one or more wavelengths of light (e.g., Red and IR) into a subject's tissue**. **For example, light source 130 may include a Red light emitting light source and an IR light emitting light source, e.g., Red and IR light emitting diodes (LEDs), for emitting light into the tissue of a subject to generate physiological signals**. In one embodiment, **the Red wavelength may be between** about 600 nm and **about 700 nm,** and **the IR wavelength may be between about 800 nm and about 1000 nm.** It will be understood that light source 130 may include any number of light sources with any suitable characteristics. In embodiments where an array of sensors is used in place of single sensor 102, each sensor may be configured to emit a single

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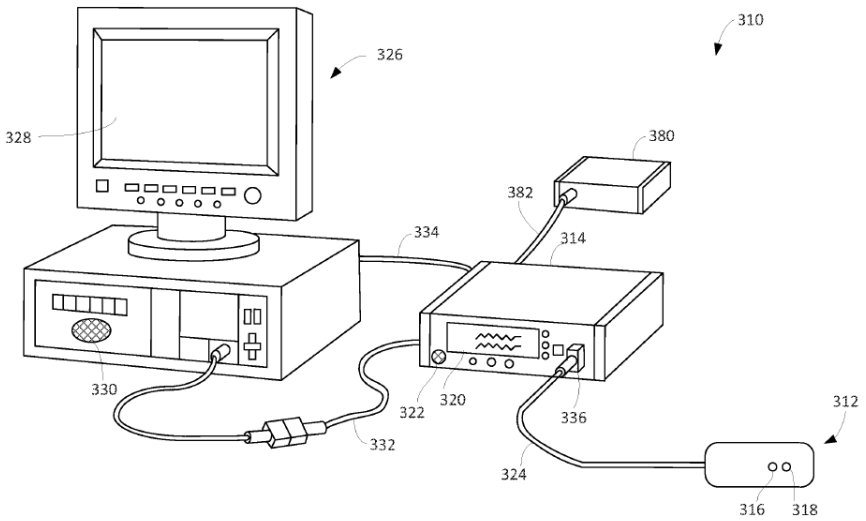
	wavelength. For example, a first sensor may emit only a Red light while a second may emit only an IR light. It will be understood that, as used herein, **the term “light” may refer to energy produced by radiative sources and may include one or more of** ultrasound, radio, microwave, millimeter wave, **infrared, visible**, ultraviolet, gamma ray or X-ray electromagnetic radiation. As used herein, light may also include any wavelength within the radio, microwave, infrared, visible, ultraviolet, or X-ray spectra, and that any suitable wavelength of electromagnetic radiation may be appropriate for use with the present techniques. Detector 140 may be chosen to be specifically sensitive to the chosen targeted energy spectrum of light source 130. Lisogurski at 10:48-11:8  FIG. 3 Lisogurski at Fig. 3. **FIG. 3 is a perspective view of an embodiment of a physiological monitoring system 310** in accordance with some embodiments of the present disclosure. In some embodiments, one or more components of physiological monitoring system 310 may include one or more components of

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	physiological monitoring system 100 of FIG. 1. System 310 may include sensor unit 312 and monitor 314. In some embodiments, sensor unit 312 may be part of an oximeter. **Sensor unit 312 may include one or more light source 316 for emitting light at one or more wavelengths into a subject's tissue**. One or more detector 318 may also be provided in sensor unit 312 for detecting the light that is reflected by or has traveled through the subject's tissue. **Any suitable configuration of light source 316 and detector 318 may be used**. In an embodiment, sensor unit 312 may include multiple light sources and detectors, which may be spaced apart. Lisogurski at 17:30-45. In step 402, the system may generate a first light drive signal. The light drive signal may be used by a light source to emit a photonic signal. **The light source may be one or more LEDs, laser diodes, other suitable device, or any combination thereof. For example, the light source may include light source 130 of FIG. 1** or light source 316 of FIG. 3. In some embodiments, **the light source may include LEDs of multiple wavelengths, for example, a red LED and an IR led.** In some embodiments, **the light source may include multiple LEDs of the same wavelength, multiple LEDs of different wavelengths, any other suitable arrangement**, or any combination thereof. In some embodiments, the light source may include a fiber optic or other light pipe to communicate light from one location to another. In some embodiments, the light drive signal may include or be a component of a cardiac cycle modulation. For example, the first light drive signal may be configured to activate one LED to emit a photonic signal and not activate other LEDs, such that some physiological parameters may be determined, but with lower power consumption than when the other LEDs are illuminated. Lisogurski at 19:20-39.

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	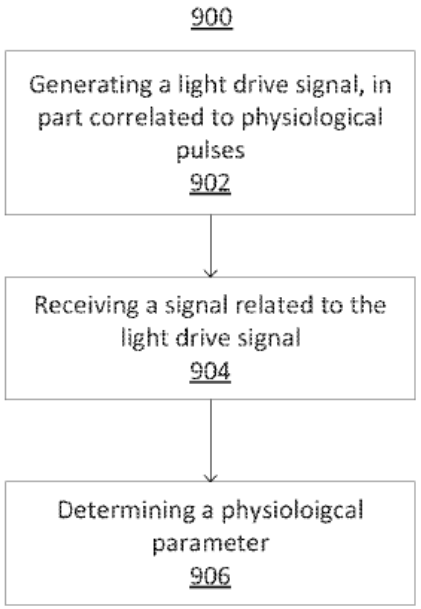 Lisogurski at Fig. 9. **FIG. 9 is flow diagram 900 showing illustrative steps for determining a physiological parameter in accordance with some embodiments of the present disclosure**. In some embodiments, the system may emit a photonic signal correlated to physiological pulses from a light source, and use information from the related attenuated signal to determine physiological parameters. In some embodiments, varying parameters of the light drive signal may reduce, optimize, or otherwise suitably alter the power consumption of the system. In step 902, the system may generate a light drive signal, in part correlated to physiological pulses. **The system may generate a light drive signal used by a light source to emit a photonic signal. The light source may be one or more emitters of one or more wavelengths, and they may emit one or more photonic signals**. For example**, the light source may include light source 130 of FIG. 1 or light source 316 of FIG. 3**. In some embodiments, **the light source may include LEDs of multiple wavelengths, for example, a red LED and an IR LED**. In some embodiments**, the light source may include**

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	multiple LEDs of the same wavelength, multiple LEDs of different wavelengths, any other suitable arrangement, or any combination thereof. Lisogurski at 25:22-43. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Lisogurski, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Lisogurski, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[c]. the wearable device comprising one or more lenses configured to receive at least a portion of the output optical light and to deliver a lens output light to tissue comprising skin;	Lisogurski discloses or renders obvious the wearable device comprising one or more lenses configured to receive at least a portion of the output optical light and to deliver a lens output light to tissue comprising skin. **Sensor 102 of physiological monitoring system 100 may include light source 130** and detector 140. **Light source 130 may be configured to emit photonic signals having one or more wavelengths of light (e.g., Red and IR) into a subject's tissue**. For example, **light source 130 may include a Red light emitting light source and an IR light emitting light source, e.g., Red and IR light emitting diodes (LEDs), for emitting light into the tissue of a subject to generate physiological signals.** In one embodiment, the Red wavelength may be between about 600 nm and about 700 nm, and the IR wavelength may be between about 800 nm and about 1000 nm. It will be understood that light source 130 may include any number of light sources with any suitable characteristics. In embodiments where an array of sensors is used in place of single sensor 102, each sensor may be configured to emit a single wavelength. For example, a first sensor may emit only a Red light while a second may emit only an IR light. Lisogurski at 10:48-64 In step 402, the system may generate a first light drive signal. The light drive signal may be used by a light source to emit a photonic signal. **The light source may be one or more LEDs, laser diodes, other suitable device, or any combination thereof.** For example, the light source may include light source

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	130 of FIG. 1 or light source 316 of FIG. 3. In some embodiments, the light source may include LEDs of multiple wavelengths, for example, a red LED and an IR led. In some embodiments, the light source may include multiple LEDs of the same wavelength, multiple LEDs of different wavelengths, any other suitable arrangement, or any combination thereof. In some embodiments, the light source may include a fiber optic or other light pipe to communicate light from one location to another. In some embodiments, the light drive signal may include or be a component of a cardiac cycle modulation. For example, the first light drive signal may be configured to activate one LED to emit a photonic signal and not activate other LEDs, such that some physiological parameters may be determined, but with lower power consumption than when the other LEDs are illuminated. Lisogurski at 19:20-39 In an embodiment, **the subject may be a medical patient** and display 184 may exhibit a list of values which may generally apply to the patient, such as, for example, age ranges or medication families, which the user may select using user input 182. Lisogurski at 15:26-30 System 310 may include sensor unit 312 and monitor 314. In some embodiments, sensor unit 312 may be part of an oximeter. **Sensor unit 312 may include one or more light source 316 for emitting light at one or more wavelengths into a subject's tissue. One or more detector 318 may also be provided in sensor unit 312 for detecting the light that is reflected by or has traveled through the subject's tissue.** Any suitable configuration of light source 316 and detector 318 may be used. In an embodiment, sensor unit 312 may include multiple light sources and detectors, which may be spaced apart. Lisogurski at 17:35-45 **FIG. 9 is flow diagram 900 showing illustrative steps for determining a physiological parameter in accordance with some embodiments of the present disclosure**. In some embodiments, the system may emit a photonic signal correlated to physiological pulses from a light source, and use information from the related attenuated signal to determine physiological parameters. In some embodiments, varying parameters of the light drive signal may reduce, optimize, or otherwise suitably alter the power consumption of the system.

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	In step 902, the system may generate a light drive signal, in part correlated to physiological pulses. **The system may generate a light drive signal used by a light source to emit a photonic signal. The light source may be one or more emitters of one or more wavelengths, and they may emit one or more photonic signals**. For example**, the light source may include light source 130 of FIG. 1 or light source 316 of FIG. 3**. In some embodiments, **the light source may include LEDs of multiple wavelengths, for example, a red LED and an IR LED**. In some embodiments**, the light source may include multiple LEDs of the same wavelength, multiple LEDs of different wavelengths, any other suitable arrangement, or any combination thereof**. Lisogurski at 25:22-43 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Lisogurski, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Lisogurski, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[d]. the wearable device further comprising a detection system configured to receive at least a portion of the lens output light reflected from the tissue and to generate an output signal having a signal-to-noise ratio, wherein the detection system is configured to be synchronized to the light source;	Lisogurski discloses or renders obvious the wearable device further comprising a detection system configured to receive at least a portion of the lens output light reflected from the tissue and to generate an output signal having a signal-to-noise ratio, wherein the detection system is configured to be synchronized to the light source. The present disclosure is directed towards power optimization in a medical device. **A physiological monitoring system** may monitor one or more physiological parameters of a patient, typically using one or more physiological sensors. **The system may include, for example,** a light source and **a photosensitive detector**. Lisogurski at 3:43-46

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	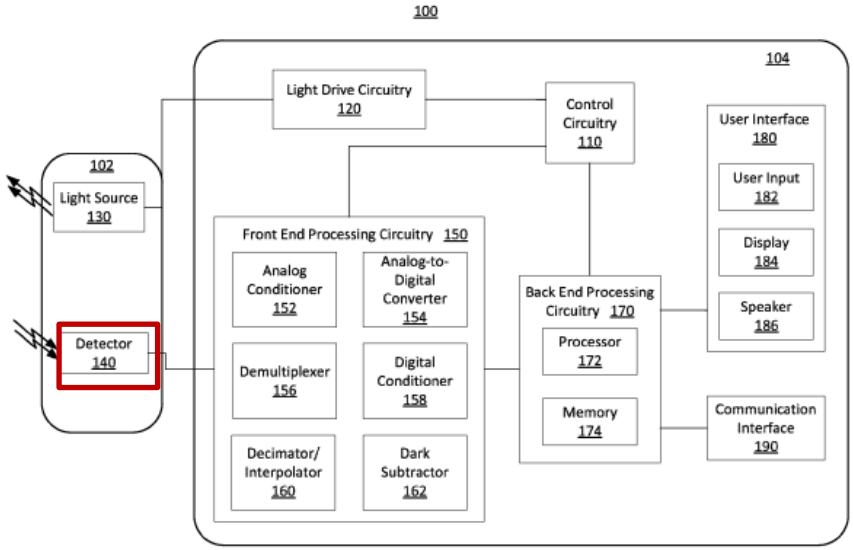 FIG. 1 Lisogurski at Fig. 1 **FIG. 1 is a block diagram of an illustrative physiological monitoring system 100** in accordance with some embodiments of the present disclosure. **System 100 may include a sensor 102** and a monitor 104 for generating and processing physiological signals of a subject. In some embodiments, sensor 102 and monitor 104 may be part of an oximeter. **Sensor 102 of physiological monitoring system 100 may include** light source 130 and **detector 140**. Lisogurski at 10:42-49 In some embodiments, **detector 140 may be configured to detect the intensity of light at the Red and IR wavelengths**. In some embodiments, an array of sensors may be used and each sensor in the array may be configured to detect an intensity of a single wavelength. In operation, **light may enter detector 140 after passing through the subject's tissue**. **Detector 140 may convert the intensity of the received light into an electrical signal. The light intensity may be directly related to the absorbance and/or reflectance of light in the tissue.** That is, when more light at a certain wavelength is absorbed

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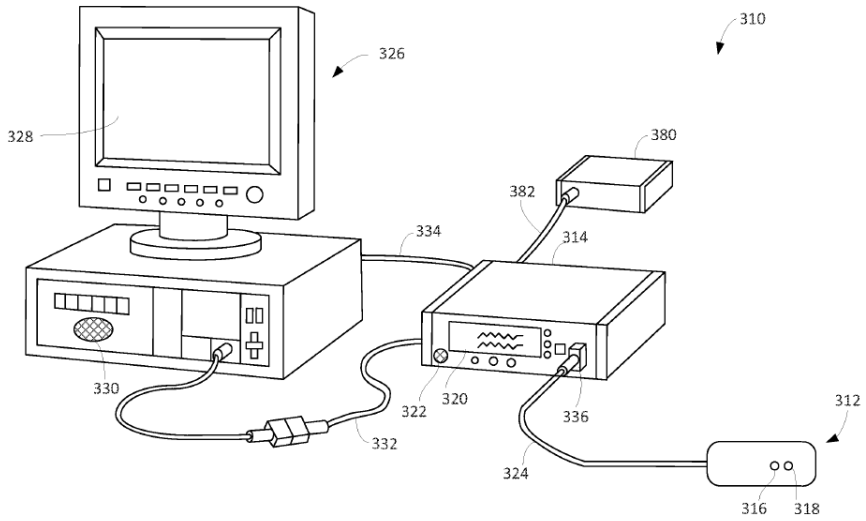
	or reflected, less light of that wavelength is received from the tissue by detector 140. After converting the received light to an electrical signal, detector 140 may send the detection signal to monitor 104, where the detection signal may be processed and physiological parameters may be determined (e.g., based on the absorption of the Red and IR wavelengths in the subject's tissue). In some embodiments, the detection signal may be preprocessed by sensor 102 before being transmitted to monitor 104. Lisogurski at 11:9-27  FIG. 3 Lisogurski at Fig. 3. **FIG. 3 is a perspective view of an embodiment of a physiological monitoring system 310** in accordance with some embodiments of the present disclosure. In some embodiments, one or more components of physiological monitoring system 310 may include one or more components of physiological monitoring system 100 of FIG. 1. System 310 may include sensor unit 312 and monitor 314. In some embodiments, sensor unit 312 may be part of an oximeter**.** Sensor unit 312 may include one or more light source 316 for emitting light at one or more wavelengths into a subject's tissue. **One or more detector 318 may also be provided in sensor unit 312 for detecting the light that is reflected by or has traveled through the subject's tissue**. Any suitable configuration of light source 316 and

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	detector 318 may be used. In an embodiment, sensor unit 312 may include multiple light sources and detectors, which may be spaced apart. Lisogurski at 17:30-45 Referring back to FIG. 1, **front end processing circuitry 150 may receive a detection signal from detector 140 and provide one or more processed signals to back end processing circuitry 170. The term “detection signal,” as used herein, may refer to any of the signals generated within front end processing circuitry 150 as it processes the output signal of detector 140**. Front end processing circuitry 150 may perform various analog and digital processing of the detector signal. One suitable detector signal that may be received by front end processing circuitry 150 is shown in FIG. 2B. Lisogurski at 12:42-51 In some embodiments, the system may alter the cardiac cycle modulation technique based on the level of noise, ambient light, other suitable reasons, or any combination thereof. **The system may receive, for example, an increased level of background noise in the signal due to patient motion**. **The system may increase the brightness of the light sources in response to the noise to improve the signal-to-noise ratio**. In some embodiments, the system may increase brightness throughout the cardiac cycle because the system may require increased signal amplitudes to differentiate between fiducial and other points of interest related to physiological parameters and those related to noise or motion. In some embodiments, the system may change from a modulated light output to a constant light output in response to noise, patient motion, or ambient light. Lisogurski at 9:46-60 **Control circuitry 110 may be coupled to light drive circuitry 120, front end processing circuitry 150, and back end processing circuitry 170, and may be configured to control the operation of these components**. In some embodiments, **control circuitry 110 may be configured to provide timing control signals to coordinate their operation**. For example, **light drive circuitry 120 may generate a light drive signal, which may be used to turn on and off the light source 130, based on the timing control signals. The front end processing circuitry 150 may use the timing control signals to operate synchronously with light drive circuitry 120**. For example, front end processing circuitry 150 may synchronize the operation of an analog-to-digital converter and a demultiplexer with the light drive signal

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	based on the timing control signals. In addition, the back end processing circuitry 170 may use the timing control signals to coordinate its operation with front end processing circuitry 150. Lisogurski at 11:33-49 FIG. 2B shows an illustrative plot of detector signal 214 that may be generated by a sensor in accordance with some embodiments of the present disclosure. The peaks of detector current waveform 214 may represent current signals provided by a detector, such as detector 140 of FIG. 1, when light is being emitted from a light source. The amplitude of detector current waveform 214 may be proportional to the light incident upon the detector. **The peaks of detector current waveform 214 may be synchronous with light “on” periods driving one or more emitters of a light source, such as light source 130 of FIG. 1. For example, detector current waveform 214 may be generated in response to a light source being driven by the light drive signal** of FIG. 2A. The valleys of detector current waveform 214 may be synchronous with periods of time during which no light is being emitted by the light source. While no light is being emitted by a light source during the valleys, detector current waveform 214 may not fall all of the way to zero. Rather, dark current 222 may be present in the detector waveform. Since dark current 222 may interfere with accurate determinations of physiological characteristics, dark current 222 may be removed as discussed in more detail below. Lisogurski at 12:52-13:6 As used herein, the terms “on” and “off” are merely exemplary and may not necessarily refer to a fully on or off state. **For example, “on” and “off” may refer to switching power or other components, high and low brightness output states, high and low values within a continuous modulation, high and low values of electrical current provided to an emitter, high and low values of a duty cycle, high and low values of a decimation ratio (i.e., how often an emitter is switched on), any other suitable relatively distinct states, or any combination thereof**. In some embodiments, “on” and “off” states may relate to high and low values of a variable that varies with multiple discrete steps. For example, an emitter brightness may be provided by the system as off, low, medium, and high. In this example, an “off” state may refer to off or low emission and “on” may refer to medium or high. In another example, “off” may refer to an off state and “on” may refer to a low, medium, or high output depending on a second input or system variable. Lisogurski at 8:27-44

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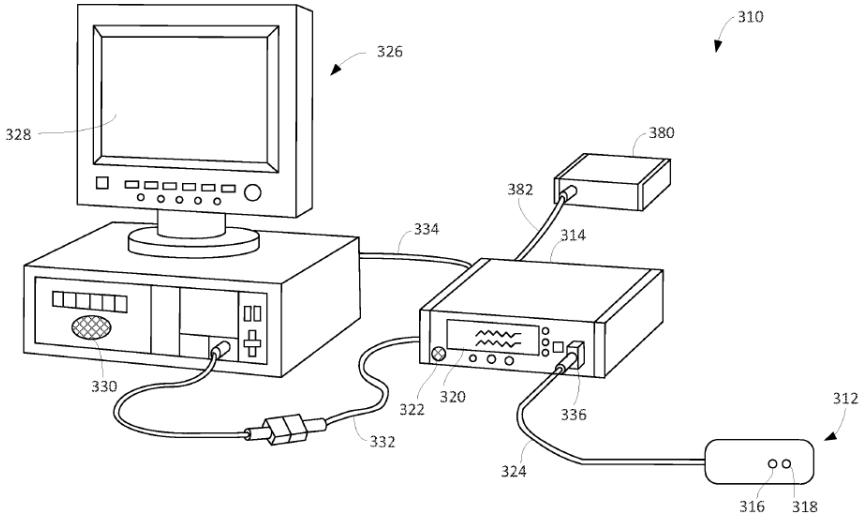
	In an embodiment, **the subject may be a medical patient** and display 184 may exhibit a list of values which may generally apply to the patient, such as, for example, age ranges or medication families, which the user may select using user input 182. Lisogurski at 15:26-30 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Lisogurski, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Lisogurski, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[e]. wherein the detection system comprises a plurality of detectors that are spatially separated from each other, and wherein at least one analog to digital converter is coupled to at least one of the plurality of detectors;	Lisogurski discloses or renders obvious the detection system comprises a plurality of detectors that are spatially separated from each other, and wherein at least one analog to digital converter is coupled to at least one of the plurality of detectors.  FIG. 3

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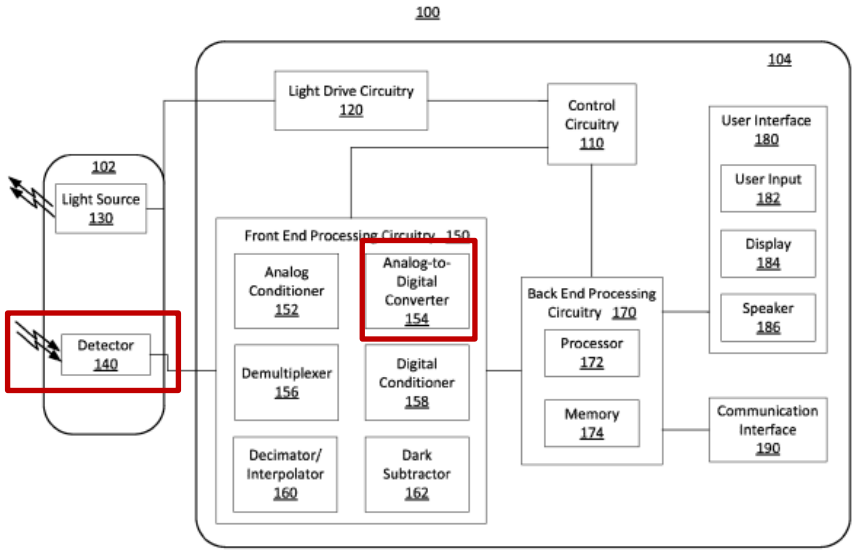
	Lisogurski at Fig. 3. **System 310 may include sensor unit 312** and monitor 314. In some embodiments, sensor unit 312 may be part of an oximeter. Sensor unit 312 may include one or more light source 316 for emitting light at one or more wavelengths into a subject's tissue. **One or more detector 318 may also be provided in sensor unit 312 for detecting the light that is reflected by or has traveled through the subject's tissue**. Any suitable configuration of light source 316 and detector 318 may be used. In an embodiment, **sensor unit 312 may include multiple** light sources and **detectors, which may be spaced apart**. Lisogurski at 17:35-45.  FIG. 1 Lisogurski at Fig. 1. **FIG. 1 is a block diagram of an illustrative physiological monitoring system 100** in accordance with some embodiments of the present disclosure. **System 100 may include a sensor 102 and a monitor 104** for generating and processing physiological signals of a subject. In some embodiments, sensor 102 and monitor 104 may be part of an oximeter.

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	Lisogurski at 10:42-47. In the embodiment shown, **monitor 104 includes** control circuitry 110, light drive circuitry 120, **front end processing circuitry 150**, back end processing circuitry 170, user interface 180, and communication interface 190. Monitor 104 may be communicatively coupled to sensor 102. Lisogurski at 11:28-32. Referring back to FIG. 1, **front end processing circuitry 150**, which may receive a detection signal, such as detector current waveform 214, **may include** analog conditioner 152, **analog-to-digital converter 154**, demultiplexer 156, digital conditioner 158, decimator/interpolator 160, and dark subtractor 162. Analog conditioner 152 may perform any suitable analog conditioning of the detector signal. The conditioning performed may include any type of filtering (e.g., low pass, high pass, band pass, notch, or any other suitable filtering), amplifying, performing an operation on the received signal (e.g., taking a derivative, averaging), performing any other suitable signal conditioning (e.g., converting a current signal to a voltage signal), or any combination thereof. **The conditioned analog signal may be processed by analog-to-digital converter 154, which may convert the conditioned analog signal into a digital signal**. Analog-to-digital converter 154 may operate under the control of control circuitry 110. Analog-to-digital converter 154 may use timing control signals from control circuitry 110 to determine when to sample the analog signal. **Analog-to-digital converter 154 may be any suitable type of analog-to-digital converter of sufficient resolution to enable a physiological monitor to accurately determine physiological parameters**. Lisogurski at 13:7-30. In step 1702, **the system may receive a signal**. The signal may be sampled at a first rate. **The signal may be sampled using an analog-to-digital converter in the front end processing circuitry**. **For example, an attenuated light signal may be converted to an analog electronic signal by a detector. The analog electronic signal may be converted to a digital signal at a particular rate by an analog to digital converter**, such that at each sampling point the converter determines the amplitude of the

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	analog signal (e.g., current or voltage) and outputs a digital word related to that amplitude. The rate at which sampling occurs may be controlled by, for example, a timing control signal (e.g., provided by control circuitry 110 of FIG. 1). In some embodiments, the sampling rate may represent the number of samples taken during an “on” period of the drive cycle modulation. In some embodiments, the sampling rate may represent the amount of time between “on” periods. Lisogurski at 33:65-34:13. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Lisogurski, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Lisogurski, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[f]. wherein the output signal is indicative of the one or more of the physiological parameters;	Lisogurski discloses or renders obvious the output signal is indicative of the one or more of the physiological parameters.

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	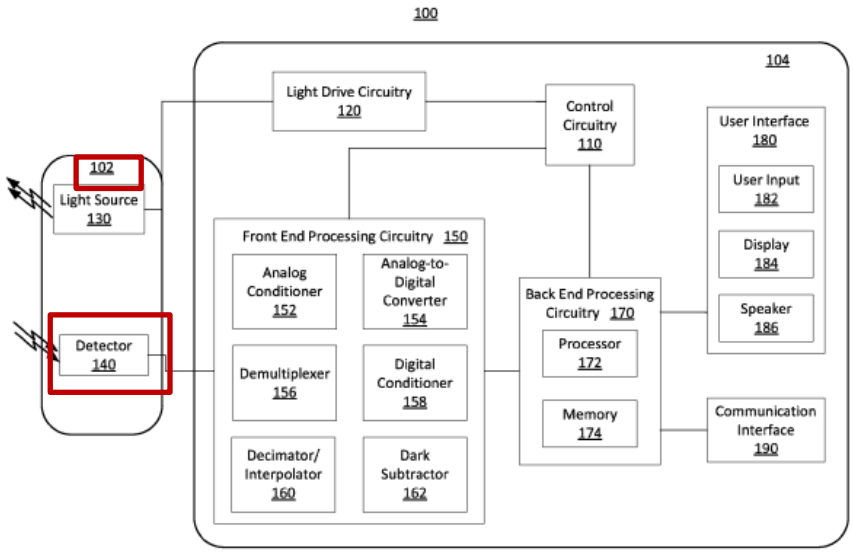 FIG. 1 Lisogurski at Fig. 1. **FIG. 1 is a block diagram of an illustrative physiological monitoring system 100** in accordance with some embodiments of the present disclosure. **System 100 may include a sensor 102** and a monitor 104 for generating and processing physiological signals of a subject. In some embodiments, sensor 102 and monitor 104 may be part of an oximeter. **Sensor 102 of physiological monitoring system 100 may include** light source 130 and **detector 140**. Lisogurski at 10:42-49. In some embodiments, detector 140 may be configured to detect the intensity of light at the Red and IR wavelengths. In some embodiments, an array of sensors may be used and each sensor in the array may be configured to detect an intensity of a single wavelength. In operation, light may enter detector 140 after passing through the subject's tissue. **Detector 140 may convert the intensity of the received light into an electrical signal. The light intensity may be directly related to the absorbance and/or reflectance of light in the tissue.** That is, when more light at a certain wavelength is absorbed or

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	reflected, less light of that wavelength is received from the tissue by detector 140. **After converting the received light to an electrical signal, detector 140 may send the detection signal to monitor 104, where the detection signal may be processed and physiological parameters may be determined (e.g., based on the absorption of the Red and IR wavelengths in the subject's tissue). In some embodiments, the detection signal may be preprocessed by sensor 102 before being transmitted to monitor 104**. Lisogurski at 11:9-27. In some embodiments, **sensor unit 312 may be connected to monitor 314** as shown. Sensor unit 312 may be powered by an internal power source, e.g., a battery (not shown). Sensor unit 312 may draw power from monitor 314. In another embodiment, the sensor may be wirelessly connected to monitor 314 (not shown). **Monitor 314 may be configured to calculate physiological parameters based at least in part on data relating to light emission and acoustic detection received from one or more sensor units such as sensor unit 312**. **For example, monitor 314 may be configured to determine pulse rate, blood pressure, blood oxygen saturation (e.g., arterial, venous, or both), hemoglobin concentration (e.g., oxygenated, deoxygenated, and/or total), any other suitable physiological parameters, or any combination thereof**. In some embodiments, **calculations may be performed on the sensor units** or an intermediate device and **the result of the calculations may be passed to monitor 314.** Further, monitor 314 may include display 320 configured to display the physiological parameters or other information about the system. Lisogurski at 17:54-18:10. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Lisogurski, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Lisogurski, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[g]. the wearable device configured to increase the signal-to-noise ratio by	Lisogurski discloses or renders obvious the wearable device configured to increase the signal-to-noise ratio by increasing light intensity of at least one of the plurality of semiconductor diodes from an initial light intensity.

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increasing light intensity of at least one of the plurality of semiconductor diodes from an initial light intensity; and	In some embodiments, the system may alter the cardiac cycle modulation technique based on the level of noise, ambient light, other suitable reasons, or any combination thereof. **The system may receive, for example, an increased level of background noise in the signal due to patient motion**. **The system may increase the brightness of the light sources in response to the noise to improve the signal-to-noise ratio**. In some embodiments, the system may increase brightness throughout the cardiac cycle because the system may require increased signal amplitudes to differentiate between fiducial and other points of interest related to physiological parameters and those related to noise or motion. In some embodiments, the system may change from a modulated light output to a constant light output in response to noise, patient motion, or ambient light. Lisogurski at 9:46-60. In step 402, the system may generate a first light drive signal. The light drive signal may be used by a light source to emit a photonic signal. **The light source may be one or more LEDs, laser diodes, other suitable device, or any combination thereof.** For example, the light source may include light source 130 of FIG. 1 or light source 316 of FIG. 3. In some embodiments, the light source may include LEDs of multiple wavelengths, for example, a red LED and an IR led. Lisogurski at 19:20-27. In step 404, the system may receive a light signal. **The light may be received using a sensor, for example, detector 140 of FIG. 1 or detector 318 of FIG. 3.** The light signal may be attenuated by the subject. The received light signal may in part include light from the first photonic signal. For example, the system may emit light that is reflected by the subject or transmitted through the subject. The interaction of the emitted light with the subject may cause the light to become attenuated. In some embodiments, the attenuation of the light may depend on the wavelength of the light and the tissue with which the light interacts. For example, particular wavelengths of light may be attenuated more strongly by oxyhemoglobin than other wavelengths. **In some embodiments, the system may amplify the received signal using front end processor circuitry**. In some embodiments, the gain may be modulated using a technique correlated to the cardiac cycle modulation. **The gain of the amplifier may be adjusted based on the emitted light brightness**, historical information related to the brightness of prior received attenuated signals, other suitable information, or any combination thereof, so that the amplified signal matches the range of the analog-to-digital converter and thus increases resolution. In some embodiments,

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	the system may account for the gain using hardware, software, or any combination thereof, such that the original intensity information is retained. Lisogurski at 19:40-64. For example, a signal with amplitudes that are large may saturate an analog to digital convertor. In response to a signal with high amplitudes, the system may reduce emitter brightness. **In a further example, the quality of a low amplitude signal may be degraded by quantization noise by an analog to digital converter. In response, the system may increase the emitter brightness**. Lisogurski at 5:67-6:6. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Lisogurski, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Lisogurski, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[h]. the detection system further configured to: generate a first signal responsive to light received while the semiconductor diodes are off,	Lisogurski discloses or renders obvious the detection system further configured to: generate a first signal responsive to light received while the semiconductor diodes are off. In some embodiments, **a technique to remove ambient and background signals may be used** in addition to or in place of a power saving light modulation scheme. In a drive cycle modulation technique, the system may cycle light output at a rate significantly greater than the cardiac cycle. For example, **a drive cycle modulation cycle may include the system turning on a first light source, followed by a “dark” period, followed by a second light source, followed by a “dark” period. The system may measure the ambient light detected by the detector during the “dark” period and then subtract this ambient contribution from the signals received during the first and second “on” periods.** Lisogurski at 6:7-19. As used herein, the terms “on” and “off” are merely exemplary and may not necessarily refer to a fully on or off state. **For example, “on” and “off” may refer to** switching power or other components, **high**

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	and low brightness output states, high and low values within a continuous modulation, **high and low values of electrical current provided to an emitter**, high and low values of a duty cycle, high and low values of a decimation ratio (i.e., how often an emitter is switched on), **any other suitable relatively distinct states, or any combination thereof**. In some embodiments, “on” and “off” states may relate to high and low values of a variable that varies with multiple discrete steps. **For example, an emitter brightness may be provided by the system as off, low, medium, and high. In this example, an “off” state may refer to off or low emission and “on” may refer to medium or high. In another example, “off” may refer to an off state and “on” may refer to a low, medium, or high output** depending on a second input or system variable. Lisogurski at 8:27-44. Control circuitry 110 may be coupled to light drive circuitry 120, front end processing circuitry 150, and back end processing circuitry 170, and may be configured to control the operation of these components. In some embodiments, control circuitry 110 may be configured to provide timing control signals to coordinate their operation. **For example, light drive circuitry 120 may generate a light drive signal, which may be used to turn on and off the light source 130, based on the timing control signals**. The front end processing circuitry 150 may use the timing control signals to operate synchronously with light drive circuitry 120. For example, front end processing circuitry 150 may synchronize the operation of an analog-to-digital converter and a demultiplexer with the light drive signal based on the timing control signals. In addition, the back end processing circuitry 170 may use the timing control signals to coordinate its operation with front end processing circuitry 150. Light drive circuitry 120, as discussed above, may be configured to generate a light drive signal that is provided to light source 130 of sensor 102. **The light drive signal may, for example, control the intensity of light source 130 and the timing of when light source 130 is turned on and off**. When light source 130 is configured to emit two or more wavelengths of light, the light drive signal may be configured to control the operation of each wavelength of light. The light drive signal may comprise a single signal or may comprise multiple signals (e.g., one signal for each wavelength of light). An illustrative light drive signal is shown in FIG. 2A. FIG. 2A shows an illustrative plot of a light drive signal including red light “on” period 202 and IR light “on period” 204 in accordance with some embodiments of the present disclosure. Light “on” periods 202, and 204 may be generated by light drive circuitry 120 under the control of control circuitry 110. As

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	used herein, “on” and “off” may refer to switching power or other components, high and low output states, high and low values within a continuous modulation, high and low duty cycles, other suitable relatively distinct states, or any combination thereof. The light drive signal may be provided to light source 130, including red “on” period 202 and IR “on” period 204 to drive red and IR light emitters, respectively, within light source 130. Red “on” period 202 may have a higher amplitude than IR “on” period 204 since red LEDs may be less efficient than IR LEDs at converting electrical energy into light energy. Additionally, red light may be absorbed and scattered more than IR light when passing through perfused tissue at certain oxygen saturations. When the red and IR light sources are driven in this manner they emit pulses of light at their respective wavelengths into the tissue of a subject in order generate physiological signals that physiological monitoring system 100 may process to calculate physiological parameters. It will be understood that the light drive amplitudes of FIG. 2A are merely exemplary, and that any suitable amplitudes or combination of amplitudes may be used, and may be based on the light sources, the subject tissue, the determined physiological parameter, modulation techniques, power sources, any other suitable criteria, or any combination thereof. The light drive signal of FIG. 2A may also include “off” periods 220 between the Red and IR light “on” periods. **“Off” periods 220 are periods during which no drive current may be applied to light source 130. “Off” periods 220 may be provided, for example, to prevent overlap of the emitted light, since light source 130 may require time to turn completely on and completely off**. The period from time 216 to time 218 may be referred to as a drive cycle, which includes four segments: a Red light “on” periods 202, followed by an “off” period 220, followed by an IR light “on” period 204, and followed by an “off” period 220. After time 218 the drive cycle may be repeated (e.g., as long as a light drive signal is provided to light source 130). It will be understood that the starting point of the drive cycle is merely illustrative and that the drive cycle can start at any location within FIG. 2A, provided the cycle spans two light “on” periods and two “off” periods. Thus, each Red light “on” period 202 and each IR “on” period 204 may be understood to be surrounded by two dark periods 220. Lisogurski at 11:33-12:41. FIG. 2B shows an illustrative plot of detector signal 214 that may be generated by a sensor in accordance with some embodiments of the present disclosure. The peaks of detector current waveform 214 may represent current signals provided by a detector, such as detector 140 of FIG. 1, when light is being emitted from a light source. The amplitude of detector current waveform 214 may be proportional to the light incident upon the detector. The peaks of detector current waveform 214 may be synchronous with

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	light “on” periods driving one or more emitters of a light source, such as light source 130 of FIG. 1. For example, detector current waveform 214 may be generated in response to a light source being driven by the light drive signal of FIG. 2A**. The valleys of detector current waveform 214 may be synchronous with periods of time during which no light is being emitted by the light source. While no light is being emitted by a light source during the valleys, detector current waveform 214 may not fall all of the way to zero. Rather, dark current 222 may be present in the detector waveform. Since dark current 222 may interfere with accurate determinations of physiological characteristics, dark current 222 may be removed** as discussed in more detail below. Lisogurski at 12:52-13:6. **Referring back to FIG. 1, front end processing circuitry 150, which may receive a detection signal**, such as detector current waveform 214, **may include** analog conditioner 152, analog-to-digital converter 154, demultiplexer 156, digital conditioner 158, decimator/interpolator 160, and **dark subtractor 162**. Lisogurski at 13:7-12. **Dark subtractor 162 may operate on the digital signal**. In some embodiments, dark subtractor 162 may subtract dark values from the Red and IR components to generate adjusted Red and IR signals. For example, **dark subtractor 162 may determine a subtraction amount from the dark signal portion of the detection signal and subtract it from the peak portion of the detection signal in order to reduce the effect of the dark signal on the peak**. For example, in reference to FIG. 2A, **a detection signal peak corresponding to red “on” period 202 may be adjusted by determining the amount of dark signal during the “off” period 220 preceding red “on” period 202**. **The dark signal amount determined in this manner may be subtracted from the detector peak corresponding to red “on” period 202. Alternatively, the “off” period 220 after red “on” period 202 may be used to correct red “on” period 202 rather than the “off” period 220 preceding it. Additionally, an average of the “off” periods 220 before and after red “on” period 202 may be used**. Lisogurski at 13:60-14:10. FIG. 2C shows illustrative timing diagrams of drive cycle modulation and cardiac cycle modulation in accordance with some embodiments of the present disclosure. Plot 250 may include a timing diagram of an exemplary cardiac cycle modulation, including red light modulation 252 and IR light modulation 254.

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	In the embodiment illustrated in plot 250, the IR light remains at a constant level and the red light is “on” only during the diastole period. The period of the modulation cycle may correspond to time interval 260. In a further embodiment, the system may replace some or all of the “off” periods with “on” periods of lower light intensity, shorter duty cycles, any other suitable parameter variations, or a combination thereof. It will be understood that the aforementioned cardiac cycle modulation technique is merely exemplary and that the system may use any suitable cardiac cycle modulation technique. Region 256 of plot 250 indicates an interval of the timing diagram where both red light modulation 252 and IR light modulation 254 are in an “on” portion of the cardiac cycle modulation. Plot 270 shows an illustrative portion of region 256, where the system is employing a cardiac cycle modulation in addition to the drive cycle modulation. Plot 250 may include a drive cycle modulation technique with a period of time interval 272. The time scale of plot 270 may be significantly shorter than the time scale of plot 250, such that time interval 272 is significantly shorter than time interval 260. For example, time interval 260 (i.e., the period of the cardiac cycle modulation) may be on the order of 1 second, while time interval 272 (i.e., the period of the drive cycle modulation) may be on the order of 1 ms. **Time interval 272 may include a sequence of red “on” portion 274, a first “off” portion 276, IR “on” portion 278, and a second “off” portion 280. The first “off” portion 276 and second “off” portion 280 may be used to determine the level of ambient light, noise, dark current, other suitable signals, or any combination thereof. The system may subtract the background or dark level from the levels received during red “on” portion 274 and IR “on” period 278.** Region 258 of plot 250 indicates an interval of the timing diagram where the red light modulation 252 is in an “off” portion of the cardiac cycle modulation and IR light modulation 254 is in an “on” portion of the cardiac cycle modulation. Plot 282 shows an illustrative portion of region 258, where the system is employing a drive cycle modulation technique in addition to the cardiac cycle modulation. Plot 282 may include a drive cycle modulation technique with a period of time interval 284. The time scale of plot 282 may be significantly shorter than the time scale of plot 250, such that time interval 284 is significantly shorter than time interval 260. In some embodiments, the time scale of plot 282 may be the same as the time scale of plot 270. **Time interval 284 may include a sequence of red “on” portion 286, a first “off” portion 288, IR “on” portion 290, and a second “off” portion 292. The red “on” portion 286 may include less red light emitted than during red “on” portion 274, or no red light emitted, as red light modulation 252 is in an “off” phase during region 258. The first “off” portion 288 and second “off” portion 292 may be used to determine the level of ambient light, noise, dark current, other**

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	suitable signals, or any combination thereof. The system may subtract the background or dark level from the levels received during red “on” portion 286 and IR “on” portion 290. Red light modulation 252 may be in an “on” portion during region 256 (illustrated in detail in plot 270) and an “off” portion during region 258 (illustrated in detail in plot 282). Thus, the level of red light indicated by red “on” portion 274 is at a high level and the level of red light indicated by red “on” portion 286 is at a low level. This is illustrative of an embodiment where drive cycle modulation occurs together with cardiac cycle modulation. It will be understood that the techniques illustrated by FIG. 2C are merely exemplary and that other suitable techniques may be used for drive cycle modulation, as described above. It will also be understood that other suitable methods may be used to combine the drive cycle modulation and the cardiac cycle modulation. It will also be understood that the combining technique may depend in part on the particular drive cycle modulation and cardiac cycle modulation technique. It will also be understood that conventional servo algorithms may be used in addition to combinations of drive cycle modulation and cardiac cycle modulation. Lisogurski at 16:17-17:29. In step 402, the system may generate a first light drive signal. The light drive signal may be used by a light source to emit a photonic signal. **The light source may be one or more LEDs, laser diodes, other suitable device, or any combination thereof.** For example, the light source may include light source 130 of FIG. 1 or light source 316 of FIG. 3. In some embodiments, the light source may include LEDs of multiple wavelengths, for example, a red LED and an IR led. Lisogurski at 19:20-27. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Lisogurski, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Lisogurski, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.

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7[i]. generate a second signal responsive to light received while at least one of the semiconductor diodes is on, and	Lisogurski discloses or renders obvious the detection system further configured to: generate a second signal responsive to light received while at least one of the semiconductor diodes is on. In some embodiments, **a technique to remove ambient and background signals may be used** in addition to or in place of a power saving light modulation scheme. In a drive cycle modulation technique, the system may cycle light output at a rate significantly greater than the cardiac cycle. For example, **a drive cycle modulation cycle may include the system turning on a first light source, followed by a “dark” period, followed by a second light source, followed by a “dark” period. The system may measure the ambient light detected by the detector during the “dark” period and then subtract this ambient contribution from the signals received during the first and second “on” periods.** Lisogurski at 6:7-19. As used herein, the terms “on” and “off” are merely exemplary and may not necessarily refer to a fully on or off state. **For example, “on” and “off” may refer to** switching power or other components, **high and low brightness output states**, high and low values within a continuous modulation, **high and low values of electrical current provided to an emitter**, high and low values of a duty cycle, high and low values of a decimation ratio (i.e., how often an emitter is switched on), **any other suitable relatively distinct states, or any combination thereof**. In some embodiments, “on” and “off” states may relate to high and low values of a variable that varies with multiple discrete steps. **For example, an emitter brightness may be provided by the system as off, low, medium, and high. In this example, an “off” state may refer to off or low emission and “on” may refer to medium or high. In another example, “off” may refer to an off state and “on” may refer to a low, medium, or high output** depending on a second input or system variable. Lisogurski at 8:27-44. Control circuitry 110 may be coupled to light drive circuitry 120, front end processing circuitry 150, and back end processing circuitry 170, and may be configured to control the operation of these components. In some embodiments, control circuitry 110 may be configured to provide timing control signals to coordinate their operation. **For example, light drive circuitry 120 may generate a light drive signal, which may be used to turn on and off the light source 130, based on the timing control signals**. The front end processing circuitry 150 may use the timing control signals to operate synchronously with light drive circuitry 120. For example, front end processing circuitry 150 may synchronize the operation of an

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	analog-to-digital converter and a demultiplexer with the light drive signal based on the timing control signals. In addition, the back end processing circuitry 170 may use the timing control signals to coordinate its operation with front end processing circuitry 150. Light drive circuitry 120, as discussed above, may be configured to generate a light drive signal that is provided to light source 130 of sensor 102. **The light drive signal may, for example, control the intensity of light source 130 and the timing of when light source 130 is turned on and off**. When light source 130 is configured to emit two or more wavelengths of light, the light drive signal may be configured to control the operation of each wavelength of light. The light drive signal may comprise a single signal or may comprise multiple signals (e.g., one signal for each wavelength of light). An illustrative light drive signal is shown in FIG. 2A. **FIG. 2A shows an illustrative plot of a light drive signal including red light “on” period 202 and IR light “on period” 204 in accordance with some embodiments of the present disclosure. Light “on” periods 202, and 204 may be generated by light drive circuitry 120 under the control of control circuitry 110.** As used herein, “on” and “off” may refer to switching power or other components, high and low output states, high and low values within a continuous modulation, high and low duty cycles, other suitable relatively distinct states, or any combination thereof. The light drive signal may be provided to light source 130, including red “on” period 202 and IR “on” period 204 to drive red and IR light emitters, respectively, within light source 130. Red “on” period 202 may have a higher amplitude than IR “on” period 204 since red LEDs may be less efficient than IR LEDs at converting electrical energy into light energy. Additionally, red light may be absorbed and scattered more than IR light when passing through perfused tissue at certain oxygen saturations. **When the red and IR light sources are driven in this manner they emit pulses of light at their respective wavelengths into the tissue of a subject in order generate physiological signals that physiological monitoring system 100 may process to calculate physiological parameters**. It will be understood that the light drive amplitudes of FIG. 2A are merely exemplary, and that any suitable amplitudes or combination of amplitudes may be used, and may be based on the light sources, the subject tissue, the determined physiological parameter, modulation techniques, power sources, any other suitable criteria, or any combination thereof. The light drive signal of FIG. 2A may also include “off” periods 220 between the Red and IR light “on” periods. **“**Off” periods 220 are periods during which no drive current may be applied to light source 130. “Off” periods 220 may be provided, for example, to prevent overlap of the emitted light, since light source 130 may require time to turn completely on and completely off. The period from time 216 to time

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	218 may be referred to as a drive cycle, which includes four segments: a Red light “on” periods 202, followed by an “off” period 220, followed by an IR light “on” period 204, and followed by an “off” period 220. After time 218 the drive cycle may be repeated (e.g., as long as a light drive signal is provided to light source 130). It will be understood that the starting point of the drive cycle is merely illustrative and that the drive cycle can start at any location within FIG. 2A, provided the cycle spans two light “on” periods and two “off” periods. Thus, each Red light “on” period 202 and each IR “on” period 204 may be understood to be surrounded by two dark periods 220. Lisogurski at 11:33-12:41. FIG. 2B shows an illustrative plot of detector signal 214 that may be generated by a sensor in accordance with some embodiments of the present disclosure. The peaks of detector current waveform 214 may represent current signals provided by a detector, such as detector 140 of FIG. 1, when light is being emitted from a light source. The amplitude of detector current waveform 214 may be proportional to the light incident upon the detector. **The peaks of detector current waveform 214 may be synchronous with light “on” periods driving one or more emitters of a light source, such as light source 130 of FIG. 1. For example, detector current waveform 214 may be generated in response to a light source being driven by the light drive signal** of FIG. 2A. The valleys of detector current waveform 214 may be synchronous with periods of time during which no light is being emitted by the light source. While no light is being emitted by a light source during the valleys, detector current waveform 214 may not fall all of the way to zero. Rather, dark current 222 may be present in the detector waveform. Since dark current 222 may interfere with accurate determinations of physiological characteristics, dark current 222 may be removed as discussed in more detail below. Lisogurski at 12:52-13:6. **Referring back to FIG. 1, front end processing circuitry 150, which may receive a detection signal**, such as detector current waveform 214, **may include** analog conditioner 152, analog-to-digital converter 154, demultiplexer 156, digital conditioner 158, decimator/interpolator 160, and **dark subtractor 162**. Lisogurski at 13:7-12. **Dark subtractor 162 may operate on the digital signal**. In some embodiments, dark subtractor 162 may subtract dark values from the Red and IR components to generate adjusted Red and IR signals. For

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	example, **dark subtractor 162 may determine a subtraction amount from the dark signal portion of the detection signal and subtract it from the peak portion of the detection signal in order to reduce the effect of the dark signal on the peak**. For example, in reference to FIG. 2A, **a detection signal peak corresponding to red “on” period 202 may be adjusted by determining the amount of dark signal during the “off” period 220 preceding red “on” period 202**. **The dark signal amount determined in this manner may be subtracted from the detector peak corresponding to red “on” period 202. Alternatively, the “off” period 220 after red “on” period 202 may be used to correct red “on” period 202 rather than the “off” period 220 preceding it. Additionally, an average of the “off” periods 220 before and after red “on” period 202 may be used**. Lisogurski at 13:60-14:10. FIG. 2C shows illustrative timing diagrams of drive cycle modulation and cardiac cycle modulation in accordance with some embodiments of the present disclosure. Plot 250 may include a timing diagram of an exemplary cardiac cycle modulation, including red light modulation 252 and IR light modulation 254. In the embodiment illustrated in plot 250, the IR light remains at a constant level and the red light is “on” only during the diastole period. The period of the modulation cycle may correspond to time interval 260. In a further embodiment, the system may replace some or all of the “off” periods with “on” periods of lower light intensity, shorter duty cycles, any other suitable parameter variations, or a combination thereof. It will be understood that the aforementioned cardiac cycle modulation technique is merely exemplary and that the system may use any suitable cardiac cycle modulation technique. Region 256 of plot 250 indicates an interval of the timing diagram where both red light modulation 252 and IR light modulation 254 are in an “on” portion of the cardiac cycle modulation. Plot 270 shows an illustrative portion of region 256, where the system is employing a cardiac cycle modulation in addition to the drive cycle modulation. Plot 250 may include a drive cycle modulation technique with a period of time interval 272. The time scale of plot 270 may be significantly shorter than the time scale of plot 250, such that time interval 272 is significantly shorter than time interval 260. For example, time interval 260 (i.e., the period of the cardiac cycle modulation) may be on the order of 1 second, while time interval 272 (i.e., the period of the drive cycle modulation) may be on the order of 1 ms. **Time interval 272 may include a sequence of red “on” portion 274, a first “off” portion 276, IR “on” portion 278, and a second “off” portion 280. The first “off” portion 276 and second “off” portion 280 may be used to determine the level of ambient light, noise, dark current, other suitable signals, or any combination**

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	thereof. The system may subtract the background or dark level from the levels received during red "on" portion 274 and IR "on" period 278. Region 258 of plot 250 indicates an interval of the timing diagram where the red light modulation 252 is in an "off" portion of the cardiac cycle modulation and IR light modulation 254 is in an "on" portion of the cardiac cycle modulation. Plot 282 shows an illustrative portion of region 258, where the system is employing a drive cycle modulation technique in addition to the cardiac cycle modulation. Plot 282 may include a drive cycle modulation technique with a period of time interval 284. The time scale of plot 282 may be significantly shorter than the time scale of plot 250, such that time interval 284 is significantly shorter than time interval 260. In some embodiments, the time scale of plot 282 may be the same as the time scale of plot 270. **Time interval 284 may include a sequence of red "on" portion 286, a first "off" portion 288, IR "on" portion 290, and a second "off" portion 292. The red "on" portion 286 may include less red light emitted than during red "on" portion 274, or no red light emitted, as red light modulation 252 is in an "off" phase during region 258. The first "off" portion 288 and second "off" portion 292 may be used to determine the level of ambient light, noise, dark current, other suitable signals, or any combination thereof. The system may subtract the background or dark level from the levels received during red "on" portion 286 and IR "on" portion 290**. Red light modulation 252 may be in an "on" portion during region 256 (illustrated in detail in plot 270) and an "off" portion during region 258 (illustrated in detail in plot 282). Thus, the level of red light indicated by red "on" portion 274 is at a high level and the level of red light indicated by red "on" portion 286 is at a low level. This is illustrative of an embodiment where drive cycle modulation occurs together with cardiac cycle modulation. It will be understood that the techniques illustrated by FIG. 2C are merely exemplary and that other suitable techniques may be used for drive cycle modulation, as described above. It will also be understood that other suitable methods may be used to combine the drive cycle modulation and the cardiac cycle modulation. It will also be understood that the combining technique may depend in part on the particular drive cycle modulation and cardiac cycle modulation technique. It will also be understood that conventional servo algorithms may be used in addition to combinations of drive cycle modulation and cardiac cycle modulation. Lisogurski at 16:17-17:29. In step 402, the system may generate a first light drive signal. The light drive signal may be used by a light source to emit a photonic signal. **The light source may be one or more LEDs, laser diodes, other**

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	suitable device, or any combination thereof. For example, the light source may include light source 130 of FIG. 1 or light source 316 of FIG. 3. In some embodiments, the light source may include LEDs of multiple wavelengths, for example, a red LED and an IR led. Lisogurski at 19:20-27. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Lisogurski, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Lisogurski, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[j]. increase the signal-to-noise ratio by comparing the first signal and the second signal; and	Lisogurski discloses or renders obvious the detection system further configured to: increase the signal-to-noise ratio by comparing the first signal and the second signal. In some embodiments, **a technique to remove ambient and background signals may be used** in addition to or in place of a power saving light modulation scheme. In a drive cycle modulation technique, the system may cycle light output at a rate significantly greater than the cardiac cycle. For example, **a drive cycle modulation cycle may include the system turning on a first light source, followed by a “dark” period, followed by a second light source, followed by a “dark” period. The system may measure the ambient light detected by the detector during the “dark” period and then subtract this ambient contribution from the signals received during the first and second “on” periods.** Lisogurski at 6:7-19. As used herein, the terms “on” and “off” are merely exemplary and may not necessarily refer to a fully on or off state. **For example, “on” and “off” may refer to** switching power or other components, **high and low brightness output states**, high and low values within a continuous modulation, **high and low values of electrical current provided to an emitter**, high and low values of a duty cycle, high and low values of a decimation ratio (i.e., how often an emitter is switched on), **any other suitable relatively distinct states, or any combination thereof**. In some embodiments, “on” and “off” states may relate to high and low values of a variable that varies with multiple discrete steps. **For example, an emitter brightness may be provided by the system as off, low, medium, and high. In this example, an “off”**

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	state may refer to off or low emission and “on” may refer to medium or high. In another example, “off” may refer to an off state and “on” may refer to a low, medium, or high output depending on a second input or system variable. Lisogurski at 8:27-44. In some embodiments, the system may alter the cardiac cycle modulation technique based on the level of noise, ambient light, other suitable reasons, or any combination thereof. **The system may receive, for example, an increased level of background noise in the signal due to patient motion**. **The system may increase the brightness of the light sources in response to the noise to improve the signal-to-noise ratio**. In some embodiments, the system may increase brightness throughout the cardiac cycle because the system may require increased signal amplitudes to differentiate between fiducial and other points of interest related to physiological parameters and those related to noise or motion. In some embodiments, the system may change from a modulated light output to a constant light output in response to noise, patient motion, or ambient light. Lisogurski at 9:46-60. **Referring back to FIG. 1, front end processing circuitry 150, which may receive a detection signal**, such as detector current waveform 214, **may include** analog conditioner 152, analog-to-digital converter 154, demultiplexer 156, digital conditioner 158, decimator/interpolator 160, and **dark subtractor 162**. Lisogurski at 13:7-12. **Dark subtractor 162 may operate on the digital signal**. In some embodiments, dark subtractor 162 may subtract dark values from the Red and IR components to generate adjusted Red and IR signals. For example, **dark subtractor 162 may determine a subtraction amount from the dark signal portion of the detection signal and subtract it from the peak portion of the detection signal in order to reduce the effect of the dark signal on the peak**. For example, in reference to FIG. 2A, **a detection signal peak corresponding to red “on” period 202 may be adjusted by determining the amount of dark signal during the “off” period 220 preceding red “on” period 202**. **The dark signal amount determined in this manner may be subtracted from the detector peak corresponding to red “on” period 202. Alternatively, the “off” period 220 after red “on” period 202 may be used to correct**

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	red “on” period 202 rather than the “off” period 220 preceding it. Additionally, an average of the “off” periods 220 before and after red “on” period 202 may be used. Lisogurski at 13:60-14:10. FIG. 2C shows illustrative timing diagrams of drive cycle modulation and cardiac cycle modulation in accordance with some embodiments of the present disclosure. Plot 250 may include a timing diagram of an exemplary cardiac cycle modulation, including red light modulation 252 and IR light modulation 254. In the embodiment illustrated in plot 250, the IR light remains at a constant level and the red light is “on” only during the diastole period. The period of the modulation cycle may correspond to time interval 260. In a further embodiment, the system may replace some or all of the “off” periods with “on” periods of lower light intensity, shorter duty cycles, any other suitable parameter variations, or a combination thereof. It will be understood that the aforementioned cardiac cycle modulation technique is merely exemplary and that the system may use any suitable cardiac cycle modulation technique. Region 256 of plot 250 indicates an interval of the timing diagram where both red light modulation 252 and IR light modulation 254 are in an “on” portion of the cardiac cycle modulation. Plot 270 shows an illustrative portion of region 256, where the system is employing a cardiac cycle modulation in addition to the drive cycle modulation. Plot 250 may include a drive cycle modulation technique with a period of time interval 272. The time scale of plot 270 may be significantly shorter than the time scale of plot 250, such that time interval 272 is significantly shorter than time interval 260. For example, time interval 260 (i.e., the period of the cardiac cycle modulation) may be on the order of 1 second, while time interval 272 (i.e., the period of the drive cycle modulation) may be on the order of 1 ms. **Time interval 272 may include a sequence of red “on” portion 274, a first “off” portion 276, IR “on” portion 278, and a second “off” portion 280. The first “off” portion 276 and second “off” portion 280 may be used to determine the level of ambient light, noise, dark current, other suitable signals, or any combination thereof. The system may subtract the background or dark level from the levels received during red “on” portion 274 and IR “on” period 278.** Region 258 of plot 250 indicates an interval of the timing diagram where the red light modulation 252 is in an “off” portion of the cardiac cycle modulation and IR light modulation 254 is in an “on” portion of the cardiac cycle modulation. Plot 282 shows an illustrative portion of region 258, where the system is employing a drive cycle modulation technique in addition to the cardiac cycle modulation. Plot 282 may include a drive cycle modulation technique with a period of time interval 284. The time scale of plot 282

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	may be significantly shorter than the time scale of plot 250, such that time interval 284 is significantly shorter than time interval 260. In some embodiments, the time scale of plot 282 may be the same as the time scale of plot 270. **Time interval 284 may include a sequence of red “on” portion 286, a first “off” portion 288, IR “on” portion 290, and a second “off” portion 292. The red “on” portion 286 may include less red light emitted than during red “on” portion 274, or no red light emitted, as red light modulation 252 is in an “off” phase during region 258. The first “off” portion 288 and second “off” portion 292 may be used to determine the level of ambient light, noise, dark current, other suitable signals, or any combination thereof. The system may subtract the background or dark level from the levels received during red “on” portion 286 and IR “on” portion 290**. Red light modulation 252 may be in an “on” portion during region 256 (illustrated in detail in plot 270) and an “off” portion during region 258 (illustrated in detail in plot 282). Thus, the level of red light indicated by red “on” portion 274 is at a high level and the level of red light indicated by red “on” portion 286 is at a low level. This is illustrative of an embodiment where drive cycle modulation occurs together with cardiac cycle modulation. It will be understood that the techniques illustrated by FIG. 2C are merely exemplary and that other suitable techniques may be used for drive cycle modulation, as described above. It will also be understood that other suitable methods may be used to combine the drive cycle modulation and the cardiac cycle modulation. It will also be understood that the combining technique may depend in part on the particular drive cycle modulation and cardiac cycle modulation technique. It will also be understood that conventional servo algorithms may be used in addition to combinations of drive cycle modulation and cardiac cycle modulation. Lisogurski at 16:17-17:29. In step 402, the system may generate a first light drive signal. The light drive signal may be used by a light source to emit a photonic signal. **The light source may be one or more LEDs, laser diodes, other suitable device, or any combination thereof.** For example, the light source may include light source 130 of FIG. 1 or light source 316 of FIG. 3. In some embodiments, the light source may include LEDs of multiple wavelengths, for example, a red LED and an IR led. Lisogurski at 19:20-27. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the

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	art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Lisogurski, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Lisogurski, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[k]. wherein the wearable device is at least in part configured to identify an object.	Lisogurski discloses or renders obvious the wearable device is at least in part configured to identify an object. **Systems and methods are provided for** optimizing power consumption in **an optical physiological monitoring system**. The system may vary light drive signal parameters to reduce power consumption or vary power use. The system may vary parameters in a technique correlated to cardiac pulse cycles. In some embodiments, reducing power consumption may allow for increased battery life in portable systems or increased portability. In some embodiments, varying light output during a cardiac cycle may reduce heating effects of the emitters. Parameters that may be varied include light intensity, firing rate, duty cycle, other suitable parameters, or any combination thereof. **The generated signals may be used to determined physiological parameters such as blood oxygen saturation, hemoglobin, blood pressure, pulse rate, other suitable parameters, or any combination thereof**. Lisogurski at 1:10-25. **An oximeter is a medical device that may determine the oxygen saturation of an analyzed tissue**. **One common type of oximeter is a pulse oximeter, which may non-invasively measure the oxygen saturation of a patient's blood (as opposed to measuring oxygen saturation directly by analyzing a blood sample taken from the patient). Pulse oximeters may be included in patient monitoring systems that measure and display various blood flow characteristics including, but not limited to, the oxygen saturation of hemoglobin in arterial blood**. Such patient monitoring systems may also measure and display additional physiological parameters, such as a patient's pulse rate and blood pressure. Lisogurski at 3:61-4:5. **An oximeter may include a light sensor that is placed at a site on a patient, typically a fingertip, toe, forehead or earlobe, or in the case of a neonate, across a foot. The oximeter may use a light source to pass light through blood perfused tissue and photoelectrically sense the absorption of the**

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	light in the tissue. In addition, **locations which are not typically understood to be optimal for pulse oximetry serve as suitable sensor locations for the blood pressure monitoring processes described herein, including any location on the body that has a strong pulsatile arterial flow**. For example, **additional suitable sensor locations include, without limitation,** the neck to monitor carotid artery pulsatile flow, **the wrist to monitor radial artery pulsatile flow**, the inside of a patient's thigh to monitor femoral artery pulsatile flow, the ankle to monitor tibial artery pulsatile flow, and around or in front of the ear. Lisogurski at 4:6-20. In some embodiments, sensor unit 312 may be connected to monitor 314 as shown. Sensor unit 312 may be powered by an internal power source, e.g., a battery (not shown). Sensor unit 312 may draw power from monitor 314. In another embodiment, the sensor may be wirelessly connected to monitor 314 (not shown). **Monitor 314 may be configured to calculate physiological parameters based at least in part on data relating to light emission and acoustic detection received from one or more sensor units such as sensor unit 312. For example, monitor 314 may be configured to determine pulse rate, blood pressure, blood oxygen saturation (e.g., arterial, venous, or both), hemoglobin concentration (e.g., oxygenated, deoxygenated, and/or total), any other suitable physiological parameters, or any combination thereof**. In some embodiments, calculations may be performed on the sensor units or an intermediate device and the result of the calculations may be passed to monitor 314. Further, monitor 314 may include display 320 configured to display the physiological parameters or other information about the system. Lisogurski at 17:54-18:10. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Lisogurski, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Lisogurski, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.

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EXHIBIT F2

U.S. Pat. No. 12,193,790 B2 in view of U.S. Patent Publication No. 20150057511 to Amar Sarbbasesh Basu ("Basu")

As described in detail below, Basu (individually or collectively) anticipates and/or renders obvious claim 7 ("Asserted Claim") of U.S. Patent No. 12,193,790 B2 (the "'790 Patent") under 35 U.S.C. §102 and/or §103, either alone in combination with the knowledge of a person of ordinary skill, and/or additional prior art references discussed in discussed in Exhibits F1-F14, the contents of which are hereby incorporated by reference into this chart. One of ordinary skill in the art, as of the priority date of the '790 Patent, would have known to combine the prior art elements disclosed by the foregoing references using known methods, and to use these elements according to their established functions in order to achieve a known and predictable result. This invalidity claim chart is based on Defendants' present understanding of the Asserted Claim and Plaintiff's apparent construction of the Asserted Claims in its Preliminary Infringement Contentions ("Infringement Contentions").

The following invalidity chart includes references to the structure, function, operation, and/or features of the technology described in Basu. The cited portions of Basu are merely illustrative, and Defendants reserve the right to rely on alternative or additional evidence, including uncited portions of Basu. Where a particular figure is cited, the citation should be understood to encompass the caption and description of the figure as well as any text relating to or describing the figure. Conversely, where particular text referring to a figure is cited, the citation should be understood to include the figure as well. Although the documentation collectively evidences prior knowledge, use, or sale, Defendants reserve the right to rely upon individual documents as printed publications. Where the chart below states that Basu "describes" or "provides for" a limitation, such disclosure may be express, inherent, or implicit. To the extent it is found Basu does not expressly disclose certain limitations in the Asserted Claim, such limitations are inherent. Defendants reserve the right to present direct evidence of the structure, function, operation, and/or features of the technology described in Basu (including product samples, source code, and/or witness testimony) and/or its prior art status, and to present alternative or additional documents concerning the same as evidence that the technology described in Basu anticipates and/or renders obvious the Asserted Claim of the '790 Patent

This chart is subject to all reservations, objections, and disclaimers in Defendants' Invalidity Contentions and any amendment, supplement, or modification thereof, which are incorporated herein by reference in their entirety. Nothing stated herein shall be treated as an admission or suggestion that Defendants agree with Plaintiff regarding the scope of the Asserted Claim, Plaintiff's apparent claim constructions, or the accuracy of any particular claim construction. Defendants reserve all rights to challenge any of the claim terms herein under 35 U.S.C. § 112, including by arguing that they are indefinite, are not supported by the written description, and/or are not enabled. Defendants further reserve all rights to amend this invalidity claim chart without leave of court pursuant to the Court's Docket Control Order, or upon a showing of good cause.

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Claim 7	
7[pre] An optical system, comprising:	By providing this disclosure, Defendants do not take a position on whether the preamble is limiting. Basu discloses or renders obvious an optical system. An optical proximity sensor assembly includes an optical proximity sensor with an IR LED emitting light having an infrared wavelength, an IR photo detector sensitive to the infrared wavelength, an optical barrier blocking direct light rays from the LED to the IR photo detector and permitting reflected light rays to reach the at least one photo detector; and an electronic integrated circuit with an amplifier for amplifying a signal detected by the photo detector, an analog to digital converter, LED drivers, noise reduction and ambient light cancellation circuitry, and a digital interface for communication with a microcontroller. Basu at Abstract **According to a first aspect of the invention, an optical proximity sensor assembly** includes an optical proximity sensor with an IR LED emitting light having an infrared wavelength, an IR photo detector sensitive to the infrared wavelength, an optical barrier blocking direct light rays from the LED to the IR photo detector and permitting reflected light rays to reach the at least one photo detector; and an electronic integrated circuit with an amplifier for amplifying a signal detected by the photo detector, an analog to digital converter, LED drivers, noise reduction and ambient light cancellation circuitry, and a digital interface for communication with a microcontroller. The optical proximity sensor is accommodated on a wearable carrier. Basu at [0007] **The present invention relates to a device, a system, and a method for vascular health monitoring of a person.** More particularly, the invention relates to a sensor suitable for remote patient monitoring. Basu at [0002] **An optical proximity sensor assembly for cardiovascular monitoring**, the optical proximity sensor assembly comprising: an optical proximity sensor having a first IR LED emitting light having an infrared wavelength,

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	a first IR photo detector sensitive to the infrared wavelength; and an electronic integrated circuit with an amplifier for amplifying a signal detected by the photo detector, an analog to digital converter, LED drivers, noise reduction and ambient light cancellation circuitry, and a digital interface for communication with a microcontroller; and a wearable carrier accommodating the optical proximity sensor and configured for placing the optical proximity sensor in contact with skin. Basu at Claim 1 **This invention includes new technologies for simultaneously sensing heart rate, blood pressure and pulse oximetry.** These technologies can be combined in one sensor. The blood pressure may be indirectly measured using pulse wave velocity by placing several sensors in different locations along an artery. In this manner, vascular conditions can be detected, such as restricted blood flow. Basu at [0034] **In a first approach, this device utilizes electronic optical proximity sensors (OPS) 10 to sense a patient's heart rate. Optical proximity sensors, also called light beam sensors, detect distance by measuring the magnitude of light reflected from an object**. Variations of OPS are widely used for non-contact distance measurement in a variety of applications. In smart phones, for example, OPS detect when a phone is placed in a pocket, triggering touch-screen locking. In factory robotics, OPS are used for motion feedback control. In many industrial and consumer applications, OPS serve as touchless switches and gesture sensing devices in personal notebooks, vending machines, sanitary dispensers, lavatories, dimming control, and video games. Basu at [0035] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Basu, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Basu, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.

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7[a] a wearable device for measuring one or more physiological parameters, the wearable device adapted to be placed on a wrist of a user;	Basu discloses or renders obvious a wearable device for measuring one or more physiological parameters, the wearable device adapted to be placed on a wrist of a user. An optical proximity sensor assembly for cardiovascular monitoring, **the optical proximity sensor assembly comprising:** an optical proximity sensor having a first IR LED emitting light having an infrared wavelength, a first IR photo detector sensitive to the infrared wavelength; and an electronic integrated circuit with an amplifier for amplifying a signal detected by the photo detector, an analog to digital converter, LED drivers, noise reduction and ambient light cancellation circuitry, and a digital interface for communication with a microcontroller; and **a wearable carrier accommodating the optical proximity sensor and configured for placing the optical proximity sensor in contact with skin**. Basu at Claim 1 **These technologies are integrated with a Bluetooth module 46 or another suitable wireless technology and with rechargeable batteries 32 in a small package, making the sensor assembly wireless and comfortably wearable throughout the day.** OPS 10 and a low power Bluetooth transmitter can be integrated into the underside of a ring 44 or placed on a separate board 12′ along with the battery 32. Beside Bluetooth technology and Bluetooth Low Energy technology, any other low-power transmission protocol is suitable for communication with a computer for evaluation. Basu at [0062] An optical proximity sensor assembly includes an optical proximity sensor with an IR LED emitting light having an infrared wavelength, an IR photo detector sensitive to the infrared wavelength, an optical barrier blocking direct light rays from the LED to the IR photo detector and permitting reflected light rays to reach the at least one photo detector; and an electronic integrated circuit with an amplifier for amplifying a signal detected by the photo detector, an analog to digital converter, LED drivers, noise reduction and ambient light cancellation circuitry, and a digital interface for communication with a microcontroller. **The optical proximity sensor is accommodated on a wearable carrier**. A single sensor may include a plurality of identical or different LEDs, a plurality of photodiodes, or both. **Also,**

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	several sensors may be placed on a person’s skin along a vascular path to obtain data relating to blood flow and artery stiffness. Basu at Abstract Also, several **sensors may be placed on a person's skin along a vascular path to obtain data relating to blood flow and artery or vascular stiffness this type of measurement is referred to as pulse wave velocity and is an indicator of cardiovascular health.** Basu at [0009] **This invention includes new technologies for simultaneously sensing heart rate, blood pressure and pulse oximetry. These technologies can be combined in one sensor**. **The blood pressure may be indirectly measured using pulse wave velocity by placing several sensors in different locations along an artery.** In this manner, vascular conditions can be detected, such as restricted blood flow. Basu at [0034] **In a first approach, this device utilizes electronic optical proximity sensors (OPS) 10 to sense a patient's heart rate. Optical proximity sensors, also called light beam sensors, detect distance by measuring the magnitude of light reflected from an object**. **Variations of OPS are widely used for non-contact distance measurement in a variety of applications. In smart phones, for example, OPS detect when a phone is placed in a pocket, triggering touch-screen locking. In factory robotics, OPS are used for motion feedback control**. In many industrial and consumer applications, OPS serve as touchless switches and gesture sensing devices in personal notebooks, vending machines, sanitary dispensers, lavatories, dimming control, and video games. Basu at [0035]

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	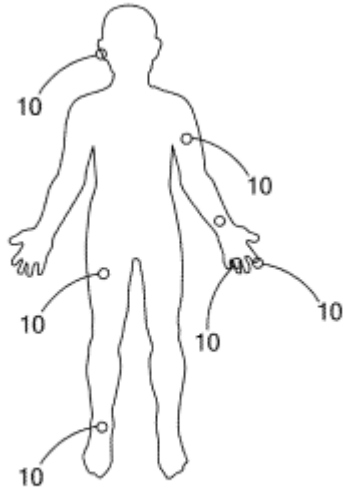 FIG. 8 Basu at Fig. 8 FIG. 8 shows various options of such placements. **For example, a first OPS 10 on an upper arm and a second OPS 10 on the same arm, but on the lower arm provides for subsequent measurements of the same pulse waves traveling through the arm arteries.** Likewise, placement of the OPS 10 on an upper leg and a lower leg of the same leg allows for measuring the speed of a pulse through the leg arteries. A placement of OPS 10 on fingers and on an earlobe are also illustrated in FIG. 8 Basu at [0075] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Basu, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Basu, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.

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7[b] the wearable device including a light source comprising a plurality of semiconductor diodes that are configured to generate an output optical light having one or more optical wavelengths, wherein at least a portion of the one or more optical wavelengths is a near-infrared wavelength between 700 nanometers and 2500 nanometers;	Basu discloses or renders obvious the wearable device including a light source comprising a plurality of semiconductor diodes that are configured to generate an output optical light having one or more optical wavelengths, wherein at least a portion of the one or more optical wavelengths is a near-infrared wavelength between 700 nanometers and 2500 nanometers. **An optical proximity sensor assembly includes an optical proximity sensor with an IR LED emitting light having an infrared wavelength**, an IR photo detector sensitive to the infrared wavelength, an optical barrier blocking direct light rays from the LED to the IR photo detector and permitting reflected light rays to reach the at least one photo detector; and an electronic integrated circuit with an amplifier for amplifying a signal detected by the photo detector, an analog to digital converter, LED drivers, noise reduction and ambient light cancellation circuitry, and a digital interface for communication with a microcontroller. **The optical proximity sensor is accommodated on a wearable carrier. A single sensor may include a plurality of identical or different LEDs, a plurality of photodiodes, or both.** Also, several sensors may be placed on a person’s skin along a vascular path to obtain data relating to blood flow and artery stiffness. Basu at Abstract. **According to further embodiments of the invention, a single sensor may include a plurality of identical or different LEDs, a plurality of photodiodes, or both.** Basu at [0008] An optical proximity sensor assembly for cardiovascular monitoring, **the optical proximity sensor assembly comprising:** an optical proximity sensor having **a first IR LED emitting light having an infrared wavelength,** a first IR photo detector sensitive to the infrared wavelength; and an electronic integrated circuit with an amplifier for amplifying a signal detected by the photo detector, an analog to digital converter, LED drivers, noise reduction and ambient light cancellation circuitry, and a digital interface for communication with a microcontroller; and **a wearable carrier accommodating the optical proximity sensor and configured for placing the optical proximity sensor in contact with skin**.

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	Basu at Claim 1 Thus, **suitable wavelengths for pulse oximetry are in the range of about 600 nm to 700 nm for the red LED 15, preferably between about 650 nm and 670 nm, and about 850 nm to 950 nm, preferably about 900 nm to 940 nm for the near infrared LED 14**. Notably, a deviation from the preferred wavelengths is feasible and may make the sensor 10 cheaper due to the availability of commercially produced LEDs 14 and 15. The two LEDs 14 and 15 may be pulsed. Optionally, the two LEDs 14 and 15 may be pulsed at different frequencies through frequency multiplexing. Alternatively. The LEDs 14 and 15 may be pulsed in an alternating mode through time multiplexing. Pulsing the LEDs 14 and 15 promotes an easy distinction of the two signals where both signals are received by the same photo detector. Basu at [0099] Integrated IR LED and visible light blocking filter: In many integrated OPS 10, **the emitter wavelength is in the near infrared range (850-950 nm), which is ideal for photoplethysmography**. Other OPS 10 allow the designer to add any discrete LED 14′ and 15, as will be later described in connection with FIGS. 14 and 15. The visible light blocking filter 14 included on some OPS 10 reduces the impact of ambient light. Basu at [0050] In yet a further development, **a compact OPS 10 may contain a plurality of LEDs that may each emit light in a different spectral range** (FIGS. 14 and 15). A photo detector equipped with different photodiodes 16 and 20 tuned to the emitted wavelengths can distinguish the individual reflected photons by their wavelength. Basu at [0093] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Basu, it would

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	have been obvious to one of ordinary skill in the art to combine, with the teachings of Basu, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[c] the wearable device comprising one or more lenses configured to receive at least a portion of the output optical light and to deliver a lens output light to tissue comprising skin;	Basu discloses or renders obvious the wearable device comprising one or more lenses configured to receive at least a portion of the output optical light and to deliver a lens output light to tissue comprising skin. **An optical proximity sensor assembly includes an optical proximity sensor with an IR LED emitting light having an infrared wavelength**, an IR photo detector sensitive to the infrared wavelength, **an optical barrier blocking direct light rays from the LED to the IR photo detector and permitting reflected light rays to reach the at least one photo detector**; and an electronic integrated circuit with an amplifier for amplifying a signal detected by the photo detector, an analog to digital converter, LED drivers, noise reduction and ambient light cancellation circuitry, and a digital interface for communication with a microcontroller. **The optical proximity sensor is accommodated on a wearable carrier. A single sensor may include a plurality of identical or different LEDs, a plurality of photodiodes, or both. Also, several sensors may be placed on a person’s skin along a vascular path to obtain data relating to blood flow and artery stiffness.** Basu at Abstract FIGS. 3D and 1 illustrate the general working mechanism. T**he OPS 10 is placed in direct contact with the skin**, **near a capillary bed 40. Ideal locations include the fingertip, earlobe, or forehead. A protective overlay (not shown in this figure) can be added if desired. The IR LED 14 emits light into the tissue, where it experiences diffuse reflection from the tissue** and capillary bed 40. **This establishes a baseline reflectance signal at the IR photodiode** 16. When a pressure wave propagates through the capillary bed 40, the signal falls slightly (0.5-5%) due to increased light scattering. The change is detected by an amplification and signal processing circuitry in the IC 24 embedded in the OPS 10. In the case of an earlobe or fingertip sensor, a metal backing can be placed on the opposite side of the earlobe or fingertip to improve the reflectance signal. In some embodiments, the metal backing may be provided by the battery 32. Basu at [0045] **The light travels from the LED 14 through the finger to the blood vessel and tissue, where it is partially reflected. The reflected signal is sensed by each of the photodiodes 16**. As a pulse of blood

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	flows through the capillary bed, both photodiodes experience nearly identical pulse waves offset by a short transit time due to the finite velocity of the pulse wave. A difference amplifier will produce a series of pulses whose width is inversely proportional to pulse wave velocity. An illustrative electronic circuit is shown in FIG. 7. Basu at [0042] Also, **several sensors may be placed on a person's skin along a vascular path to obtain data relating to blood flow and artery or vascular stiffness this type of measurement is referred to as pulse wave velocity and is an indicator of cardiovascular health.** Basu at [0009] The assembly of claim 1, wherein the optical proximity sensor further comprises a transparent cover covering the first IR LED and the first IR photo detector. Basu at Claim 2 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Basu, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Basu, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[d] the wearable device further comprising a detection system configured to receive at least a portion of the lens output light reflected from the tissue and to generate an output signal having a signal-to-noise ratio, wherein the detection system is configured to be	Basu discloses or renders obvious the wearable device further comprising a detection system configured to receive at least a portion of the lens output light reflected from the tissue and to generate an output signal having a signal-to-noise ratio, wherein the detection system is configured to be synchronized to the light source. **An optical proximity sensor assembly includes an optical proximity sensor** with an IR LED emitting light having an infrared wavelength, **an IR photo detector sensitive to the infrared wavelength**, **an optical barrier blocking direct light rays from the LED to the IR photo detector and permitting reflected light rays to reach the at least one photo detector**; **and an electronic integrated circuit with an amplifier for amplifying a signal detected by the photo detector**, an analog to digital

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synchronized to the light source;	converter, LED drivers, **noise reduction and ambient light cancellation circuitry**, and a digital interface for communication with a microcontroller. **The optical proximity sensor is accommodated on a wearable carrier**. A single sensor may include a plurality of identical or different LEDs, a plurality of photodiodes, or both. Also, several sensors may be placed on a person’s skin along a vascular path to obtain data relating to blood flow and artery stiffness. Basu at Abstract According to a first aspect of the invention, an optical proximity sensor assembly includes an optical proximity sensor with an IR LED emitting light having an infrared wavelength, an IR photo detector sensitive to the infrared wavelength, an optical barrier blocking direct light rays from the LED to the IR photo detector and permitting reflected light rays to reach the at least one photo detector; and an electronic integrated circuit with an amplifier for amplifying a signal detected by the photo detector, an analog to digital converter, LED drivers, noise reduction and ambient light cancellation circuitry, and a digital interface for communication with a microcontroller. The optical proximity sensor is accommodated on a wearable carrier. Basu at [0007] An optical proximity sensor assembly for cardiovascular monitoring, **the optical proximity sensor assembly comprising:** an optical proximity sensor having a first IR LED emitting light having an infrared wavelength, **a first IR photo detector sensitive to the infrared wavelength**; and **an electronic integrated circuit with an amplifier for amplifying a signal detected by the photo detector**, an analog to digital converter, LED drivers, **noise reduction and ambient light cancellation circuitry**, and a digital interface for communication with a microcontroller; and **a wearable carrier** accommodating the optical proximity sensor and configured for placing the optical proximity sensor in contact with skin. Basu at Claim 1 As, for example, shown in FIG. 1, **An OPS 10 includes an infrared (IR) light emitter, such as an IR LED 14, and an integrated circuit (IC) 24 providing LED drivers modulating the infrared light**

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	emitter at a fixed or varying frequency. The drivers may also operate in a burst or low duty cycle operation where the measurement is performed quickly, and then the IR emitter is shut off to conserve power. The OPS 10 includes mixed signal circuits for amplification, signal conditioning, and digitization, i.e. analog-digital conversion, of the detected radiation. **During frequency modulation, the LED 14 is pulsed at a predetermined and unique, fixed or variable, frequency. In return the detection circuitry is operated with a digital lock-in technique to detect and select the photodiode signal at the same frequency and phase as the operation of the LED driver**. uses a digital lock in technique to select the photodiode signal which is at the same frequency and phase as the signal driving the LED. Basu at [0036] **The influx of ambient light can be measured during OFF phases of the LED 14. The ambient light component can then be subtracted from the photo detector signal during ON phases to provide a sensitivity offset for proper calibration**. This technique being similar in concept to **lock-in detection** or to **electronic noise cancellation, it improves the signal to noise ratio and reduces the impact of noise and ambient light.** Basu at [0037] Optical barrier for reduced light leakage: One drawback of a small LED-PD spacing is light leakage between the two components, which increases the so-called baseline photoplethysmography signal. As shown in FIG. 3D and FIG. 6A Integrated OPS 10 include an optical barrier 28, placed between the LED 14 and the photodiode 16, which greatly reduces light leakage. The dimensions of the optical barrier 28 are important, particularly in “zero-distance detection” where the skin is in direct contact with the sensor. If the optical barrier 28 is too wide, it will block the reflectance signal completely, and if it is too thin, the baseline leakage signal could be large enough to obscure the pulsation signal. An appropriately sized **optical barrier 28 helps to ensure a high signal-to-noise ratio.** Basu at [0053] **The light travels from the LED 14 through the finger to the blood vessel and tissue, where it is partially reflected. The reflected signal is sensed by each of the photodiodes 16**. As a pulse of blood flows through the capillary bed, both photodiodes experience nearly identical pulse waves offset by a

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	short transit time due to the finite velocity of the pulse wave. A difference amplifier will produce a series of pulses whose width is inversely proportional to pulse wave velocity. An illustrative electronic circuit is shown in FIG. 7. Basu at [0042] The OPS 10 is generally illustrated in FIG. 1 and includes an embedded 895 nm IR LED 14 and a photodiode 16 with visible light blocking filter 22. The spacing between the LED 14 and photodiode 16 is about 2 mm, resulting in a large reflectance and sensitivity. The LED14 is embedded in a recessed region which serves as an optical barrier28 to reduce light leakage. The embedded signal processing IC 24 handles LED modulation, current control (10-200 mA in 10 mA steps), **photo detector amplification** and signal conditioning, ambient light cancellation, 16-bit analog to digital conversion (ADC), and I2C bus communication. The ADC can resolve pulsation indices of 15 ppm. The LED 14 can be modulated at frequencies up to 3.1 MHz (user selectable) for electronic noise cancellation. Basu at [0047] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Basu, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Basu, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[e] wherein the detection system comprises a plurality of detectors that are spatially separated from each other, and wherein at least one analog to digital converter is coupled to at least one of the plurality of detectors;	Basu discloses or renders obvious wherein the detection system comprises a plurality of detectors that are spatially separated from each other, and wherein at least one analog to digital converter is coupled to at least one of the plurality of detectors. **An optical proximity sensor assembly includes an optical proximity sensor with** an IR LED emitting light having an infrared wavelength, an IR photo detector sensitive to the infrared wavelength, an optical barrier blocking direct light rays from the LED to the IR photo detector and permitting reflected light rays to reach the at least one photo detector; and an electronic integrated circuit with an amplifier for amplifying a signal detected by the photo detector, **an analog to digital converter**, LED drivers, noise reduction and ambient light cancellation circuitry, and a digital interface for communication with a

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	microcontroller. The optical proximity sensor is accommodated on a wearable carrier. A single sensor may include a plurality of identical or different LEDs, a plurality of photodiodes, or both. Also, several sensors may be placed on a person’s skin along a vascular path to obtain data relating to blood flow and artery stiffness. Basu at Abstract An optical proximity sensor assembly for cardiovascular monitoring, **the optical proximity sensor assembly comprising:** an optical proximity sensor having a first IR LED emitting light having an infrared wavelength, **a** first IR photo detector sensitive to the infrared wavelength; and an electronic integrated circuit with an amplifier for amplifying a signal detected by the photo detector, **an analog to digital converter**, LED drivers, noise reduction and ambient light cancellation circuitry, and a digital interface for communication with a microcontroller; and **a wearable carrier** accommodating the optical proximity sensor and configured for placing the optical proximity sensor in contact with skin. Basu at Claim 1 **According to a first aspect of the invention, an optical proximity sensor assembly includes** an optical proximity sensor with an IR LED emitting light having an infrared wavelength, an IR photo detector sensitive to the infrared wavelength, an optical barrier blocking direct light rays from the LED to the IR photo detector and permitting reflected light rays to reach the **at least one photo detector**; and an electronic integrated circuit with an amplifier for amplifying a signal detected by the photo detector, **an analog to digital converter**, LED drivers, noise reduction and ambient light cancellation circuitry, and a digital interface for communication with a microcontroller. The optical proximity sensor is accommodated on a wearable carrier. Basu at [0007] FIG. 6A: A schematic of a proposed sensor system for blood pressure monitoring with two photo detectors and two optical barriers;

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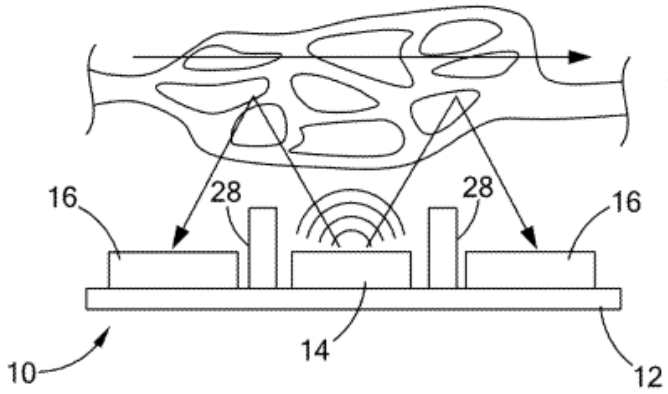
	Basu at [0019]  FIG. 6A Basu at Fig. 6A High sensitivity and dynamic range due to high-resolution analog to digital conversion: A fundamental requirement in photoplethysmography sensors is the ability to detect a small pulsation superimposed on a large baseline (DC) signal. In a standard photoplethysmography sensor arrangement, the AC signal is extracted using a 0.5-5 Hz bandpass filter and additional amplifiers. Recently available digital **OPS 10 incorporate a high resolution analog to digital converter (ADC), which can resolve small pulsations without additional filters.** For example, a 16 bit ADC can resolve a PI as little as ½16, or 15 ppm. The advantage of this approach is that both DC and AC components of the photoplethysmography signal can be simultaneously measured. This is useful for direct measurement of the PI, and for adjusting the LED intensity to prevent saturation of the light detector. A lower resolution of at least 12 bit may even be sufficient to perform this task. Basu at [0054] The **photo detector 50 includes photodiodes** sensitive to all three wavelengths. Basu at [0109]

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	An OPS 10 for detecting pulse wave velocity uses a novel sensor setup which detects how fast a pulse wave travels from one side of the sensor to the other side of the sensor (FIGS. 6A and 7). This approach can be robust to environmental noise and to drift of the sensor. Pulse wave velocity can be correlated with blood pressure. The device works in the near infrared (˜950 nm) range. **By putting two generally identical photodiodes 16 in two different locations on a circuit board 12 symmetrically on opposite sides of an IR LED 14**, the time it takes for a pulse wave to move through the vessel can be measured as shown in the diagram of FIG. 6B. The light travels from the LED 14 through the finger to the blood vessel and tissue, where it is partially reflected. The reflected signal is sensed by each of the photodiodes 16. As a pulse of blood flows through the capillary bed, both photodiodes experience nearly identical pulse waves offset by a short transit time due to the finite velocity of the pulse wave. A difference amplifier will produce a series of pulses whose width is inversely proportional to pulse wave velocity. An illustrative electronic circuit is shown in FIG. 7. Basu at [0042] The arrangement of FIG. 14 further shows copper barriers 60 embedded in circuit board 12′ extending from underneath each of the LEDs 14 and 15 to a location underneath the adjacent optical barrier 28, respectively, to avoid a light leakage through the circuit board 12′ from the LEDs 14 and 15 to the **photodiodes 16 and 20.** Basu at [0093]

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	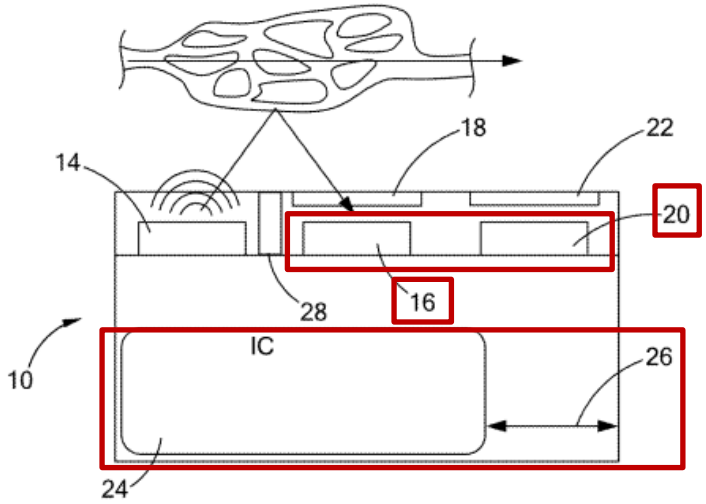 FIG. 1 Basu at Fig. 1 The OPS 10 is generally illustrated in FIG. 1 and includes an embedded 895 nm IR LED 14 and a photodiode 16 with visible light blocking filter 22. The spacing between the LED 14 and photodiode 16 is about 2 mm, resulting in a large reflectance and sensitivity. The LED14 is embedded in a recessed region which serves as an optical barrier28 to reduce light leakage. **The embedded signal processing IC 24 handles** LED modulation, current control (10-200 mA in 10 mA steps), photo detector amplification and signal conditioning, ambient light cancellation, **16-bit analog to digital conversion (ADC),** and I2C bus communication. **The ADC can resolve pulsation indices of 15 ppm**. The LED 14 can be modulated at frequencies up to 3.1 MHz (user selectable) for electronic noise cancellation. Basu at [0047] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Basu, it would

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	have been obvious to one of ordinary skill in the art to combine, with the teachings of Basu, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[f] wherein the output signal is indicative of the one or more of the physiological parameters;	Basu discloses or renders obvious wherein the output signal is indicative of the one or more of the physiological parameters. **The proposed system can be used to monitor physiological activity and health on a continual basis.** For example, the low-cost, hear rate sensor could be used to monitor sleep, exercise, and stress levels, enabling patient self-monitoring and driven decision making by health care providers. The key benefits to the proposed approach is 1) low cost, so it can be deployed to a large number of patients, ii) the sensor is small and nonintrusive, reducing patient discomfort and thereby increasing patient compliance, iii) it consumes low power, so it can provide 24 hour operation, iv) data is automatically transmitted wirelessly via Bluetooth, further reducing patient burden. The technology will result in new methods to assess efficacy and improve patient compliance to with physician-prescribed regimens. Basu at [0080] **FIG. 19 shows the normalized sensitivities of two photodiodes 20 and 16, one for the visible spectrum and one for the near infrared spectrum.** The sensitivities overlap so that the diode for the visible spectrum will also sense near infrared light and vice versa. Proper calibrations can compensate this disturbance with algorithms reducing the component of the respective other light source. Calibration measurements can be performed periodically or sporadically by individually taking measurements without any LED light, with one LED light operating, and with the other LED light operating. **For pulse oximetry, the Silicon Labs Si1143 was used, a triple-LED digital OPS 10, as is schematically indicated in FIG. 17. The chip 48 includes a photodiode 50 with FWHM spectral bandwidth of 600-1000 nm, 3 LED drivers, and a signal conditioning logic on the embedded IC.** Unlike the VCNL4000, the Si1143 does not include the LEDs on the chip 48 itself. Surface mount IR LEDs 14, 14′, and 15 (OSRAM) were placed within 3 mm on either side of the photodiode. The half angle of the chosen LEDs 14, 14′, and 15 is 22 degrees, which limits the light leakage. Each LED current can be set between 5.6 and 360 mA. The Si1143 uses time multiplexing to measure the reflectance from two or three LEDs on a single photo detector. Like the VCNL4000, it uses short LED pulses (25 μsec), which reduces the power consumption of the system. With three 100 mA LEDs 14, 14′, and 15 operating at a 100 Hz data rate, the power consumption is still less than about 800 μW. The Si1143 also includes an I2 C bus interface 26 for sensor configuration and reading sensor data. **The ambient light sensor 20**

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	included on the chip 48 can be used for sensing whether the chip 48 has been placed in contact with the skin. Results from the Multi-LED are shown in FIG. 16. **This experiment used three LEDs 14, 14′, and 15 placed 3 mm from a photo detector 50 formed by a Si1143 sensor** as indicated in FIG. 15. **A single measurement was taken at the fingertip at a fixed, moderate pressure**. The three simultaneous photoplethysmography waveforms are shown in the same graph. The signal-to-noise ratio is somewhat lower than similar measurements taken with the VCNL4000, but this is likely due to the smaller LED current used (30 mA vs. 100 mA). The pulsation index is slightly larger, which may be due to the placement or emission characteristics of the LEDs. **The SPO2 measurement can be found by taking the ratio of amplitudes in two LED channels. This calculation is performed by a microcontroller** (not shown). Basu at [0103-0105] In summary, OPS 10 have traditionally been used in robotics and smart phones, but here we show that **OPS 10 perform all photoplethysmography functions in a single, 4 mm-by-4 mm package which links directly to a microcontroller via a standard serial interface**. Moreover, it provides substantial performance advantages over existing state-of-the-art photoplethysmography sensors, including: i) 10 times lower power consumption (200 μW), ii) 5 times lower cost ($4), iii) 20 times smaller area, and iv) High signal-to-noise ratio (more than about 90), as a result of built-in optical barriers 28, filters, and ambient light cancellation. The versatility of the device can be demonstrated by measuring photoplethysmography data in several anatomical locations. A multi-LED OPS 10 can provide dual wavelength measurements required for pulse oximetry. **These unique qualities make OPS 10 an elegant solution for battery-powered, wearable physiological monitors.** Basu at [0110] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Basu, it would

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	have been obvious to one of ordinary skill in the art to combine, with the teachings of Basu, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[g] the wearable device configured to increase the signal-to-noise ratio by increasing light intensity of at least one of the plurality of semiconductor diodes from an initial light intensity; and	Basu discloses or renders obvious the wearable device configured to increase the signal-to-noise ratio by increasing light intensity of at least one of the plurality of semiconductor diodes from an initial light intensity. The influx of ambient light can be measured during OFF phases of the LED 14. The ambient light component can then be subtracted from the photo detector signal during ON phases to provide a sensitivity offset for proper calibration. **This technique being similar in concept** to lock-in detection or **to electronic noise cancellation**, **it improves the signal to noise ratio and reduces the impact of noise and ambient light.** Basu at [0037] **Intensity control: To maximize the signal-to-noise ratio in photoplethysmography, the LED intensity should be made as large as possible** without saturating the detector. **In the OPS 10, the LED intensity and modulation frequencies are programmable through the serial interface**. **In the case of the Vishay VCNL4000, the intensity is programmable from 10-200 mA in 10 mA increments**. Others (like the APDS-9190), include digital interrupts which trigger when the photo detector signal is saturated. Basu at [0058] **According to further embodiments of the invention, a single sensor may include a plurality of identical or different LEDs, a plurality of photodiodes, or both** Basu at [0008] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Basu, it would

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	have been obvious to one of ordinary skill in the art to combine, with the teachings of Basu, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[h] the detection system further configured to: generate a first signal responsive to light received while the semiconductor diodes are off,	Basu discloses or renders obvious the detection system further configured to: generate a first signal responsive to light received while the semiconductor diodes are off. **The influx of ambient light can be measured during OFF phases of the LED** 14. The ambient light component can then be subtracted from the photo detector signal during ON phases to provide a sensitivity offset for proper calibration. This technique being similar in concept to lock-in detection or to electronic noise cancellation, it improves the signal to noise ratio and reduces the impact of noise and ambient light. Basu at [0037] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Basu, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Basu, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[i] generate a second signal responsive to light received while at least one of the semiconductor diodes is on, and	Basu discloses or renders obvious the detection system further configured to: generate a second signal responsive to light received while at least one of the semiconductor diodes is on. The influx of ambient light can be measured during OFF phases of the LED 14. **The ambient light component can then be subtracted from the photo detector signal during ON phases** to provide a sensitivity offset for proper calibration. This technique being similar in concept to lock-in detection or to electronic noise cancellation, it improves the signal to noise ratio and reduces the impact of noise and ambient light. Basu at [0037] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references

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	identified in Defendant's Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Basu, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Basu, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[j] increase the signal-to-noise ratio by comparing the first signal and the second signal; and	Basu discloses or renders obvious the detection system further configured to: increase the signal-to-noise ratio by comparing the first signal and the second signal. **The influx of ambient light can be measured during OFF phases of the LED 14. The ambient light component can then be subtracted from the photo detector signal during ON phases to provide a sensitivity offset for proper calibration**. **This technique being similar in concept to lock-in detection or to electronic noise cancellation, it improves the signal to noise ratio and reduces the impact of noise and ambient light.** Basu at [0037] Electronic noise and offset reduction: The second function of the bandpass filter in photoplethysmography sensors is to remove high frequency noise, including 60/120 Hz noise from ambient light sources. While a 0.5-5 Hz filter can usually remove such noise, it limits the bandwidth of the photoplethysmography sensor, which makes it difficult to resolve some time dependent features of the pressure pulse. An OPS 10 uses electronic modulation to cancel noise and ambient light. The LED 14 is modulated at 1 KHz frequency or higher. The received PD signal oscillates at the same frequency, and the on-chip signal processing utilizes a bandpass or lock-in filtering scheme to remove all the other signal components. This technique effectively eliminates both high and low frequency noise without limiting the bandwidth. It also diminishes the impact of sunlight, which occurs as direct current (DC). Finally, offset can be reduced if a glass overlay (not shown) is placed between the sensor and the skin. An ambient light sensor (ALS) in the form of a visible-light photodiode 20 can also be used as a reference for additional ambient light cancellation. Basu at [0055] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant's Invalidity Contentions. Rather than repeat those disclosures here, they are

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	incorporated by reference into this chart. To the extent this limitation is not disclosed by Basu, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Basu, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[k] wherein the wearable device is at least in part configured to identify an object.	Basu discloses or renders obvious wherein the wearable device is at least in part configured to identify an object. An optical proximity sensor assembly includes an optical proximity sensor with an IR LED emitting light having an infrared wavelength, an IR photo detector sensitive to the infrared wavelength, an optical barrier blocking direct light rays from the LED to the IR photo detector and permitting reflected light rays to reach the at least one photo detector; and an electronic integrated circuit with an amplifier for amplifying a signal detected by the photo detector, an analog to digital converter, LED drivers, noise reduction and ambient light cancellation circuitry, and a digital interface for communication with a microcontroller. **The optical proximity sensor is accommodated on a wearable carrier**. A single sensor may include a plurality of identical or different LEDs, a plurality of photodiodes, or both. **Also, several sensors may be placed on a person’s skin along a vascular path to obtain data relating to blood flow and artery stiffness.** Basu at Abstract In a first approach, this device utilizes electronic optical proximity sensors (OPS) 10 to sense a patient's heart rate. Optical proximity sensors, also called light beam sensors, detect distance by **measuring the magnitude of light reflected from an object**. Variations of OPS are widely used for non-contact distance measurement in a variety of applications. In smart phones, for example, **OPS detect when a phone is placed in a pocket**, triggering touch-screen locking. In factory robotics, OPS are used for motion feedback control. In many industrial and consumer applications, OPS serve as touchless switches and gesture sensing devices in personal notebooks, vending machines, sanitary dispensers, lavatories, dimming control, and video games. Basu at [0035] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are

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’790 Patent	Basu
	incorporated by reference into this chart. To the extent this limitation is not disclosed by Basu, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Basu, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.

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EXHIBIT F3

U.S. Pat. No. 12,193,790 B2 in view of U.S. Patent No. 6,616,613 to Jesse B. Goodman ("Goodman")

As described in detail below, Goodman (individually or collectively) anticipates and/or renders obvious claim 7 ("Asserted Claim") of U.S. Patent No. 12,193,790 B2 (the "'790 Patent") under 35 U.S.C. §102 and/or §103, either alone in combination with the knowledge of a person of ordinary skill, and/or additional prior art references discussed in discussed in Exhibits F1-F14, the contents of which are hereby incorporated by reference into this chart. One of ordinary skill in the art, as of the priority date of the '790 Patent, would have known to combine the prior art elements disclosed by the foregoing references using known methods, and to use these elements according to their established functions in order to achieve a known and predictable result. This invalidity claim chart is based on Defendants' present understanding of the Asserted Claim and Plaintiff's apparent construction of the Asserted Claim in its Preliminary Infringement Contentions ("Infringement Contentions").

The following invalidity chart includes references to the structure, function, operation, and/or features of the technology described in Goodman. The cited portions of Goodman are merely illustrative, and Defendants reserve the right to rely on alternative or additional evidence, including uncited portions of Goodman. Where a particular figure is cited, the citation should be understood to encompass the caption and description of the figure as well as any text relating to or describing the figure. Conversely, where particular text referring to a figure is cited, the citation should be understood to include the figure as well. Although the documentation collectively evidences prior knowledge, use, or sale, Defendants reserve the right to rely upon individual documents as printed publications. Where the chart below states that Goodman "describes" or "provides for" a limitation, such disclosure may be express, inherent, or implicit. To the extent it is found Goodman does not expressly disclose certain limitations in the Asserted Claim, such limitations are inherent. Defendants reserve the right to present direct evidence of the structure, function, operation, and/or features of the technology described in Goodman (including product samples, source code, and/or witness testimony) and/or its prior art status, and to present alternative or additional documents concerning the same as evidence that the technology described in Goodman anticipates and/or renders obvious the Asserted Claim of the '790 Patent

This chart is subject to all reservations, objections, and disclaimers in Defendants' Invalidity Contentions and any amendment, supplement, or modification thereof, which are incorporated herein by reference in their entirety. Nothing stated herein shall be treated as an admission or suggestion that Defendants agree with Plaintiff regarding the scope of the Asserted Claim, Plaintiff's apparent claim constructions, or the accuracy of any particular claim construction. Defendants reserve all rights to challenge any of the claim terms herein under 35 U.S.C. § 112, including by arguing that they are indefinite, are not supported by the written description, and/or are not enabled. Defendants further reserve all rights to amend this invalidity claim chart without leave of court pursuant to the Court's Docket Control Order, or upon a showing of good cause.

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EXHIBIT F3

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Claim 7	
7pre. An optical system, comprising:	By providing this disclosure, Defendants do not take a position on whether the preamble is limiting. Goodman discloses or renders obvious an optical system. A health monitoring and biofeedback system comprising a photoplethysmography (PPG) sensor, a processing device, and a Web site server for determining, displaying and analyzing various cardiovascular parameters. The PPG sensor is installed within a manually operated user input device such as a mouse or keyboard, measures a user's blood volume contour and transmits it to a processing device such as a personal computer or a personal digital assistant (PDA). The system determines a plurality of cardiovascular indices including mean blood pressure, heart rate, body temperature, respiratory rate, and arterial compliance on the basis of signal characteristics of the systolic wave pulse and the systolic reflected wave pulse present within the digital volume pulse derived from the PPG pulse contour. Signal characteristics of the systolic reflected wave pulse can be determined through various pulse analysis techniques including derivative analysis of the digital volume pulse signal, bandpass filtering or respiratory matrix frequency extraction techniques. By subtracting the systolic reflected wave pulse contour from the digital volume pulse contour, characteristics of the systolic wave pulse can also be identified. The system also provides for the accurate determination of systolic and diastolic blood pressure by using a non-invasive blood pressure monitor to calibrate the relationships between arterial or digital blood pressure and characteristics of the user's digital volume pulse contour. In this way, a wide variety of cardiovascular and respiratory data can be obtained. The system also facilitates the transmittal of such data to the system web site for further analysis, storage, and retrieval purposes. Goodman at Abstact

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	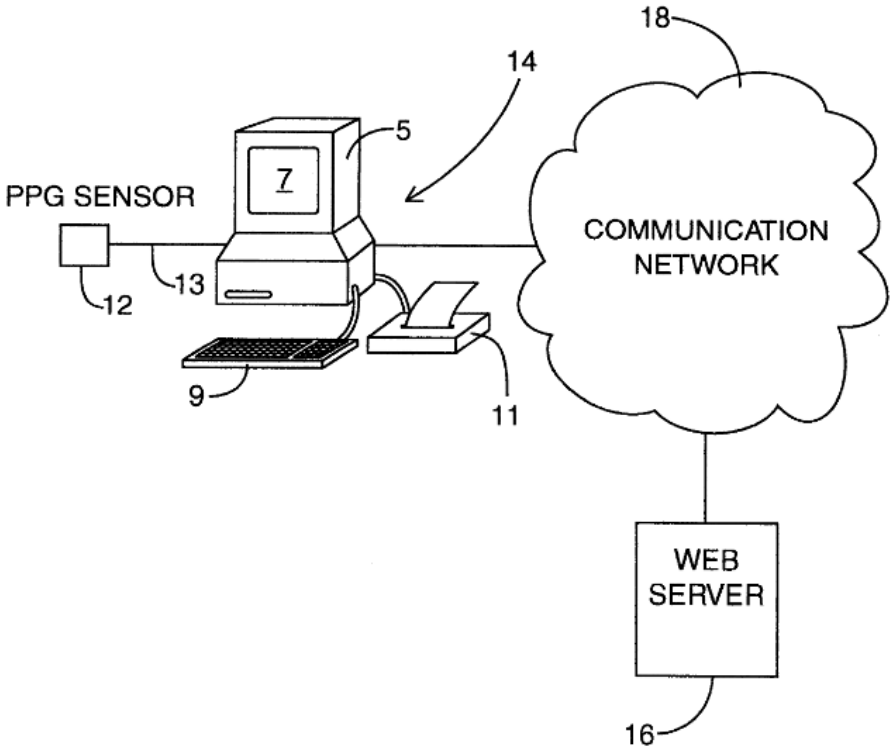 Goodman at Fig. 1 Reference is first made to FIG. 1, which shows the overall configuration of the preferred **embodiment of a physiological monitoring system 10, according to the present invention**. **System 10 comprises a conventional plethysmography (PPG) sensor 12 coupled to a processing device 14 which is in data communication with a Web site server 16 through a communication network 18 (i.e. the Internet).** **PPGs are well-known instruments which use light for determining and registering variations in a patient's blood volume.** They can instantaneously track arterial blood volume changes during the cardiac cycle. PPG sensor 12 is installed within a computer mouse or some other computer peripheral (e.g. keyboard, touchpad, joystick) commonly associated with a computer processing device 14. It should be understood that it would be also possible to implement the invention by incorporating PPG sensor 12

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	within the casing of a personal digital assistant (PDA) or within some other type of stand alone data processing and transmitting device (e.g. a watch) or simply as a stand alone sensor device. Goodman at 8:53-9:5 FIG. 5 shows another possible configuration of system 10 wherein processing device 14 is a PDA (e.g. Palm Pilot™) having PPG sensor 12 interfaced therein. PPG sensor 12 could be directly integrated into the shell of the PDA processing device 14. Alternatively**, PPG sensor 12 could be implemented within a PDA accessory card or device, or adapted to interface with the PDA processing device 14 as an external wearable device. In the latter case, it would be possible for a user to wear a wearable user input device 12 such that blood volume pulse signal information could be collected by the PDA processing device 14 over the course of a day.** It would be possible to arrange for periodic download of recorded volume pulse contour signal information collected by user input device 12 to processing device 14 and/or to Web site server 16 through processing device 14 over the communication network 18. Goodman at 13:26-42 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Goodman, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Goodman, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7a. a wearable device for measuring one or more physiological parameters, the wearable device adapted to be placed on a wrist of a user;	Goodman discloses or renders obvious a wearable device for measuring one or more physiological parameters, the wearable device adapted to be placed on a wrist of a user. A health monitoring and biofeedback system comprising a photoplethysmography (PPG) sensor, a processing device, and a Web site server for determining, displaying and analyzing various cardiovascular parameters. The PPG sensor is installed within a manually operated user input device such as a mouse or keyboard, measures a user's blood volume contour and transmits it to a processing device such as a personal computer or a personal digital assistant (PDA). The system determines a plurality of cardiovascular indices including mean blood pressure, heart rate, body temperature,

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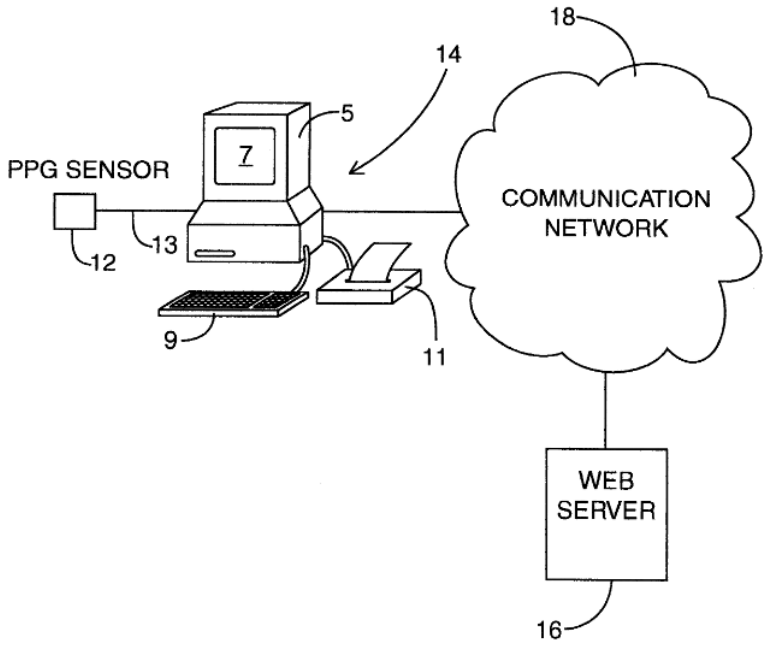
	respiratory rate, and arterial compliance on the basis of signal characteristics of the systolic wave pulse and the systolic reflected wave pulse present within the digital volume pulse derived from the PPG pulse contour. Signal characteristics of the systolic reflected wave pulse can be determined through various pulse analysis techniques including derivative analysis of the digital volume pulse signal, bandpass filtering or respiratory matrix frequency extraction techniques. By subtracting the systolic reflected wave pulse contour from the digital volume pulse contour, characteristics of the systolic wave pulse can also be identified. The system also provides for the accurate determination of systolic and diastolic blood pressure by using a non-invasive blood pressure monitor to calibrate the relationships between arterial or digital blood pressure and characteristics of the user's digital volume pulse contour. In this way, a wide variety of cardiovascular and respiratory data can be obtained. The system also facilitates the transmittal of such data to the system web site for further analysis, storage, and retrieval purposes. Goodman at Abstact  Goodman at Fig. 1

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	Reference is first made to FIG. 1, which shows the overall configuration of the preferred **embodiment of a physiological monitoring system 10, according to the present invention**. **System 10 comprises a conventional plethysmography (PPG) sensor 12 coupled to a processing device 14 which is in data communication with a Web site server 16 through a communication network 18 (i.e. the Internet).** **PPGs are well-known instruments which use light for determining and registering variations in a patient's blood volume.** They can instantaneously track arterial blood volume changes during the cardiac cycle. PPG sensor 12 is installed within a computer mouse or some other computer peripheral (e.g. keyboard, touchpad, joystick) commonly associated with a computer processing device 14. It should be understood that it would be also possible to implement the invention by incorporating PPG sensor 12 within the casing of a personal digital assistant (PDA) or within some other type of stand alone data processing and transmitting device (e.g. a watch) or simply as a stand alone sensor device. Goodman at 8:53-9:5 Processing device 14 is preferably a conventional personal computer having a central processing unit (CPU) 5, display 7, keyboard 9 and printer 11. Processing device 14 also preferably has a standard Universal Serial Bus (USB), sufficient memory and processing power to run the application programs associated with system 10, and a data transmission controller for sending and receiving data over data transmission cable 13, all built integrally with processing device 14. An executable program is installed within the permanent memory of processing device 14 to instruct the user through interactive menus to utilize the PPG sensor 12 such that proper PPG signals can be obtained from the user and to provide the user with his/her own generated physiological information through graphical means. It should be understood that such an executable program could also be available for downloading online from Web site server 16. The executable program has the functionality to allow a user to observe his/her own physiological signals in real time such that biofeedback is facilitated. Also, it is contemplated that processing device 14 could be used to store a user's physiological signals for later retrieval, comparative and display purposes. Commercially available signal measurement and analysis display software such as LabVIEW™ (available from National Instruments of Austin, Tex.) is utilized to perform the necessary data analysis as well as display the results of the calculations in easy-to-understand format. It should be understood that processing device 14 could just as easily be a PDA, as discussed above. Goodman at 9:6-32

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	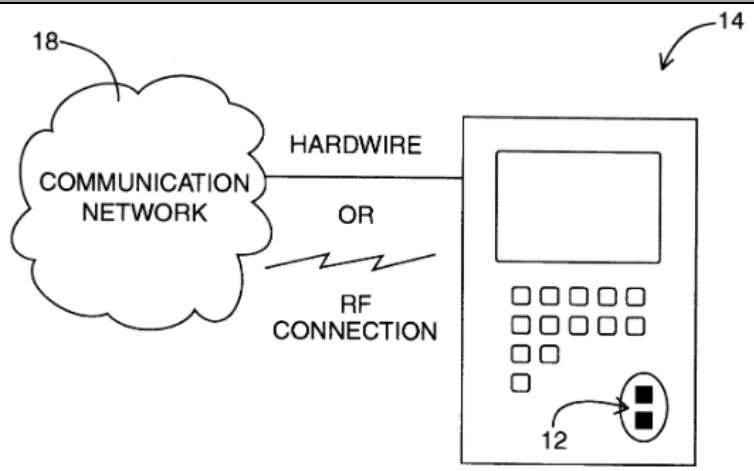 FIG. 5 Goodman at Fig. 5 FIG. 5 shows another possible configuration of system 10 wherein processing device 14 is a PDA (e.g. Palm Pilot™) having PPG sensor 12 interfaced therein. PPG sensor 12 could be directly integrated into the shell of the PDA processing device 14. Alternatively**, PPG sensor 12 could be implemented within a PDA accessory card or device, or adapted to interface with the PDA processing device 14 as an external wearable device. In the latter case, it would be possible for a user to wear a wearable user input device 12 such that blood volume pulse signal information could be collected by the PDA processing device 14 over the course of a day.** It would be possible to arrange for periodic download of recorded volume pulse contour signal information collected by user input device 12 to processing device 14 and/or to Web site server 16 through processing device 14 over the communication network 18. Goodman at 13:26-42 PPGs are well-known instruments which use light for determining and registering variations in a patient's blood volume. They can instantaneously track arterial blood volume changes during the cardiac cycle. PPG sensor 12 is installed within a computer mouse or some other computer peripheral (e.g. keyboard, touchpad, joystick) commonly associated with a computer processing device 14**. It should be understood that it would be also possible to implement the invention by incorporating PPG sensor**

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	12 within the casing of a personal digital assistant (PDA) or within some other type of stand alone data processing and transmitting device (e.g. a watch) or simply as a stand alone sensor device. Goodman at 8:60-9:5 Further embodiments of the invention whereby PPG sensor 12 and processing device 14 are integrated together into a single unit with a compact design are also contemplated as processing speed and device memory increase as physical dimensions decrease. For example**, it is likely that PPG sensor 12 and processing device 14, and all of its associated functionality, could feasibly be incorporated into a wrist watch device in the foreseeable future. It is contemplated that PPG sensor 12 could be integrated together with a computing means, wireless transmission means (e.g. well known convention radio frequency techniques as well as emerging radio frequency communication protocols such as the BlueTooth™ standard) and a battery in a small (e.g. 2 cm2) component that would adhere to a body skin area for extended periods of time (e.g. weeks) and would transmit data to a remote computing device on a continuous basis.** Goodman at 13:43-58 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant's Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Goodman, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Goodman, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7b. the wearable device including a light source comprising a plurality of semiconductor diodes that are configured to generate an output optical light having one or more optical wavelengths, wherein at least a portion of the one or	Goodman discloses or renders obvious the wearable device including a light source comprising a plurality of semiconductor diodes that are configured to generate an output optical light having one or more optical wavelengths, wherein at least a portion of the one or more optical wavelengths is a near-infrared wavelength between 700 nanometers and 2500 nanometers. Alternatively, **it would be possible to use two infrared LEDs which are close to the isobestic point of haemoglobin (i.e. approximately 880 nanometres). The isobestic point of haemoglobin is defined as being the wavelength at which the haemoglobin is relatively insensitive to the oxygenated status of the haemoglobin molecule. Light emitting at 880 nanometres is close to the point where the**

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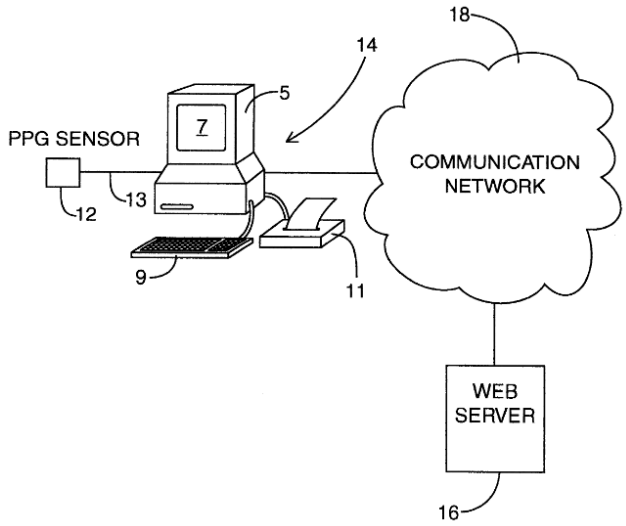
more optical wavelengths is a near-infrared wavelength between 700 nanometers and 2500 nanometers;	**absorption of light by haemoglobin is not affected by the oxygenation status of the haemoglobin molecule.** Goodman at 32:50-58  Goodman at Fig. 1 **PPG sensor 12 has a relatively small footprint (e.g. few square centimeters) and is implemented using a red LED1 and an infrared LED2, each associated with a photodiode PD1 and PD2 (FIG. 3) in a known configuration for reflective mode operation (i.e. light is transmitted into a body part and the amount of light reflected back is detected). The emitted monochromatic light emitted from LED1 and LED2 travels through a user's finger along a light path which passes through blood in a plurality of arteries as well as background tissue.** As the monochromatic light travels along its light path it is partially absorbed by the background tissue and the blood. A portion of the monochromatic light is not absorbed and is reflected back to the appropriate photodiode PDor PD2. **As is conventionally known, reflective mode PPG uses the reflected light from a site to estimate absorption of light and to generate a raw blood volume pulse contour signal. The detector is positioned on the same side as the radiating LED in order to detect the reflected light.** Goodman at 9:57-10:5

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	One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Goodman, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Goodman, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7c. the wearable device comprising one or more lenses configured to receive at least a portion of the output optical light and to deliver a lens output light to tissue comprising skin;	Goodman discloses or renders obvious the wearable device comprising one or more lenses configured to receive at least a portion of the output optical light and to deliver a lens output light to tissue comprising skin. **PPGs are well-known instruments which use light for determining and registering variations in a patient's blood volume. They can instantaneously track arterial blood volume changes during the cardiac cycle.** PPG sensor 12 is installed within a computer mouse or some other computer peripheral (e.g. keyboard, touchpad, joystick) commonly associated with a computer processing device 14. It should be understood that it would be also possible to implement the invention by incorporating PPG sensor 12 within the casing of a personal digital assistant (PDA) or within some other type of stand alone data processing and transmitting device (e.g. a watch) or simply as a stand alone sensor device. Goodman at 8:60-9:5 PPG sensor 12 has a relatively small footprint (e.g. few square centimeters) and is implemented using a red LED1 and an infrared LED2, each associated with a photodiode PD1 and PD2 (FIG. 3) in a known configuration for **reflective mode operation (i.e. light is transmitted into a body part and the amount of light reflected back is detected). The emitted monochromatic light emitted from LED1 and LED2 travels through a user's finger along a light path which passes through blood in a plurality of arteries as well as background tissue. As the monochromatic light travels along its light path it is partially absorbed by the background tissue and the blood. A portion of the monochromatic light is not absorbed and is reflected back to the appropriate photodiode PDor PD2. As is conventionally known, reflective mode PPG uses the reflected light from a site to estimate absorption of light and to generate a raw blood volume pulse contour signal. The detector is positioned on the same side as the radiating LED in order to detect the reflected light.**

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	Goodman at 9:57-10:5 Microcontroller 26 is also programmed to control the operation of LED1 and LED2 of PPG sensor 12 for optimal sensor operation. Microcontroller 26 is programmed to generate digital switching pulses to drive LED1 and LED2 of PPG sensor 12 alternately at a repetition rate of 1 KHz (i.e. each LED accomplishes sampling at a rate of 1 KHz). It has been determined that the sampling frequency should be 10 times the highest frequency of interest. The conditioned PPG signal has frequency components as high as 30 Hertz. However, 60 Hertz noise from electrical sources in the environment necessitates sampling of the signal at a high enough rate to ensure the effectiveness of the associated noise filtering software of CPU 5. Goodman 12:22-35 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Goodman, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Goodman, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7d. the wearable device further comprising a detection system configured to receive at least a portion of the lens output light reflected from the tissue and to generate an output signal having a signal-to-noise ratio, wherein the detection system is configured to be synchronized to the light source;	Goodman discloses or renders obvious the wearable device further comprising a detection system configured to receive at least a portion of the lens output light reflected from the tissue and to generate an output signal having a signal-to-noise ratio, wherein the detection system is configured to be synchronized to the light source. PPG sensor 12 has a relatively small footprint (e.g. few square centimeters) and is implemented using a red LED1 and an infrared LED2, each associated with a photodiode PD1 and PD2 (FIG. 3) in a known configuration for **reflective mode operation (i.e. light is transmitted into a body part and the amount of light reflected back is detected). The emitted monochromatic light emitted from LED1 and LED2 travels through a user's finger along a light path which passes through blood in a plurality of arteries as well as background tissue. As the monochromatic light travels along its light path it is partially absorbed by the background tissue and the blood. A portion of the monochromatic light is not absorbed and is reflected back to the appropriate photodiode PDor PD2. As is conventionally known, reflective mode PPG uses the reflected light from a site to estimate**

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	absorption of light and to generate a raw blood volume pulse contour signal. The detector is positioned on the same side as the radiating LED in order to detect the reflected light. Goodman at 9:57-10:5 **Following this filtering process, the PPG voltage signal is applied to a combined amplifier and low pass filter stage comprised of resistors R15, R11, and R16, variable resistor VAR17, capacitor C8 and operational amplifier U2A. The gain of the amplifier is set by adjusting variable resistor VAR17. The values of resistors R16, R17 and capacitor C8 determine the corner frequency which is typically 30 Hertz. The conditioned PPG voltage signal generated by this stage (at point B) is provided to the processing device 14. In this way signal conditioner module 24 improves the signal to noise ratio of the PPG signal prior to digitization.** Goodman at 11:41-52 **Microcontroller 26 is also programmed to control the operation of LED1 and LED2 of PPG sensor 12 for optimal sensor operation. Microcontroller 26 is programmed to generate digital switching pulses to drive LED1 and LED2 of PPG sensor 12 alternately at a repetition rate of 1 KHz (i.e. each LED accomplishes sampling at a rate of 1 KHz)**. It has been determined that the sampling frequency should be 10 times the highest frequency of interest. The conditioned PPG signal has frequency components as high as 30 Hertz. However, 60 Hertz noise from electrical sources in the environment necessitates sampling of the signal at a high enough rate to ensure the effectiveness of the associated noise filtering software of CPU 5. Goodman at 12:12-34 **The interaction between primary and reflected waves obscures wave detail preventing the determination of exact timing and amplitude relationships between primary and reflected waves. Also, the shape of the DVP changes on a beat to beat basis due to changes in the timing and amplitude of the reflected wave components associated with respiration.** With inspiration, blood pressure falls and the aortic reflected waves will arrive later at the finger and with smaller amplitude. As blood pressure decreases, the pulse transit time increases. This inverse relationship between blood pressure and pulse transit time causes the reflected wave signal to appear earlier or later in the DVP signal.

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	Goodman at 20:1-15 FIG. 12B is a flowchart showing how the individual DVP beats of the DVP signal are synchronized and normalized. Goodman 7:64-65; Fig. 12B. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Goodman, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Goodman, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7e. wherein the detection system comprises a plurality of detectors that are spatially separated from each other, and wherein at least one analog to digital converter is coupled to at least one of the plurality of detectors;	Goodman discloses or renders obvious wherein the detection system comprises a plurality of detectors that are spatially separated from each other, and wherein at least one analog to digital converter is coupled to at least one of the plurality of detectors. PPG sensor 12 has a relatively small footprint (e.g. few square centimeters) and is implemented using a red LED1 and an infrared LED2, each associated with a photodiode PD1 and PD2 (FIG. 3) in a known configuration for reflective mode operation (i.e. light is transmitted into a body part and the amount of light reflected back is detected). The emitted monochromatic light emitted from LED1 and LED2 travels through a user's finger along a light path which passes through blood in a plurality of arteries as well as background tissue. As the monochromatic light travels along its light path it is partially absorbed by the background tissue and the blood. A portion of the monochromatic light is not absorbed and is reflected back to the appropriate photodiode PDor PD2. As is conventionally known, reflective mode PPG uses the reflected light from a site to estimate absorption of light and to generate a raw blood volume pulse contour signal. **The detector is positioned on the same side as the radiating LED in order to detect the reflected light.** Goodman at 9:57-10:5

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	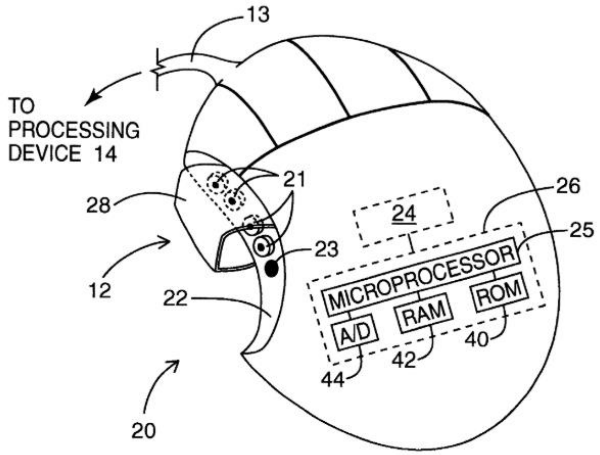 Goodman at Fig. 2 Accordingly, **the PPG voltage signal from photodiodes PD1 and PD2 is converted into conditioned PPG voltage signals at outputs at nodes B and B′, respectively. These conditioned PPG voltage signals are provided to microcontroller 26 for digitizing and analysis**. Microcontroller 26 (FIG. 2) may be any commercially available programmable device such as a Mitsubishi USB microcontroller (available from Mitsubishi Semiconductors, Inc. of Japan), **although it should be understood that any type of logic circuit with similar operating functions (particularly one which has a USB interface and which includes an on-board analog-to-digital converter) can be utilized. Storage of program instructions and other static data is provided by a read only memory (ROM) 40, while storage of dynamic data is provided by a random access memory (RAM) 42.** Both memory units 40 and 42 are controlled and accessed by microprocessor 25. **On board analog-to-digital converter A/D 44 (10 bit, 5 channel input) is used to convert the conditioned PPG signals at B and B′ into time sampled digital signals which are then provided to processing device 14.** Also, all of the circuitry of signal conditioner module 24 is provided with a 5 volt source from the USB line of microcontroller 26. Goodman at 11:66-12:21 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the

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	art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Goodman, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Goodman, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7f. wherein the output signal is indicative of the one or more of the physiological parameters;	Goodman discloses or renders obvious wherein the output signal is indicative of the one or more of the physiological parameters. PPG sensor 12 has a relatively small footprint (e.g. few square centimeters) and is implemented using a red LED1 and an infrared LED2, each associated with a photodiode PD1 and PD2 (FIG. 3) in a known configuration for reflective mode operation (i.e. light is transmitted into a body part and the amount of light reflected back is detected). The emitted monochromatic light emitted from LED1 and LED2 travels through a user's finger along a light path which passes through blood in a plurality of arteries as well as background tissue. As the monochromatic light travels along its light path it is partially absorbed by the background tissue and the blood. **A portion of the monochromatic light is not absorbed and is reflected back to the appropriate photodiode PDor PD2**. **As is conventionally known, reflective mode PPG uses the reflected light from a site to estimate absorption of light and to generate a raw blood volume pulse contour signal.** The detector is positioned on the same side as the radiating LED in order to detect the reflected light. Goodman at 9:57-10:5 **Accordingly, the PPG voltage signal from photodiodes PD1 and PD2 is converted into conditioned PPG voltage signals at outputs at nodes B and B′, respectively. These conditioned PPG voltage signals are provided to microcontroller 26 for digitizing and analysis.** Goodman at 11:66-12:3 Preferably the communication protocol used with the invention would be TCP/IP. Those skilled in the art will understand the manner in which the data is formatted by processing device 14 prior to being transmitted over communication network 18 to Web server 16. TCP/IP then parses the data into packets, each packet including a field indicating the destination Web site 16. Processing device 14 then outputs the packets onto communication network 18. At minimum, **the packets will contain data relating to the identity of the user and an indication of the type of measurement data being is encoded within**

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	the data message. Optionally, other types of information could be provided such as the time and date of the measurement and the type of medical device which took the measurement. Goodman at 33:61-34:7 1. **A physiological signal monitoring system comprising:** **(a) a PPG sensor adapted to come into skin contact with a user's body part, for sensing a physiological characteristic of the user and for generating electrical signals which correspond to said physiological characteristic, wherein said physiological characteristic comprises the user's blood volume contour**; (b) first processing means operatively coupled to said sensor for receiving and converting said electrical signals into data, for computing a set of physiological parameters on the basis of said data and for conducting analysis of said physiological parameters, said first processing means comprising: (i) filtering means for filtering nonpulsatile and slowly pulsatile signals from the blood volume contour to obtain a filtered blood volume contour; (ii) **extraction means for extracting characteristics of the user's aortic reflected wave contour from a volume contour chosen from one of the blood volume contour and the filtered blood volume contour, the characteristics of the user's aortic reflected wave contour being determined in part from a fourth derivative of said volume contour**; (iii) **computing means for determining the set of physiological parameters based on characteristics of said aortic reflected wave**; and, (c) display means coupled to said first processing means for displaying said physiological parameters. Goodman at Claim 1 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Goodman, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Goodman, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.

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7g. the wearable device configured to increase the signal-to-noise ratio by increasing light intensity of at least one of the plurality of semiconductor diodes from an initial light intensity; and	Goodman discloses or renders obvious the wearable device configured to increase the signal-to-noise ratio by increasing light intensity of at least one of the plurality of semiconductor diodes from an initial light intensity. PPG sensor 12 has a relatively small footprint (e.g. few square centimeters) and is implemented using a red LED1 and an infrared LED2, each associated with a photodiode PD1 and PD2 (FIG. 3) in a known configuration for reflective mode operation (i.e. light is transmitted into a body part and the amount of light reflected back is detected). The emitted monochromatic light emitted from LED1 and LED2 travels through a user's finger along a light path which passes through blood in a plurality of arteries as well as background tissue. As the monochromatic light travels along its light path it is partially absorbed by the background tissue and the blood. A portion of the monochromatic light is not absorbed and is reflected back to the appropriate photodiode PDor PD2. As is conventionally known, reflective mode PPG uses the reflected light from a site to estimate absorption of light and to generate a raw blood volume pulse contour signal. The detector is positioned on the same side as the radiating LED in order to detect the reflected light. Goodman at 9:56-67 **By driving LED1 and LED2 alternately, it is ensured that only one LED is turned on at any one time so that the light signals are isolated from each other's photodiode. Also, both LED1 and LED2 are periodically turned off to acquire a signal used to correct for ambient light effects. Specifically, ambient light effects are eliminated through subtraction of the signal generated when the applicable LED1 or LED2 is off.** Finally, the presence or absence of a finger on PPG sensor 12 can be determined by turning on an LED for a brief period at a regular time interval and determining whether the associated photodiode detects any reflected light. This polling activity allows PPG sensor 12 to be active only when necessary. Goodman at 12:35-48 Following this filtering process, **the PPG voltage signal is applied to a combined amplifier and low pass filter stage comprised of resistors R15, R11, and R16, variable resistor VAR17, capacitor C8 and operational amplifier U2A. The gain of the amplifier is set by adjusting variable resistor VAR17.** The values of resistors R16, R17 and capacitor C8 determine the corner frequency which is typically 30 Hertz. **The conditioned PPG voltage signal generated by this stage (at point B) is**

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	provided to the processing device 14. In this way signal conditioner module 24 improves the signal to noise ratio of the PPG signal prior to digitization. Goodman at 11:41-52 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Goodman, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Goodman, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7h. the detection system further configured to: generate a first signal responsive to light received while the semiconductor diodes are off,	Goodman discloses or renders obvious the detection system further configured to: generate a first signal responsive to light received while the semiconductor diodes are off. PPG sensor 12 has a relatively small footprint (e.g. few square centimeters) and is implemented using a red LED1 and an infrared LED2, each associated with a photodiode PD1 and PD2 (FIG. 3) in a known configuration for reflective mode operation (i.e. light is transmitted into a body part and the amount of light reflected back is detected). The emitted monochromatic light emitted from LED1 and LED2 travels through a user's finger along a light path which passes through blood in a plurality of arteries as well as background tissue. As the monochromatic light travels along its light path it is partially absorbed by the background tissue and the blood. A portion of the monochromatic light is not absorbed and is reflected back to the appropriate photodiode PDor PD2. As is conventionally known, reflective mode PPG uses the reflected light from a site to estimate absorption of light and to generate a raw blood volume pulse contour signal. The detector is positioned on the same side as the radiating LED in order to detect the reflected light. Goodman at 9:56-67 By driving LED1 and LED2 alternately, it is ensured that only one LED is turned on at any one time so that the light signals are isolated from each other's photodiode**.** Also, **both LED1 and LED2 are periodically turned off to acquire a signal used to correct for ambient light effects**. Specifically, ambient light effects are eliminated through subtraction of the signal generated when the applicable LED1 or LED2 is off. Finally, the presence or absence of a finger on PPG sensor 12 can be determined

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	by turning on an LED for a brief period at a regular time interval and determining whether the associated photodiode detects any reflected light. This polling activity allows PPG sensor 12 to be active only when necessary. Goodman at 12:36-48 The output of operational amplifier U1A follows two signal paths. **The first path connects the raw PPG voltage signal to a unity gain buffer circuit comprised of operational amplifier U3A and resistor R18.** The raw PPG voltage signal can be simultaneously monitored or utilized by system 10 (at point A in FIG. 3) as will be discussed, while the raw PPG voltage signal is further processed by the second path in the circuit to produce a conditioned PPG voltage signal (at point B in FIG. 3). The second path in the circuit (FIG. 3) connects the raw PPG voltage signal to a series of signal conditioning stages. The first conditioning stage is a ‘Sallen and Key’ high pass filter. This filter is comprised of capacitors C6 and C1, resistors R13 and R14 and operational amplifier U4A. The values of capacitors C6 and C1 and resistors R13 and R14 are chosen to provide the high pass filter with a corner frequency of approximately 0.1 Hertz. The purpose of this filtering stage is to suppress low frequency noise within the PPG voltage signal. Goodman at 11:22-40 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Goodman, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Goodman, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7i. generate a second signal responsive to light received while at least one of the semiconductor diodes is on, and	Goodman discloses or renders obvious the detection system further configured to: generate a second signal responsive to light received while at least one of the semiconductor diodes is on. PPG sensor 12 has a relatively small footprint (e.g. few square centimeters) and is implemented using a red LED1 and an infrared LED2, each associated with a photodiode PD1 and PD2 (FIG. 3) in a known configuration for reflective mode operation (i.e. light is transmitted into a body part and the amount of light reflected back is detected). The emitted monochromatic light emitted from LED1 and LED2 travels

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	through a user's finger along a light path which passes through blood in a plurality of arteries as well as background tissue. As the monochromatic light travels along its light path it is partially absorbed by the background tissue and the blood. A portion of the monochromatic light is not absorbed and is reflected back to the appropriate photodiode PDor PD2. As is conventionally known, reflective mode PPG uses the reflected light from a site to estimate absorption of light and to generate a raw blood volume pulse contour signal. The detector is positioned on the same side as the radiating LED in order to detect the reflected light. Goodman at 9:56-67 **By driving LED1 and LED2 alternately, it is ensured that only one LED is turned on at any one time so that the light signals are isolated from each other's photodiode**. Also, both LED1 and LED2 are periodically turned off to acquire a signal used to correct for ambient light effects. Specifically, ambient light effects are eliminated through subtraction of the signal generated when the applicable LED1 or LED2 is off. Finally, **the presence or absence of a finger on PPG sensor 12 can be determined by turning on an LED for a brief period at a regular time interval and determining whether the associated photodiode detects any reflected light**. This polling activity allows PPG sensor 12 to be active only when necessary. Goodman at 12:36-48 The output of operational amplifier U1A follows two signal paths. The first path connects the raw PPG voltage signal to a unity gain buffer circuit comprised of operational amplifier U3A and resistor R18. The raw PPG voltage signal can be simultaneously monitored or utilized by system 10 (at point A in FIG. 3) as will be discussed, while the raw PPG voltage signal is further processed by the second path in the circuit to produce a conditioned PPG voltage signal (at point B in FIG. 3). **The second path in the circuit (FIG. 3) connects the raw PPG voltage signal to a series of signal conditioning stages.** The first conditioning stage is a ‘Sallen and Key’ high pass filter. This filter is comprised of capacitors C6 and C1, resistors R13 and R14 and operational amplifier U4A. The values of capacitors C6 and C1 and resistors R13 and R14 are chosen to provide the high pass filter with a corner frequency of approximately 0.1 Hertz. The purpose of this filtering stage is to suppress low frequency noise within the PPG voltage signal. Goodman at 11:22-40

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	One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Goodman, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Goodman, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7j. increase the signal-to-noise ratio by comparing the first signal and the second signal; and	Goodman discloses or renders obvious the detection system further configured to: increase the signal-to-noise ratio by comparing the first signal and the second signal. PPG sensor 12 has a relatively small footprint (e.g. few square centimeters) and is implemented using a red LED1 and an infrared LED2, each associated with a photodiode PD1 and PD2 (FIG. 3) in a known configuration for reflective mode operation (i.e. light is transmitted into a body part and the amount of light reflected back is detected). The emitted monochromatic light emitted from LED1 and LED2 travels through a user's finger along a light path which passes through blood in a plurality of arteries as well as background tissue. As the monochromatic light travels along its light path it is partially absorbed by the background tissue and the blood. A portion of the monochromatic light is not absorbed and is reflected back to the appropriate photodiode PDor PD2. As is conventionally known, reflective mode PPG uses the reflected light from a site to estimate absorption of light and to generate a raw blood volume pulse contour signal. The detector is positioned on the same side as the radiating LED in order to detect the reflected light. Goodman at 9:56-67 **Following this filtering process, the PPG voltage signal is applied to a combined amplifier and low pass filter stage comprised of resistors R15, R11, and R16, variable resistor VAR17, capacitor C8 and operational amplifier U2A. The gain of the amplifier is set by adjusting variable resistor VAR17. The values of resistors R16, R17 and capacitor C8 determine the corner frequency which is typically 30 Hertz. The conditioned PPG voltage signal generated by this stage (at point B) is provided to the processing device 14. In this way signal conditioner module 24 improves the signal to noise ratio of the PPG signal prior to digitization.** Goodman at 11:41-52

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	By driving LED1 and LED2 alternately, it is ensured that only one LED is turned on at any one time so that the light signals are isolated from each other's photodiode. Also**,** both LED1 and LED2 are periodically turned off to acquire a signal used to correct for ambient light effects. Specifically**, ambient light effects are eliminated through subtraction of the signal generated when the applicable LED1 or LED2 is off.** Finally, the presence or absence of a finger on PPG sensor 12 can be determined by turning on an LED for a brief period at a regular time interval and determining whether the associated photodiode detects any reflected light. This polling activity allows PPG sensor 12 to be active only when necessary. Goodman at 12:36-48 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Goodman, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Goodman, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7k. wherein the wearable device is at least in part configured to identify an object.	Goodman discloses or renders obvious wherein the wearable device is at least in part configured to identify an object.

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	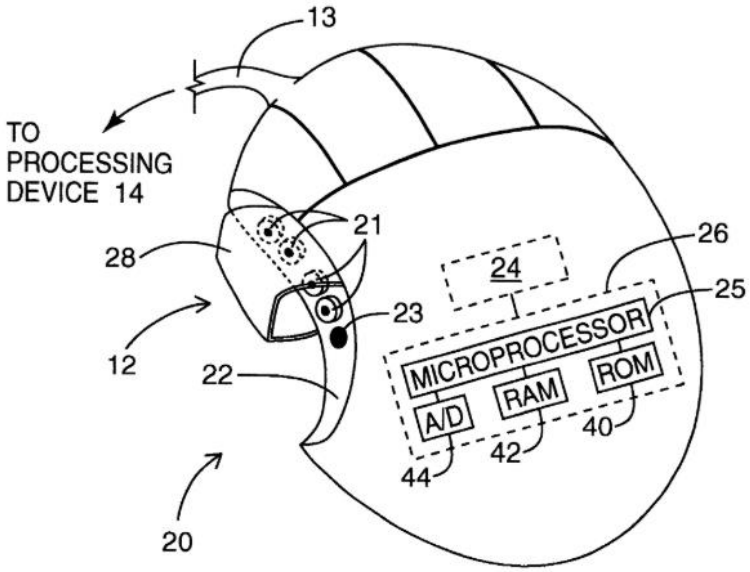 Goodman at Fig. 2 PPG sensor 12 is installed within the housing in depression 22 such that PPG.sensor 12 is positioned underneath the part of depression 22 that corresponds to a user's distal thumb and so that a user's thumb when positioned within depression 22 would be completely covered by; an elastic restraint 28. **It has been determined that this is an optimal configuration, since the transmitted light can penetrate adequately into the skin at a user's fingertip and due to the fact that elastic restraint 28 shields PPG sensor 12 from ambient light.** For convenient operation within user input device 20, the LED and photodiode pairs are installed within depression 22 approximately one centimeter apart from each other. Goodman at 10:35-48

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	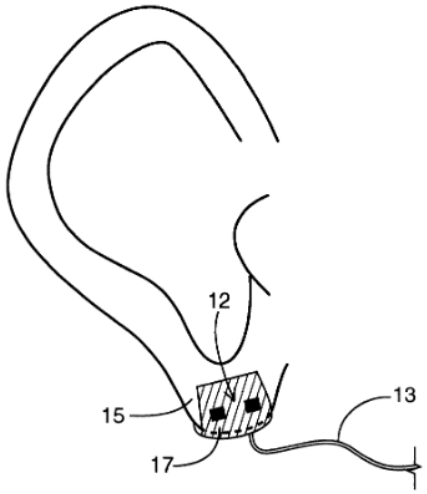 FIG. 6 Goodman, Fig. 6 FIG. 6 shows how PPG sensor 12 could be associated with the user's earlobe 15 instead of the user's finger. As discussed, it is well known that the reflective wave originating in the aorta has a significant presence in the volume pulse contour obtained from a fingertip, ear or other points on the surface of the body. As is conventionally known, the volume pulse signal acquired from the ear lobe, like the finger, is similar to that acquired from the carotid artery. Specifically**, it is contemplated that PPG sensor 12 operating in transmission mode could be implanted in a “clip” device 17 which would provide for skin contact between PPG sensor 12 and a user's earlobe 15.** This embodiment would provide analogous pulse volume signal information from which various cardiovascular and respiratory indices could be obtained, while allowing for hands free functionality. Goodman at 13:59-14:6. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Goodman, it

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	would have been obvious to one of ordinary skill in the art to combine, with the teachings of Goodman, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.

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EXHIBIT F4

U.S. Pat. No. 12,193,790 B2 in view of WO Patent Publication No. 2012099536 to Md. Irwan bin Kassim Md. ("Kassim")

As described in detail below, Kassim (individually or collectively) anticipates and/or renders obvious claim 7 ("Asserted Claim") of U.S. Patent No. 12,193,790 B2 (the "'790 Patent") under 35 U.S.C. §102 and/or §103, either alone in combination with the knowledge of a person of ordinary skill, and/or additional prior art references discussed in discussed in Exhibits F1-F4, the contents of which are hereby incorporated by reference into this chart. One of ordinary skill in the art, as of the priority date of the '790 Patent, would have known to combine the prior art elements disclosed by the foregoing references using known methods, and to use these elements according to their established functions in order to achieve a known and predictable result. This invalidity claim chart is based on Defendants' present understanding of the Asserted Claim and Plaintiff's apparent construction of the Asserted Claim in its Preliminary Infringement Contentions ("Infringement Contentions").

The following invalidity chart includes references to the structure, function, operation, and/or features of the technology described in Kassim. The cited portions of Kassim are merely illustrative, and Defendants reserve the right to rely on alternative or additional evidence, including uncited portions of Kassim. Where a particular figure is cited, the citation should be understood to encompass the caption and description of the figure as well as any text relating to or describing the figure. Conversely, where particular text referring to a figure is cited, the citation should be understood to include the figure as well. Although the documentation collectively evidences prior knowledge, use, or sale, Defendants reserve the right to rely upon individual documents as printed publications. Where the chart below states that Kassim "describes" or "provides for" a limitation, such disclosure may be express, inherent, or implicit. To the extent it is found Kassim does not expressly disclose certain limitations in the Asserted Claim, such limitations are inherent. Defendants reserve the right to present direct evidence of the structure, function, operation, and/or features of the technology described in Kassim (including product samples, source code, and/or witness testimony) and/or its prior art status, and to present alternative or additional documents concerning the same as evidence that the technology described in Kassim anticipates and/or renders obvious the Asserted Claim of the '790 Patent

This chart is subject to all reservations, objections, and disclaimers in Defendants' Invalidity Contentions and any amendment, supplement, or modification thereof, which are incorporated herein by reference in their entirety. Nothing stated herein shall be treated as an admission or suggestion that Defendants agree with Plaintiff regarding the scope of the Asserted Claim, Plaintiff's apparent claim constructions, or the accuracy of any particular claim construction. Defendants reserve all rights to challenge any of the claim terms herein under 35 U.S.C. § 112, including by arguing that they are indefinite, are not supported by the written description, and/or are not enabled. Defendants further reserve all rights to amend this invalidity claim chart without leave of court pursuant to the Court's Docket Control Order, or upon a showing of good cause.

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Claim 7	
7[pre]. An optical system, comprising:	By providing this disclosure, Defendants do not take a position on whether the preamble is limiting. Kassim discloses or renders obvious an optical system. An **optical measurement device** and a method **for optical measurement** are provided. The device comprises an illumination assembly configured to output light to a surface portion of a user for measurement; a detection assembly configured to detect the output light reflected from said surface portion of the user as a signal; an amplifier module coupled to the detection assembly configured to apply a gain to an AC component of the signal; a microcontroller coupled to the detection assembly configured to assess a DC voltage level of the signal; wherein the microcontroller is configured to control the light output at the illumination assembly based on said assessing the DC voltage level; and further wherein the microcontroller is configured to select a gain value for said applying the gain based on said assessing the DC voltage level. Specific embodiments of the device relate to a photoplethysmograph or pulse oximeter. Kassim at Abstract **In accordance with an aspect of the present invention, there is provided an optical measurement device**, the device comprising an illumination assembly configured to output light to a surface portion of a user for measurement; a detection assembly configured to detect the output light reflected from said surface portion of the user as a signal; an amplifier module coupled to the detection assembly configured to apply a gain to an alternating- current component of the signal; a microcontroller coupled to the detection assembly configured to assess a direct-current voltage level of the signal; wherein the microcontroller is configured to control the light output at the illumination assembly based on said assessing the direct-current voltage level; and further wherein the microcontroller is configured to select a gain value for said applying the gain based on said assessing the direct-current voltage level. Kassim at 2:34-3:9 The example embodiments described herein can **provide an optical measurement device and method that can obtain a photoplethysmography (PPG) signal from a user in a low perfusion scenario. The measurements in the example embodiments are non-invasive optical physiological measurements.** In the example embodiments, DC signals can be made available for saturation of peripheral oxygen (SpO2) calculations/measurements. In an example implementation**, an optical measurement device is**

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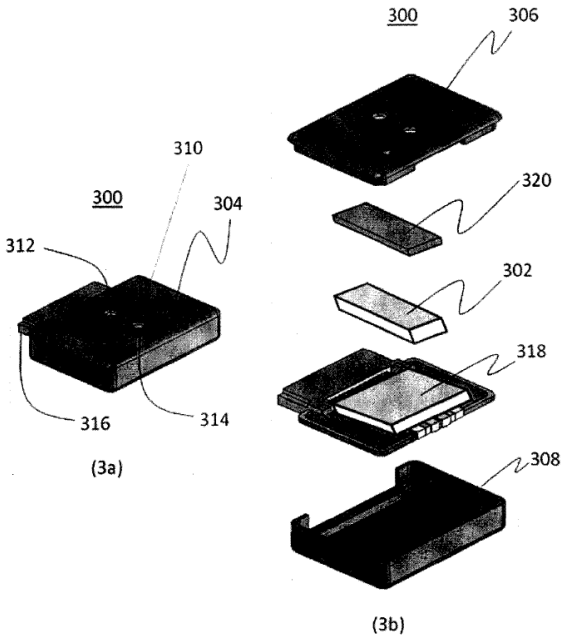
	used for illuminating a surface portion of the user and detecting reflected light from the surface portion. The measurement device can transmit the detected light information to another device, for e.g. a personal mobile processing device, to carry out further processing, e.g. for removal of ambient light interference for SpO2 values determination. Kassim at 8:24-35  Figure 3 Kassim at Fig. 3 Figure 3(a) is a schematic illustration of an **optical measurement device** in an example embodiment. Figure 3(b) shows schematically an exploded view of the **optical measurement device**. Kassim at 11:30-32

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	One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Kassim, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kassim, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[a]. a wearable device for measuring one or more physiological parameters, the wearable device adapted to be placed on a wrist of a user;	Kassim discloses or renders obvious a wearable device for measuring one or more physiological parameters, the wearable device adapted to be placed on a wrist of a user. Optical monitoring of physiological characteristics utilizes the detection of light transmitted through a location of a user being measured. **Photoplethysmography (PPG) is an optical measurement technique used to detect blood volume changes in the microvascular bed of living tissue**, typically by detecting light transmitted through the ear lobe or fingertip. As arterial pulsations enter the capillary bed, changes in the volume of the blood vessels or characteristics of the blood itself modify the optical properties of the capillary bed. **A PPG signal is used to measure saturation of peripheral oxygen (SpO2), which is an estimation of the level of oxygen saturation in a fluid, such as blood. The PPG signal can also be used to measure blood pressure**. Kassim at 1:14-22 The example embodiments described herein can **provide an optical measurement device and method that can obtain a photoplethysmography (PPG) signal from a user in a low perfusion scenario. The measurements in the example embodiments are non-invasive optical physiological measurements.** In the example embodiments, **DC signals can be made available for saturation of peripheral oxygen (SpO2) calculations/measurements**. In an example implementation**, an optical measurement device is used for illuminating a surface portion of the user and detecting reflected light from the surface portion. The measurement device can transmit the detected light information to another device, for e.g. a personal mobile processing device, to carry out further processing, e.g. for removal of ambient light interference for SpO2 values determination.** Kassim at 8:24-35

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	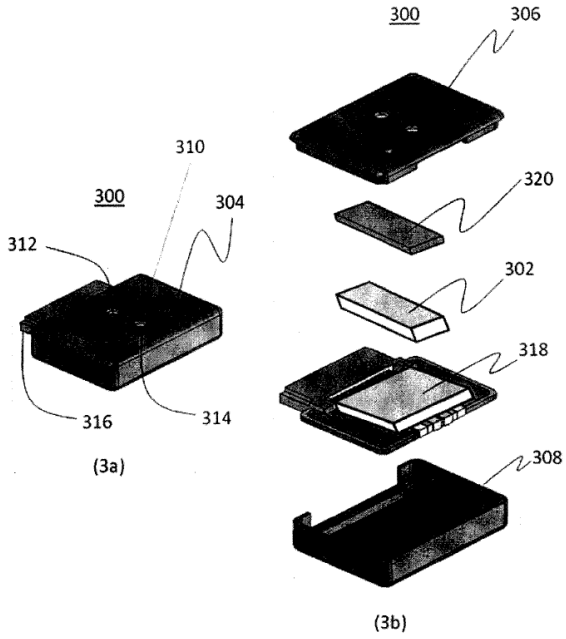 Figure 3 Kassim at Fig. 3 The optical measurement device 300 is a reflectance-based device in the example embodiment. **The optical measurement device 300 comprises an illumination and detection assembly 302 encased in a housing 304**. In the exploded view in Figure 3(b}, the housing 304 is shown divided into a top casing 306 and a base casing 308. The top casing 306 comprises a measurement surface 310, shown schematically with dotted lines. The measurement site/surface 310 is coupled to a light source 312 and one or more light detectors e.g. 314 of the illumination and detection assembly 302. The optical measurement device 300 further comprises a coupling member 316 that can provide coupling between the measurement device 300 to a personal mobile processing device/feedback unit (not shown) in a cableless configuration. The coupling member 316 may be in the form of an interface port such as a universal serial bus (USB) port or the 30 pin connection used in the Apple® iPhone® (Apple Computer, Inc., Cupertino, CA) etc. Kassim at 11:34-12:10

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	In the example embodiment, **the light source 312 can propagate light through a surface portion of a user for measurement, e.g. a portion of living tissue of the user placed at the measurement site. The light detectors e.g. 314 can detect light reflected from the portion of living tissue of the user**. The detected light information at the light detectors e.g. 314 can be transmitted via the coupling member 316 to a personal mobile processing device (not shown), for example, for further processing. Kassim at 12:20-25 In the example embodiment, optionally, a pressure detection assembly 318 may be provided in the optical measurement device 300. **The pressure detection assembly 318 can be configured to detect and transmit to a personal mobile processing device (not shown) an amount of pressure applied by a body part of a user to the measurement device 300 during optical measurement. The pressure information can be used, for example but not limited to, to detect whether a body part has been placed on the measurement device** and/or whether the pressure exerted by a body part is sufficient for accurate readings to be obtained. Kassim at 12:27-33 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Kassim, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kassim, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[b]. the wearable device including a light source comprising a plurality of semiconductor diodes that are configured to generate an output optical light having one or more optical wavelengths, wherein at	Kassim discloses or renders obvious the wearable device including a light source comprising a plurality of semiconductor diodes that are configured to generate an output optical light having one or more optical wavelengths, wherein at least a portion of the one or more optical wavelengths is a near-infrared wavelength between 700 nanometers and 2500 nanometers. An optical measurement device and a method for optical measurement are provided. The device comprises **an illumination assembly configured to output light to a surface portion of a user for measurement**; a detection assembly configured to detect the output light reflected from said surface

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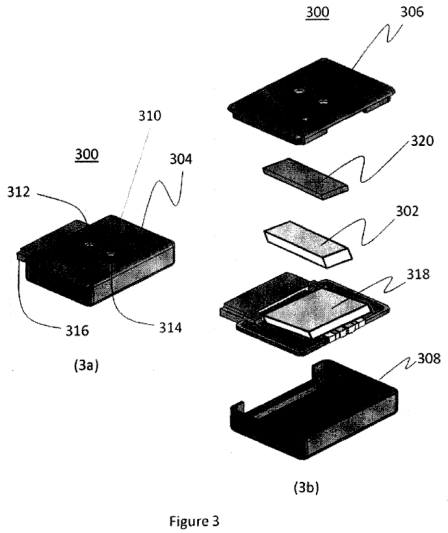
least a portion of the one or more optical wavelengths is a near-infrared wavelength between 700 nanometers and 2500 nanometers;	portion of the user as a signal; an amplifier module coupled to the detection assembly configured to apply a gain to an AC component of the signal; a microcontroller coupled to the detection assembly configured to assess a DC voltage level of the signal; wherein the microcontroller is configured to control the light output at the illumination assembly based on said assessing the DC voltage level; and further wherein the microcontroller is configured to select a gain value for said applying the gain based on said assessing the DC voltage level. Specific embodiments of the device relate to a photoplethysmography or pulse oximeter. Kassim at Abstract  Figure 3 Kassim at Fig. 3 **The optical measurement device 300 is a reflectance-based device in the example embodiment**. **The optical measurement device 300 comprises an illumination and detection assembly 302 encased in a housing 304**. In the exploded view in Figure 3(b}, the housing 304 is shown divided into a top casing 306 and a base casing 308. The top casing 306 comprises a measurement surface 310, shown schematically with dotted lines. **The measurement site/surface 310 is coupled to a light source 312 and one or more light detectors e.g. 314 of the illumination and detection assembly 302.** The optical measurement device 300 further comprises a coupling member 316 that can provide coupling between

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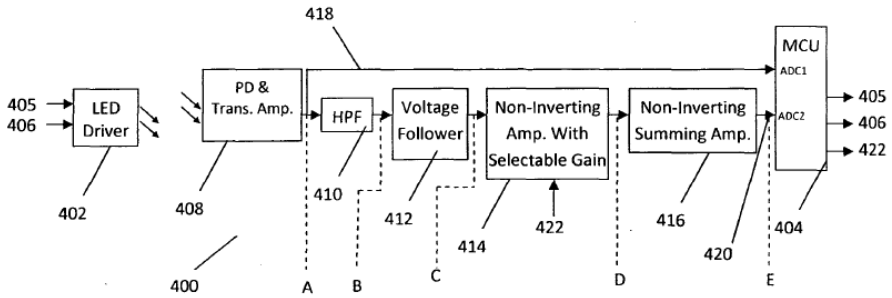
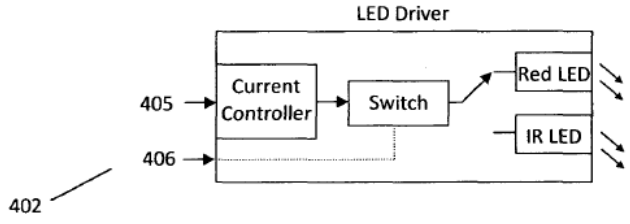
	the measurement device 300 to a personal mobile processing device/feedback unit (not shown) in a cableless configuration. The coupling member 316 may be in the form of an interface port such as a universal serial bus (USB) port or the 30 pin connection used in the Apple® iPhone® (Apple Computer, Inc., Cupertino, CA) etc. Kassim at 11:34-12:10 In the example embodiment, **the light source 312 can propagate light through a surface portion of a user for measurement, e.g. a portion of living tissue of the user placed at the measurement site. The light detectors e.g. 314 can detect light reflected from the portion of living tissue of the user.** The detected light information at the light detectors e.g. 314 can be transmitted via the coupling member 316 to a personal mobile processing device (not shown), for example, for further processing. Kassim at 12:20-25  Figure 4(a) Kassim at Fig. 4a  Figure 4(b)

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	Kassim, Fig. 4b **Figure 4(a) is a schematic block diagram illustrating an optical measurement device 400** in an example embodiment. **Figure 4(b) is a schematic block drawing illustrating an illumination assembly** in an example embodiment. Figure 4(c) is a schematic block drawing illustrating a non-inverting amplifier with selectable gain in an example embodiment. **An illumination assembly 402 is provided for propagating light through a surface portion of a user for measurement. The illumination assembly 402 can comprise one or more light sources e.g. light emitting diodes (LEDs) that can vary in light intensity based on variable resistors and controlled by a microcontroller MCU 404 (see control at numeral 405). In the example embodiment, the MCU 404 may also control the activation of the one or more light sources e.g. Red or IR LED, via the control at numeral 406.** A detection assembly 408 is provided to detect light reflected/transmitted off the surface portion of the user. The detection assembly 408 can comprise a photodetector (PD) coupled to a transimpedance amplifier. Kassim at 13:14-25 Figure 3(c) is a diagram illustrating optical transmission characteristics of optical filtering in an example embodiment. In this example embodiment, **wavelengths of light below about 600nm is filtered out and prevented from reaching the light detectors e.g. 314. This can be effective as the wavelengths of interest are that of e.g. about 600nm and about 940 nm only. Alternatively, filters which target specific wavelengths of interest can be used. For example, filters which, e.g. when used in combination, allow transmission of light from about 600-700nm, and about 900-1000nm can be used. Alternatively, a single filter which allow transmission of light from about 600-1000nm can be used alone.** Kassim at 13:5-12 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Kassim, it would

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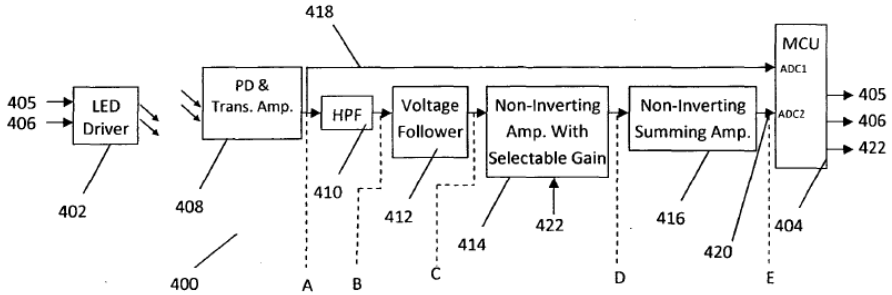
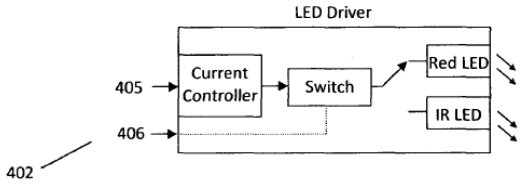
	have been obvious to one of ordinary skill in the art to combine, with the teachings of Kassim, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[c]. the wearable device comprising one or more lenses configured to receive at least a portion of the output optical light and to deliver a lens output light to tissue comprising skin;	Kassim discloses or renders obvious the wearable device comprising one or more lenses configured to receive at least a portion of the output optical light and to deliver a lens output light to tissue comprising skin.  Figure 4(a) Kassim at Fig. 4a  Figure 4(b) Kassim at Fig. 4b **Figure 4(a) is a schematic block diagram illustrating an optical measurement device 400** in an example embodiment. **Figure 4(b) is a schematic block drawing illustrating an illumination assembly** in an example embodiment. Figure 4(c) is a schematic block drawing illustrating a non-inverting amplifier with selectable gain in an example embodiment. **An illumination assembly 402 is provided for propagating light through a surface portion of a user for measurement. The illumination assembly 402 can comprise one or more light sources e.g. light emitting diodes (LEDs) that can vary in light intensity based on variable resistors and controlled by a microcontroller**

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	MCU 404 (see control at numeral 405). In the example embodiment, the MCU 404 may also control the activation of the one or more light sources e.g. Red or IR LED, via the control at numeral 406. A detection assembly 408 is provided to detect light reflected/transmitted off the surface portion of the user. The detection assembly 408 can comprise a photodetector (PD) coupled to a transimpedance amplifier. Kassim at 13:14-25 **Figures 1 and 2 are provided to briefly describe components of a PPG signal. Figure 1 illustrates a graphical representation of a photoplethysmograph (PPG) signal 100, which can generally be divided into two components: an AC component 102 due to the absorption of light in pulsatile arterial blood volume 106; and a DC component 104 caused by the absorption produced by non-pulsatile arterial blood - i.e. venous blood and capillary blood 108, and tissue absorption 110.** Kassim at 9:4-9 In one exemplary embodiment, the feedback unit may be a portable device, such as a mobile phone, smartphone, personal digital assistant (PDA), tablet, netbook or laptop, although this list is not exhaustive by any means. However, the feedback unit may not need to be portable, and could similarly be a computer or server. The feedback unit may be connected with the device 300 in a wired or wireless fashion, or through a proprietary connector, such a universal serial bus (USB) port or the 30 pin connection used in the Apple® iPhone® (Apple Computer, Inc., Cupertino, CA). **In the example embodiment, the light source 312 can propagate light through a surface portion of a user for measurement, e.g. a portion of living tissue of the user placed at the measurement site. The light detectors e.g. 314 can detect light reflected from the portion of living tissue of the user. The detected light information at the light detectors e.g. 314 can be transmitted via the coupling member 316 to a personal mobile processing device (not shown), for example, for further processing.** Kassim at 12:12-19 In the example embodiment, **the light source 312 can propagate light through a surface portion of a user for measurement, e.g. a portion of living tissue of the user placed at the measurement site. The light detectors e.g. 314 can detect light reflected from the portion of living tissue of the user**.

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	The detected light information at the light detectors e.g. 314 can be transmitted via the coupling member 316 to a personal mobile processing device (not shown), for example, for further processing. Kassim at 12:20-25 **A device such as a pulse oximeter provides for measuring enhanced optical pulsatile signals emitted by the changes in the volume of blood flowing through a user**. The pulse oximeter typically has a pair of small light emitting diodes (LEDs) facing a photodiode/ photodetector, with a translucent part of the user's body, usually a fingertip or an earlobe, positioned there between. **The LEDs illuminate the tissue (e.g. skin) of the user** and the photodetector measures small variations in light intensity associated with changes in perfusion in a catchment volume. Kassim at 1:24-30 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Kassim, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kassim, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[d]. the wearable device further comprising a detection system configured to receive at least a portion of the lens output light reflected from the tissue and to generate an output signal having a signal-to-noise ratio, wherein the detection system is configured to be synchronized to the light source;	Kassim discloses or renders obvious the wearable device further comprising a detection system configured to receive at least a portion of the lens output light reflected from the tissue and to generate an output signal having a signal-to-noise ratio, wherein the detection system is configured to be synchronized to the light source. An optical measurement device and a method for optical measurement are provided. The device comprises an illumination assembly configured to output light to a surface portion of a user for measurement; **a detection assembly configured to detect the output light reflected from said surface portion of the user as a signal**; an amplifier module coupled to the detection assembly configured to apply a gain to an AC component of the signal; **a microcontroller coupled to the detection assembly configured to assess a DC voltage level of the signal; wherein the microcontroller is configured to control the light output at the illumination assembly based on said assessing the DC voltage level**; and further wherein the microcontroller is configured to select a gain value for said applying the gain

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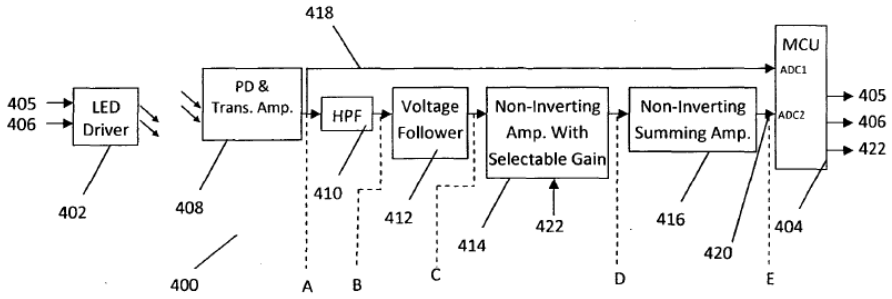
	based on said assessing the DC voltage level. Specific embodiments of the device relate to a photoplethysmography or pulse oximeter. Kassim at Abstract  Figure 4(a) Kassim at Fig. 4a **Figure 4(a) is a schematic block diagram illustrating an optical measurement device 400 in an example embodiment**. Figure 4(b) is a schematic block drawing illustrating an illumination assembly in an example embodiment. Figure 4(c) is a schematic block drawing illustrating a non-inverting amplifier with selectable gain in an example embodiment. **An illumination assembly 402 is provided for propagating light through a surface portion of a user for measurement**. The illumination assembly 402 can comprise one or more light sources e.g. light emitting diodes (LEDs) that can vary in light intensity based on variable resistors and controlled by a microcontroller MCU 404 (see control at numeral 405). In the example embodiment, the MCU 404 may also control the activation of the one or more light sources e.g. Red or IR LED, via the control at numeral 406. **A detection assembly 408 is provided to detect light reflected/transmitted off the surface portion of the user. The detection assembly 408 can comprise a photodetector (PD) coupled to a transimpedance amplifier.** The detection assembly 408 is coupled to a high-pass filter 410 that is in turn coupled to a voltage follower amplifier module 412. The high-pass filter 410 can be implemented using a capacitor and a resistor. The voltage follower amplifier module 412 is coupled to a non-inverting amplifier module 414 that can provide a selectable gain. As shown in Figure 4(c), the gain is selectable between a number of possible gain options, with the selection being controlled by the MCU 404 via the control signal 422. The non-inverting amplifier module 414 is coupled to a non-inverting summing amplifier module 416 that can provide a unity gain.

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	As seen in Figure 4(a), ADC1 418 provides the DC portion of a measured signal and ADC2 420 provides the AC portion of a measured signal. In the example embodiment, t**he LEDs illumination intensity can be adjusted based on feedback at the MCU 404**. The MCU 404 can adjust the respective current (at 405) to the LEDs so as to obtain respective raw PPG signals which are as close as possible in amplitude at point A, and e.g. between about 2-2.5V at the detection assembly 408. In the example embodiment, **the LEDs can comprise a red LED and an infra-red LED. Each LED can be individually adjusted in illumination intensity**. During operation, at **the output of the detection assembly 408, a raw PPG signal** is recorded. **This enables the DC component of the signal to be acquired e.g. for LED illumination intensity adjustment and SpO2 calculation**. The high-pass filter 410 can introduce a filter with a high-pass cut off of e.g. about 0.12 Hz so as to remove the DC component of the raw PPG signal. This can also produce the AC component of the signal, with the AC component oscillating about ground voltage. The output of the high-pass filter 410 is transmitted to the voltage follower amplifier module 412 to create a high impedance signal. The inventors have recognised that without a high impedance, the signal may be lost at the amplification stage subsequently. Kassim at 13:14-14:19 It is appreciated that the detected light information or Vppg signal e.g. to be transmitted to a personal mobile processing device for further processing has a substantial extent of ambient light interference. Therefore**, ambient light or noise cancellation can be performed e.g. at the personal mobile processing device. The description below relating to ambient noise cancellation for SPO2 calculations can be implemented through software and/or hardware modules. The hardware modules can comprise electronic circuitry or dedicated application chips such as an ASIC chip. A graphical user interface (GUI) may be provided, such as an "app" or software application on a smartphone, to be run on the personal mobile processing device to implement and display the ambient noise cancellation**. Kassim at 21:33-22:6

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	In example embodiments, **there can be provided a method and system for noise cancellation, e.g. for SpO2 measurements**. In one example embodiment, AC and DC values are respectively obtained for a Red PPG signal measurement, an IR PPG signal measurement and an ambient PPG signal measurement (where both the red and IR LEDs are turned off). The maximum and minimum values of the PPG signal measurements are determined. A SpO2 value based on a ratio R value calculated using the determined maximum and minimum values can then be determined. Advantageously, in the example embodiment, a signal reconstruction of true Red and/or IR PPG signals to remove ambient signal interference can be avoided. The inventors have recognised that by identifying and utilising only significant information for SpO2 calculation, an efficient and accurate calculation can be carried out. The inventors have recognized that by using only the maximum and minimum values of the respective red, IR and ambient signal pulses, the calculation of SpO2 can be carried out. For example, **a maximum of the true Red PPG signal (devoid of ambient noise) can simply be obtained by subtracting the obtained maximum value of the Red PPG signal, obtained when the Red LED is turned on, with the obtained maximum value of the ambient PPG signal, i.e. when none of the LEDs is turned on**. In other words, instead of reconstructing a true Red PPG signal (devoid of ambient signal) and a true IR PPG signal (devoid of ambient signal), advantageously, reconstruction is avoided in example embodiments, **and only the maximum and minimum values of 3 PPG signals are obtained for analysis to obtain SpO2 value**. This can minimise processing and consume less power. 22:19-23:9 **A feedback unit/personal processing device can be provided for removal of ambient noise signal from an optical measurement** in an example embodiment. The device can comprise a coupling member e.g. for coupling to an optical measurement device. **The coupling member can receive a first signal waveform obtained based on detecting light based on a first light illumination, a second signal waveform obtained based on detecting light based on a second light illumination, and a third signal waveform obtained based on detecting ambient light. The device can also comprise a processor module that can obtain respective maximum and minimum values of at least two of the first, second and third signal waveforms; and the processor can derive signal values of the first and second signal waveforms with the removal of ambient noise by using the maximum and minimum values of at least two of the first, second and third signal waveforms**.

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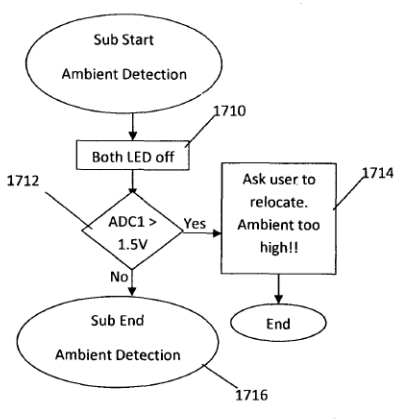
	Kassim at 23:11-21  Figure 17 Kassim at Fig. 17

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	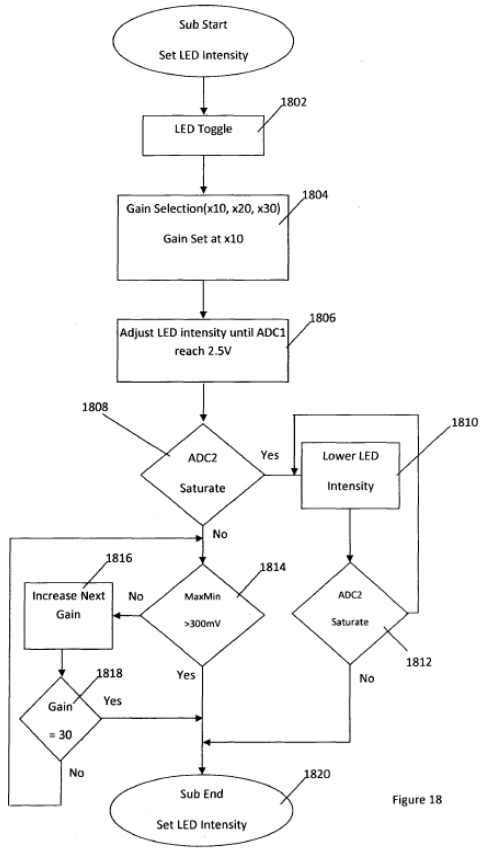 Figure 18 Kassim at Fig. 18 Figure 17 is a schematic flow diagram illustrating an ambient light detection process in an example embodiment. An optical measurement device is coupled to a personal mobile processing device. At step 1710, **both the Red and IR LEDs are switched off. At step 1712, it is determined whether ADC1 of the MCU of the measurement device reads a value of e.g. more than about 1.5V. If the reading is more than the exemplary value of 1.5Vat step 1712, at step 1714, the personal mobile processing device is configured to alert the user to relocate to another location for the optical measurement as the ambient light interference is determined to be too high. If the reading is less than the exemplary value of 1.5V at step 1712, at step 1716, the ambient light detection process ends**.

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	Figure 18 is a schematic flow diagram illustrating a light intensity setting process in an example embodiment. This process can be used for scenarios for normal measurements. At step 1802, a LED toggle sequence is performed. At step 1804, the light data detected at step 1802 undergoes a gain process. The gain may be selected from, for example, ten times, twenty times or thirty times etc. In the example embodiment, a gain of e.g. ten times is selected. **At step 1806, it is determined whether ADC1 of the MCU of the measurement device reads a value of e.g. about 2.5V. The LEDs intensity is adjusted until the reading reaches 2.5V. This can ensure that the contribution of the ambient light is not substantially more than the contribution of the LEDs, when measured by the detector. In this example embodiment, because the ambient light cannot exceed 1.5V, and each LED is adjusted to result in a measurement of about 2.5V, the ambient light does not exceed more than about 60% of the light detected by the detector, when each LED is switched on**. At step 1808, it is determined whether ADC2 of the MCU of the measurement device reaches saturation, e.g. at about 3.3V. If ADC2 has reached saturation, at step 1810, the LEDs intensity is lowered until ADC2 is no longer saturated at step 1812. Kassim at 32:26-33:16 1. An optical measurement device, the device comprising, an illumination assembly configured to output light to a surface portion of a user for s measurement; **a detection assembly configured to detect the output light reflected from said surface portion of the user as a signal;** an amplifier module coupled to the detection assembly configured to apply a gain to an alternating-current component of the signal; **a microcontroller coupled to the detection assembly configured to assess a directcurrent voltage level of the signal;** **wherein the microcontroller is configured to control the light output at the illumination assembly based on said assessing the direct-current voltage level; and** **further wherein the microcontroller is configured to select a gain value for said applying the gain based on said assessing the direct-current voltage level**. Kassim at Claim 1

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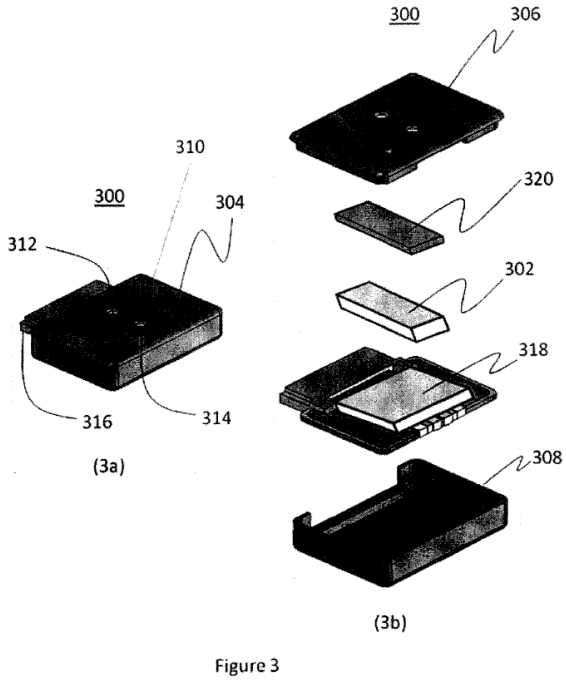
	One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Kassim, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kassim, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[e]. wherein the detection system comprises a plurality of detectors that are spatially separated from each other, and wherein at least one analog to digital converter is coupled to at least one of the plurality of detectors;	Kassim discloses or renders obvious the detection system comprises a plurality of detectors that are spatially separated from each other, and wherein at least one analog to digital converter is coupled to at least one of the plurality of detectors.  Figure 3 Kassim at Fig. 3 The optical measurement device 300 is a reflectance-based device in the example embodiment. **The optical measurement device 300 comprises an illumination and detection assembly 302 encased in a housing 304**. **In the exploded view in Figure 3(b}, the housing 304 is shown divided into a top**

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	casing 306 and a base casing 308. The top casing 306 comprises a measurement surface 310, shown schematically with dotted lines. The measurement site/surface 31 0 is coupled to a light source 312 and one or more light detectors e.g. 314 of the illumination and detection assembly 302. The optical measurement device 300 further comprises a coupling member 316 that can provide coupling between the measurement device 300 to a personal mobile processing device/feedback unit (not shown) in a cableless configuration. The coupling member 316 may be in the form of an interface port such as a universal serial bus (USB) port or the 30 pin connection used in the Apple® iPhone® (Apple Computer, Inc., Cupertino, CA) etc. Kassim at 11:34-12:10 In the example embodiment, the light source 312 can propagate light through a surface portion of a user for measurement, e.g. a portion of living tissue of the user placed at the measurement site. **The light detectors e.g. 314 can detect light reflected from the portion of living tissue of the user. The detected light information at the light detectors e.g. 314 can be transmitted via the coupling member 316 to a personal mobile processing device (not shown), for example, for further processing.** Kassim at 12:20-25 **Figure 5 is a schematic flow graph diagram illustrating signal conditioning for a single detected signal in an example embodiment**. Reference is also made to Figure 4. The signal is detected at the detection assembly 408. **The signal may be either a Red signal or an IR signal detected from a red LED illumination or a IR LED illumination respectively.** The graph at Point A shows the signal with both DC and AC components at the output of the detection assembly 408. It can be seen that the AC component is small from the graph. The graph at Point B shows the signal at the output of the high-pass filter 410 with the DC component of the signal removed and the AC component of the signal being forced to oscillate about ground voltage. The graph at Point C shows the high impedance AC signal at the output of the voltage follower amplifier module 412. The graph at Point D shows the AC signal at the output of the non-inverting amplifier module 414 with a suitable gain provided to the signal. The graph at Point E shows the AC signal at the output of the non-inverting summing amplifier module 416. A DC value of about 1.5V has been added to the AC signal such that the signal is pushed above the ground voltage. **This can advantageously allow the signal to be digitized by the analog-to-digital converter of the microcontroller 404.**

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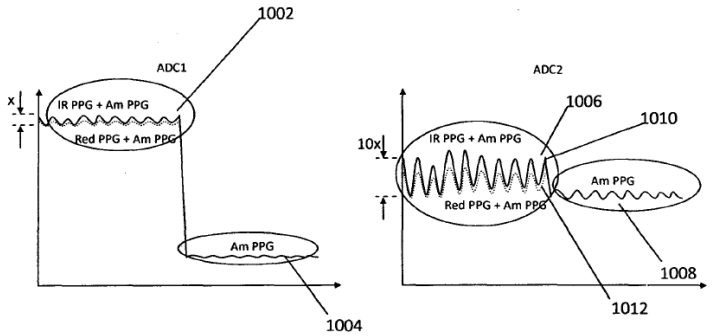
	Kassim at 14:30-15:9  Figure 10 Kassim at Fig. 10 **Figure 10(a) is a graph illustrating signals acquired at an analog to digital converter (compare ADC1 of Figure 4(a)) in an example embodiment**. The y-axis is in terms of mV and the x-axis is in terms of ms. Numeral 002 shows the signals obtained when the Red and IR LEDs are turned on during the toggling sequence 606 (Figure 6(a)). Numeral 1004 shows the signals obtained when the Red and IR LEDs are turned off during the OFF condition 602 (Figure 6(a)). As shown, the amplitude of the signals obtained during the toggling sequence 606 (Figure 6) is notated as x'. **Figure 10(b) is a graph illustrating AC signals acquired at an analog to digital converter (compare ADC2 of Figure 4(a)) in an example embodiment**. The y-axis is in terms of mV and the x-axis is in terms of ms. Numeral 1006 shows the AC signals when the Red and IR LEDs are turned on during the toggling sequence 606 (Figure 6(a)). Numeral 1008 shows the AC signals when the Red and IR LEDs are turned off during the OFF condition 602 (Figure 6(a)). The IR signals are shown with solid lines at 1010 and the Red signals are shown with dotted lines at 1012. With the amplification provided in Figure 4(a), as shown, the difference between the Red and IR detected AC signals is notated as 10x', i.e. a gain of about 10 times has been provided. Kassim at 23:31-24:4

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	One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Kassim, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kassim, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[f]. wherein the output signal is indicative of the one or more of the physiological parameters;	Kassim discloses or renders obvious the output signal is indicative of the one or more of the physiological parameters. Optical monitoring of physiological characteristics utilizes the detection of light transmitted through a location of a user being measured. **Photoplethysmography (PPG) is an optical measurement technique used to detect blood volume changes in the microvascular bed of living tissue**, typically by detecting light transmitted through the ear lobe or fingertip. As arterial pulsations enter the capillary bed, changes in the volume of the blood vessels or characteristics of the blood itself modify the optical properties of the capillary bed. **A PPG signal is used to measure saturation of peripheral oxygen (SpO2), which is an estimation of the level of oxygen saturation in a fluid, such as blood. The PPG signal can also be used to measure blood pressure**. Kassim at 1:14-22 The example embodiments described herein can provide an **optical measurement device and method that can obtain a photoplethysmography (PPG) signal from a user in a low perfusion scenario. The measurements in the example embodiments are non-invasive optical physiological measurements. In the example embodiments, DC signals can be made available for saturation of peripheral oxygen (SpO2) calculations/measurements.** Kassim at 8:24-29 In an example implementation, **an optical measurement device is used for illuminating a surface portion of the user and detecting reflected light from the surface portion. The measurement device can transmit the detected light information to another device, for e.g. a personal mobile processing**

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	device, to carry out further processing, e.g. for removal of ambient light interference for SpO2 values determination. Kassim at 8:30-35 **In some example embodiments, saturation of peripheral oxygen (SPO2) information of a user is derivable from detected output light information from both a red LED and an infra-red LED**. Further, in the description herein, the term "light" as used herein is meant to be interpreted in a broad sense and is not limited to visible light only. The term "light" as used herein can include, but is not limited to, X-ray light rays, visible light rays, ultraviolet light rays and infra-red light rays. Figure 3(a) is a schematic illustration of an optical measurement device in an example embodiment. Figure 3(b) shows schematically an exploded view of the optical measurement device. Kassim at 11:23-28 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Kassim, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kassim, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[g]. the wearable device configured to increase the signal-to-noise ratio by increasing light intensity of at least one of the plurality of semiconductor diodes from an initial light intensity; and	Kassim discloses or renders obvious the wearable device configured to increase the signal-to-noise ratio by increasing light intensity of at least one of the plurality of semiconductor diodes from an initial light intensity. With the AC and DC signal portions, the inventors have recognised that significant information can be further extracted for SpO2 calculation. Using the circuit of Figure4(a), it can be seen from Figures 1 0(a) and (b) that the AC and DC components of the Red and IR PPG signals are larger than those of the ambient PPG signal. Therefore, the contribution of the ambient PPG signal is less significant compared with the contribution of the RED or IR PPG signals. This can provide for a more accurate SpO2 calculation. That is, in example embodiments**, the LED illumination intensity can be tuned to a level that provides for detected signals that provide as high a detected voltage as possible, without saturating the signals. The intensity can be controlled by the MCU. The tuning can ensure that**

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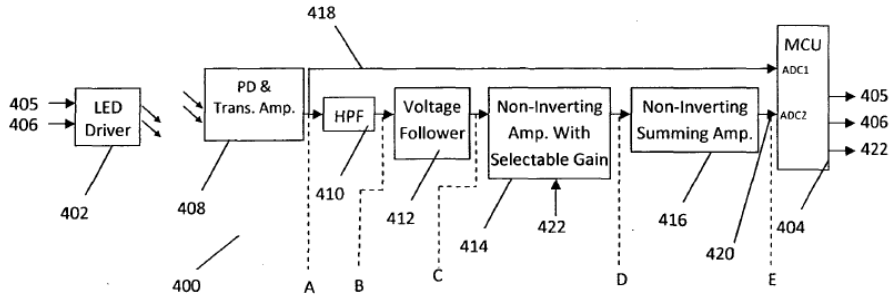
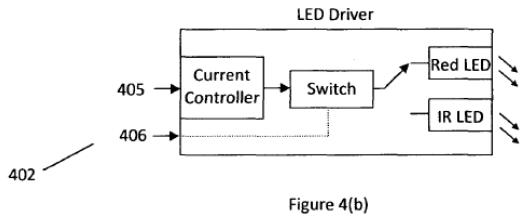
	both Red and IR signals transmitted to ADC1 can reach an amplitude level significantly higher than Ambient signals transmitted to ADC1. For example, **if an Ambient signal at ADC1 is about 0.5V, both Red and IR signals at ADC1 can preferably be set at about 2V or above**. This is described and illustrated in more detail below with Figure 18. In addition, there can be steps taken to ensure that detected Ambient light signals are not too high. Exemplary steps are described and illustrated in more detail below with Figure 17. Kassim at 24:14-29  Figure 4(a) Kassim at Fig. 4a  Figure 4(b) Kassim at Fig. 4b Figure 4(a) is a schematic block diagram illustrating an optical measurement device400 in an example embodiment. Figure 4(b) is a schematic block drawing illustrating an illumination assembly in an example embodiment. Figure 4(c) is a schematic block drawing illustrating a non-inverting amplifier with selectable gain in an example embodiment. An illumination assembly 402 is provided for

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	propagating light through a surface portion of a user for measurement. **The illumination assembly 402 can comprise one or more light sources e.g. light emitting diodes (LEDs) that can vary in light intensity based on variable resistors and controlled by a microcontroller MCU 404 (see control at numeral 405).** In the example embodiment, the MCU 404 may also control the activation of the one or more light sources e.g. Red or IR LED, via the control at numeral 406. A detection assembly 408 is provided to detect light reflected/transmitted off the surface portion of the user. Kassim at 13:14-24 In the example embodiment, **the LEDs illumination intensity can be adjusted based on feedback at the MCU 404**. The MCU 404 can adjust the respective current (at 405) to the LEDs so as to obtain respective raw PPG signals which are as close as possible in amplitude at point A, and e.g. between about 2-2.5V at the detection assembly 408. In the example embodiment, the LEDs can comprise a red LED and an infra-red LED. **Each LED can be individually adjusted in illumination intensity**. During operation, at the output of the detection assembly 408, a raw PPG signal is recorded. This enables the DC component of the signal to be acquired e.g. for LED illumination intensity adjustment and SpO2 calculation. The high-pass filter 410 can introduce a filter with a high-pass cut off of e.g. about 0.12 Hz so as to remove the DC component of the raw PPG signal. This can also produce the AC component of the signal, with the AC component oscillating about ground voltage. The output of the high-pass filter 410 is transmitted to the voltage follower amplifier module 412 to create a high impedance signal. The inventors have recognised that without a high impedance, the signal may be lost at the amplification stage subsequently. Kassim at 14:11-19 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Kassim, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kassim, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.

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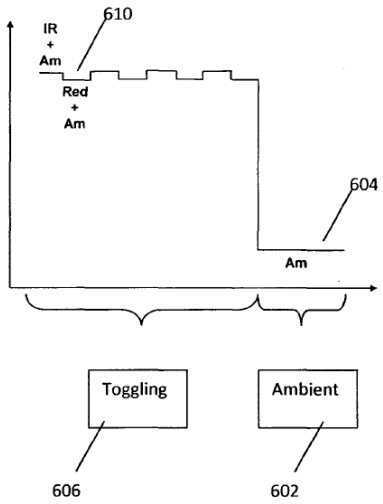
7[h]. the detection system further configured to: generate a first signal responsive to light received while the semiconductor diodes are off,	Kassim discloses or renders obvious the detection system further configured to: generate a first signal responsive to light received while the semiconductor diodes are off.  Figure 6(a) Kassim at Fig. 6(a) Figure 6(a) is a schematic graphical illustration of **output obtained at a light detector (compare 408 of Figure 4) during a light emitting diode (LED) firing sequence in an example embodiment. During an Ambient (Am) or OFF condition 602, both the IR and RED LEDs are turned off, and an ambient PPG signal 604 can be obtained.** During a toggling sequence 606, the IR and RED LEDs are alternatingly turned on. The MCU can then perform time based de-multiplexing to extract the respective IR and RED PPG signals. Kassim at 15:16-21

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	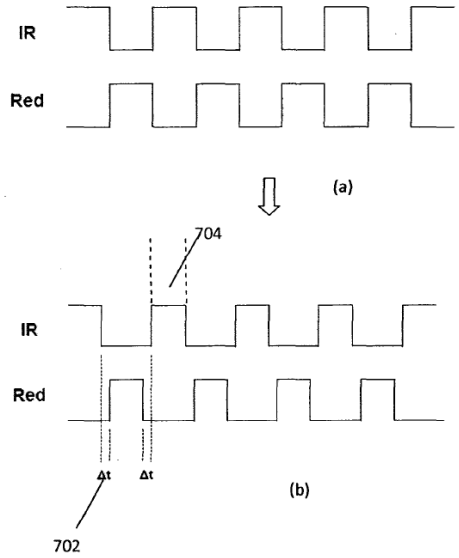 Kassim at Fig. 7 Figure 7(a) is an exemplary schematic timing wave diagram for toggling on/off of an IR LED and a Red LED. Figure 7(b) is an alternative schematic timing wave diagram for toggling on/off of an IR LED and a Red LED in an example embodiment. Figure 7(b) is a modification of Figure 7(a) to allow an ambient PPG signal to be obtained. Figure 7(b) also illustrates a toggling sequence within sequence 606 of Figure 6. **There is a relatively brief period ~t 702 between each toggling, e.g. about 100µs, when both the Red and IR LEDs are turned off.** Each LED is turned on for about 2.9ms e.g. numeral 704, which makes each toggling cycle to be about 6ms. This can improve the IR and Red PPG signals accuracy. The brief period ~t 702 allows a time break between switching from a Red and IR signal condition (or vice versa). This may be useful to a single path system whereby detection of the red and IR signals are performed using the same circuitry, i.e. a single path system. The brief period ~t 702 introduced can ensure that each detected Red and IR light information displays its own behavior. The inventors have recognised that if there is no break e.g. provided by period ~t 702, the light signal of the previously switched on LED may still be present in the processing path. That is, using the brief period can reduce "crosstalk" issues. Kassim at 16:1-15

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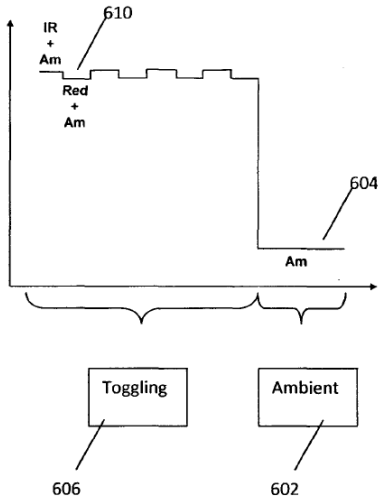
	One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Kassim, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kassim, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[i]. generate a second signal responsive to light received while at least one of the semiconductor diodes is on, and	Kassim discloses or renders obvious the detection system further configured to: generate a second signal responsive to light received while at least one of the semiconductor diodes is on.  Figure 6(a) Kassim at Fig. 6(a) Figure 6(a) is a schematic graphical illustration of output obtained at a light detector (compare 408 of Figure 4) during a light emitting diode (LED) firing sequence in an example embodiment. During an Ambient (Am) or OFF condition 602, both the IR and RED LEDs are turned off, and an ambient PPG

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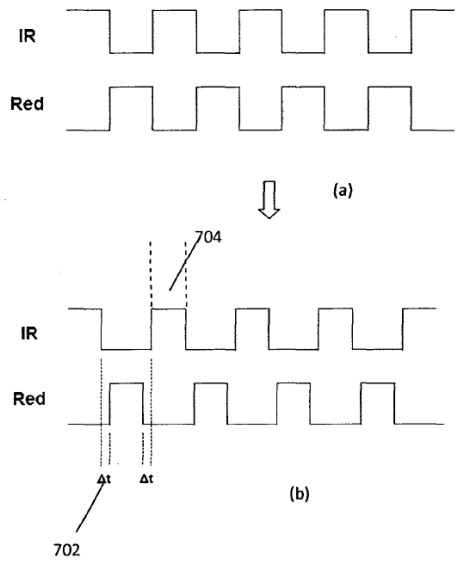
	signal 604 can be obtained. **During a toggling sequence 606, the IR and RED LEDs are alternatingly turned on. The MCU can then perform time based de-multiplexing to extract the respective IR and RED PPG signals.** Kassim at 15:16-21  Kassim at Fig. 7 Figure 7(a) is an exemplary schematic timing wave diagram for toggling on/off of an IR LED and a Red LED. Figure 7(b) is an alternative schematic timing wave diagram for toggling on/off of an IR LED and a Red LED in an example embodiment. Figure 7(b) is a modification of Figure 7(a) to allow an ambient PPG signal to be obtained. Figure 7(b) also illustrates a toggling sequence within sequence 606 of Figure 6. There is a relatively brief period ~t 702 between each toggling, e.g. about 1 00μs, when both the Red and IR LEDs are turned off**. Each LED is turned on for about 2.9ms e.g. numeral 704, which makes each toggling cycle to be about 6ms. This can improve the IR and Red PPG signals accuracy.** The brief period ~t 702 allows a time break between switching from a Red and IR signal condition (or vice versa). This may be useful to a single path system whereby detection of the red and IR signals are performed using the same circuitry, i.e. a single path system. The brief period ~t 702 introduced can

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	ensure that each detected Red and IR light information displays its own behavior. The inventors have recognised that if there is no break e.g. provided by period ~t 702, the light signal of the previously switched on LED may still be present in the processing path. That is, using the brief period can reduce "crosstalk" issues. Kassim at 16:1-15 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant's Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Kassim, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kassim, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[j]. increase the signal-to-noise ratio by comparing the first signal and the second signal; and	Kassim discloses or renders obvious the detection system further configured to: increase the signal-to-noise ratio by comparing the first signal and the second signal. With the AC and DC signal portions, the inventors have recognised that significant information can be further extracted for SpO2 calculation. Using the circuit of Figure4(a), it can be seen from Figures 1 0(a) and (b) that the AC and DC components of the Red and IR PPG signals are larger than those of the ambient PPG signal. Therefore, the contribution of the ambient PPG signal is less significant compared with the contribution of the RED or IR PPG signals. This can provide for a more accurate SpO2 calculation. That is, in example embodiments**, the LED illumination intensity can be tuned to a level that provides for detected signals that provide as high a detected voltage as possible, without saturating the signals. The intensity can be controlled by the MCU. The tuning can ensure that both Red and IR signals transmitted to ADC1 can reach an amplitude level significantly higher than Ambient signals transmitted to ADC1.** For example, if an Ambient signal at ADC1 is about 0.5V, both Red and IR signals at ADC1 can preferably be set at about 2V or above. This is described and illustrated in more detail below with Figure 18. In addition, there can be steps taken to ensure that detected Ambient light signals are not too high. Exemplary steps are described and illustrated in more detail below with Figure 17. Kassim at 24:14-29

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	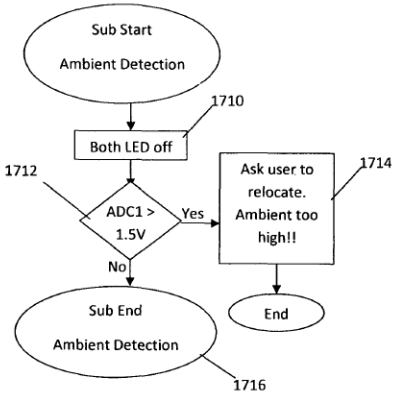 Figure 17 Kassim at Fig. 17

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	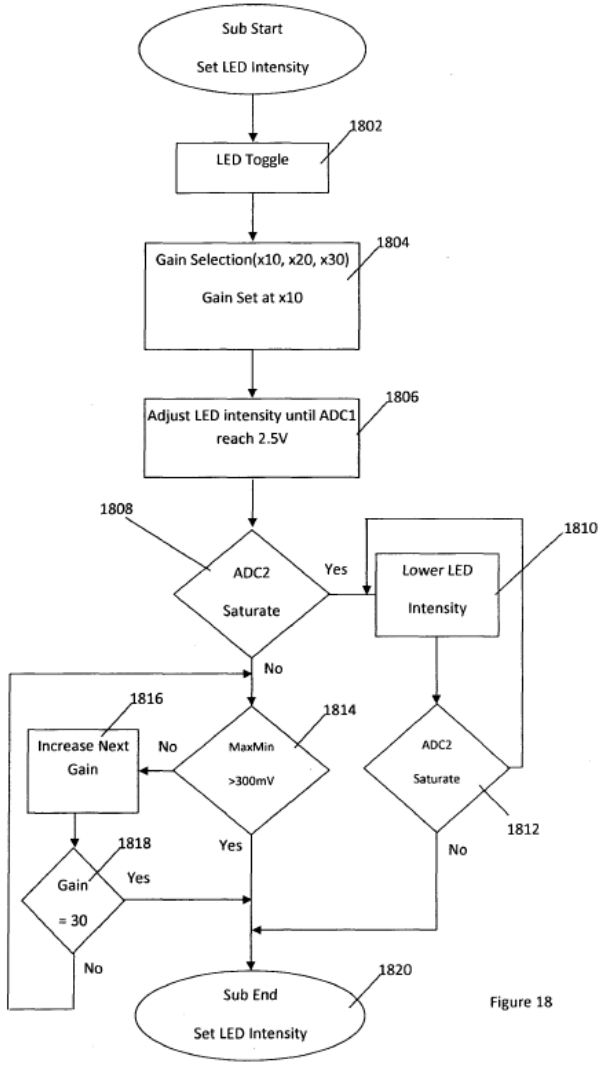 Figure 18 Kassim at Fig. 18 **Figure 17 is a schematic flow diagram illustrating an ambient light detection process in an example embodiment. An optical measurement device is coupled to a personal mobile processing device. At step 1710, both the Red and IR LEDs are switched off. At step 1712, it is determined whether**

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	ADC1 of the MCU of the measurement device reads a value of e.g. more than about 1.5V. If the reading is more than the exemplary value of 1.5V at step 1712, at step 1714, the personal mobile processing device is configured to alert the user to relocate to another location for the optical measurement as the ambient light interference is determined to be too high. If the reading is less than the exemplary value of 1.5V at step 1712, at step 1716, the ambient light detection process ends. **Figure 18 is a schematic flow diagram illustrating a light intensity setting process in an example embodiment. This process can be used for scenarios for normal measurements. At step 1802, a LED toggle sequence is performed. At step 1804, the light data detected at step 1802 undergoes a gain process. The gain may be selected from, for example, ten times, twenty times or thirty times etc. In the example embodiment, a gain of e.g. ten times is selected. At step 1806, it is determined whether ADC1 of the MCU of the measurement device reads a value of e.g. about 2.5V. The LEDs intensity is adjusted until the reading reaches 2.5V. This can ensure that the contribution of the ambient light is not substantially more than the contribution of the LEDs, when measured by the detector. In this example embodiment, because the ambient light cannot exceed 1.5V, and each LED is adjusted to result in a measurement of about 2.5V, the ambient light does not exceed more than about 60% of the light detected by the detector, when each LED is switched on. At step 1808, it is determined whether ADC2 of the MCU of the measurement device reaches saturation, e.g. at about 3.3V. If ADC2 has reached saturation, at step 1810, the LEDs intensity is lowered until ADC2 is no longer saturated at step 1812.** **If ADC2 has not reached saturation at step 1808, at step 1814, it is determined whether the maximum and minimum data points have a difference of more than e.g. about 300mV. If the difference at step 1814 is not more than e.g. about 300mV, at step 1816, the gain can be increased. At step 1818, it is determined whether the gain is thirty times. If the gain is thirty times, the LED intensity is set and the setting process is ended at step 1820. If the gain is not yet thirty times at step 1818, the process loops back to step 1814.** Kassim at 32:27-33:23 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references

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	identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Kassim, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kassim, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[k]. wherein the wearable device is at least in part configured to identify an object.	Kassim discloses or renders obvious the wearable device is at least in part configured to identify an object. Optical monitoring of physiological characteristics utilizes the detection of light transmitted through a location of a user being measured. **Photoplethysmography (PPG) is an optical measurement technique used to detect blood volume changes in the microvascular bed of living tissue,** typically by detecting light transmitted through the ear lobe or fingertip. **As arterial pulsations enter the capillary bed, changes in the volume of the blood vessels or characteristics of the blood itself modify the optical properties of the capillary bed. A PPG signal is used to measure saturation of peripheral oxygen (SpO2), which is an estimation of the level of oxygen saturation in a fluid, such as blood. The PPG signal can also be used to measure blood pressure**. Kassim at 1:14-22 The example embodiments described herein can **provide an optical measurement device and method that can obtain a photoplethysmography (PPG) signal from a user in a low perfusion scenario. The measurements in the example embodiments are non-invasive optical physiological measurements.** In the example embodiments, DC signals can be made available for saturation of peripheral oxygen (SpO2) calculations/measurements. In an example implementation**, an optical measurement device is used for illuminating a surface portion of the user and detecting reflected light from the surface portion. The measurement device can transmit the detected light information to another device, for e.g. a personal mobile processing device, to carry out further processing, e.g. for removal of ambient light interference for SpO2 values determination.** Kassim at 8:24-35

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	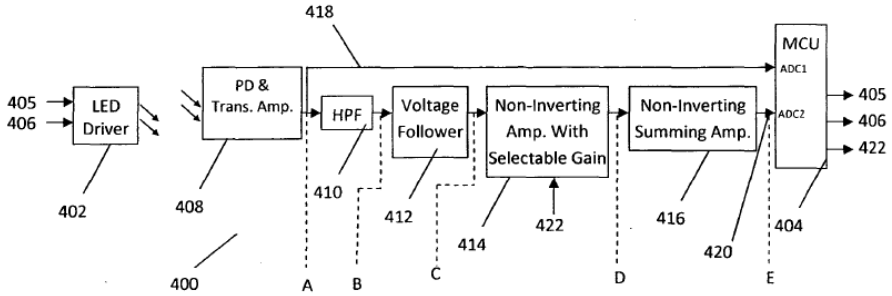 Figure 4(a) Kassim at Fig. 4a Figure 4(a) is a schematic block diagram illustrating an optical measurement device 400 in an example embodiment. Figure 4(b) is a schematic block drawing illustrating an illumination assembly in an example embodiment. Figure 4(c) is a schematic block drawing illustrating a non-inverting amplifier with selectable gain in an example embodiment. **An illumination assembly 402 is provided for propagating light through a surface portion of a user for measurement. The illumination assembly 402 can comprise one or more light sources e.g. light emitting diodes (LEDs) that can vary in light intensity based on variable resistors and controlled by a microcontroller MCU 404 (see control at numeral 405). In the example embodiment, the MCU 404 may also control the activation of the one or more light sources e.g. Red or IR LED, via the control at numeral 406.** A detection assembly 408 is provided to detect light reflected/transmitted off the surface portion of the user. The detection assembly 408 can comprise a photodetector (PD) coupled to a transimpedance amplifier. Kassim at 13:14-25 In the example embodiment, **the light source 312 can propagate light through a surface portion of a user for measurement, e.g. a portion of living tissue of the user placed at the measurement site. The light detectors e.g. 314 can detect light reflected from the portion of living tissue of the user**. The detected light information at the light detectors e.g. 314 can be transmitted via the coupling member 316 to a personal mobile processing device (not shown), for example, for further processing. Kassim at 12:20-25

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	In the example embodiment, optionally, a pressure detection assembly **318** may be provided in the optical measurement device **300**. **The pressure detection assembly 318 can be configured to detect and transmit to a personal mobile processing device (not shown) an amount of pressure applied by a body part of a user to the measurement device 300 during optical measurement. The pressure information can be used, for example but not limited to, to detect whether a body part has been placed on the measurement device** and/or whether the pressure exerted by a body part is sufficient for accurate readings to be obtained. Kassim at 12:27-33 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Kassim, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kassim, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.

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EXHIBIT F5

U.S. Pat. No. 12,193,790 B2 in view of US Patent No. 9,095,291 to Babs R. Soller ("Soller")

As described in detail below, Soller (individually or collectively) anticipates and/or renders obvious claim 7 ("Asserted Claim") of U.S. Patent No. 12,193,790 B2 (the "'790 Patent") under 35 U.S.C. §102 and/or §103, either alone in combination with the knowledge of a person of ordinary skill, and/or additional prior art references discussed in discussed in Exhibits F1-F14, the contents of which are hereby incorporated by reference into this chart. One of ordinary skill in the art, as of the priority date of the '790 Patent, would have known to combine the prior art elements disclosed by the foregoing references using known methods, and to use these elements according to their established functions in order to achieve a known and predictable result. This invalidity claim chart is based on Defendants' present understanding of the Asserted Claim and Plaintiff's apparent construction of the Asserted Claim in its Preliminary Infringement Contentions ("Infringement Contentions").

The following invalidity chart includes references to the structure, function, operation, and/or features of the technology described in Soller. The cited portions of Soller are merely illustrative, and Defendants reserve the right to rely on alternative or additional evidence, including uncited portions of Soller. Where a particular figure is cited, the citation should be understood to encompass the caption and description of the figure as well as any text relating to or describing the figure. Conversely, where particular text referring to a figure is cited, the citation should be understood to include the figure as well. Although the documentation collectively evidences prior knowledge, use, or sale, Defendants reserve the right to rely upon individual documents as printed publications. Where the chart below states that Soller "describes" or "provides for" a limitation, such disclosure may be express, inherent, or implicit. To the extent it is found Soller does not expressly disclose certain limitations in the Asserted Claim, such limitations are inherent. Defendants reserve the right to present direct evidence of the structure, function, operation, and/or features of the technology described in Soller (including product samples, source code, and/or witness testimony) and/or its prior art status, and to present alternative or additional documents concerning the same as evidence that the technology described in Soller anticipates and/or renders obvious the Asserted Claim of the '790 Patent.

This chart is subject to all reservations, objections, and disclaimers in Defendants' Invalidity Contentions and any amendment, supplement, or modification thereof, which are incorporated herein by reference in their entirety. Nothing stated herein shall be treated as an admission or suggestion that Defendants agree with Plaintiff regarding the scope of the Asserted Claim, Plaintiff's apparent claim constructions, or the accuracy of any particular claim construction. Defendants reserve all rights to challenge any of the claim terms herein under 35 U.S.C. § 112, including by arguing that they are indefinite, are not supported by the written description, and/or are not enabled. Defendants further reserve all rights to amend this invalidity claim chart without leave of court pursuant to the Court's Docket Control Order, or upon a showing of good cause.

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Claim 7	
7[pre]. An optical system, comprising:	By providing this disclosure, Defendants do not take a position on whether the preamble is limiting. Soller discloses or renders obvious an optical system. Disclosed herein are sensors that include: (a) a circuit board that includes an electronic processor; (b) a plurality of radiation sources, each source being attached to the circuit board; and (c) a spectral detector attached to the circuit board, the spectral detector being configured to analyze radiation derived from one or more of the plurality of radiation sources. During use, the sensors are configured to be worn on a portion of a body of a subject. The electronic processor is configured to cause two or more of the plurality of radiation sources to direct incident radiation to the subject, to cause the spectral detector to analyze radiation from the subject, and to determine one or more properties of the subject based on the radiation from the subject. Methods of making and using these sensors are also disclosed. Soller at Abstract Disclosed herein are sensors and associated methods for determining properties of samples including, in particular, human subjects. **The sensors are typically, but not exclusively, configured to measure near-infrared absorbance or reflectance spectra from the samples, and to calculate one or more sample parameters based on the absorbance or reflectance spectra.** The sensors are relatively small, and can include a circuit board upon which are mounted all sensor components. As a result, the sensors are particularly amenable to prolonged wear by a human subject, even during periods of relatively high physical stress. Soller at 13:11-21 FIGS. lA and 1B are schematic diagrams showing bottom and top surfaces, respectively, of a sensor 10. **Sensor 10 includes a spectral detector 12, two short-distance radiation sources 14a and 14b, and six long-distance radiation sources l6a, l6b, 16c, 16d, 16e, and 16/ Detector 12 and radiation sources 14a-band 16a:f aremounted to circuit board 18.** Each of short-distance radiation sources 14a and 14b can include one or more packages, and each package can include one or more elements that produce illumination radiation. Similarly, each oflong-distance radiation sources 16a:f can include one or more packages, and each package can include one or more elements that produce illumination radiation.

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	Soller at 13:22-33 In general, a variety of different collimating elements 56 can be used in sensor 10. **Exemplary collimating elements include fiber faceplates (e.g., fiber optic windows), collimating hole devices, gradient index (GRIN) lenses, fiber bundles, lens arrays, optical windows (including shaped optical windows), and other similar devices**. Sensor 10 typically includes a plurality of radiation sources. **In some embodiments, some or all of the radiation sources include light emitting diodes (LEDs). Some (or all) of the radiation sources of sensor 10 can provide relatively broad bandwidth incident radiation for illuminating sample 30.** To provide such radiation, the radiation sources can include one or more LEDs. For example, in certain embodiments, some radiation sources can include a single broadband LED. In some embodiments, certain radiation sources can include multiple LEDs. The multiple LEDs can each emit radiation having different central wavelengths and/or spectral bandwidths. In some embodiments, some of the multiple LEDs can emit radiation having the same central wavelength and/or bandwidth. Soller at 18:37-56 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Soller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Soller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[a]. a wearable device for measuring one or more physiological parameters, the wearable device adapted to be placed on a wrist of a user;	Soller discloses or renders obvious a wearable device for measuring one or more physiological parameters, the wearable device adapted to be placed on a wrist of a user. Disclosed herein are sensors that include: (a) a circuit board that includes an electronic processor; (b) a plurality of radiation sources, each source being attached to the circuit board; and (c) a spectral detector attached to the circuit board, the spectral detector being configured to analyze radiation derived from one or more of the plurality of radiation sources. During use, the sensors are configured to be worn on a portion of a body of a subject. The electronic processor is configured to cause two or more of the plurality of radiation sources to direct incident radiation to the subject, to cause the spectral detector to analyze

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	radiation from the subject, and to determine one or more properties of the subject based on the radiation from the subject. Methods of making and using these sensors are also disclosed. Soller at Abstract Disclosed herein are sensors and associated methods for determining properties of samples including, in particular, human subjects. **The sensors are typically, but not exclusively, configured to measure near-infrared absorbance or reflectance spectra from the samples, and to calculate one or more sample parameters based on the absorbance or reflectance spectra.** The sensors are relatively small, and can include a circuit board upon which are mounted all sensor components. **As a result, the sensors are particularly amenable to prolonged wear by a human subject, even during periods of relatively high physical stress.** Soller at 13:11-21 Data can also be transmitted to one or more display devices that can be used by medical personnel, athletic trainers, a subject wearing sensor 10, and other personnel to observe the analyzed data. Typically, **data which is transmitted to display devices includes one or more parameters derived from absorbance spectra of a sample. Data which is transmitted to net works and/or storage devices can include one or more calculated parameters and can also include, for example, measured absorbance spectra and sensor calibration and/or configuration information.** Soller at 27:62-28:4 **FIG. 2 shows a schematic diagram of sensor 10 mounted on a sample 30. Sample 30 includes one or more layers of skin 32, a subcutaneous layer of fat 34, and underlying muscle tissue 36. Sensor 10 is configured to interrogate muscle tissue 36 by directing radiation 38, generated by at least one (e.g., all) of radiation sources l4a-b and at least one of the radiation sources l6a-f, to be incident on muscle tissue 36.** Scattered radiation 40 is received and analyzed by detector 12 (not shown) to determine a spectrum of the scattered radiation. The scattered radiation spectrum is then processed by electronic processor 20 and/or processor 22 (not shown) to determine an absorbance spectrum of muscle tissue 36. Based on the absorbance spectrum, electronic processor 20 and/or 22 can determine one or more properties of sample 30 (and in particular, of muscle tissue 36 within sample 30).

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	Soller at 15:21-35 The rabbit spectra were obtained directly from muscle tissue, while in this study, the muscle spectra were obtained by illuminating the muscle tissue through layers of skin and fat, and correcting the measured spectra to reduce or eliminate contributions from the skin and fat layers prior to model development. **This further suggests that the sensors disclosed herein can be used to obtain accurate estimates of a wide variety of physiological parameters, including parameters that are relatively sensitive to the optical arrangement used to measure the reflectance spectra**. Soller at 55:12-21 FIGS. lA and 1B are schematic diagrams showing bottom and top surfaces, respectively, of a sensor 10. **Sensor 10 includes a spectral detector 12, two short-distance radiation sources 14a and 14b, and six long-distance radiation sources l6a, l6b, 16c, 16d, 16e, and 16/ Detector 12 and radiation sources 14a-band 16a:f aremounted to circuit board 18.** Each of short-distance radiation sources 14a and 14b can include one or more packages, and each package can include one or more elements that produce illumination radiation. Similarly, each oflong-distance radiation sources 16a:f can include one or more packages, and each package can include one or more elements that produce illumination radiation. Soller at 13:22-33

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	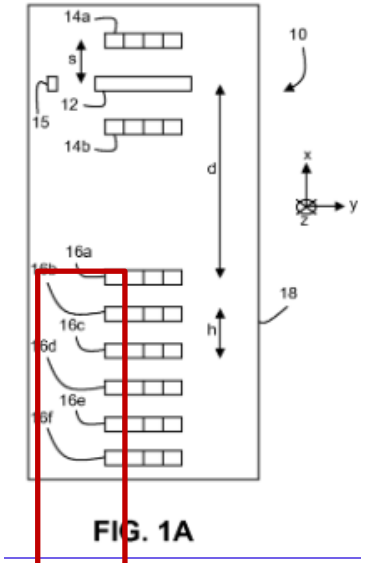 FIG. 1A Soller at Fig. 1A In addition to converting scattered radiation information into absorbance and/or reflectance spectra, processor 20 and/or 22 can be configured (e.g., using calibration equations and/or data stored in memory units, magnetic storage units, and/or optical storage units) to analyze absorbance spectra to obtain measurements of physiologically important parameters for sample 30. In general, processor 20 and/or 22 can be configured to perform any of the analysis steps that are discussed herein. Soller at 15:51-59 In general, a variety of different collimating elements 56 can be used in sensor 10. **Exemplary collimating elements include fiber faceplates (e.g., fiber optic windows), collimating hole devices, gradient index (GRIN) lenses, fiber bundles, lens arrays, optical windows (including shaped optical windows), and other similar devices**. Sensor 10 typically includes a plurality of radiation sources. **In some embodiments, some or all of the radiation sources include light emitting diodes (LEDs). Some (or all) of the radiation sources of sensor 10 can provide relatively broad bandwidth incident radiation for illuminating sample 30.** To provide such radiation, the radiation sources can include one or more LEDs. For example, in certain embodiments, some radiation sources can include a single broadband LED. In some embodiments, certain radiation sources can include multiple LEDs. The

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	multiple LEDs can each emit radiation having different central wavelengths and/or spectral bandwidths. In some embodiments, some of the multiple LEDs can emit radiation having the same central wavelength and/or bandwidth. Soller at 18:37-56 **Sensor 10 can be configured to transmit and receive data over both wireless and wired communication interfaces to a variety of external devices. For example, data can be transmitted to external processing devices such as computers, personal digital assistants, cellular telephones and/or smartphones, and other dedicated processing devices. Data can also be transmitted to storage units, including flash drives, and magnetic and/or optical storage devices. Storage devices can also be portable storage devices that can be worn by a subject, for example (e.g., around the waist of a subject), or embedded in a subject's clothing (e.g., a chip-based storage device embedded in a shoe of the subject).** Further, data can be transmitted to devices over one or more networks, including private networks, public networks, local and/or wide area networks, mobile telephone and/or data networks, and the internet. Soller at 27:46-61

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	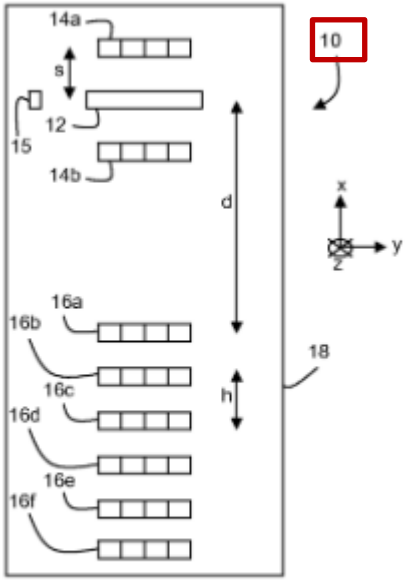 FIG. 1A Soller at Fig. 1A **In step 208, one or more sample parameters are calculated by processor 20 based on the corrected long-distance spectral data. As discussed previously, calculated parameters can include one or more of oxygen saturation, oxygen tension, pH, hematocrit, hemoglobin concentration, anaerobic threshold, water content, and oxygen consumption of the sample. The measured data and/or calculated parameters can be stored in one or more storage units and/or transmitted to one or more external devices or networks in step 210.** If display 24 is present (or if another display is linked to sensor 10), the display can be updated with newly measured and/or calculated values. As discussed previously, trend information—including previously-measured values of the one or more parameters—can be displayed on display 24 for a user-selectable time window. Trend information can be updated on display 24 as additional values of the one or more parameters are measured by the sensor. Soller at 36:63-37:12

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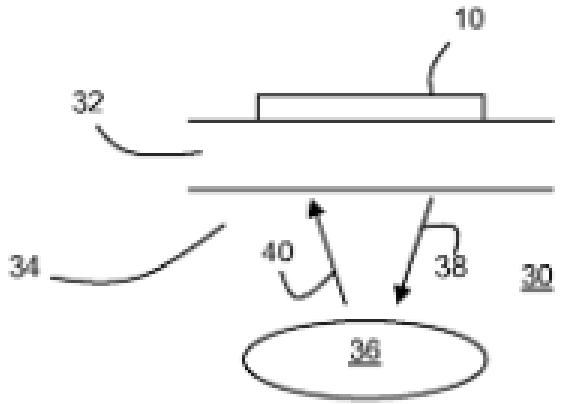
	FIG. 2 shows a schematic diagram of sensor 10 mounted on a sample 30. Sample 30 includes one or more layers of skin 32, a subcutaneous layer of fat 34, and underlying muscle tissue 36. Sensor 10 is configured to interrogate muscle tissue 36 by directing radiation 38, generated by at least one (e.g., all) of radiation sources l4a-b and at least one of the radiation sources l6a-f, to be incident on muscle tissue 36. Scattered radiation 40 is received and analyzed by detector 12 (not shown) to determine a spectrum of the scattered radiation. The scattered radiation spectrum is then processed by electronic processor 20 and/or processor 22 (not shown) to determine an absorbance spectrum of muscle tissue 36. Based on the absorbance spectrum, electronic processor 20 and/or 22 can determine one or more properties of sample 30 (and in particular, of muscle tissue 36 within sample 30). Soller at 15:21-35  FIG. 2 Soller at Fig. 2 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the

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	art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Soller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Soller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[b]. the wearable device including a light source comprising a plurality of semiconductor diodes that are configured to generate an output optical light having one or more optical wavelengths, wherein at least a portion of the one or more optical wavelengths is a near-infrared wavelength between 700 nanometers and 2500 nanometers;	Soller discloses or renders obvious the wearable device including a light source comprising a plurality of semiconductor diodes that are configured to generate an output optical light having one or more optical wavelengths, wherein at least a portion of the one or more optical wavelengths is a near-infrared wavelength between 700 nanometers and 2500 nanometers. In general, a variety of different collimating elements 56 can be used in sensor 10. **Exemplary collimating elements include fiber faceplates (e.g., fiber optic windows), collimating hole devices, gradient index (GRIN) lenses, fiber bundles, lens arrays, optical windows (including shaped optical windows), and other similar devices**. Sensor 10 typically includes a plurality of radiation sources. **In some embodiments, some or all of the radiation sources include light emitting diodes (LEDs). Some (or all) of the radiation sources of sensor 10 can provide relatively broad bandwidth incident radiation for illuminating sample 30.** To provide such radiation, the radiation sources can include one or more LEDs. For example, in certain embodiments, some radiation sources can include a single broadband LED. In some embodiments, certain radiation sources can include multiple LEDs. The multiple LEDs can each emit radiation having different central wavelengths and/or spectral bandwidths. In some embodiments, some of the multiple LEDs can emit radiation having the same central wavelength and/or bandwidth. Soller at 18:37-56 **Sensor 10 typically includes a plurality of radiation sources. In some embodiments, some or all of the radiation sources include light emitting diodes (LEDs). Some (or all) of the radiation sources of sensor 10 can provide relatively broad bandwidth incident radiation for illuminating sample 30. To provide such radiation, the radiation sources can include one or more LEDs**. For example, in certain embodiments, some radiation sources can include a single broadband LED. In some embodiments, certain radiation sources can include multiple LEDs. The multiple LEDs can each emit radiation having different central wavelengths and/or spectral bandwidths. In some embodiments, some of the multiple LEDs can emit radiation having the same central wavelength and/or bandwidth.

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	Soller at 18:43-56 **Typically, for example, each radiation source of sensor 10 emits radiation that includes multiple radiation wavelengths**. In some embodiments, **a FWHM spectral bandwidth of the emitted radiation from each source is 10 nm or more** (e.g., 15 nm or more, 20 nm or more, 50 nm or more, 100 nm or more, 200 nm or more, 300 nm or more, 400 nm or more, 500 nm or more, **700 nm or more**). The usable range of the radiation emitted by each source can be determined by a transmission range of detector 12. In certain embodiments, for example, **detector 12 includes a LVF with a transmission range of from 600 nm to 1100 nm. The usable range of the emitted radiation can also depend, in some embodiments, on the spectral response of a detector coupled to the wavelength dispersive element in detector 12**. **For example, photodiode arrays, CCD arrays, and CMOS arrays that are formed of silicon typically have a usable spectral response that reaches an upper limit at about 1100 nm.** Detectors formed of other materials can be used to measure sample responses at even longer wavelengths. Soller at 20:59-21:10 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant's Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Soller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Soller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[c]. the wearable device comprising one or more lenses configured to receive at least a portion of the output optical light and to deliver a lens output light to tissue comprising skin;	Soller discloses or renders obvious the wearable device comprising one or more lenses configured to receive at least a portion of the output optical light and to deliver a lens output light to tissue comprising skin. **FIG. 2 shows a schematic diagram of sensor 10 mounted on a sample 30. Sample 30 includes one or more layers of skin 32, a subcutaneous layer of fat 34, and underlying muscle tissue 36. Sensor 10 is configured to interrogate muscle tissue 36 by directing radiation 38, generated by at least one (e.g., all) of radiation sources l4a-b and at least one of the radiation sources l6a-f, to be incident on muscle tissue 36.** Scattered radiation 40 is received and analyzed by detector 12 (not shown) to determine a spectrum of the scattered radiation. The scattered radiation spectrum is then processed by electronic

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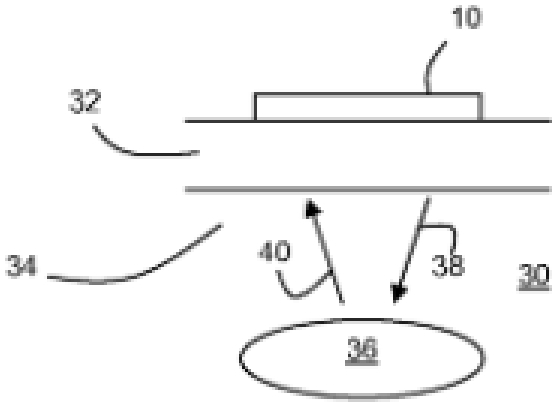
	processor 20 and/or processor 22 (not shown) to determine an absorbance spectrum of muscle tissue 36. Based on the absorbance spectrum, electronic processor 20 and/or 22 can determine one or more properties of sample 30 (and in particular, of muscle tissue 36 within sample 30). Soller at 15:21-35  **FIG. 2** Soller at Fig. 2 In general, a variety of different collimating elements 56 can be used in sensor 10. **Exemplary collimating elements include fiber faceplates (e.g., fiber optic windows), collimating hole devices, gradient index (GRIN) lenses, fiber bundles, lens arrays, optical windows (including shaped optical windows), and other similar devices**. Sensor 10 typically includes a plurality of radiation sources. **In some embodiments, some or all of the radiation sources include light emitting diodes (LEDs). Some (or all) of the radiation sources of sensor 10 can provide relatively broad bandwidth incident radiation for illuminating sample 30.** To provide such radiation, the radiation sources can include one or more LEDs. For example, in certain embodiments, some radiation sources can include a single broadband LED. In some embodiments, certain radiation sources can include multiple LEDs. The

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	multiple LEDs can each emit radiation having different central wavelengths and/or spectral bandwidths. In some embodiments, some of the multiple LEDs can emit radiation having the same central wavelength and/or bandwidth. Soller at 18:37-56 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Soller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Soller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[d]. the wearable device further comprising a detection system configured to receive at least a portion of the lens output light reflected from the tissue and to generate an output signal having a signal-to-noise ratio, wherein the detection system is configured to be synchronized to the light source;	Soller discloses or renders obvious the wearable device further comprising a detection system configured to receive at least a portion of the lens output light reflected from the tissue and to generate an output signal having a signal-to-noise ratio, wherein the detection system is configured to be synchronized to the light source. In general, a variety of different collimating elements 56 can be used in sensor 10. **Exemplary collimating elements include fiber faceplates (e.g., fiber optic windows), collimating hole devices, gradient index (GRIN) lenses, fiber bundles, lens arrays, optical windows (including shaped optical windows), and other similar devices**. Sensor 10 typically includes a plurality of radiation sources. In some embodiments, some or all of the radiation sources include light emitting diodes (LEDs). Some (or all) of the radiation sources of sensor 10 can provide relatively broad bandwidth incident radiation for illuminating sample 30. To provide such radiation, the radiation sources can include one or more LEDs. For example, in certain embodiments, some radiation sources can include a single broadband LED. In some embodiments, certain radiation sources can include multiple LEDs. The multiple LEDs can each emit radiation having different central wavelengths and/or spectral bandwidths. In some embodiments, some of the multiple LEDs can emit radiation having the same central wavelength and/or bandwidth. Soller at 18:37-56 Sensor 10 also includes a plurality of long-distance sources 16 a-f. In some embodiments, as shown in FIG. 1A, sensor 10 includes six long-distance sources 16 a-f. The depth to which incident radiation from

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	a particular radiation source penetrates a sample and generates detected scattered radiation from a tissue of interest therein is generally related to a linear distance between the radiation source and the detector. Each of the long-distance sources of sensor 10 therefore generally corresponds to interrogation of the sample to a certain depth below the sample surface. Typically**, an appropriate long-distance source is selected to illuminate muscle tissue 36 in sample 30 by selecting a long-distance source that produces radiation that can penetrate through overlying layers to sufficiently illuminate muscle tissue 36 below the surface of sample 30 so that reflected light from the muscle can be adequately measured by detector 12**. Sensor 10 can, in general, include any number of long-distance sources to enable measurement of tissues at a variety of depths below the surface of a sample. In certain embodiments, for example, sensor 10 can include one or more long-distance sources (e.g., two or more long-distance sources, three or more long-distance sources, four or more long-distance sources, five or more long-distance sources, seven or more long-distance sources, nine or more long-distance sources, or even more long-distance sources). All of the long-distance sources can be positioned at different distances measured along the x-direction from detector 12, as shown in FIG. 1A, or at least some of the sources can be positioned at the same distance from detector 12. Soller at 21:63-22:24 As discussed previously, **sensor 10 typically includes a plurality of long-distance radiation sources, each of which corresponds to interrogation of tissues (e.g., muscle tissue 36) at a different depth below a surface of sample 30.** Prior to use, sensor 10 is typically calibrated (e.g., by performing a standardization check routine) relative to a standard, and then attached to a sample (such as a portion of a subject's body) and activated for use. Sensor 10 is typically configured, in an initial measurement step, to select an appropriate long-distance radiation source for sample illumination. Soller at 28:16-25 As a further example, in some embodiments, the sample (e.g., sample 30) can include moieties that absorb incident radiation at one or more well-known wavelengths. **To enhance a signal-to-noise ratio in measured scattered radiation (and even, to enable measurement of scattered radiation at the wavelengths of absorption), the emission intensities of certain radiation emitters can be increased and/or decreased relative to other radiation emitters.** In particular, emission intensities of radiation emitters that emit radiation that falls within absorption bands can be increased relative to emission

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	intensities of other emitters (or the intensities of the other emitters can be decreased relative to the emission intensities of the emitters that emit within the absorption bands). Soller at 20:46-58 The number and positions of detectors in FIG. 34 can generally be selected as desired. **Any number of detectors can be positioned on the bottom surface of sensor 10, in analogous fashion to the placement of radiation sources in the 15 embodiments shown in FIGS. 31-33. Detectors 23a-f can generally have a wide variety of shapes, including circular, annular, rectangular, square, and other regular and/or irregular shapes.** The numbers, positions, and shapes of detectors 23a-f are chosen to be consistent with the functionality of sensor 10 disclosed herein.Soller at 40:11-20 **When some or all of the radiation sources of sensor 10 include multiple radiation emitting elements, electronic processor 20 can be configured to adjust the radiation emitting elements to control the properties of the output radiation produced by the multiple elements**. In particular, for example, when certain radiation sources of sensor 10 include multiple LEDs, **processor 20 can control the emitted radiation intensity from each of the individual LEDs to control the overall distribution of radiation produced by the sources**. Control of the emitted radiation intensity can be achieved, for example, through a digital-to-analog converter (DAC) which converts a digital control signal from processor 20 and/or 22 into an analog control voltage applied to a given radiation source element. With a DAC of suitable resolution (e.g., 14-bit), relatively fine control over emission intensities of individual LEDs can be achieved, and continuous-wave emission can be implemented. Soller at 19:42-58 As another example, in some embodiments, **the sensitivity of detector 12 to incident radiation can vary as a function of the wavelength of the radiation**. Accordingly, **the spectral profile of the illumination radiation can be selected to reduce or remove spectral features in measured scattered radiation spectra that arise from such variations in detector sensitivity**. As above, **selecting the spectral profile of the illumination radiation can include increasing and/or decreasing emitted radiation intensity from certain radiation emitters relative to other radiation emitters under the control of processor 20 and/or 22**. Soller at 20:35-45

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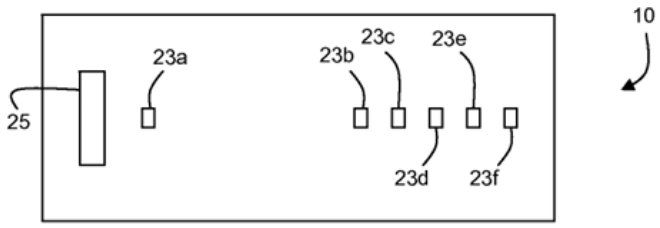
	One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Soller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Soller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[e]. wherein the detection system comprises a plurality of detectors that are spatially separated from each other, and wherein at least one analog to digital converter is coupled to at least one of the plurality of detectors;	Soller discloses or renders obvious wherein the detection system comprises a plurality of detectors that are spatially separated from each other, and wherein at least one analog to digital converter is coupled to at least one of the plurality of detectors. In a further aspect, the invention features sensors that include: (a) a circuit board including at least one electronic processor; (b) a radiation source attached to the circuit board; (c) and a plurality of spectral detectors attached to the circuit board, each spectral detector being configured to analyze radiation derived from the radiation source. The electronic processor(s) can be configured to cause the radiation source to direct incident radiation to a sample, to cause two or more of the plurality of spectral detectors to analyze radiation scattered from the sample, and to determine one or more properties of the sample based on the scattered radiation. Soller at 3:16-27  FIG. 34 Soller at Fig. 34

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	The number and positions of detectors in FIG. 34 can generally be selected as desired. **Any number of detectors can be positioned on the bottom surface of sensor 10, in analogous fashion to the placement of radiation sources in the 15 embodiments shown in FIGS. 31-33. Detectors 23a-f can generally have a wide variety of shapes, including circular, annular, rectangular, square, and other regular and/or irregular shapes.** The numbers, positions, and shapes of detectors 23a-f are chosen to be consistent with the functionality of sensor 10 disclosed herein. Soller at 40:11-20 In general, **the scattered radiation spectrum measured by detector 12, which typically includes wavelength-dependent information about scattered radiation from sample 30, can be converted by an electronic processor to an absorbance spectrum of muscle tissue 36 using well-known methods**. Soller at 15:36-40 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Soller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Soller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[f]. wherein the output signal is indicative of the one or more of the physiological parameters;	Soller discloses or renders obvious wherein the output signal is indicative of the one or more of the physiological parameters. In general, **the scattered radiation spectrum measured by detector 12, which typically includes wavelength-dependent information about scattered radiation from sample 30, can be converted by an electronic processor to an absorbance spectrum of muscle tissue 36 using well-known methods**. Soller at 15:36-40 In addition to converting scattered radiation information into absorbance and/or reflectance spectra, **processor 20 and/or 22 can be configured (e.g., using calibration equations and/or data stored in memory units, magnetic storage units, and/or optical storage units) to analyze absorbance spectra**

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	to obtain measurements of physiologically important parameters for sample 30. In general, processor 20 and/or 22 can be configured to perform any of the analysis steps that are discussed herein. Soller at 15:51-59 Following selection of a suitable long-distance radiation source (or sources), measurement of spectral data from the sample and calculation of one or more parameters from the spectral data can begin. **FIG. 11 shows a flow chart 200 that includes a series of measurement steps. In first step 202, the short-distance radiation sources are activated and a shortdistance absorbance spectrum of the sample is determined, as discussed in connection with step 106 of FIG. 10. Then, in step 204, the selected long-distance radiation source is activated and a long-distance absorbance spectrum of the sample is determined in a marmer similar to step 108 of FIG. 10. In step 206, the long-distance spectrum is corrected to reduce spectral effects due to skin and fat layers by orthogonalizing the long-distance spectral data against spectral components derived from the short-distance spectrum, in accordance with step 110 of FIG. 10.** Soller at 36:47-63 In step 208, one or more sample parameters are calculated by processor 20 based on the corrected long-distance spectral data. As discussed previously**, calculated parameters can include one or more of oxygen saturation, oxygen tension, pH, hematocrit, hemoglobin concentration, anaerobic threshold, water content, and oxygen consumption of the sample.** The measured data and/or calculated parameters can be stored in one or more storage units and/or transmitted to one or more external devices or networks in step 210. If display 24 is present (or if another display is linked to sensor 10), the display can be updated with newly measured and/or calculated values. As discussed previously, trend informationincluding previously-measured values of the one or more parameters-can be displayed on display 24 for a user-selectable time window. Trend information can be updated on display 24 as additional values of the one or more parameters are measured by the sensor. Soller at 36:63-37:12 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the

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	art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant's Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Soller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Soller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[g]. the wearable device configured to increase the signal-to-noise ratio by increasing light intensity of at least one of the plurality of semiconductor diodes from an initial light intensity; and	Soller discloses or renders obvious the wearable device configured to increase the signal-to-noise ratio by increasing light intensity of at least one of the plurality of semiconductor diodes from an initial light intensity. As a further example, in some embodiments, **the sample (e.g., sample 30) can include moieties that absorb incident radiation at one or more well-known wavelengths. To enhance a signal-to-noise ratio in measured scattered radiation (and even, to enable measurement of scattered radiation at the wavelengths of absorption), the emission intensities of certain radiation emitters can be increased and/or decreased relative to other radiation emitters. In particular, emission intensities of radiation emitters that emit radiation that falls within absorption bands can be increased relative to emission intensities of other emitters (or the intensities of the other emitters can be decreased relative to the emission intensities of the emitters that emit within the absorption bands).** Soller at 20:46-58 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant's Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Soller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Soller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[h]. the detection system further configured to: generate a first signal responsive to light received while the semiconductor diodes are off,	Soller discloses or renders obvious the detection system further configured to: generate a first signal responsive to light received while the semiconductor diodes are off. Alternatively, in some embodiments, direct digital control of individual LEDs can be achieved via pulse width modulation (PWM) of the LEDs by processor 20 and/or 22**. Pulse width modulation provides a modulated (e.g., pulsed) LED output. Under PWM control, the integrated intensity of LED output**

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	over a selected temporal window is controlled, from a maximum value (always on) to zero (always off), as defined by the duty cycle of the modulated signal. Emission intensities between these limits are realized by high frequency pulsing of the LEDs by processor 20 and/or 22. By controlling the rate at which pulses are emitted by the LEDs, the duty cycle of the LEDs can be adjusted. For example, to reduce the emission intensity of a particular LED from its maximum value to a half-maximum value, the duty cycle of the LED is reduced to 50%. Soller at 20:35-45 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Soller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Soller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[i]. generate a second signal responsive to light received while at least one of the semiconductor diodes is on, and	Soller discloses or renders obvious the detection system further configured to: generate a second signal responsive to light received while at least one of the semiconductor diodes is on. Alternatively, in some embodiments, direct digital control of individual LEDs can be achieved via pulse width modulation (PWM) of the LEDs by processor 20 and/or 22**. Pulse width modulation provides a modulated (e.g., pulsed) LED output. Under PWM control, the integrated intensity of LED output over a selected temporal window is controlled, from a maximum value (always on) to zero (always off), as defined by the duty cycle of the modulated signal.** Emission intensities between these limits are realized by high frequency pulsing of the LEDs by processor 20 and/or 22. By controlling the rate at which pulses are emitted by the LEDs, the duty cycle of the LEDs can be adjusted. For example, to reduce the emission intensity of a particular LED from its maximum value to a half-maximum value, the duty cycle of the LED is reduced to 50%. Soller at 20:35-45 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references

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	identified in Defendant's Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Soller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Soller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[j]. increase the signal-to-noise ratio by comparing the first signal and the second signal; and	Soller discloses or renders obvious the detection system further configured to: increase the signal-to-noise ratio by comparing the first signal and the second signal. Alternatively, in some embodiments, direct digital control of individual LEDs can be achieved via pulse width modulation (PWM) of the LEDs by processor 20 and/or 22**.** Pulse width modulation provides a modulated (e.g., pulsed) LED output. Under PWM control, the integrated intensity of LED output over a selected temporal window is controlled, from a maximum value (always on) to zero (always off), as defined by the duty cycle of the modulated signal. Emission intensities between these limits are realized by high frequency puls ing of the LEDs by processor 20 and/or 22. **By controlling the rate at which pulses are emitted by the LEDs, the duty cycle of the LEDs can be adjusted.** For example, to reduce the emission intensity of a particular LED from its maximum value to a half-maximum value, the duty cycle of the LED is reduced to 50%. Soller at 20:35-45 As another example, in some embodiments, **the sensitivity of detector 12 to incident radiation can vary as a function of the wavelength of the radiation. Accordingly, the spectral profile of the illumination radiation can be selected to reduce or remove spectral features in measured scattered radiation spectra that arise from such variations in detector sensitivity. As above, selecting the spectral profile of the illumination radiation can include increasing and/or decreasing emitted radiation intensity from certain radiation emitters relative to other radiation emitters under the control of processor 20 and/or 22**. As a further example, **in some embodiments, the sample (e.g., sample 30) can include moieties that absorb incident radiation at one or more well-known wavelengths. To enhance a signal-to-noise ratio in measured scattered radiation (and even, to enable measurement of scattered radiation at the wavelengths of absorption), the emission intensities of certain radiation emitters can be increased and/or decreased relative to other radiation emitters**. In particular, emission intensities of radiation emitters that emit radiation that falls within absorption bands can be increased relative to

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	emission intensities of other emitters (or the intensities of the other emitters can be decreased relative to the emission intensities of the emitters that emit within the absorption bands). Soller at 20:35-58 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Soller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Soller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[k]. wherein the wearable device is at least in part configured to identify an object.	Soller discloses or renders obvious wherein the wearable device is at least in part configured to identify an object. Disclosed herein are sensors and associated methods for determining properties of samples including, in particular, human subjects. **The sensors are typically, but not exclusively, configured to measure near-infrared absorbance or reflectance spectra from the samples, and to calculate one or more sample parameters based on the absorbance or reflectance spectra.** The sensors are relatively small, and can include a circuit board upon which are mounted all sensor components. **As a result, the sensors are particularly amenable to prolonged wear by a human subject, even during periods of relatively high physical stress.** Soller at 13:11-21 **FIG. 2 shows a schematic diagram of sensor 10 mounted on a sample 30. Sample 30 includes one or more layers of skin 32, a subcutaneous layer of fat 34, and underlying muscle tissue 36. Sensor 10 is configured to interrogate muscle tissue 36 by directing radiation 38, generated by at least one (e.g., all) of radiation sources l4a-b and at least one of the radiation sources l6a-f, to be incident on muscle tissue 36.** Scattered radiation 40 is received and analyzed by detector 12 (not shown) to determine a spectrum of the scattered radiation. The scattered radiation spectrum is then processed by electronic processor 20 and/or processor 22 (not shown) to determine an absorbance spectrum of muscle tissue 36.

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	Based on the absorbance spectrum, electronic processor 20 and/or 22 can determine one or more properties of sample 30 (and in particular, of muscle tissue 36 within sample 30). Soller at 15:21-35 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Soller, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Soller, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.

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EXHIBIT F6

U.S. Pat. No. 12,193,790 B2 in view of US Patent No. 11,638,532 to Jeroen Poeze ("Poeze")

As described in detail below, Poeze (individually or collectively) anticipates and/or renders obvious claim 7 ("Asserted Claim") of U.S. Patent No. 12,193,790 B2 (the "'790 Patent") under 35 U.S.C. §102 and/or §103, either alone in combination with the knowledge of a person of ordinary skill, and/or additional prior art references discussed in discussed in Exhibits F1-F14, the contents of which are hereby incorporated by reference into this chart. One of ordinary skill in the art, as of the priority date of the '790 Patent, would have known to combine the prior art elements disclosed by the foregoing references using known methods, and to use these elements according to their established functions in order to achieve a known and predictable result. This invalidity claim chart is based on Defendants' present understanding of the Asserted Claim and Plaintiff's apparent construction of the Asserted Claim in its Preliminary Infringement Contentions ("Infringement Contentions").

The following invalidity chart includes references to the structure, function, operation, and/or features of the technology described in Poeze. The cited portions of Poeze are merely illustrative, and Defendants reserve the right to rely on alternative or additional evidence, including uncited portions of Poeze. Where a particular figure is cited, the citation should be understood to encompass the caption and description of the figure as well as any text relating to or describing the figure. Conversely, where particular text referring to a figure is cited, the citation should be understood to include the figure as well. Although the documentation collectively evidences prior knowledge, use, or sale, Defendants reserve the right to rely upon individual documents as printed publications. Where the chart below states that Poeze "describes" or "provides for" a limitation, such disclosure may be express, inherent, or implicit. To the extent it is found Poeze does not expressly disclose certain limitations in the Asserted Claim, such limitations are inherent. Defendants reserve the right to present direct evidence of the structure, function, operation, and/or features of the technology described in Poeze (including product samples, source code, and/or witness testimony) and/or its prior art status, and to present alternative or additional documents concerning the same as evidence that the technology described in Poeze anticipates and/or renders obvious the Asserted Claim of the '790 Patent

This chart is subject to all reservations, objections, and disclaimers in Defendants' Invalidity Contentions and any amendment, supplement, or modification thereof, which are incorporated herein by reference in their entirety. Nothing stated herein shall be treated as an admission or suggestion that Defendants agree with Plaintiff regarding the scope of the Asserted Claim, Plaintiff's apparent claim constructions, or the accuracy of any particular claim construction. Defendants reserve all rights to challenge any of the claim terms herein under 35 U.S.C. § 112, including by arguing that they are indefinite, are not supported by the written description, and/or are not enabled. Defendants further reserve all rights to amend this invalidity claim chart without leave of court pursuant to the Court's Docket Control Order, or upon a showing of good cause.

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Claim 7	
7[pre]. An optical system, comprising:	By providing this disclosure, Defendants do not take a position on whether the preamble is limiting. Poeze discloses or renders obvious an optical system. The present disclosure generally relates to non-invasive medical devices. In the present disclosure**, a sensor can measure various blood constituents or analytes noninvasively using multi-stream spectroscopy. In an embodiment, the multi-stream spectroscopy can employ visible, infrared and near infrared wavelengths.** As disclosed herein, the sensor is capable of noninvasively measuring blood analytes or percentages thereof (e.g., saturation) based on various combinations of features and components. Poeze at 7:18-26; Poeze II at [0049] In various embodiments, **the present disclosure relates to an interface for a noninvasive glucose sensor that comprises a front-end adapted to receive an input signals from optical detectors and provide corresponding output signals.** The front-end may comprise, among other things, switched capacitor circuits or transimpedance amplifiers. In an embodiment, the front-end may comprise switched capacitor circuits that are configured to convert the output of sensor's detectors into a digital signal. In another embodiment, the front-end may comprise transimpedance amplifiers. These transimpedance amplifiers may be configured to match one or more photodiodes in a detector based on a noise model that accounts for characteristics, such as the impedance, of the transimpedance amplifier, characteristics of each photodiode, such as the impedance, and the number of photodiodes coupled to the transimpedance amplifier. Poeze at 7:27-42; Poeze II at [0077]-[0082] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Poeze, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Poeze, those elements, as known to them or as disclosed by other prior art identified in the cover pleading

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7[a]. a wearable device for measuring one or more physiological parameters, the wearable device adapted to be placed on a wrist of a user;	Poeze discloses or renders obvious a wearable device for measuring one or more physiological parameters, the wearable device adapted to be placed on a wrist of a user. The present disclosure relates to noninvasive methods, devices, and systems for measuring various blood constituents or analytes, such as glucose. Poeze at Abstract; Poeze II at Abstract The protrusion can include a cylindrical or partially cylindrical shape. **The protrusion can be sized or shaped differently for different types of patients, such as an adult, child, or infant. The protrusion can also be sized or shaped differently for different measurement sites, including, for example, a finger, toe, hand, foot, ear, forehead, or the like. The protrusion can thus be helpful in any type of noninvasive sensor. The external surface of the protrusion can include one or more openings or windows. The openings can be made from glass to allow attenuated light from a measurement site, such as a finger, to pass through to one or more detectors.** Alternatively, some of all of the protrusion can be a lens, such as a partially cylindrical lens. Poeze at 8:18-30; Poeze II at [0107] The present disclosure generally relates to non-invasive medical devices. In the present disclosure, **a sensor can measure various blood constituents or analytes noninvasively using multi-stream spectroscopy. In an embodiment, the multi-stream spectroscopy can employ visible, infrared and near infrared wavelengths. As disclosed herein, the sensor is capable of noninvasively measuring blood analytes or percentages thereof (e.g., saturation) based on various combinations of features and components.** Poeze at 7:18-26; Poeze II at [0049] The spatial configuration of the detectors provides a geometry having a diversity of path lengths among the detectors. For example, a detector in the sensor may comprise multiple detectors that are arranged to have a sufficient difference in mean path length to allow for noise cancellation and noise reduction. In addition, walls may be used to separate individual photodetectors and prevent mixing of detected optical radiation between the different locations on the measurement site. **A window may also be employed to facilitate the passing of optical radiation at various wavelengths for measuring glucose in the tissue.**

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	Poeze at 9:28-38; Poeze II at [0051] 34. **A user-worn device configurable to non-invasively measure an oxygen saturation of a user, the user-worn device** comprising: a sensor structure configurable to non-invasively measure the oxygen saturation of the user, the sensor structure comprising: a first set of light emitting diodes (LEDs), the first set of LEDs comprising at least an LED configured to emit light at a first wavelength and an LED configured to emit light at a second wavelength; a second set of LEDs spaced apart from the first set of LEDs, the second set of LEDs comprising at least an LED configured to emit light at the first wavelength and an LED configured to emit light at the second wavelength; a photodiode mount; three or more photodiodes arranged in a quadrant configuration on the photodiode mount and config ured to receive light after at least a portion of the light has been attenuated by tissue of the user; a protruding cover different from the photodiode mount, the protruding cover comprising: a convex surface extending across at least a portion of the photodiode mount, the portion of the photodiode mount including the three or more photodiodes, the convex surface configured to shape tissue of a measurement site; and at least three transmissive windows within the convex surface that allow light to penetrate through the protruding cover, the windows aligned with the three or more photodiodes; and at least one opaque wall extending between the photodiode mount and the protruding cover, wherein at least the photodiode mount, the opaque wall, and the Protruding cover form cavities, wherein the photodiodes are arranged on the photodiode mount within the cavities; one or more processors configured to receive one or more signals from at least one of the photodiodes and calculate a measurement of a physiological parameter of the user; a network interface configured to wirelessly communicate the measurement to at least one of a mobile phone or an electronic network; a user interface comprising a touch-screen display, wherein the user interface is configured to display indicia responsive to the measurement of the user; a storage device configured to at least temporarily store at least the measurement; and **a strap configured to position the user-worn device on the user.** Poeze at Claim 34; Poeze II at Claims 1, 10, 14

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	One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Poeze, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Poeze, those elements, as known to them or as disclosed by other prior art identified in the cover pleading
7[b]. the wearable device including a light source comprising a plurality of semiconductor diodes that are configured to generate an output optical light having one or more optical wavelengths, wherein at least a portion of the one or more optical wavelengths is a near-infrared wavelength between 700 nanometers and 2500 nanometers;	Poeze discloses or renders obvious the wearable device including a light source comprising a plurality of semiconductor diodes that are configured to generate an output optical light having one or more optical wavelengths, wherein at least a portion of the one or more optical wavelengths is a near-infrared wavelength between 700 nanometers and 2500 nanometers. In an embodiment, the system includes a noninvasive sensor and a patient monitor communicating with the noninvasive sensor. The non-invasive sensor may include different architectures to implement some or all of the disclosed features. In addition, an artisan will recognize that the non-invasive sensor may include or may be coupled to other components, such as a network interface, and the like. Moreover, the patient monitor may include a display device, a network interface communicating with any one or combination of a computer network, a handheld computing device, a mobile phone, the Internet, or the like. In addition, embodiments may include **multiple optical sources that emit light at a plurality of wavelengths and that are arranged from the perspective of the light detector(s) as a point source**. Poeze at 2:47-60; Poeze II at [0007]

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	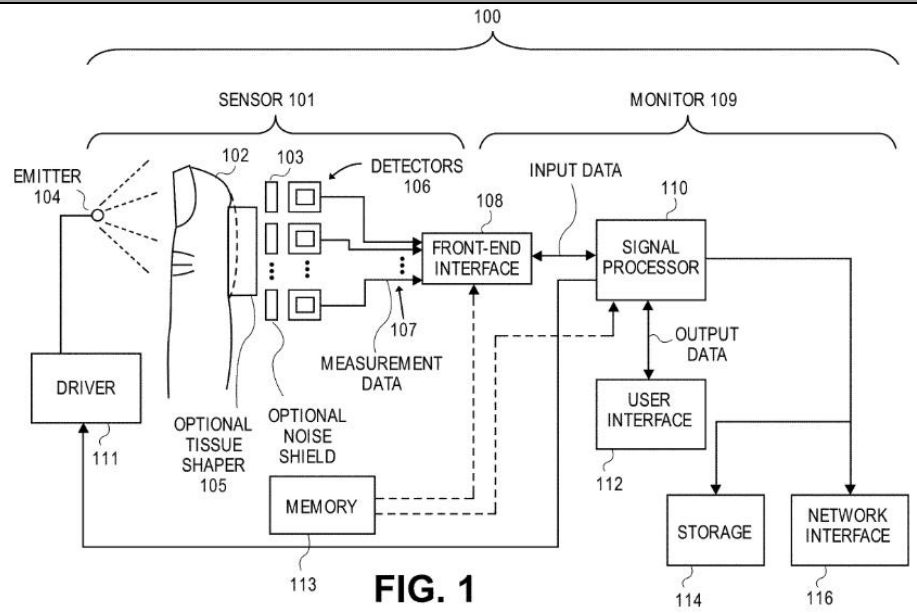 **FIG. 1** Poeze at Fig. 1; Poeze II at Fig. 1 In the depicted embodiment shown in FIG. 1, the sensor 101 includes an emitter 104, a tissue shaper 105, a set of detectors 106, and a front-end interface 108. **The emitter 104 can serve as the source of optical radiation transmitted towards measurement site 102. As will be described in further detail below, the emitter 104 can include one or more sources of optical radiation, such as LEDs, laser diodes, incandescent bulbs with appropriate frequency-selective filters, combinations of the same, or the like. In an embodiment, the emitter 104 includes sets of optical sources that are capable of emitting visible and near-infrared optical radiation.** Poeze at 12:1-12; Poeze II at [0063] As briefly described above, **the emitter 104 can include sets of light-emitting diodes (LEDs) as its optical source. The emitter 104 can use one or more top-emitting LEDs. In particular, in some embodiments, the emitter 104 can include top-emitting LEDs emitting light at about 850 nm to 1350 nm**. Poeze at 13:16-21; Poeze II at [0070]

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	In contrast, the emitter 104 of the data collection system 100 can emit, in certain embodiments, combinations of optical radiation in various bands of interest. **For example, in some embodiments, for analytes like glucose, the emitter 104 can emit optical radiation at three (3) or more wavelengths between about 1600 nm to about 1700 nm.** In particular, the emitter 104 can emit optical radiation at or about 1610 nm, about 1640 nm, and about 1665 nm. In some circumstances, the use of three wavelengths within about 1600 nm to about 1700 nm enable sufficient SNRs of about 100 dB, which can result in a measurement accuracy of about 20 mg/dL or better for analytes like glucose. Poeze at 12:33-44; Poeze II at [0066] **For example, the emitter 104 can emit optical radiation across other spectra for other analytes. In particular, the emitter 104 can employ light wavelengths to measure various blood analytes or percentages (e.g., saturation) thereof.** For example, in one embodiment, the emitter 104 can emit optical radiation in the form of pulses at wavelengths about 905 nm, about 1050 nm, about 1200 nm, about 1300 nm, about 1330 nm, about 1610 nm, about 1640 nm, and about 1665 nm. In another embodiment, the emitter 104 can emit optical radiation ranging from about 860 nm to about 950 nm, about 950 nm to about 1100 nm, about 1100 nm to about 1270 nm, about 1250 nm to about 1350 nm, about 1300 nm to about 1360 nm, and about 1590 nm to about 1700 nm. **Of course, the emitter 104 can transmit any of a variety of wavelengths of visible or near-infrared optical radiation.** Poeze at 12:60-13:7; Poeze II at [0068] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Poeze, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Poeze, those elements, as known to them or as disclosed by other prior art identified in the cover pleading
7[c]. the wearable device comprising one or more lenses configured to receive at least a portion of the	Poeze discloses or renders obvious the wearable device comprising one or more lenses configured to receive at least a portion of the output optical light and to deliver a lens output light to tissue comprising skin.

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output optical light and to deliver a lens output light to tissue comprising skin;	In an embodiment, a physiological sensor includes a detector housing that can be coupled to a measurement site, such as a patient's finger. The sensor housing can include a curved bed that can generally conform to the shape of the measurement site. In addition, the curved bed can include a protrusion shaped to increase an amount of light radiation from the measurement site. In an embodiment, the protrusion is used to thin out the measurement site. This allows the light radiation to pass through less tissue, and accordingly is attenuated less. In an embodiment, the protrusion can be used to increase the area from which attenuated light can be measured. **In an embodiment, this is done through the use of a lens which collects attenuated light exiting the measurement site and focuses onto one or more detectors. The protrusion can advantageously include plastic, including a hard opaque plastic, such as a black or other colored plastic, helpful in reducing light noise.** In an embodiment, such light noise includes light that would otherwise be detected at a photodetector that has not been attenuated by tissue of the measurement site of a patient sufficient to cause the light to adequately included information indicative of one or more physiological parameters of the patient. Such light noise includes light piping. Poeze at 7:52-8:7; Poeze II at [0059], [0107]-[0119] **The protrusion can include a cylindrical or partially cylindrical shape.** The protrusion can be sized or shaped differently for different types of patients, such as an adult, child, or infant. The protrusion can also be sized or shaped differently for different measurement sites, including, for example, a finger, toe, hand, foot, ear, forehead, or the like. The protrusion can thus be helpful in any type of noninvasive sensor. **The external surface of the protrusion can include one or more openings or windows. The openings can be made from glass to allow attenuated light from a measurement site, such as a finger, to pass through to one or more detectors. Alternatively, some of all of the protrusion can be a lens, such as a partially cylindrical lens.** Poeze at 8:18-30; Poeze II at [0107] **The depicted protrusion 605 is a partially cylindrical lens having a partial cylinder 608 and an extension 610.** The partial cylinder 608 can be a half cylinder in some embodiments; however, a smaller or greater portion than half of a cylinder can be used. **Advantageously, in certain embodiments, the partially cylindrical protrusion 605 focuses light onto a smaller area, such that fewer detectors can be used to detect the light attenuated by a measurement site.** Poeze at 24:12-20; Poeze II at [0136]

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	Advantageously, in certain embodiments, placing the partially cylindrical protrusion 605 over the photodiodes in any of the sensors described above adds multiple benefits to any of the sensors described above. In one embodiment, the partially cylindrical protrusion 605 penetrates into the tissue and reduces the path length of the light traveling in the tissue, similar to the protrusions described above. **The partially cylindrical protrusion 605 can also collect light from a large surface and focus down the light to a smaller area.** As a result, in certain embodiments, signal strength per area of the photodiode can be increased. The partially cylindrical protrusion 605 can therefore facilitate a lower cost sensor because, in certain embodiments, less photodiode area can be used to obtain the same signal strength. Less photodiode area can be realized by using smaller photodiodes or fewer photodiodes (see, e.g., FIG. 14). If fewer or smaller photodiodes are used, the partially cylindrical protrusion 605 can also facilitate an improved SNR of the sensor because fewer or smaller photodiodes can have less dark current. Poeze at 24:27-46; Poeze II at [0138]-[0139] Placing a photodiode at a given distance below the partially cylindrical protrusion 605 can facilitate capturing some or all of the light traveling perpendicular to the lens within the active area of the photodiode (see FIG. 14). Poeze at 25:42-45; Poeze II at [0144]

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	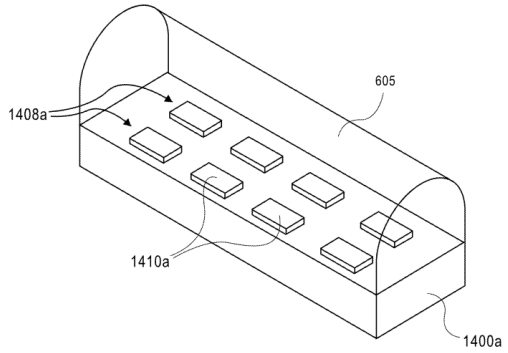 **FIG. 14A** Poeze, Fig. 14A; Poeze II at Fig. 14A FIG. 14A illustrates an embodiment of a detector submount 1400 a positioned beneath the partially cylindrical protrusion 605 of FIG. 6 (or alternatively, the protrusion 605 b). The detector submount 1400 a includes two rows 1408 a of detectors 1410 a. The partially cylindrical protrusion 605 can facilitate reducing the number and/or size of detectors used in a sensor because the protrusion 605 can act as a lens that focuses light onto a smaller area. Poeze at 35:45-52; Poeze II at [0224] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Poeze, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Poeze, those elements, as known to them or as disclosed by other prior art identified in the cover pleading
7[d]. the wearable device further comprising a detection system configured to receive at least a portion	Poeze discloses or renders obvious the wearable device further comprising a detection system configured to receive at least a portion of the lens output light reflected from the tissue and to generate an output signal having a signal-to-noise ratio, wherein the detection system is configured to be synchronized to the light source.

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of the lens output light reflected from the tissue and to generate an output signal having a signal-to noise ratio, wherein the detection system is configured to be synchronized to the light source;	**The detectors 106 capture and measure light from the measurement site 102. For example, the detectors 106 can capture and measure light transmitted from the emitter 104 that has been attenuated or reflected from the tissue in the measurement site 102. The detectors 106 can output a detector signal 107 responsive to the light captured or measured. The detectors 106 can be implemented using one or more photodiodes, phototransistors, or the like.** Poeze at 14:11-19; Poeze II at [0075] A sensor can include photocommunicative components, such as an emitter, a detector, and other components. The emitter is configured as a point optical source that comprises a plurality of LEDs that emit a sequence of pulses of optical radiation across a spectrum of wavelengths. In some embodiments, the plurality of sets of optical sources may each comprise at least one top-emitting LED and at least one super luminescent LED. In some embodiments, **the emitter comprises optical sources that transmit optical radiation in the infrared or near-infrared wavelengths suitable for detecting blood analytes like glucose. In order to achieve the desired SNR for detecting analytes like glucose, the emitter may be driven using a progression from low power to higher power. In addition, the emitter may have its duty cycle modified to achieve a desired SNR.** Poeze at 9:56-10:3; Poeze II at [0050], [0172]-[0177] The **data collection system 100 can measure a range of approximately about 2 nA to about 100 nA full scale. The data collection system 100 can also include sensor front-ends that are capable of processing and amplifying current from the detector(s) at signal-to-noise ratios (SNRs) of about 100 decibels (dB) or more, such as about 120 dB in order to measure various desired analytes.** The data collection system 100 can operate with a lower SNR if less accuracy is desired for an analyte like glucose. Poeze at 10:53-61; Poeze II at [0057] **Modulation in the duty cycle of the individual pulses may also be useful because duty cycle can affect the signal noise ratio of the system 100. That is, as the duty cycle is increased so may the signal to noise ratio.**

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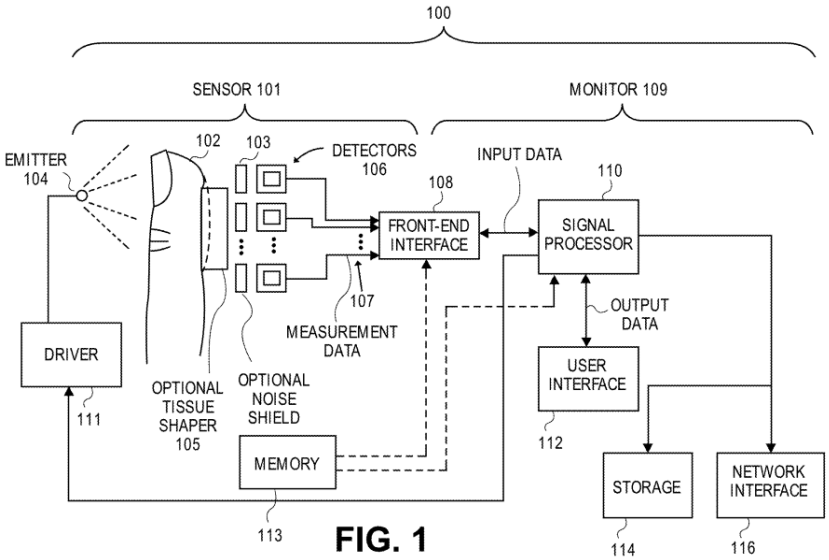
	Poeze at 31:16-20; Poeze II at [0179]  FIG. 1 Poeze at Fig. 1; Poeze II at Fig. 1 As shown in FIG. 1 , the monitor 109 can include the signal processor 110 and a user interface, such as a display 112. The monitor 109 can also include optional outputs alone or in combination with the display 112, such as a storage device 114 and a network interface 116. **In an embodiment, the signal processor 110 includes processing logic that determines measurements for desired analytes, such as glucose, based on the signals received from the detectors 106.** The signal processor 110 can be implemented using one or more microprocessors or subprocessors (e.g., cores), digital signal processors, application specific integrated circuits (ASICs), field programmable gate arrays (FPGAs), combinations of the same, and the like. **The signal processor 110 can provide various signals that control the operation of the sensor 101. For example, the signal processor 110 can provide an emitter control signal to the driver 111. This control signal can be useful in order to synchronize, minimize, or reduce jitter in the timing of pulses emitted from the emitter 104. Accordingly, this control signal can be useful in order to cause optical radiation pulses emitted from the emitter 104 to follow a precise timing and consistent pattern.**

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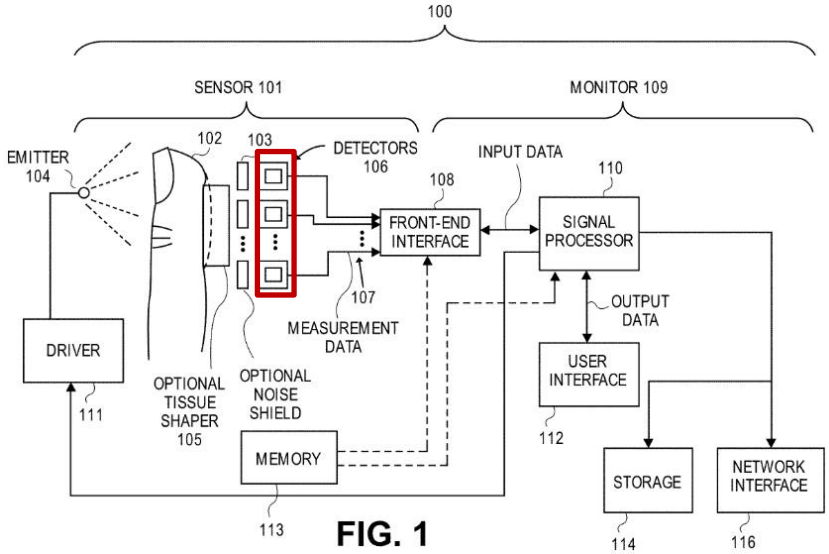
	Poeze at 15:27-48; Poeze II at [0083]-[0084] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Poeze, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Poeze, those elements, as known to them or as disclosed by other prior art identified in the cover pleading
7[e]. wherein the detection system comprises a plurality of detectors that are spatially separated from each other, and wherein at least one analog to digital converter is coupled to at least one of the plurality of detectors;	Poeze discloses or renders obvious the detection system comprises a plurality of detectors that are spatially separated from each other, and wherein at least one analog to digital converter is coupled to at least one of the plurality of detectors.  FIG. 1 Poeze at Fig. 1; Poeze II at Fig. 1 In certain embodiments**, multiple detectors are employed and arranged in a spatial geometry. This spatial geometry provides a diversity of path lengths among at least some of the detectors and allows for multiple bulk and pulsatile measurements that are robust. Each of the detectors can provide a respective output stream based on the detected optical radiation, or a sum of output**

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	streams can be provided from multiple detectors. In some embodiments, the sensor can also include other components, such as one or more heat sinks and one or more thermistors. Poeze at 9:18-27; Poeze II at [0051] **Front-end interfaces 108 may be implemented using transimpedance amplifiers that are coupled to analog to digital converters in a sigma delta converter.** In some embodiments, a programmable gain amplifier (PGA) can be used in combination with the transimpedance-based front-ends. For example, the output of a transimpedance-based front-end may be output to a sigma-delta ADC that comprises a PGA. A PGA may be useful in order to provide another level of amplification and control of the stream of signals from detectors 106. The PGA may be an integrated circuit or built from a set of micro-relays. **Alternatively, the PGA and ADC components in converter 900 may be integrated with the transimpedance-based front-end in sensor 101.** Poeze at 40:15-27; Poeze II at [0259] In an embodiment, the system includes a noninvasive sensor and a patient monitor communicating with the noninvasive sensor. The non-invasive sensor may include different architectures to implement some or all of the disclosed features. **In addition, an artisan will recognize that the non-invasive sensor may include or may be coupled to other components, such as a network interface, and the like.** Poeze at 2:47-53; Poeze II at [0007] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Poeze, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Poeze, those elements, as known to them or as disclosed by other prior art identified in the cover pleading
7[f]. wherein the output signal is indicative of the one or more of the physiological parameters;	Poeze discloses or renders obvious the output signal is indicative of the one or more of the physiological parameters.

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	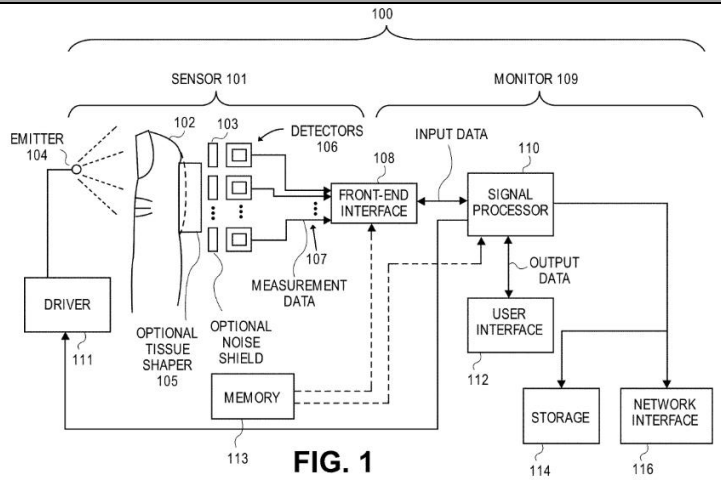 **FIG. 1** Poeze at Fig. 1; Poeze II at Fig. 1 **In an embodiment, a noninvasive, physiological sensor is capable of outputting a signal responsive to a blood analyte present in a monitored patient.** The sensor may comprise a sensor housing, an optical source, and photodetectors. The optical source is positioned by the housing with respect to a tissue site of a patient when said housing is applied to the patient. The photodetectors are positioned by the housing with respect to said tissue site when the housing is applied to the patient with a variation in path length among at least some of the photodetectors from the optical source. The photodetectors are configured to detect a sequence of optical radiation from the optical source after attenuation by tissue of the tissue site. The photodetectors may be each configured to output a respective signal stream responsive to the detected sequence of optical radiation. **An output signal responsive to one or more of the signal streams is then usable to determine the blood analyte based at least in part on the variation in path length.** Poeze at 2:61-3:3; Poeze II at [0009] **FIG. 1 illustrates an example of a data collection system 100. In certain embodiments, the data collection system 100 noninvasively measure a blood analyte, such as oxygen, carbon monoxide, methemoglobin, total hemoglobin, glucose, proteins, glucose, lipids, a percentage thereof (e.g., saturation) or for measuring many other physiologically relevant patient characteristics**. The system 100 can also measure additional blood analytes and/or other physiological parameters useful in determining a state or trend of wellness of a patient.

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	Poeze at 10:30-39; Poeze II at [0055] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Poeze, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Poeze, those elements, as known to them or as disclosed by other prior art identified in the cover pleading
7[g]. the wearable device configured to increase the signal-to-noise ratio by increasing light intensity of at least one of the plurality of semiconductor diodes from an initial light intensity; and	Poeze discloses or renders obvious the wearable device configured to increase the signal-to-noise ratio by increasing light intensity of at least one of the plurality of semiconductor diodes from an initial light intensity. The **data collection system 100 can measure a range of approximately about 2 nA to about 100 nA full scale. The data collection system 100 can also include sensor front-ends that are capable of processing and amplifying current from the detector(s) at signal-to-noise ratios (SNRs) of about 100 decibels (dB) or more, such as about 120 dB in order to measure various desired analytes**. The data collection system 100 can operate with a lower SNR if less accuracy is desired for an analyte like glucose. Poeze at 10:53-61; Poeze II at [0057] In other embodiments, the emitter 104 can use two (2) wavelengths within about 1600 nm to about 1700 nm to advantageously enable SNRs of about 85 dB, which can result in a measurement accuracy of about 25-30 mg/dL or better for analytes like glucose. Furthermore, in some embodiments, the emitter 104 can emit light at wavelengths above about 1670 nm. Measurements at these wavelengths can be advantageously used to compensate or confirm the contribution of protein, water, and other non-hemoglobin species exhibited in measurements for analytes like glucose conducted between about 1600 nm and about 1700 nm. Of course, other wavelengths and combinations of wavelengths can be used to measure analytes and/or to distinguish other types of tissue, fluids, tissue properties, fluid properties, combinations of the same or the like. Poeze at 12:45-59; Poeze II at [0067]

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	FIG. 11B illustrates a configuration of emitting optical radiation into a measurement site for measuring a blood constituent or analyte like glucose. In some embodiments, emitter 104 may be driven in a progressive fashion to minimize noise and increase SNR of sensor 101. For example, emitter 104 may be driven based on a progression of power/current delivered to LEDs 1102 and 1104. Poeze at 30:1-7; Poeze II at [0172] As noted, this progression may be useful in some embodiments because it allows the circuitry of driver circuit 1105 to stabilize its power delivery to LEDs 1102 and 1104. **Driver circuit 1105 may be allowed to stabilize based on the duty cycle of the pulses or, for example, by configuring a variable waiting period to allow for stabilization of driver circuit 1105. Of course, other variations in power/current and wavelength may also be employed in the present disclosure.** **Modulation in the duty cycle of the individual pulses may also be useful because duty cycle can affect the signal noise ratio of the system 100. That is, as the duty cycle is increased so may the signal to noise ratio.** Poeze at 31:8-20; Poeze II at [0178]-[0179]

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	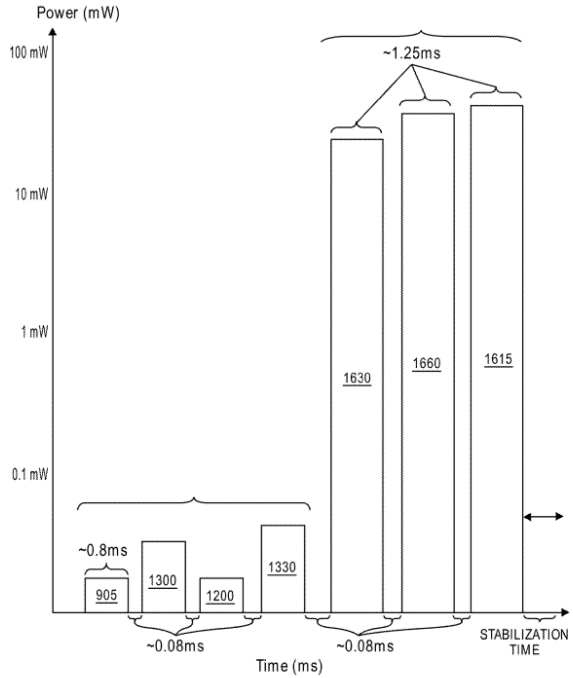 **FIG. 11B** Poeze, at Fig. 11B; Poeze II at Fig. 11B A single light source having multiple emitters can allow for a range of wavelengths of light to be used. For example, visible, infrared, and near infrared wavelengths can be employed. V**arying powers of light intensity for different wavelengths can also be employed.** Poeze at 34:39-43; Poeze II at [0214] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Poeze, it would

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	have been obvious to one of ordinary skill in the art to combine, with the teachings of Poeze, those elements, as known to them or as disclosed by other prior art identified in the cover pleading
7[h]. the detection system further configured to: generate a first signal responsive to light received while the semiconductor diodes are off,	Poeze discloses or renders obvious the detection system further configured to: generate a first signal responsive to light received while the semiconductor diodes are off. For example, as shown in FIG. 11B, the sequence of optical radiation pulses are shown having a logarithmic-like progression in power/current. In some embodiments, the timing of these pulses is based on a cycle of about 400 slots running at 48 kHz (e.g. each time slot may be approximately 0.02 ms or 20 microseconds). An artisan will recognize that term "slots" includes its ordinary meaning, which includes a time period that may also be expressed in terms of a frequency. In the example shown**, pulses from top emitting LEDs 1102 may have a pulse width of about 40 time slots (e.g., about 0.8 ms) and an off period of about 4 time slots in between**. In addition, **pulses from side emitting LEDs 1104 (e.g., or a laser diode) may have a pulse width of about 60 time slots (e.g., about 1.25 ms) and a similar off period of about 4 time slots.** A pause of about 70 time slots (e.g. 1.5 ms) may also be provided in order to allow driver circuit 1105 to stabilize after operating at higher current/power. Poeze at 30:29-45; Poeze II at [0175] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant's Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Poeze, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Poeze, those elements, as known to them or as disclosed by other prior art identified in the cover pleading
7[i]. generate a second signal responsive to light received while at least one of the semiconductor diodes is on, and	Poeze discloses or renders obvious the detection system further configured to: generate a second signal responsive to light received while at least one of the semiconductor diodes is on. For example, as shown in FIG. 11B, the sequence of optical radiation pulses are shown having a logarithmic-like progression in power/current. In some embodiments, the timing of these pulses is based on a cycle of about 400 slots running at 48 kHz (e.g. each time slot may be approximately 0.02 ms or 20 microseconds). An artisan will recognize that term "slots" includes its ordinary meaning, which includes a time period that may also be expressed in terms of a frequency. In the example shown**, pulses from top emitting LEDs 1102 may have a pulse width of about 40 time slots (e.g., about 0.8 ms)**

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	and an off period of about 4 time slots in between. In addition, **pulses from side emitting LEDs 1104 (e.g., or a laser diode) may have a pulse width of about 60 time slots (e.g., about 1.25 ms) and a similar off period of about 4 time slots.** A pause of about 70 time slots (e.g. 1.5 ms) may also be provided in order to allow driver circuit 1105 to stabilize after operating at higher current/power. Poeze at 30:29-45; Poeze II at [0175] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Poeze, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Poeze, those elements, as known to them or as disclosed by other prior art identified in the cover pleading
7[j]. increase the signal-to-noise ratio by comparing the first signal and the second signal; and	Poeze discloses or renders obvious the detection system further configured to: increase the signal-to-noise ratio by comparing the first signal and the second signal. The **data collection system 100 can measure a range of approximately about 2 nA to about 100 nA full scale. The data collection system 100 can also include sensor front-ends that are capable of processing and amplifying current from the detector(s) at signal-to-noise ratios (SNRs) of about 100 decibels (dB) or more, such as about 120 dB in order to measure various desired analytes**. The data collection system 100 can operate with a lower SNR if less accuracy is desired for an analyte like glucose. Poeze at 10:53-61; Poeze II at [0057] **Due to the different responses of analytes to the different wavelengths, certain embodiments of the data collection system 100 can advantageously use the measurements at these different wavelengths to improve the accuracy of measurements.** For example, the measurements of water from visible and infrared light can be used to compensate for water absorbance that is exhibited in the near-infrared wavelengths. Poeze at 13:8-21; Poeze II at [0069]

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	As noted, this progression may be useful in some embodiments because it allows the circuitry of driver circuit 1105 to stabilize its power delivery to LEDs 1102 and 1104. **Driver circuit 1105 may be allowed to stabilize based on the duty cycle of the pulses or, for example, by configuring a variable waiting period to allow for stabilization of driver circuit 1105. Of course, other variations in power/current and wavelength may also be employed in the present disclosure.** **Modulation in the duty cycle of the individual pulses may also be useful because duty cycle can affect the signal noise ratio of the system 100. That is, as the duty cycle is increased so may the signal to noise ratio.** Poeze at 31:8-20; Poeze II at [0178]-[0179] FIGS. 10A through 10B illustrate comparative noise floors of example implementations of the sensors described above. Noise can include optical noise from ambient light and electro-magnetic noise, for example, from surrounding electrical equipment. In FIG. 10A, **a graph 1000 depicts possible noise floors for different frequencies of noise for an embodiment in which one of the sensors described above included separate windows for four (4) detectors 106.** One or more of the windows included an embedded grid of wiring as a noise shield. Symbols 1030-1033 illustrate the noise floor performance for this embodiment. As can be seen, **the noise floor performance can vary for each of the openings and based on the frequency of the noise.** Poeze at 28:58-29:3; Poeze II at [0166] In FIG. 10B, a graph 1050 **depicts a noise floor for frequencies of noise 1070 for an embodiment in which the sensor included separate openings for four (4) detectors 106 and one or more windows that include an ITO coating.** In this embodiment, a surface resistivity of the ITO used was about 500 ohms per square inch. Symbols 1080-1083 illustrate the noise floor performance for this embodiment. As can be seen, **the noise floor performance for this embodiment can vary less for each of the openings and provide lower noise floors in comparison to the embodiment of FIG. 10A**. Poeze at 29:4-15; Poeze II at [0167] **FIG. 11B illustrates a configuration of emitting optical radiation into a measurement site for measuring a blood constituent or analyte like glucose. In some embodiments, emitter 104 may be**

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	driven in a progressive fashion to minimize noise and increase SNR of sensor 101. For example, emitter 104 may be driven based on a progression of power/current delivered to LEDs 1102 and 1104. Poeze at 30:1-7; Poeze II at [0172] In other embodiments, the emitter 104 can use two (2) wavelengths within about 1600 nm to about 1700 nm to advantageously enable SNRs of about 85 dB, which can result in a measurement accuracy of about 25-30 mg/dL or better for analytes like glucose. Furthermore, in some embodiments, the emitter 104 can emit light at wavelengths above about 1670 nm. Measurements at these wavelengths can be advantageously used to compensate or confirm the contribution of protein, water, and other non-hemoglobin species exhibited in measurements for analytes like glucose conducted between about 1600 nm and about 1700 nm. Of course, other wavelengths and combinations of wavelengths can be used to measure analytes and/or to distinguish other types of tissue, fluids, tissue properties, fluid properties, combinations of the same or the like. Poeze at 12:45-59; Poeze II at [0067] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Poeze, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Poeze, those elements, as known to them or as disclosed by other prior art identified in the cover pleading
7[k]. wherein the wearable device is at least in part configured to identify an object.	Poeze discloses or renders obvious the wearable device is at least in part configured to identify an object. The protrusion can include a cylindrical or partially cylindrical shape. **The protrusion can be sized or shaped differently for different types of patients, such as an adult, child, or infant. The protrusion can also be sized or shaped differently for different measurement sites, including, for example, a finger, toe, hand, foot, ear, forehead, or the like. The protrusion can thus be helpful in any type of noninvasive sensor. The external surface of the protrusion can include one or more openings or windows. The openings can be made from glass to allow attenuated light from a measurement site, such as a finger, to pass through to one or more detectors.** Alternatively, some of all of the protrusion can be a lens, such as a partially cylindrical lens.

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	Poeze at 8:18-30; Poeze II at [0107] The present disclosure generally relates to non-invasive medical devices. In the present disclosure, **a sensor can measure various blood constituents or analytes noninvasively using multi-stream spectroscopy. In an embodiment, the multi-stream spectroscopy can employ visible, infrared and near infrared wavelengths. As disclosed herein, the sensor is capable of noninvasively measuring blood analytes or percentages thereof (e.g., saturation) based on various combinations of features and components.** Poeze at 7:18-26; Poeze II at [0049] **The user-worn device of claim 1 further comprising: one or more processors configured to receive one or more signals from at least one of the photodiodes and calculate a measurement of a physiological parameter of the user, wherein the physiological parameter comprises total hemoglobin.** Poeze at Claim 8; Poeze II at Claim 1-22 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Poeze, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Poeze, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.

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EXHIBIT F6

At least Claim 22 of Poeze is supported by the written description of U.S. Pub. No. 2011/0004082 A1 ("Poeze II"), as required by 35 U.S.C. § 112(a). Thus, the effective filing date of Poeze is at least as early as the filing date of Poeze II, which is July 1, 2010.

Poeze, Claim 22	**Poeze II, Exemplary Citations**
22[pre]. A user-worn device configurable to non-invasively measure an oxygen saturation of a user, the user-worn device comprising:	In an embodiment, the system includes a noninvasive sensor and a patient monitor communicating with the noninvasive sensor. The non-invasive sensor may include different architectures to implement some or all of the disclosed features. In addition, an artisan will recognize that the non-invasive sensor may include or may be coupled to other components, such as a network interface, and the like. Moreover, the patient monitor may include a display device, a network interface communicating with any one or combination of a computer network, a handheld computing device, a mobile phone, the Internet, or the like. In addition, embodiments may include multiple optical sources that emit light at a plurality of wavelengths and that are arranged from the perspective of the light detector(s) as a point source. Poeze II at [0007] The data collection system 100 can measure analyte concentrations, including glucose, at least in part by detecting light attenuated by a measurement site 102. The measurement site 102 can be any location on a patient's body, such as a finger, foot, ear lobe, or the like. For convenience, this disclosure is described primarily in the context of a finger measurement site 102. However, the features of the embodiments disclosed herein can be used with other measurement sites 102. Poeze II at [0058] The emitter 104 can also use super luminescent LEDs (SLEDs) or side-emitting LEDs. In some embodiments, the emitter 104 can employ SLEDs or side-emitting LEDs to emit optical radiation at about 1600 nm to about 1800 nm. Emitter 104 can use SLEDs or side-emitting LEDs to transmit near infrared optical radiation because these types of sources can transmit at high power or relatively high power, e.g., about 40 mW to about 100 mW. This higher power capability can be useful to compensate or overcome the greater attenuation of these wavelengths of light in tissue and water. For example, the higher power emission can effectively compensate and/or normalize the absorption signal for light in the mentioned wavelengths to be similar in amplitude and/or effect as other wavelengths that can be detected by one or more photodetectors after absorption. However, the embodiments of the present disclosure do not necessarily require the use of high power optical sources. For example, some embodiments may be configured to measure analytes, such as total hemoglobin (tHb), oxygen saturation (SpO2),

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	carboxyhemoglobin, methemoglobin, etc., without the use of high power optical sources like side emitting LEDs. Instead, such embodiments may employ other types of optical sources, such as top emitting LEDs. Alternatively, the emitter 104 can use other types of sources of optical radiation, such as a laser diode, to emit near-infrared light into the measurement site 102. Poeze II at [0071]
22[b]. a plurality of emitters configured to emit light, each of the emitters comprising at least two light emitting diodes (LEDs);	Embodiments of the present disclosure can employ a different approach that in part allows for the measurement of analytes like glucose. Some embodiments can employ a bulk, non-pulsatile measurement in order to confirm or validate a pulsatile measurement. In addition, both the non-pulsatile and pulsatile measurements can employ, among other things, the multi-stream operation described above in order to attain sufficient SNR. In particular, a single light source having multiple emitters can be used to transmit light to multiple detectors having a spatial configuration. A single light source having multiple emitters can allow for a range of wavelengths of light to be used. For example, visible, infrared, and near infrared wavelengths can be employed. Varying powers of light intensity for different wavelengths can also be employed. Poeze II at [0213]-[0214]
22[c]. a photodiode mount;	The submount 1106 provides a support structure in certain embodiments for aligning the top-emitting LEDs 1102 and the side-emitting LEDs 1104 so that their optical radiation is transmitted generally towards the measurement site. In some embodiments, the submount 1106 is also constructed of aluminum nitride (AlN) or beryllium oxide (BEO) for heat dissipation, although other materials or combinations of materials suitable for the submount 1106 can be used. Poeze II at [0171]
22[d]. at least three photodiodes arranged on the photodiode mount and configured to receive light after at least a portion of the light has been attenuated by tissue of the user;	In the depicted embodiment, the detector shell 316 can hold multiple (e.g., two, three, four, etc.) photodiode arrays that are arranged in a two-dimensional grid pattern. Multiple photodiode arrays can also be useful to detect light piping (e.g., light that bypasses measurement site 102). In the detector shell 316, walls can be provided to separate the individual photodiode arrays to prevent or reduce mixing of light signals from distinct quadrants. In addition, the detector shell 316 can be covered by windows of transparent material, such as glass, plastic, or the like, to allow maximum or increased transmission of power light captured. In various embodiments, the transparent materials used can also be partially transparent or translucent or can otherwise pass

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	some or all of the optical radiation passing through them. As noted, this window can include some shielding in the form of an embedded grid of wiring, or a conductive layer or coating. Poeze II at [0127]
22[e]. a protruding cover different from the photodiode mount, wherein at least a portion of the protruding cover comprises a convex surface, wherein the convex surface includes separate windows comprising optically transparent material within the convex surface, wherein each window is aligned with a different one of the at least three photodiodes, and wherein the convex surface is configured to protrude into tissue of the user when worn by the user; and	In an embodiment, a noninvasive, physiological sensor is capable of outputting a signal responsive to a blood analyte present in a monitored patient. The sensor may comprise a sensor housing, an optical source, and photodetectors. The optical source is positioned by the housing with respect to a tissue site of a patient when said housing is applied to the patient. The photodetectors are positioned by the housing with respect to said tissue site when the housing is applied to the patient with a variation in path length among at least some of the photodetectors from the optical source. The photodetectors are configured to detect a sequence of optical radiation from the optical source after attenuation by tissue of the tissue site. The photodetectors may be each configured to output a respective signal stream responsive to the detected sequence of optical radiation. An output signal responsive to one or more of the signal streams is then usable to determine the blood analyte based at least in part on the variation in path length Poeze II at [0009] In the depicted embodiment, the system 100 includes an optional tissue thickness adjuster or tissue shaper 105, which can include one or more protrusions, bumps, lenses, or other suitable tissue-shaping mechanisms. In certain embodiments, the tissue shaper 105 is a flat or substantially flat surface that can be positioned proximate the measurement site 102 and that can apply sufficient pressure to cause the tissue of the measurement site 102 to be flat or substantially flat. In other embodiments, the tissue shaper 105 is a convex or substantially convex surface with respect to the measurement site 102. Many other configurations of the tissue shaper 105 are possible. Advantageously, in certain embodiments, the tissue shaper 105 reduces thickness of the measurement site 102 while preventing or reducing occlusion at the measurement site 102. Reducing thickness of the site can advantageously reduce the amount of attenuation of the light because there is less tissue through which the light must travel. Shaping the tissue in to a convex (or alternatively concave) surface can also provide more surface area from which light can be detected. Poeze II at [0059]

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	The cylindrical housing 1430 can be made of metal, plastic, or another suitable material. The transparent cover 1432 can be fabricated from glass or plastic, among other materials. The cylindrical housing 1430 can be attached to the submount 1400 *c* at the same time or substantially the same time as the detectors 1410 *c* to reduce manufacturing costs. A shape other than a cylinder can be selected for the housing 1430 in various embodiments. Poeze II at [0232]
22[f]. one or more processors configurable to receive one or more signals from at least one of the at least three photodiodes and output measurements responsive to the one or more signals, the measurements indicative of the oxygen saturation of the user.	The standard of care in caregiver environments includes patient monitoring through spectroscopic analysis using, for example, a pulse oximeter. Devices capable of spectroscopic analysis generally include a light source(s) transmitting optical radiation into or reflecting off a measurement site, such as, body tissue carrying pulsing blood. After attenuation by tissue and fluids of the measurement site; a photodetection device(s) detects the attenuated light and outputs a detector signal(s) responsive to the detected attenuated light. A signal processing device(s) process the detector(s) signal(s) and outputs a measurement indicative of a blood constituent of interest, such as glucose, oxygen, met hemoglobin, total hemoglobin, other physiological parameters, or other data or combinations of data useful in determining a state or trend of wellness of a patient. Poeze II at [0004] The sensor can be integrated with a monitor, for example, into a handheld unit including the sensor, a display and user controls. In other embodiments, the sensor can communicate with one or more processing devices. The communication can be via wire(s), cable(s), flex circuit(s), wireless technologies, or other suitable analog or digital communication methodologies and devices to perform those methodologies. Many of the foregoing arrangements allow the sensor to be attached to the measurement site while the device is attached elsewhere on a patient, such as the patient's arm, or placed at a location near the patient, such as a bed, shelf or table. The sensor or monitor can also provide outputs to a storage device or network interface. Poeze II at [0053] As shown in FIG. 1, the monitor 109 can include the signal processor 110 and a user interface, such as a display 112. The monitor 109 can also include optional outputs alone or in combination with the display 112, such as a storage device 114 and a network interface 116. In an embodiment, the signal processor 110 includes processing logic that determines measurements

	for desired analytes, such as glucose, based on the signals received from the detectors 106. The signal processor 110 can be implemented using one or more microprocessors or subprocessors (e.g., cores), digital signal processors, application specific integrated circuits (ASICs), field programmable gate arrays (FPGAs), combinations of the same, and the like. The signal processor 110 can provide various signals that control the operation of the sensor 101. For example, the signal processor 110 can provide an emitter control signal to the driver 111. This control signal can be useful in order to synchronize, minimize, or reduce jitter in the timing of pulses emitted from the emitter 104. Accordingly, this control signal can be useful in order to cause optical radiation pulses emitted from the emitter 104 to follow a precise timing and consistent pattern. For example, when a transimpedance-based front end interface 108 is used, the control signal from the signal processor 110 can provide synchronization with the ADC in order to avoid aliasing, cross-talk, and the like. As also shown, an optional memory 113 can be included in the front-end interface 108 and/or in the signal processor 110. This memory 113 can serve as a buffer or storage location for the front-end interface 108 and/or the signal processor 110, among other uses. The user interface 112 can provide an output, e.g., on a display, for presentation to a user of the data collection system 100. The user interface 112 can be implemented as a touch-screen display, an LCD display, an organic LED display, or the like. In addition, the user interface 112 can be manipulated to allow for measurement on the non-dominant side of patient. For example, the user interface 112 can include a flip screen, a screen that can be moved from one side to another on the monitor 109, or can include an ability to reorient its display indicia responsive to user input or device orientation. In alternative embodiments, the data collection system 100 can be provided without a user interface 112 and can simply provide an output signal to a separate display or system. Poeze II at [0083]-[0085]

EXHIBIT F7

U.S. Pat. No. 12,193,790 B2 in view of U.S. Patent No. 20120150047 to Koji Terumoto ("Terumoto")

As described in detail below, Terumoto (individually or collectively) anticipates and/or renders obvious claim 7 ("Asserted Claim") of U.S. Patent No. 12,193,790 B2 (the "'790 Patent") under 35 U.S.C. §102 and/or §103, either alone in combination with the knowledge of a person of ordinary skill, and/or additional prior art references discussed in discussed in Exhibits F1-F14, the contents of which are hereby incorporated by reference into this chart. One of ordinary skill in the art, as of the priority date of the '790 Patent, would have known to combine the prior art elements disclosed by the foregoing references using known methods, and to use these elements according to their established functions in order to achieve a known and predictable result. This invalidity claim chart is based on Defendants' present understanding of the Asserted Claim and Plaintiff's apparent construction of the Asserted Claim in its Preliminary Infringement Contentions ("Infringement Contentions").

The following invalidity chart includes references to the structure, function, operation, and/or features of the technology described in Terumoto. The cited portions of Terumoto are merely illustrative, and Defendants reserve the right to rely on alternative or additional evidence, including uncited portions of Terumoto. Where a particular figure is cited, the citation should be understood to encompass the caption and description of the figure as well as any text relating to or describing the figure. Conversely, where particular text referring to a figure is cited, the citation should be understood to include the figure as well. Although the documentation collectively evidences prior knowledge, use, or sale, Defendants reserve the right to rely upon individual documents as printed publications. Where the chart below states that Terumoto "describes" or "provides for" a limitation, such disclosure may be express, inherent, or implicit. To the extent it is found Terumoto does not expressly disclose certain limitations in the Asserted Claim, such limitations are inherent. Defendants reserve the right to present direct evidence of the structure, function, operation, and/or features of the technology described in Terumoto (including product samples, source code, and/or witness testimony) and/or its prior art status, and to present alternative or additional documents concerning the same as evidence that the technology described in Terumoto anticipates and/or renders obvious the Asserted Claim of the '790 Patent

This chart is subject to all reservations, objections, and disclaimers in Defendants' Invalidity Contentions and any amendment, supplement, or modification thereof, which are incorporated herein by reference in their entirety. Nothing stated herein shall be treated as an admission or suggestion that Defendants agree with Plaintiff regarding the scope of the Asserted Claim, Plaintiff's apparent claim constructions, or the accuracy of any particular claim construction. Defendants reserve all rights to challenge any of the claim terms herein under 35 U.S.C. § 112, including by arguing that they are indefinite, are not supported by the written description, and/or are not enabled. Defendants further reserve all rights to amend this invalidity claim chart without leave of court pursuant to the Court's Docket Control Order, or upon a showing of good cause.

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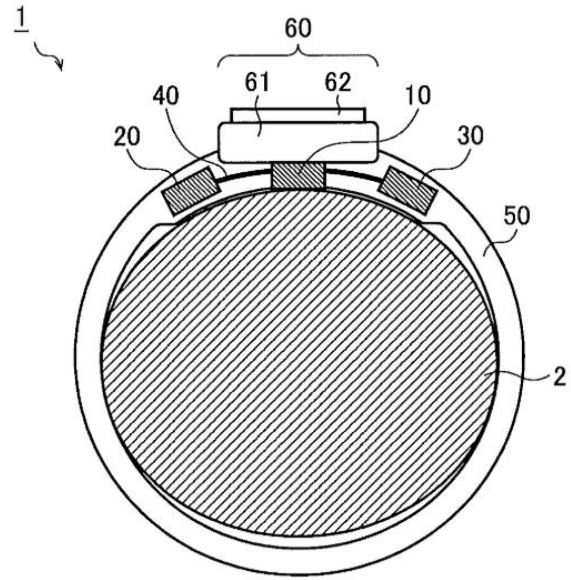
Claim 7	
7[pre]. An optical system, comprising:	By providing this disclosure, Defendants do not take a position on whether the preamble is limiting. Terumoto discloses or renders obvious an optical system.  Terumoto at Fig. 3 FIG. 3 is a cross section diagram illustrating a first implementation of the pulse wave sensor schematically in accordance with the implementation example 1. The pulse wave sensor 1 of the first implementation has a construction to measure the pulse wave at the wrist 2, to be more concrete, which has an armlet construction (i.e., a wrist watch construction in the first implementation) to measure the pulse wave to be worn on the wrist 2. In addition, with respect to the construction elements, the pulse wave sensor 1 of the first implementation includes a measurement unit 10, a power source unit 20, a communication unit 30, a cable 40, an armlet type housing 50, and a display unit 60. Terumoto at [0103] This invention relates to a pulse wave sensor.

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	Terumoto at [0003] C**onventionally, the pulse wave sensor is a construction to measure the pulse wave by means of a light emitting portion to emit a light to a fingertip of the examinee, and a light receiving portion to detect an intensity of the light penetrates through a living body.** For example, with respect to the pulse wave sensor of the conventional construction, as illustrated in FIG. 15, it has a construction to measure the pulse wave at fingertip of the examinee. Moreover, with respect to the conventional pulse wave sensor, it has a construction to transmit the measurement data to the main CPU [Central Processing Unit] timely and to analyzes or stores the measurement data at main CPU side. Moreover, the conventional pulse wave sensor has a construction to connect with the main CPU by wire. Terumoto at [0005] Moreover, with respect to the pulse wave sensor in accordance with the construction 1-3, the measurement unit includes a light sensor to detect an intensity of the light emitted to the wrist and penetrates a living body (i.e., construction 1-4). Moreover, with respect to the pulse wave sensor in accordance with the construction 1-4, wherein an output wavelength of the light sensor belongs to the visible light region and is smaller than or equal to 600 nm approximately (i.e., construction 1-5). Terumoto at [0013]-[0014]

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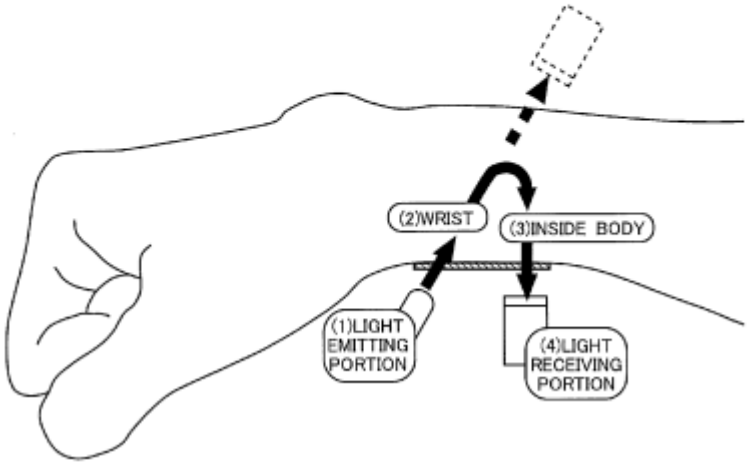
	FIG. 1  Terumoto at Fig. 1 **FIG. 1 is a schematic diagram to explain a principle of a pulse wave measurement in accordance with the implementation example 1 of the invention. FIG. 2 is a wave form diagram illustrating a situation where the amount of light attenuation within a living body (i.e., light absorption level) changes according to the time lapse illustrated in the pulse wave measurement in FIG. 1.** Terumoto at [0100] Moreover, the pulse wave sensor disclosed in this specification includes multiple light sensor portions to detect an intensity of the light emitted to a wrist and penetrates a living body, a controller to perform ON/OFF control of each of the multiple light sensor portions, and an armlet type housing to contain the multiple light sensor portions and the controller (i.e., construction 2-1).

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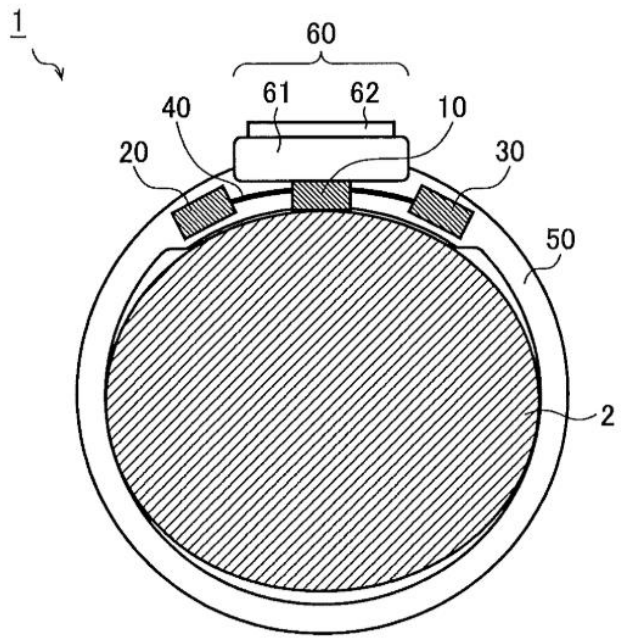
	Terumoto at [0035] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Terumoto, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Terumoto, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[a]. a wearable device for measuring one or more physiological parameters, the wearable device adapted to be placed on a wrist of a user;	Terumoto discloses or renders obvious a wearable device for measuring one or more physiological parameters, the wearable device adapted to be placed on a wrist of a user.  Terumoto at Fig. 3 For example, with respect to a pulse measurement by means of plethysmography, as illustrated in FIG. 1, the light is emitted from the light emitting portion (e.g., LED [light Emitting Diode], etc) to part of

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	the living body (i.e., other portions work well, the wrist shown in FIG. 1 or the fingertip illustrated in FIG. 24, for example) pressed to the measurement window. Then an intensity of the light which penetrates through the body and go out of the body is detected at the light receiving portion (e.g., a photo diode or a photo transistor). Here, as illustrated in FIG. 2, although the amount of light attenuation (i.e., the light absorption level) absorbed in biological tissue or venous blood (i.e., deoxyhemoglobin Hb) is constant, the amount of light attenuation (i.e., light absorption level) absorbed by the arterial blood (i.e., oxyhemoglobin HbO2) fluctuates based on the person's beat (i.e., pulse) according to the time lapse. Therefore, by using the living body window (i.e., a wave length region where the light is easy to penetrate the living body), a transition of the absorption level of the peripheral arterial can be measured and plethysmogram can be measured. Terumoto at [0101] In addition, the pulse wave controlled by a heart or autonomic nerves does not always show a constant behavior, the pulse wave gives birth the changes (i.e., fluctuations) differently based on a state of the measured person. Accordingly, based on an analysis of the pulse wave of the changes (i.e., fluctuations), various body information of the measured person can be acquired. For example, an athletic ability or tension of the measured person can be learned from the heart rate. A fatigue level, a pleasant sleep level, and a stress level of the measured person can be learned from the fluctuation of the heart rate. Furthermore, based on an acceleration pulse wave acquired by differentiating the pulse wave two times by the time axis, the blood vessel age or arterial stiffness of the measured person can be learned. Terumoto at [0102] FIG. 3 is a cross section diagram illustrating a first implementation of the pulse wave sensor schematically in accordance with the implementation example 1. **The pulse wave sensor 1 of the first implementation has a construction to measure the pulse wave at the wrist 2, to be more concrete, which has an armlet construction (i.e., a wrist watch construc-tion in the first implementation) to measure the pulse wave to be worn on the wrist 2.** In addition, with respect to the con-struction elements, the pulse wave sensor 1 of the first imple-mentation includes a measurement unit 10, a power source unit 20, a communication unit 30, a cable 40, an armlet type housing 50, and a display unit 60. Terumoto at [0103]

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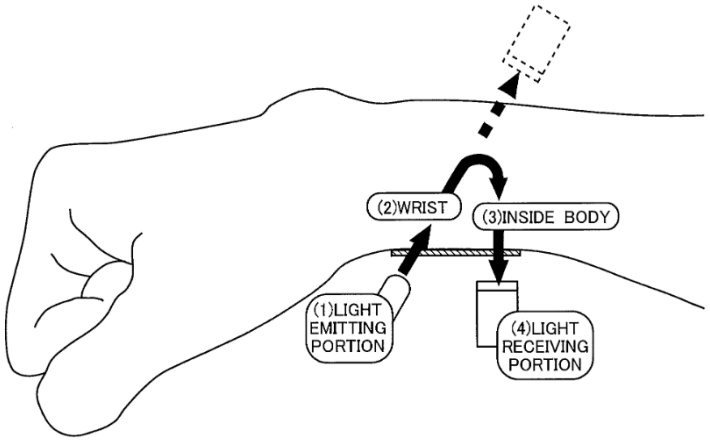
	The power source unit 20 is a unit to supply power to the measurement unit 10 and the communication unit 30 mainly, the power source unit 20 is contained within the armlet type housing 50 to be located to the back side of the wrist 2 when the armlet type 50 is worn on the wrist 2. In this way, by means oflocating the second unit 20 which can be a noise source for the first unit 10 separately from the first unit 10 as an another unit, the measurement accuracy of the pulse wave can be improved. In addition, an internal construction and an operation of the power source unit 20 is explained in detail later. Terumoto at [0105]  Terumoto at Fig. 1 The armlet type housing 50 contains the measure-ment unit 10, the power source unit 20, the communication unit 30, and the cable 40. **The armlet type housing 50 is worn on the wrist**. Terumoto at [0108] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are

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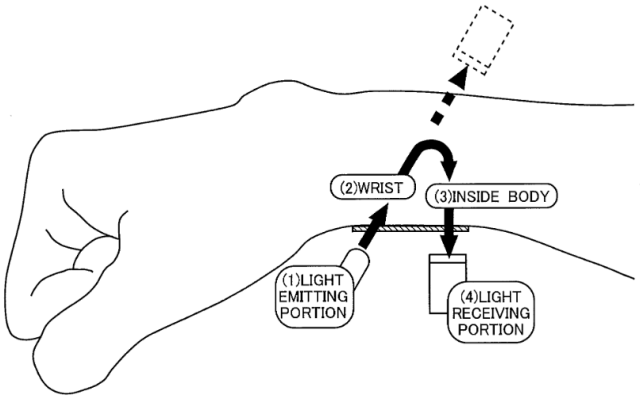
	incorporated by reference into this chart. To the extent this limitation is not disclosed by Terumoto, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Terumoto, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[b]. the wearable device including a light source comprising a plurality of semiconductor diodes that are configured to generate an output optical light having one or more optical wavelengths, wherein at least a portion of the one or more optical wavelengths is a near-infrared wavelength between 700 nanometers and 2500 nanometers;	Terumoto discloses or renders obvious the wearable device including a light source comprising a plurality of semiconductor diodes that are configured to generate an output optical light having one or more optical wavelengths, wherein at least a portion of the one or more optical wavelengths is a near-infrared wavelength between 700 nanometers and 2500 nanometers. Moreover, the pulse wave sensor disclosed in this specification includes **a first light emitting portion to emit light of a first emission intensity to a living body**, and a first light receiving portion to receive returned light emitted from the first light emitting portion and penetrates the living body and to generate a first light receiving signal. The pulse wave sensor further includes **a second light sensor including, a second light emitting portion to emit light of a second emission intensity weaker than the first emission intensity to the living body**, and a second light receiving portion to receive returned light emitted from the second light emitting portion and penetrates the living body and to generate a second light receiving signal, and a processing circuit to acquire the pulse wave data based on a subtraction of the second light receiving signal from the first light receiving signal (i.e., construction 3-1). Terumoto at [0046]  Terumoto at Fig. 1

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	For example, with respect to a pulse measurement by means of plethysmography, as illustrated in FIG. 1, **the light is emitted from the light emitting portion (e.g., LED [light Emitting Diode], etc) to part of the living body (i.e., other portions work well, the wrist shown in FIG. 1 or the fingertip illustrated in FIG. 24, for example) pressed to the measurement window.** Then an intensity of the light which penetrates through the body and go out of the body is detected at the light receiving portion (e.g., a photo diode or a photo transistor). Here, as illustrated in FIG. 2, although the amount oflight attenuation (i.e., the light absorption level) absorbed in biological tissue or venous blood (i.e., deoxyhemoglobin Hb) is constant, the amount of light attenuation (i.e., light absorption level) absorbed by the arterial blood (i.e., oxyhe-moglobin HbO2) fluctuates based on the person's beat (i.e., pulse) according to the time lapse. Therefore, by using the living body window (i.e., a wave length region where the light is easy to penetrate the living body), a transition of the absorp-tion level of the peripheral arterial can be measured and plethysmogram can be measured. Terumoto at [0101] In addition, with respect to the pulse oxymeter to detect the oxygen saturation of the arterial blood, although the wave length of the near-infrared region (approximately 700 nm) where the difference between the absorption coefficient of the oxyhemoglobin HbO2 (shown in full line) and the absorption coefficient of the deoxyhemoglobin Hb becomes maximum is used as the output wave length of the light emitting portion universally, in consideration of usage as the pulse wave sensor, as illustrated in the aforementioned experiment result, it can be determined that it is desirable to use the visible light region whose wave length is shorter than or equal to 600 nm as the output wave length of the light emitting portion. Terumoto at [0150] The first light sensor A10 is a light sensor to detect the pulse wave component mainly and includes the first light emitting portion A11, the first light receiving portion A12, and the measurement window A13. The first light emitting portion A11 emits a light of the first emission intensity P1 to the living body A2. **As the first light emitting portion A11, a visible light LED or a near-infrared LED can be used.** The first light receiving portion A12 receives a returned light emitted from the first light emitting portion A11 and penetrates the living body A2 and generates a first light receiving signal S1. As the first light receiving portion A12, a photo diode or a photo transistor can be used. The measurement window A13 is a translucency member (i.e., a glass plate or an acrylic plate) which is provided on the light

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	emitting/receiving surface of the first light sensor A10. The first light sensor A10 performs the pulse wave measurement (i.e., light emission to the living body A2 and a detection of the returned light from the living body A2) via the measurement window A13. In addition, with respect to the thickness of the measurement window A13, it is desirable to design appropriately in view of the depth of focus of the first light sensor A10. Terumoto at [0190] **The pulse wave sensor according to claim 4, wherein an output wavelength of the light sensor belongs to the visible light region and is smaller than or equal to 600 nm approxi-mately**. Terumoto at Claim 5 In the experiment, **by means of the pulse wave sen-sor 1 of so-called reflection type, each output wave length of the light emitting portions is set to Al (infrared: 940 mm), A2 (green: 630 nm), and A3 (blue: 468 nm), and each behavior is examined when the output intensity of the light emitting portions (i.e., driving current value) are varied to 1 mA, 5 mA, and 10 mA.** As the result, with respect to the visible light region whose wave length is shorter than or equal to 600 nm, it is examined that the wave form of the pulse wave can be acquired relatively easy because the absorption coefficient of oxyhemoglobin HbO2 becomes larger and the peak intensity of the measured pulse wave becomes larger. Terumoto at [0149] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant's Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Terumoto, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Terumoto, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[c]. the wearable device comprising one or more lenses configured to receive at least a portion of the	Terumoto discloses or renders obvious the wearable device comprising one or more lenses configured to receive at least a portion of the output optical light and to deliver a lens output light to tissue comprising skin.

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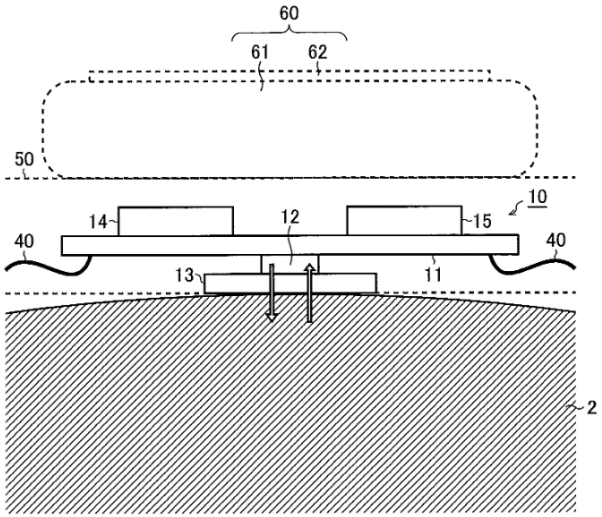
output optical light and to deliver a lens output light to tissue comprising skin;	 Terumoto at Fig. 4 **The measurement window 13 is constructed with the translucency member (i.e., a glass plate or an acrylic plate, and so on) which is provided at the light emitting/receiving surface of the light sensor 12. The light sensor 12 performs the measurement of the pulse wave (i.e., detection for the emitted light to the wrist 2 and a reflected light go back from the wrist 2) via this measurement window 13.** In addition, with respect to the thickness of the measurement window 13, it is desirable to design appropriately in view of the depth of focus of the light sensor 12. Terumoto at [0119] **With respect to the inside of the wrist 2, though fit feeling of the pulse wave sensor 1 around the center portion is scanty because of the tendon located right beneath the skin, fit feeling of the pulse wave sensor 1 around the both ends is fine because of the thick flesh**. Accordingly, with respect to the first wearing state of the pulse wave sensor 1, the pulse wave can be measured appropriately by the measurement units 10 a and 10 c located at both ends of the measurement unit row. Terumoto at [0135]

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	The armlet type housing 50 contains the measure-ment unit 10, the power source unit 20, the communication unit 30, and the cable 40. **The armlet type housing 50 is worn on the wrist**. Terumoto at [0108] FIG. 3 is a cross section diagram illustrating a first implementation of the pulse wave sensor schematically in accordance with the implementation example 1. **The pulse wave sensor 1 of the first implementation has a construction to measure the pulse wave at the wrist 2, to be more concrete, which has an armlet construction (i.e., a wrist watch construc-tion in the first implementation) to measure the pulse wave to be worn on the wrist 2.** In addition, with respect to the con-struction elements, the pulse wave sensor 1 of the first imple-mentation includes a measurement unit 10, a power source unit 20, a communication unit 30, a cable 40, an armlet type housing 50, and a display unit 60. Terumoto at [0103] **The power source unit 20 is a unit to supply power to the measurement unit 10 and the communication unit 30 mainly, the power source unit 20 is contained within the armlet type housing 50 to be located to the back side of the wrist 2 when the armlet type 50 is worn on the wrist 2.** In this way, by means oflocating the second unit 20 which can be a noise source for the first unit 10 separately from the first unit 10 as an another unit, the measurement accuracy of the pulse wave can be improved. In addition, an internal construction and an operation of the power source unit 20 is explained in detail later. Terumoto at [0105] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Terumoto, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Terumoto, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[d]. the wearable device further comprising a	Terumoto discloses or renders obvious the wearable device further comprising a detection system configured to receive at least a portion of the lens output light reflected from the tissue and to generate

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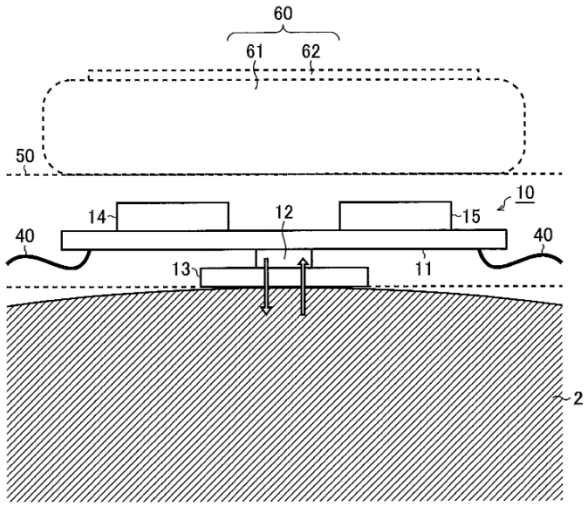
detection system configured to receive at least a portion of the lens output light reflected from the tissue and to generate an output signal having a signal-to-noise ratio, wherein the detection system is configured to be synchronized to the light source;	an output signal having a signal-to-noise ratio, wherein the detection system is configured to be synchronized to the light source. **By emitting the light from the light emitting portion to the wrist 2 and detect the intensity of the light which penetrates the living body by the light receiving portion, the light sensor 12 acquires the pulse wave data.** In addition, the light sensor 12 in accordance with this construction example is not a construction both the light emitting portion and the light receiving portion are provided at opposite side against the wrist 2 each other (i.e., a so-called penetration type, in reference to a broken line arrow in FIG. 1). **The light sensor 12 is a construction both the light emitting portion and the light receiving portion are provided at same side against the wrist 2 (i.e., a so-called reflection type, in reference to a full line arrow in FIG. 1).** Terumoto at [0118]  Terumoto at Fig. 4 The amplifier circuit 14 amplifies the output signal (i.e., a detection signal of the light receiving portion) of the light sensor 12 and provides it to the processing circuit 15. In this way, with respect to a construction to equip the amplifier circuit 14 to the vicinity of the light sensor 12, **the output signal of the light sensor 12 can be amplified before the noise is superimposed, then it makes possible to**

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	improve S/N [Signal/Noise Ratio] of the signal, furthermore, the measurement accuracy of the pulse wave can be improved. Terumoto at [0120] The measurement window 13 is constructed with the translucency member (i.e., a glass plate or an acrylic plate, and so on) which is provided at the light emitting/receiving surface of the light sensor 12. **The light sensor 12 performs the measurement of the pulse wave (i.e., detection for the emitted light to the wrist 2 and a reflected light go back from the wrist 2) via this measurement window 13.** In addition, with respect to the thickness of the measurement window 13, it is desirable to design appropriately in view of the depth of focus of the light sensor 12. Terumoto at [0119] For example, among the light sensor portions X to Z in FIG. 20, **with respect to the measurement data of the light sensor portions X and Y, though the frequencies FX and FY of output peak are within the predetermined range, with respect to the measurement data of the light sensor portion Z, the frequency FZ of output peak is not within the predetermined range because of the noise. Therefore, by turning OFF the light sensor portion Z which is not expected to measure the pulse wave normally in advance, further reduction of the energy consumption can be realized without worsening the measurement accuracy of the pulse wave** Terumoto at [0168] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant's Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Terumoto, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Terumoto, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[e]. wherein the detection system comprises a plurality of detectors that are spatially	Terumoto discloses or renders obvious the detection system comprises a plurality of detectors that are spatially separated from each other, and wherein at least one analog to digital converter is coupled to at least one of the plurality of detectors.

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separated from each other, and wherein at least one analog to digital converter is coupled to at least one of the plurality of detectors;	**Each of the light sensor portions 101-1 to 101-n detects an intensity of the light emitted to the wrist 200 and penetrates a living body. The light sensor portions 101-1 to 101-n are located equally spaced from one another and to go round the armlet type housing 107 same as the fourth to sixth implementations. In addition, because the construction and the output wave length of the light sensor portions 101-1 to 101-n are same as the aforementioned light sensor 12**, a redundant explanation is omitted here. Terumoto at [0152] For example, as illustrated in FIG. 18**, in the case of the shaft center of the armlet type housing 107 is facing to the horizontal direction or horizontal direction approximately, according to its own weight of the armlet type housing 107, among the light sensor portions 101-1 to 101-n, the light sensor portions positioned above than the horizontal line which passes the center shaft are closely contacted to the wrist 200, and the sensors located beneath the horizontal line are apart from the wrist 200.** Therefore, by turning ON the above positioned light sensor portions which are expected to perform normal pulse wave measurement, and turning OFF the beneath positioned light sensor portions which are not expected to perform normal pulse wave measurement in advance, the energy consumption can be reduced to ½ compared to all of the light sensor portions 101-1 to 101-n are turned ON without worsening the measurement accuracy of the pulse wave sensor 100. Terumoto at [0161] The pulse wave sensor according to claim 4, wherein the multiple measurement units are located equally spaced from one another around the armlet type housing. Terumoto at Claim 13 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant's Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Terumoto, it

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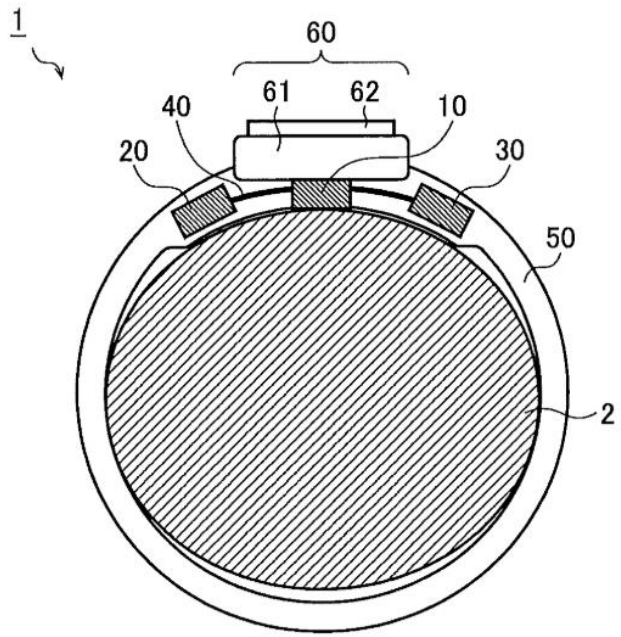
	would have been obvious to one of ordinary skill in the art to combine, with the teachings of Terumoto, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[f]. wherein the output signal is indicative of the one or more of the physiological parameters;	Terumoto discloses or renders obvious the output signal is indicative of the one or more of the physiological parameters.  Terumoto at Fig. 3 In addition, the pulse wave controlled by a heart or autonomic nerves does not always show a constant behavior, the pulse wave gives birth the changes (i.e., fluctuations) differently based on a state of the measured person. Accordingly, based on an analysis of the pulse wave of the changes (i.e., fluctuations), various body information of the measured person can be acquired. For example, an athletic ability or tension of the measured person can be learned from the heart rate. A fatigue level, a pleasant sleep level, and a stress level of the measured person can be learned from the fluctuation of the heart rate. Furthermore, based on an acceleration pulse wave acquired by differentiating the pulse wave two times by the time axis, the blood vessel age or arterial stiffness of the measured person can be learned.

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	Terumoto at [0102] **FIG. 3 is a cross section diagram illustrating a first implementation of the pulse wave sensor schematically in accordance with the implementation example 1. The pulse wave sensor 1 of the first implementation has a construction to measure the pulse wave at the wrist 2, to be more concrete, which has an armlet construction (i.e., a wrist watch construction in the first implementation) to measure the pulse wave to be worn on the wrist 2.** In addition, with respect to the construction elements, the pulse wave sensor 1 of the first implementation includes a measurement unit 10, a power source unit 20, a communication unit 30, a cable 40, an armlet type housing 50, and a display unit 60. Terumoto at [0103] The measurement unit 10 is a unit to measure the pulse wave mainly, which is contained within the armlet type housing 50 to be located at the back side of the display unit 60. Owing to this construction, in a situation where the examinee turns the face to the display unit 60 to watch information (e.g., a result of the pulse wave measurement) displayed at the display unit 60, the measurement unit 10 is pressed to the wrist 2 according to the weight of the display unit 60, **the pulse wave can be measured stably, furthermore, the accuracy for measuring the pulse wave can be improved. Moreover, with respect to the pulse wave measurement at the wrist, the inventors of this application confirmed it is possible to measure the pulse wave sufficiently, though the sensitivity is lower compared to the pulse wave measurement at the fingertip.** In addition, the internal construction and the operation of the measurement unit 10 are explained in detail later. Terumoto at [0104] The processing circuit 15 controls entire operation of the pulse wave sensor 1 generally, and **also by means of performing a various signal process for the output signal of the amplifier circuit 14, it acquires various information about the pulse wave (i.e., the fluctuation of the pulse wave, the heart rate, the fluctuation of the heart rate, and the acceleration pulse wave).** In addition, as the processing circuit 15, the CPU [Central Processing Unit] can be used appropriately. In this way, with respect to the construction both the light sensor 12 and the amplifier circuit 14 are located at the vicinity of the processing circuit 15, the output signal of the amplifier circuit 14 can be processed before the noise superimposes, therefore, it is possible to improve the analysis accuracy of the pulse wave.

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	Terumoto at [0121] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Terumoto, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Terumoto, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[g]. the wearable device configured to increase the signal-to-noise ratio by increasing light intensity of at least one of the plurality of semiconductor diodes from an initial light intensity; and	Terumoto discloses or renders obvious the wearable device configured to increase the signal-to-noise ratio by increasing light intensity of at least one of the plurality of semiconductor diodes from an initial light intensity. In step S108, a predetermined operation process is processed to the measurement data acquired in step S107. For example, as illustrated in FIG. 21, **a method can be considered to generate an added output (i.e., A+B) by adding an output A of the light sensor portion A and an output B of the light sensor portion B. Owing to performing this operation process, S/N ratio can be improved by enhancing the intensity of the output peak.** Terumoto at [0172] Moreover, as illustrated in FIG. 22, **a method can be considered to generate the subtracted output (i.e., A-B) by subtracting the output B including only the noise component (i.e., an output of the light sensor B which is provided additionally to detect only for the dark current) from the output A of the light sensor portion A which a noise component is superimposed. Owing to performing this operation process, the noise component can be removed and S/N ratio can be improved.** Terumoto at [0173] The amplifier circuit 14 amplifies the output signal (i.e., a detection signal of the light receiving portion) of the light sensor 12 and provides it to the processing circuit 15. In this way, with respect to a construction to equip the amplifier circuit 14 to the vicinity of the **light sensor 12, the output signal of the light sensor 12 can be amplified before the noise is superimposed, then it makes possible to**

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	improve S/N [Signal/Noise Ratio] of the signal, furthermore, the measurement accuracy of the pulse wave can be improved. Terumoto at [0120] Therefore, **by subtracting second light receiving signal S2 acquired at the second light sensor A20 of relatively week second light emission intensity P2 from the first light receiving signal S1 acquired at the first light sensor A10 of the first light emission intensity P1, the motion noise included in respective signals can be counterbalanced, then pure pulse wave component can be acquired** (in reference to FIG. 28). Thus, with respect to the pulse wave sensor A1 in accordance with this construction example, regardless of the movement or vibration of the examinee, the pulse wave can be measured with high accuracy, the pulse wave can be measured all day long in daily life. Terumoto at [0201] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Terumoto, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Terumoto, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[h]. the detection system further configured to: generate a first signal responsive to light received while the semiconductor diodes are off,	Terumoto discloses or renders obvious the detection system further configured to: generate a first signal responsive to light received while the semiconductor diodes are off. In step S104, with respect to the measurement data measured by each of the light sensors portion which is turned ON in step S101 among the light sensor portions 101-1 to 101-n, each output intensity and predetermined threshold value are compared, based on the comparison result, **ON/OFF control of each of the light sensor portions 101-1 to 101-n is performed**. To be more concrete, **with respect to the data whose output intensity is below than the predetermined threshold, the light sensor portion is turned OFF as interpreted output shortage is occurred.** Terumoto at [0165]

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	In step S105, with respect to the measurement data measured by each of the light sensors portion which is turned ON in step S101 among the light sensor portions 101-1 to 101-n, a judgment whether or not the frequency of each output peak is within the predetermined range is performed, based on the judgment result**, ON/OFF control of each of the light sensor portions 101-1 to 101-n is performed. To be more concrete, with respect to its frequency of output peak is not within the range of 60 bpm to 200 bpm [beats per minutes], the light sensor portion is turned OFF as interpreted frequency abnormality (e.g., noise superimpose, etc) is occurred.** Terumoto at [0167] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Terumoto, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Terumoto, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[i]. generate a second signal responsive to light received while at least one of the semiconductor diodes is on, and	Terumoto discloses or renders obvious the detection system further configured to: generate a second signal responsive to light received while at least one of the semiconductor diodes is on. **In step S102, among the light sensor portions 101-1 to 101-n, by using the light sensor turned ON in step S101, a measurement is performed to detect the intensity and the frequency of the output peak.** With respect to the pulse wave measurement in this step, it is performed to acquire information required to select the light sensor portion furthermore, and transmission of the measured date to the outside is not performed. Terumoto at [0163] In step S105, with respect to **the measurement data measured by each of the light sensors portion which is turned ON in step S101 among the light sensor portions 101-1 to 101-n, a judgment whether or not the frequency of each output peak is within the predetermined range is performed,** based on the judgment result, ON/OFF control of each of the light sensor portions 101-1 to 101-n is performed. To be more concrete, with respect to its frequency of output peak is not within the range of

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	60 bpm to 200 bpm [beats per minutes], the light sensor portion is turned OFF as interpreted frequency abnormality (e.g., noise superimpose, etc) is occurred. Terumoto at [0167] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Terumoto, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Terumoto, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[j]. increase the signal-to-noise ratio by comparing the first signal and the second signal; and	Terumoto discloses or renders obvious the detection system further configured to: increase the signal-to-noise ratio by comparing the first signal and the second signal. In step S108, a predetermined operation process is processed to the measurement data acquired in step S107. For example, as illustrated in FIG. 21, **a method can be considered to generate an added output (i.e., A+B) by adding an output A of the light sensor portion A and an output B of the light sensor portion B. Owing to performing this operation process, S/N ratio can be improved by enhancing the intensity of the output peak.** Terumoto at [0172] Moreover, as illustrated in FIG. 22, **a method can be considered to generate the subtracted output (i.e., A-B) by subtracting the output B including only the noise component (i.e., an output of the light sensor B which is provided additionally to detect only for the dark current) from the output A of the light sensor portion A which a noise component is superimposed. Owing to performing this operation process, the noise component can be removed and S/N ratio can be improved.** Terumoto at [0173] Therefore, **by subtracting second light receiving signal S2 acquired at the second light sensor A20 of relatively week second light emission intensity P2 from the first light receiving signal S1 acquired at the first light sensor A10 of the first light emission intensity P1, the motion noise**

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	included in respective signals can be counterbalanced, then pure pulse wave component can be acquired (in reference to FIG. 28). Thus, with respect to the pulse wave sensor A1 in accordance with this construction example, regardless of the movement or vibration of the examinee, the pulse wave can be measured with high accuracy, the pulse wave can be measured all day long in daily life. Terumoto at [0201] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Terumoto, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Terumoto, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[k]. wherein the wearable device is at least in part configured to identify an object.	Terumoto discloses or renders obvious the wearable device is at least in part configured to identify an object.

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	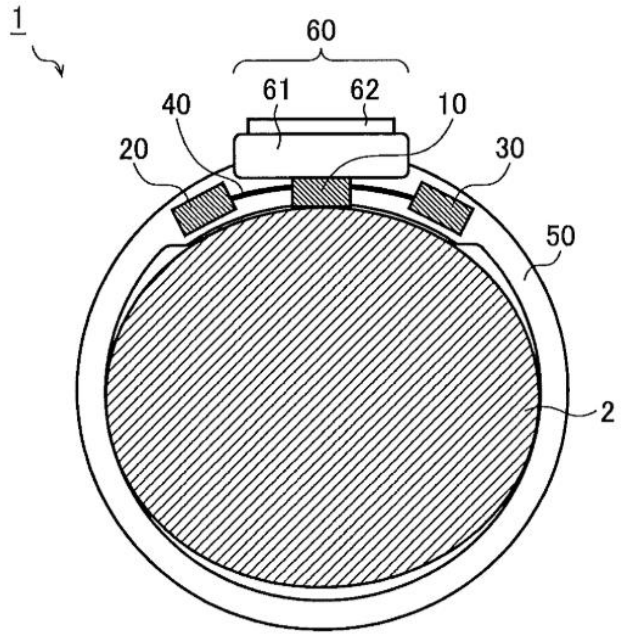 Terumoto at Fig. 3 FIG. 3 is a cross section diagram illustrating a first implementation of the pulse wave sensor schematically in accordance with the implementation example 1. **The pulse wave sensor 1 of the first implementation has a construction to measure the pulse wave at the wrist 2, to be more concrete, which has an armlet construction (i.e., a wrist watch construc-tion in the first implementation) to measure the pulse wave to be worn on the wrist 2.** In addition, with respect to the con-struction elements, the pulse wave sensor 1 of the first imple-mentation includes a measurement unit 10, a power source unit 20, a communication unit 30, a cable 40, an armlet type housing 50, and a display unit 60. Terumoto at [0103] The measurement unit 10 is a unit to measure the pulse wave mainly, which is contained within the armlet type housing 50 to be located at the back side of the display unit 60. Owing to this construction, in a situation where the examinee turns the face to the display unit 60 to watch information (e.g., a result of the pulse wave measurement) displayed at the display unit 60, the measurement unit 10 is pressed to

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	the wrist 2 according to the weight of the display unit 60, **the pulse wave can be measured stably, furthermore, the accuracy for measuring the pulse wave can be improved. Moreover, with respect to the pulse wave measurement at the wrist, the inventors of this application confirmed it is possible to measure the pulse wave sufficiently, though the sensitivity is lower compared to the pulse wave measurement at the fingertip.** In addition, the internal construction and the operation of the measurement unit 10 are explained in detail later. Terumoto at [0104] The processing circuit 15 controls entire operation of the pulse wave sensor 1 generally, and **also by means of performing a various signal process for the output signal of the amplifier circuit 14, it acquires various information about the pulse wave (i.e., the fluctuation of the pulse wave, the heart rate, the fluctuation of the heart rate, and the acceleration pulse wave).** In addition, as the processing circuit 15, the CPU [Central Processing Unit] can be used appropriately. In this way, with respect to the construction both the light sensor 12 and the amplifier circuit 14 are located at the vicinity of the processing circuit 15, the output signal of the amplifier circuit 14 can be processed before the noise superimposes, therefore, it is possible to improve the analysis accuracy of the pulse wave. Terumoto at [0121] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Terumoto, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Terumoto, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.

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EXHIBIT F8

U.S. Pat. No. 12,193,790 B2 in view of U.S. Patent No. 8,172,761 to Nikolai Rulkov ("Rulkov")

As described in detail below, Rulkov (individually or collectively) anticipates and/or renders obvious claim 7 ("Asserted Claim") of U.S. Patent No. 12,193,790 B2 (the "'790 Patent") under 35 U.S.C. §102 and/or §103, either alone in combination with the knowledge of a person of ordinary skill, and/or additional prior art references discussed in discussed in Exhibits F1-F14, the contents of which are hereby incorporated by reference into this chart. One of ordinary skill in the art, as of the priority date of the '790 Patent, would have known to combine the prior art elements disclosed by the foregoing references using known methods, and to use these elements according to their established functions in order to achieve a known and predictable result. This invalidity claim chart is based on Defendants' present understanding of the Asserted Claim and Plaintiff's apparent construction of the Asserted Claim in its Preliminary Infringement Contentions ("Infringement Contentions").

The following invalidity chart includes references to the structure, function, operation, and/or features of the technology described in Rulkov. The cited portions of Rulkov are merely illustrative, and Defendants reserve the right to rely on alternative or additional evidence, including uncited portions of Rulkov. Where a particular figure is cited, the citation should be understood to encompass the caption and description of the figure as well as any text relating to or describing the figure. Conversely, where particular text referring to a figure is cited, the citation should be understood to include the figure as well. Although the documentation collectively evidences prior knowledge, use, or sale, Defendants reserve the right to rely upon individual documents as printed publications. Where the chart below states that Rulkov "describes" or "provides for" a limitation, such disclosure may be express, inherent, or implicit. To the extent it is found Rulkov does not expressly disclose certain limitations in the Asserted Claim, such limitations are inherent. Defendants reserve the right to present direct evidence of the structure, function, operation, and/or features of the technology described in Rulkov (including product samples, source code, and/or witness testimony) and/or its prior art status, and to present alternative or additional documents concerning the same as evidence that the technology described in Rulkov anticipates and/or renders obvious the Asserted Claim of the '790 Patent

This chart is subject to all reservations, objections, and disclaimers in Defendants' Invalidity Contentions and any amendment, supplement, or modification thereof, which are incorporated herein by reference in their entirety. Nothing stated herein shall be treated as an admission or suggestion that Defendants agree with Plaintiff regarding the scope of the Asserted Claim, Plaintiff's apparent claim constructions, or the accuracy of any particular claim construction. Defendants reserve all rights to challenge any of the claim terms herein under 35 U.S.C. § 112, including by arguing that they are indefinite, are not supported by the written description, and/or are not enabled. Defendants further reserve all rights to amend this invalidity claim chart without leave of court pursuant to the Court's Docket Control Order, or upon a showing of good cause.

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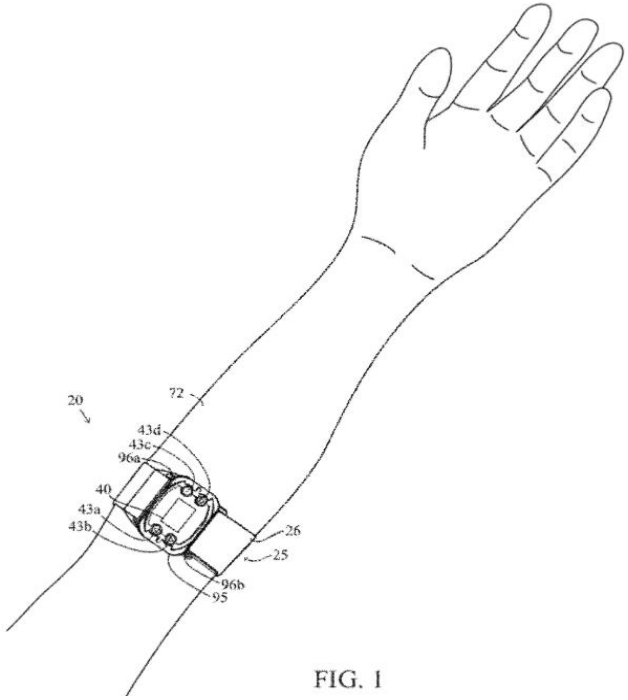
Claim 7	
7[pre]. An optical system, comprising:	By providing this disclosure, Defendants do not take a position on whether the preamble is limiting. Rulkov discloses or renders obvious an optical system. A monitoring device for monitoring the vital signs of a user is disclosed herein. The monitoring device is preferably comprises an article, an optical sensor, an accelerometer and processor. The optical sensor preferably comprises a photodetector and a plurality of light emitting diodes. A sensor signal from the optical sensor is processed with a filtered accelerometer output signal from the accelerometer to create a filtered vital sign signal used to generate a real-time vital sign for a user. Rulkov at Abstract  FIG. 1 Rulkov at Fig. 1

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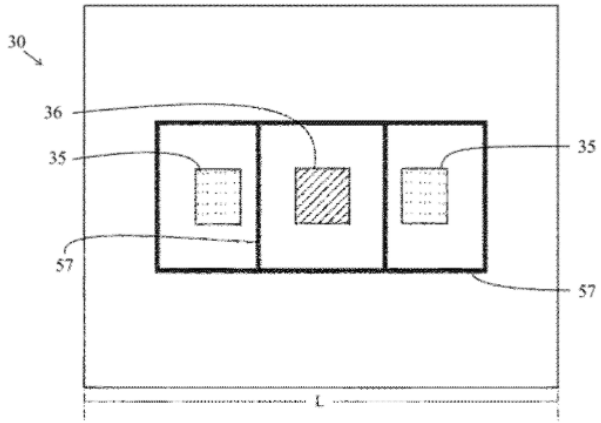
	As shown in FIGS. 1-5, a monitoring device is generally designated 20. **The monitoring device 20 preferably includes an article 25 and an attachment band 26 having an exterior surface 26 a and interior surface 26 b. The monitoring device 20 is preferably secured with VELCRO® hook and loop material 31 a and 31 b. The article 25 preferably includes an optical sensor 30, control components 43 a-43 c and optionally a display member 40.** The monitoring device 20 is preferably worn on a user's wrist, arm or ankle. Rulkov at 4:36-44  FIG. 9 Rulkov at Fig. 9 In a preferred embodiment, **the optical sensor 30 is a plurality of light emitting diodes (“LED”) 35 based on green light wherein the LEDs 35 generate green light (wavelength of 500-570 nm), and a photodetector 36 detects the green light. Yet in an alternative embodiment, the optical sensor 30 is a photodetector 36 and a single LED 35 transmitting light at a wavelength of approximately 900 nanometers as a pulsed infrared LED. Yet further, the optical sensor is a combination of a green light LED and a pulsed infrared LED to offset noise affects of ambient light and sunlight.** As the heart pumps blood through the arteries in the user's arm, ankle or wrist, the photodetector 36, which is

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	typically a photodiode, detects reflectance/transmission at the wavelengths (green, red or infrared), and in response generates a radiation-induced signal. Rulkov at 5:16-30 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Rulkov, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Rulkov, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[a]. a wearable device for measuring one or more physiological parameters, the wearable device adapted to be placed on a wrist of a user;	Rulkov discloses or renders obvious a wearable device for measuring one or more physiological parameters, the wearable device adapted to be placed on a wrist of a user. A monitoring device for monitoring the vital signs of a user is disclosed herein. The monitoring device is preferably comprises an article, an optical sensor, an accelerometer and processor. The optical sensor preferably comprises a photodetector and a plurality of light emitting diodes. A sensor signal from the optical sensor is processed with a filtered accelerometer output signal from the accelerometer to create a filtered vital sign signal used to generate a real-time vital sign for a user. Rulkov at Abstract One such device is a pulse oximetry device. Pulse oximetry is used to determine the oxygen saturation of arterial blood. Pulse oximeter devices typically contain two light emitting diodes: one in the red band of light (660 nanometers) and one in the infrared band of light (940 nanometers). Oxyhemoglobin absorbs infrared light while deoxyhemoglobin absorbs visible red light. Pulse oximeter devices also contain sensors that detect the ratio of red/infrared absorption several hundred times per second. A preferred algorithm for calculating the absorption is derived from the Beer-Lambert Law, which determines the transmitted light from the incident light multiplied by the exponential of the negative of the product of the distance through the medium, the concentration of the solute and the extinction coefficient of the solute.

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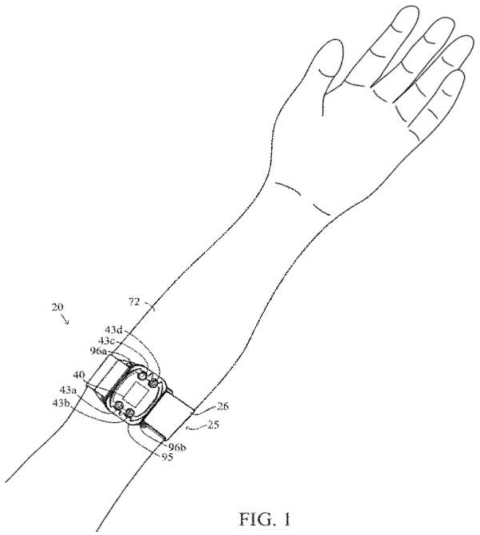
	Rolkov at 1:50-64  FIG. 1 Rulkov at Fig. 1 As shown in FIGS. 1-5, a monitoring device is generally designated 20. The monitoring device 20 preferably includes an article 25 and **an attachment band 26 having an exterior surface 26 a and interior surface 26 b. The monitoring device 20 is preferably secured with VELCRO® hook and loop material 31 a and 31 b.** The article 25 preferably includes an optical sensor 30, control components 43 a-43 c and optionally a display member 40**. The monitoring device 20 is preferably worn on a user's wrist, arm or ankle.** Rulkov at 4:36-44. **One aspect of the present invention is a system for monitoring at least one vital sign of a user**. The system comprises a smartphone and a monitoring device. The smartphone comprises a short range wireless transceiver, a processor and a display screen. **The monitoring device comprises a housing, an optical sensor for measuring blood flow through an artery of a wrist, arm or ankle of the user, a processor, a short range wireless transceiver, and a power source.** The short range wireless transceiver operates on a communication protocol using a 9 kHz communication format, a 125 kHz RFID

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	communication format, a 13.56 MHz communication format, a 433 MHz communication format, a 433 MHz RFID communication format, or a 900 MHz RFID communication format. Rulkov at 13:55-67 Although the **monitoring device20 is described in reference to an article worn on a user's arm, wrist or ankle, those skilled in the pertinent art will recognize that the monitoring device20may take other forms such as eyewear disclosed in Brady et al, U.S. Pat. No. 7,648,463, for a Monitoring Device, Method And System, which is hereby incorporated by reference in its entirety or a glove such as disclosed in Rulkov et al., U.S. Pat. No. 7,887,492, for a Monitoring Device, Method And System, which is hereby incorporated by reference in its entirety.** Rulkov at 4:61-5:3 **The optical sensor 30 of the monitoring device 20 is preferably positioned over the radial artery or ulnar artery if the article 25 is worn on the user's arm. The optical sensor 30 of the monitoring device 20 is preferably positioned over the posterior tibial artery of a user if the article 25 is worn on the user's ankle**. However, those skilled in the pertinent art will recognize that the optical sensor may be placed over other arteries of the user without departing from the scope and spirit of the present invention. Further, the optical sensor 30 need only be in proximity to an artery of the user in order to obtain a reading or signal. Rulkov at 5:6-15 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Rulkov, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Rulkov, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[b]. the wearable device including a light source	Rulkov discloses or renders obvious the wearable device including a light source comprising a plurality of semiconductor diodes that are configured to generate an output optical light having one or more optical

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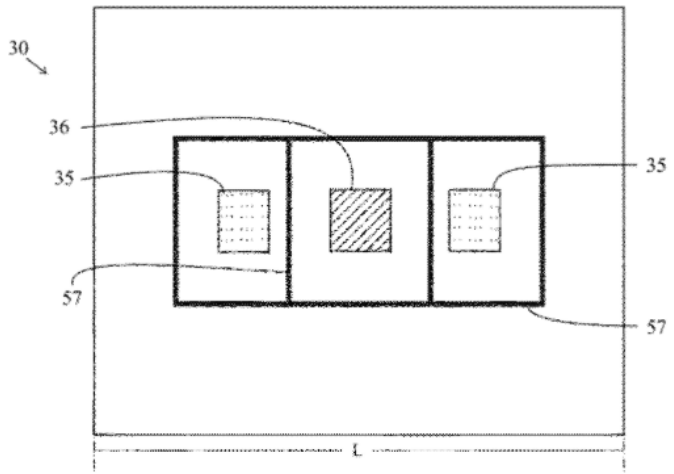
comprising a plurality of semiconductor diodes that are configured to generate an output optical light having one or more optical wavelengths, wherein at least a portion of the one or more optical wavelengths is a near-infrared wavelength between 700 nanometers and 2500 nanometers;	wavelengths, wherein at least a portion of the one or more optical wavelengths is a near-infrared wavelength between 700 nanometers and 2500 nanometers. One such device is a pulse oximetry device. Pulse oximetry is used to determine the oxygen saturation of arterial blood. Pulse oximeter devices typically contain two light emitting diodes: one in the red band of light (660 nanometers) and one in the infrared band of light (940 nanometers). Oxyhemoglobin absorbs infrared light while deoxyhemoglobin absorbs visible red light. Pulse oximeter devices also contain sensors that detect the ratio of red/infrared absorption several hundred times per second. A preferred algorithm for calculating the absorption is derived from the Beer-Lambert Law, which determines the transmitted light from the incident light multiplied by the exponential of the negative of the product of the distance through the medium, the concentration of the solute and the extinction coefficient of the solute. Rolkov at 1:50-64  FIG. 9 Rulkov at Fig. 9

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	In a preferred embodiment, **the optical sensor 30 is a plurality of light emitting diodes (“LED”) 35 based on green light wherein the LEDs 35 generate green light (wavelength of 500-570 nm), and a photodetector 36 detects the green light. Yet in an alternative embodiment, the optical sensor 30 is a photodetector 36 and a single LED 35 transmitting light at a wavelength of approximately 900 nanometers as a pulsed infrared LED. Yet further, the optical sensor is a combination of a green light LED and a pulsed infrared LED to offset noise affects of ambient light and sunlight. As the heart pumps blood through the arteries in the user's arm, ankle or wrist, the photodetector 36, which is typically a photodiode, detects reflectance/transmission at the wavelengths (green, red or infrared), and in response generates a radiation-induced signal.** Rulkov at 5:16-30. A preferred optical sensor 30 utilizing green light is a TRS1755 sensor from TAOS, Inc of Plano Tex. The TRS1755 comprises a green LED light source (567 nm wavelength) and a light-to-voltage converter. The output voltage is directly proportional to the reflected light intensity. Another preferred photodetector 36 is a light-to-voltage photodetector such as the TSL260R and TSL261, TSL261R photodetectors available from TAOS, Inc of Plano Tex. Alternatively, the photodetector 130 is a light-to-frequency photodetector such as the TSL245R, which is also available from TAOS, Inc. The light-to-voltage photodetectors have an integrated transimpedance amplifier on a single monolithic integrated circuit, which reduces the need for ambient light filtering. **The TSL261 photodetector preferably operates at a wavelength greater than 750 nanometers, and optimally at 940 nanometers, which would preferably have a LED that radiates light at those wavelengths.** Rulkov at 5:31-47 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Rulkov, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Rulkov, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.

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7[c]. the wearable device comprising one or more lenses configured to receive at least a portion of the output optical light and to deliver a lens output light to tissue comprising skin;	Rulkov discloses or renders obvious the wearable device comprising one or more lenses configured to receive at least a portion of the output optical light and to deliver a lens output light to tissue comprising skin. It is desirous to adapt the monitoring device 20 to the anatomy of the user's arm or even the user's ankle. The band 26 is preferably composed of neoprene, leather, synthetic leather, LYCRA, another similar material, or a combination thereof. **The article 25 is preferably composed of a semi-rigid or rigid plastic with a rubber-like or semi-flex plastic bottom layer for contact with the user's body. The bottom layer of the article 25 may have a curve surface for contact with a user's body.** The article 25 preferably has a mass ranging from 5 grams to 50 grams. Preferably, the lower the mass of the article 25, the more comfort to the user. The article 25 preferably has a thickness ranging from 5 mm to 10 mm, and is most preferably 6.5 mm. Rulkov at 4:48-60 **The top surface of the sensor 30 is preferably flat and in steady contact with the skin.** Under a strong motion condition, the skin moves at the border of the contact surface. The sizes of the sensor area and flat skin contact area are selected to reduce the border motion effects. If the distance between the LEDs and sensor is reduced, a lighted area of the skin is smaller, and the contact area is reduced (5×5 mm is acceptable). Rulkov at 12:65-13:5 **One aspect of the present invention is a system for monitoring at least one vital sign of a user**. The system comprises a smartphone and a monitoring device. The smartphone comprises a short range wireless transceiver, a processor and a display screen. **The monitoring device comprises a housing, an optical sensor for measuring blood flow through an artery of a wrist, arm or ankle of the user, a processor, a short range wireless transceiver, and a power source.** The short range wireless transceiver operates on a communication protocol using a 9 kHz communication format, a 125 kHz RFID communication format, a 13.56 MHz communication format, a 433 MHz communication format, a 433 MHz RFID communication format, or a 900 MHz RFID communication format. Rulkov at 13:55-67

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	The optical sensor 30 of the monitoring device 20 is preferably positioned over the radial artery or ulnar artery if the article 25 is worn on the user's arm. The optical sensor 30 of the monitoring device 20 is preferably positioned over the posterior tibial artery of a user if the article 25 is worn on the user's ankle. However, those skilled in the pertinent art will recognize that the optical sensor may be placed over other arteries of the user without departing from the scope and spirit of the present invention. Further, the optical sensor 30 need only be in proximity to an artery of the user in order to obtain a reading or signal. Rulkov at 5:4-15 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Rulkov, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Rulkov, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[d]. the wearable device further comprising a detection system configured to receive at least a portion of the lens output light reflected from the tissue and to generate an output signal having a signal-to-noise ratio, wherein the detection system is configured to be synchronized to the light source;	Rulkov discloses or renders obvious the wearable device further comprising a detection system configured to receive at least a portion of the lens output light reflected from the tissue and to generate an output signal having a signal-to-noise ratio, wherein the detection system is configured to be synchronized to the light source. **A preferred optical sensor 30 utilizing green light is a TRS1755 sensor from TAOS, Inc of Plano Tex. The TRS1755 comprises a green LED light source (567 nm wavelength) and a light-to-voltage converter.** The output voltage is directly proportional to the reflected light intensity. Another preferred **photodetector 36 is a light-to-voltage photodetector such as the TSL260R and TSL261, TSL261R photodetectors available from TAOS, Inc of Plano Tex**. Alternatively, **the photodetector 130 is a light-to-frequency photodetector such as the TSL245R, which is also available from TAOS, Inc**. The light-to-voltage photodetectors have an integrated transimpedance amplifier on a single monolithic integrated circuit, which reduces the need for ambient light filtering. **The TSL261 photodetector**

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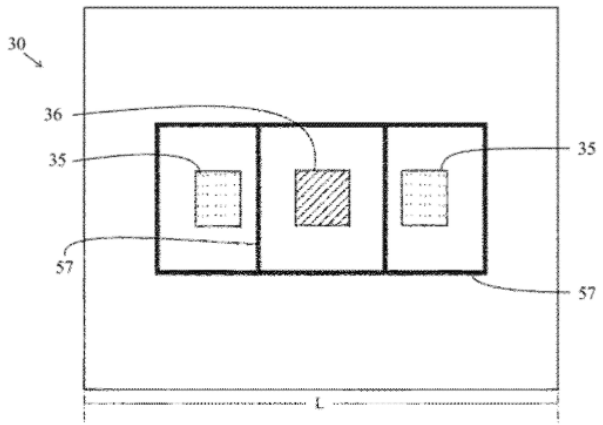
	preferably operates at a wavelength greater than 750 nanometers, and optimally at 940 nanometers, which would preferably have a LED that radiates light at those wavelengths. Rulkov at 5:31-47 **A motion sensor 1100 is included to assist in identifying motion noise and filtering the noise from the signal sent by the sensor 30. The motion sensor 1100, such as an accelerometer, is integrated into the circuitry and software of the monitoring device 20. As the motion sensor detects an arm swinging, the noise component is utilized with the signal processing noise filtering techniques to provide additional filtering to remove the noise element and improve the accuracy of the monitoring device 20**. Rulkov at 11:4-8  FIG. 9 Rulkov at Fig. 9 In a preferred embodiment, **the optical sensor 30 is a plurality of light emitting diodes (“LED”) 35 based on green light wherein the LEDs 35 generate green light (wavelength of 500-570 nm), and a photodetector 36 detects the green light. Yet in an alternative embodiment, the optical sensor 30 is**

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	a photodetector 36 and a single LED 35 transmitting light at a wavelength of approximately 900 nanometers as a pulsed infrared LED. Yet further, the optical sensor is a combination of a green light LED and a pulsed infrared LED to offset noise affects of ambient light and sunlight. As the heart pumps blood through the arteries in the user's arm, ankle or wrist, the photodetector 36, which is typically a photodiode, detects reflectance/transmission at the wavelengths (green, red or infrared), and in response generates a radiation-induced signal. Rulkov at 5:16-30 In a preferred design of the sensor 30, the distance between the centers of active areas of LEDs 35 is preferably 5-6 mm. The active area (photodetector 36) of a sensor 30 is placed in the middle of that distance. In the custom sensor, the distance of a custom sensor is preferably in the range of 3-4 mm (which means the spacing between the centers of photodetector 36 and LEDs 35 is about 1.5-2 mm). The distance is preferably sufficient for the placement of an opaque barrier between them. To control the amplitude of the LED intensity pulse a sufficient current (voltage) range of intensity ramp is used to control the LEDs 35 and to achieve the same levels of intensity in both LEDs 35 within a given range. The electrical characteristics of 520 nm SunLED in terms of voltage range for intensity ramp is sufficient. The top surface of the sensor 30 is preferably flat and in steady contact with the skin. Under a strong motion condition, the skin moves at the border of the contact surface. The sizes of the sensor area and flat skin contact area are selected to reduce the border motion effects. If the distance between the LEDs and sensor is reduced, a lighted area of the skin is smaller, and the contact area is reduced (5×5 mm is acceptable). LGA enables an easy way to seal the contact area from moisture. **The preferred embodiment uses 250 microsecond LED pulses and a 12T photodetector 36 with second order active high pass filter (100 Hz cutoff). The DC output of the sensor 30 is monitored to ensure that it is not saturated by the effects of ambient light. The use of short-term pulses reduces ambient light. In the preferred embodiment, voltage is collected at the sensor output every 2 msec. Inside the microprocessor 741, an average 8 consecutive samples improve the SNR (signal to noise ratio) and then work with the averaged numbers.** Therefore the sampling rate for raw data is preferably 2 msec, however if 8-samples averaging is utilized in the integrated sensor the data output rate is reduced to sending a new averaged value every 16 msec. An ADC is used with a 12-bit resolution. **The response of TSL 12T is acceptable. 100 Hz is the low limit for LPF cutoff. The selection of pulse duration is preferably based on the speed of the LED drivers, sensor electronics and output pick detection.**

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	The higher the low frequency cutoff that is implemented for the selected pulse duration, the better SNR. Rulkov at 12:52-13:25 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Rulkov, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Rulkov, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[e]. wherein the detection system comprises a plurality of detectors that are spatially separated from each other, and wherein at least one analog to digital converter is coupled to at least one of the plurality of detectors;	Rulkov discloses or renders obvious the detection system comprises a plurality of detectors that are spatially separated from each other, and wherein at least one analog to digital converter is coupled to at least one of the plurality of detectors. In a preferred embodiment, **the optical sensor30 is a plurality of light emitting diodes (“LED”) 35 based on green light wherein the LEDs35 generate green light (wavelength of 500-570 nm), and a photodetector36 detects the green light. Yet in an alternative embodiment, the optical sensor30 is a photodetector36 and a single LED35 transmitting light at a wavelength of approximately 900 nanometers as a pulsed infrared LED. Yet further, the optical sensor is a combination of a green light LED and a pulsed infrared LED to offset noise affects of ambient light and sunlight**. As the heart pumps blood through the arteries in the user's arm, ankle or wrist, the photodetector36, which is typically a photodiode, detects reflectance/transmission at the wavelengths (green, red or infrared), and in response generates a radiation-induced signal. Rulkov at 5:16-30 **A preferred optical sensor 30 utilizing green light is a TRS1755 sensor from TAOS, Inc of Plano Tex. The TRS1755 comprises a green LED light source (567 nm wavelength) and a light-to-voltage converter.** The output voltage is directly proportional to the reflected light intensity. Another preferred **photodetector 36 is a light-to-voltage photodetector such as the TSL260R and TSL261, TSL261R photodetectors available from TAOS, Inc of Plano Tex**. Alternatively, **the photodetector 130 is a**

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	light-to-frequency photodetector such as the TSL245R, which is also available from TAOS, Inc. The light-to-voltage photodetectors have an integrated transimpedance amplifier on a single monolithic integrated circuit, which reduces the need for ambient light filtering. **The TSL261 photodetector preferably operates at a wavelength greater than 750 nanometers, and optimally at 940 nanometers, which would preferably have a LED that radiates light at those wavelengths.** Rulkov at 5:31-47 FIG. 13 illustrates a block diagram of a flow chart of a signal processing method of the present invention. As shown in FIG. 10, the photodetector 36 of the optical sensor 30 receives light from the light source 35 while in proximity to the user's artery. The light source 35 is preferably a plurality of LEDs 35. The intensity of the light is preferably controlled by an integrator 300. In a preferred embodiment, the optical sensor 30 is a TRS1755 which includes a green LED light source (567 nm wavelength) and a light-to-voltage converter. The output voltage is directly proportional to the reflected light intensity. The signal 299 is sent to the microprocessor. At block 1300, the signal acquisition is performed. In reference to FIGS. 14 and 15, in the pulse mode the LED 35 is periodically activated for short intervals of time by a signal from the microcontroller. The reflected pulse of light is received by the sensor, with the generation of a voltage pulse having an amplitude proportional to the intensity of the reflected light. When the LED is activated, the switch, SW, is open by the action of the control signal from the microcontroller, and the capacitor, C, integrates the pulse generated from the sensor by charging through the resistor R. Immediately prior to deactivation of the LED, the analog-to-digital converter acquires the value of the voltage integrated across the capacitor, C. The analog-to-digital converter generates a data sample in digital form which is utilized by the microcontroller for evaluation of the heart rate the wearer. Subsequent to the sample being acquired by the analog-to-digital converter, the LED is deactivated and the capacitor, C, is shortcut by switch, SW, to reset the integrator, RC. A signal indicating sensor saturation is also sent to the microcontroller for light control of the LEDs. This states remains unchanged for a given time interval after which the process is repeated, which is illustrated in FIG. 15. The signals are shown in FIG. 15, with the raw sensor signal received from the sensor amplifier shown as varying between reflected light when the LEDs are on and an ambient light level when the LEDs are off. The filtered signal from the high pass filter (“HPF”) is shown as the filtered sensor signal in FIG. 14. The integrator reset signal is shown as integrator out signal in FIG. 15, and the integrator reset signal in FIG. 14.

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	Rulkov at 9:60-10:31 A block diagram for vital sign signal processing is shown in FIG. 18. **The optical sensor730 is placed on or near an artery90 of a user of the monitoring device20. The optical sensor730 has a pair of LEDs735 and a photodetector736, which receives reflected light 737 from the LEDs735. The microprocessor741 has a LED control715 connected to DAC702 for controlling the intensity of the LEDs737. The signal from the photodetector736 is transmitted to a high pass filter (HPF) 703 which sends it to an analog to digital converter704, and the signal from the photodetector737 is also sent directly to a second analog to digital converter704**. The real-time signal is then sent to a sensor data evaluation**714** to provide feedback to the LED control**715**, and then is also sent to the filter of the signal processing for mitigations of noise and heart rate evaluations**712**. Simultaneously, the accelerometer**710** transmits X-axis, Y-axis and Z-axis signals for the motion of the monitoring device**20** to an accelerometer data evaluation**711** of the microprocessor**741**. This signal is then sent to the signal processing for mitigations of noise and heart rate evaluations**712**. The output for the heart rate and/or calories is generated at block**713** of the microprocessor**741**, which then sends the results to the display**740**. Rulkov at 11:39-60 When the LED is activated, the switch, SW, is open by the action of the control signal from the microcontroller, and the capacitor, C, integrates the pulse generated from the sensor by charging through the resistor R. **Immediately prior to deactivation of the LED, the analog-to-digital converter acquires the value of the voltage integrated across the capacitor, C. The analog-to-digital converter generates a data sample in digital form which is utilized by the microcontroller for evaluation of the heart rate the wearer. Subsequent to the sample being acquired by the analog-to-digital converter, the LED is deactivated and the capacitor, C, is shortcut by switch, SW, to reset the integrator, RC.** A signal indicating sensor saturation is also sent to the microcontroller for light control of the LEDs. Rulkov at 10:10-22 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the

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	art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Rulkov, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Rulkov, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[f]. wherein the output signal is indicative of the one or more of the physiological parameters;	Rulkov discloses or renders obvious the output signal is indicative of the one or more of the physiological parameters. **Another aspect of the present invention is of the present invention is a system for monitoring a real-time vital sign of a user. The system for monitoring a real-time vital sign of a user comprises a monitoring device comprising an optical sensor for generating a real-time digitized optical signal corresponding to a flow of blood through an artery of the user and an accelerometer for generating real-time accelerometer data comprising a X-axis signal, a Y-axis signal and a Z-axis signal based on a movement of the user**. The system further comprises a first transceiver for transmitting the real-time digitized optical signal and the real-time accelerometer data from the monitoring device. Additionally, the system comprises a mobile communication device comprising a second transceiver for receiving the real-time digitized optical signal and the real-time accelerometer data from the monitoring device. Additionally, **the system comprises a processor in electrical communication with the second transceiver, the processor configured to receive the real-time digitized signal and the real-time accelerometer data, the processor configured to calculate a period of motion related harmonics from the real-time accelerometer data utilizing a repetitive motion pattern analyzer, the processor configured to modify the real-time digitized optical signal by suppressing the motion related harmonics calculated by the motion pattern analyzer to generate a modified optical signal, the processor configured to generate a real-time heart rate for the user from the modified optical signal**, Rulkov at 3:1-27 Optionally, **the modified optical signal is filtered with a narrow band filter adaptively tuned to a heart rate frequency calculated by a heart rate evaluator to generate the real-time heart rate for the user. Preferably, the repetitive motion pattern analyzer comprises an array of Comb filters. Preferably, the optical sensor comprises two green LEDs and a photodetector**

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	Rulkov at 3:28-34 **The right button 43 c is pushed to scroll through the choices of other output values, which comprises: basal metabolic rate; average heart rate; minimum heart rate; maximum heart rate; fat burn heart rate exercise target zone; cardio burn heart rate exercise target zone; and, summary of daily calories burned. The basal metabolic rate (displayed as “BMR”) is an estimate of the total calories burned by the user in one day without exercise, and is based on the user inputted personal data.** Rulkov at 7:39-46 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Rulkov, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Rulkov, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[g]. the wearable device configured to increase the signal-to-noise ratio by increasing light intensity of at least one of the plurality of semiconductor diodes from an initial light intensity; and	Rulkov discloses or renders obvious the wearable device configured to increase the signal-to-noise ratio by increasing light intensity of at least one of the plurality of semiconductor diodes from an initial light intensity. In a preferred embodiment, **the optical sensor 30 is a plurality of light emitting diodes (“LED”) 35 based on green light wherein the LEDs 35 generate green light (wavelength of 500-570 nm), and a photodetector 36 detects the green light. Yet in an alternative embodiment, the optical sensor 30 is a photodetector 36 and a single LED 35 transmitting light at a wavelength of approximately 900 nanometers as a pulsed infrared LED. Yet further, the optical sensor is a combination of a green light LED and a pulsed infrared LED to offset noise affects of ambient light and sunlight.** As the heart pumps blood through the arteries in the user's arm, ankle or wrist, the photodetector 36, which is typically a photodiode, detects reflectance/transmission at the wavelengths (green, red or infrared), and in response generates a radiation-induced signal. Rulkov at 5:16-30

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	A motion sensor 1100 is included to assist in identifying motion noise and filtering the noise from the signal sent by the sensor 30. The motion sensor 1100, such as an accelerometer, is integrated into the circuitry and software of the monitoring device 20. As the motion sensor detects an arm swinging, the noise component is utilized with the signal processing noise filtering techniques to provide **additional filtering to remove the noise element and improve the accuracy of the monitoring device 20**. More specifically, the signal from the optical sensor 30 is transmitted to the processor where a custom blood pressure filter 41 w processes the signal which is further processed at by custom adaptive filter 41 x before being sent to a heart beat tracking system 41 y and then transmitted to a heart rate beat output 41 z. The heart rate beat output 41 z provides feedback to the custom adaptive filter 41 x which also receives input from the motion sensor 1100. Rulkov at 11:4-19 The sizes of the sensor area and flat skin contact area are selected to reduce the border motion effects. If the distance between the LEDs and sensor is reduced, a lighted area of the skin is smaller, and the contact area is reduced (5×5 mm is acceptable). LGA enables an easy way to seal the contact area from moisture. The preferred embodiment uses 250 microsecond LED pulses and a 12T photodetector 36 with second order active high pass filter (100 Hz cutoff). The DC output of the sensor 30 is monitored to ensure that it is not saturated by the effects of ambient light. **The use of short-term pulses reduces ambient light. In the preferred embodiment, voltage is collected at the sensor output every 2 msec. Inside the microprocessor 741, an average 8 consecutive samples improve the SNR (signal to noise ratio) and then work with the averaged numbers. Therefore the sampling rate for raw data is preferably 2 msec, however if 8-samples averaging is utilized in the integrated sensor the data output rate is reduced to sending a new averaged value every 16 msec. An ADC is used with a 12-bit resolution. The response of TSL 12T is acceptable. 100 Hz is the low limit for LPF cutoff. The selection of pulse duration is preferably based on the speed of the LED drivers, sensor electronics and output pick detection. The higher the low frequency cutoff that is implemented for the selected pulse duration, the better SNR.** Rulkov at 13:1-25

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	One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Rulkov, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Rulkov, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[h]. the detection system further configured to: generate a first signal responsive to light received while the semiconductor diodes are off,	Rulkov discloses or renders obvious the detection system further configured to: generate a first signal responsive to light received while the semiconductor diodes are off. In reference to FIGS. 14 and 15, in the pulse mode the LED 35 is periodically activated for short intervals of time by a signal from the microcontroller. The reflected pulse of light is received by the sensor, with the generation of a voltage pulse having an amplitude proportional to the intensity of the reflected light. When the LED is activated, the switch, SW, is open by the action of the control signal from the microcontroller, and the capacitor, C, integrates the pulse generated from the sensor by charging through the resistor R. Immediately prior to deactivation of the LED, the analog-to-digital converter acquires the value of the voltage integrated across the capacitor, C. The analog-to-digital converter generates a data sample in digital form which is utilized by the microcontroller for evaluation of the heart rate the wearer. Subsequent to the sample being acquired by the analog-to-digital converter, **the LED is deactivated and the capacitor, C, is shortcut by switch, SW, to reset the integrator, RC. A signal indicating sensor saturation is also sent to the microcontroller for light control of the LEDs. This states remains unchanged for a given time interval after which the process is repeated, which is illustrated in FIG. 15. The signals are shown in FIG. 15, with the raw sensor signal received from the sensor amplifier shown as varying between reflected light when the LEDs are on and an ambient light level when the LEDs are off.** The filtered signal from the high pass filter (“HPF”) is shown as the filtered sensor signal in FIG. 14. The integrator reset signal is shown as integrator out signal in FIG. 15, and the integrator reset signal in FIG. 14. Rulkov at 10:4-31 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the

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	art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Rulkov, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Rulkov, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[i]. generate a second signal responsive to light received while at least one of the semiconductor diodes is on, and	Rulkov discloses or renders obvious the detection system further configured to: generate a second signal responsive to light received while at least one of the semiconductor diodes is on. In reference to FIGS. 14 and 15, in the pulse mode the LED 35 is periodically activated for short intervals of time by a signal from the microcontroller. The reflected pulse of light is received by the sensor, with the generation of a voltage pulse having an amplitude proportional to the intensity of the reflected light. **When the LED is activated, the switch, SW, is open by the action of the control signal from the microcontroller, and the capacitor, C, integrates the pulse generated from the sensor by charging through the resistor R. Immediately prior to deactivation of the LED, the analog-to-digital converter acquires the value of the voltage integrated across the capacitor, C. The analog-to-digital converter generates a data sample in digital form which is utilized by the microcontroller for evaluation of the heart rate the wearer**. Subsequent to the sample being acquired by the analog-to-digital converter, the LED is deactivated and the capacitor, C, is shortcut by switch, SW, to reset the integrator, RC. A signal indicating sensor saturation is also sent to the microcontroller for light control of the LEDs. This states remains unchanged for a given time interval after which the process is repeated, which is illustrated in FIG. 15. **The signals are shown in FIG. 15, with the raw sensor signal received from the sensor amplifier shown as varying between reflected light when the LEDs are on** and an ambient light level when the LEDs are off. The filtered signal from the high pass filter (“HPF”) is shown as the filtered sensor signal in FIG. 14. The integrator reset signal is shown as integrator out signal in FIG. 15, and the integrator reset signal in FIG. 14. Rulkov at 10:4-31 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Rulkov, it would

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	have been obvious to one of ordinary skill in the art to combine, with the teachings of Rulkov, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[j]. increase the signal-to-noise ratio by comparing the first signal and the second signal; and	Rulkov discloses or renders obvious the detection system further configured to: increase the signal-to-noise ratio by comparing the first signal and the second signal. **A motion sensor 1100 is included to assist in identifying motion noise and filtering the noise from the signal sent by the sensor 30.** The motion sensor 1100, such as an accelerometer, is integrated into the circuitry and software of the monitoring device 20. **As the motion sensor detects an arm swinging, the noise component is utilized with the signal processing noise filtering techniques to provide additional filtering to remove the noise element and improve the accuracy of the monitoring device 20**. Rulkov at 11:4-8 The sizes of the sensor area and flat skin contact area are selected to reduce the border motion effects. If the distance between the LEDs and sensor is reduced, a lighted area of the skin is smaller, and the contact area is reduced (5×5 mm is acceptable). LGA enables an easy way to seal the contact area from moisture. The preferred embodiment uses 250 microsecond LED pulses and a 12T photodetector 36 with second order active high pass filter (100 Hz cutoff). The DC output of the sensor 30 is monitored to ensure that it is not saturated by the effects of ambient light. **The use of short-term pulses reduces ambient light. In the preferred embodiment, voltage is collected at the sensor output every 2 msec. Inside the microprocessor 741, an average 8 consecutive samples improve the SNR (signal to noise ratio) and then work with the averaged numbers. Therefore the sampling rate for raw data is preferably 2 msec, however if 8-samples averaging is utilized in the integrated sensor the data output rate is reduced to sending a new averaged value every 16 msec. An ADC is used with a 12-bit resolution. The response of TSL 12T is acceptable. 100 Hz is the low limit for LPF cutoff. The selection of pulse duration is preferably based on the speed of the LED drivers, sensor electronics and output pick detection. The higher the low frequency cutoff that is implemented for the selected pulse duration, the better SNR.** Rulkov at 13:1-25

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	One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Rulkov, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Rulkov, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[k]. wherein the wearable device is at least in part configured to identify an object.	Rulkov discloses or renders obvious the wearable device is at least in part configured to identify an object. **The right button 43 c is pushed to scroll through the choices of other output values, which comprises: basal metabolic rate; average heart rate; minimum heart rate; maximum heart rate; fat burn heart rate exercise target zone; cardio burn heart rate exercise target zone; and, summary of daily calories burned. The basal metabolic rate (displayed as “BMR”) is an estimate of the total calories burned by the user in one day without exercise, and is based on the user inputted personal data.** Rulkov at 7:39-46 **One aspect of the present invention is a system for monitoring at least one vital sign of a user**. The system comprises a smartphone and a monitoring device. The smartphone comprises a short range wireless transceiver, a processor and a display screen. **The monitoring device comprises a housing, an optical sensor for measuring blood flow through an artery of a wrist, arm or ankle of the user, a processor, a short range wireless transceiver, and a power source.** The short range wireless transceiver operates on a communication protocol using a 9 kHz communication format, a 125 kHz RFID communication format, a 13.56 MHz communication format, a 433 MHz communication format, a 433 MHz RFID communication format, or a 900 MHz RFID communication format. Rulkov at 13:55-67 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references

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	identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Rulkov, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Rulkov, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.

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EXHIBIT F9

U.S. Pat. No. 12,193,790 B2 in view of U.S. Patent No. 20110066050 to Jim Moon ("Moon")

As described in detail below, Moon (individually or collectively) anticipates and/or renders obvious claim 7 ("Asserted Claim") of U.S. Patent No. 12,193,790 B2 (the "'790 Patent") under 35 U.S.C. §102 and/or §103, either alone in combination with the knowledge of a person of ordinary skill, and/or additional prior art references discussed in discussed in Exhibits F1-F9, the contents of which are hereby incorporated by reference into this chart. One of ordinary skill in the art, as of the priority date of the '790 Patent, would have known to combine the prior art elements disclosed by the foregoing references using known methods, and to use these elements according to their established functions in order to achieve a known and predictable result. This invalidity claim chart is based on Defendants' present understanding of the Asserted Claim and Plaintiff's apparent construction of the Asserted Claim in its Preliminary Infringement Contentions ("Infringement Contentions").

The following invalidity chart includes references to the structure, function, operation, and/or features of the technology described in Moon. The cited portions of Moon are merely illustrative, and Defendants reserve the right to rely on alternative or additional evidence, including uncited portions of Moon. Where a particular figure is cited, the citation should be understood to encompass the caption and description of the figure as well as any text relating to or describing the figure. Conversely, where particular text referring to a figure is cited, the citation should be understood to include the figure as well. Although the documentation collectively evidences prior knowledge, use, or sale, Defendants reserve the right to rely upon individual documents as printed publications. Where the chart below states that Moon "describes" or "provides for" a limitation, such disclosure may be express, inherent, or implicit. To the extent it is found Moon does not expressly disclose certain limitations in the Asserted Claim, such limitations are inherent. Defendants reserve the right to present direct evidence of the structure, function, operation, and/or features of the technology described in Moon (including product samples, source code, and/or witness testimony) and/or its prior art status, and to present alternative or additional documents concerning the same as evidence that the technology described in Moon anticipates and/or renders obvious the Asserted Claim of the '790 Patent

This chart is subject to all reservations, objections, and disclaimers in Defendants' Invalidity Contentions and any amendment, supplement, or modification thereof, which are incorporated herein by reference in their entirety. Nothing stated herein shall be treated as an admission or suggestion that Defendants agree with Plaintiff regarding the scope of the Asserted Claim, Plaintiff's apparent claim constructions, or the accuracy of any particular claim construction. Defendants reserve all rights to challenge any of the claim terms herein under 35 U.S.C. § 112, including by arguing that they are indefinite, are not supported by the written description, and/or are not enabled. Defendants further reserve all rights to amend this invalidity claim chart without leave of court pursuant to the Court's Docket Control Order, or upon a showing of good cause.

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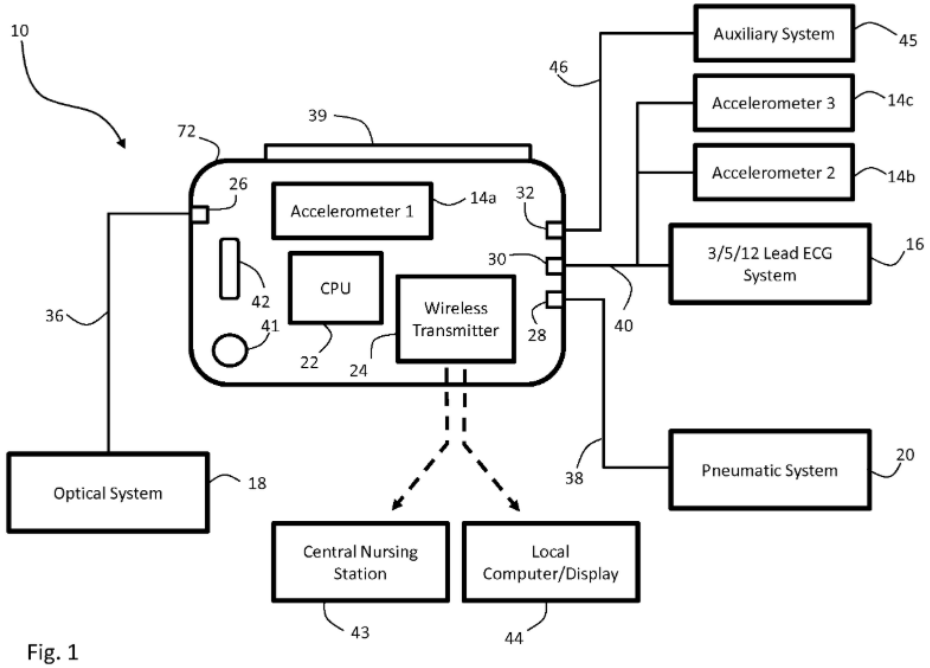
Claim 7	
7[pre]. An optical system, comprising:	By providing this disclosure, Defendants do not take a position on whether the preamble is limiting. Moon discloses or renders obvious an optical system.  Fig. 1 Moon at Fig. 1 **FIG. 1 shows a schematic drawing of a body-worn monitor 10 according to the invention featuring a wrist-worn transceiver 72 that continuously determines vital signs (e.g. blood pressure, SpO2, heart rate, respiratory rate, and temperature) and motion-related properties (e.g. posture, arm height, activity level, and degree of motion) for an ambulatory patient in a hospital.** The monitor 10 is small, lightweight, and comfortably worn on the patient's body during their stay in the hospital; its form factor is described in detail below. A medical professional can apply the monitor, for example, to a recently admitted patient waiting in the ED, and the same monitor can provide continuous monitoring during their stay in the hospital. For example, the patient can wear the monitor in their hospital room, as they receive specific procedures or tests, during transport to other rooms, and even during surgery. The

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	monitor 10 provides continuous monitoring, and features a software framework that determines alarms/alerts if the patient begins to decompensate. The framework processes both the patient's motion and their vital sign information with algorithms that reduce the occurrence of false alarms. Moon at [0054] To determine blood pressure, the transceiver 72 processes ECG and PPG waveforms measured, respectively, by the ECG 16 and optical 18 systems. **The optical system 18 features a thumb-worn sensor that includes LEDs operating in the red (λ˜660 nm) and infrared (λ˜900 nm) spectral regions, and a photodetector that detects their radiation after it passes through arteries within the patient's thumb.** The ECG waveform, as described above, is digitized and sent over the CAN interface to the wrist-worn transceiver 72, while the PPG waveform is transmitted in an analog form and digitized by an analog-to-digital converter within the transceiver's circuit board. The pneumatic system 20 provides a digitized pressure waveform and oscillometric blood pressure measurements (SYS, DIA, and MAP) through the CAN interface; these are processed by the CPU 22 to make cuff-based ‘indexing’ blood pressure measurements according to the Composite Technique. The indexing measurement typically only takes about 40-60 seconds, after which the pneumatic system 20 is unplugged from its connector 28 so that the patient can move within the hospital without wearing an uncomfortable cuff-based system. Moon at [0060]

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	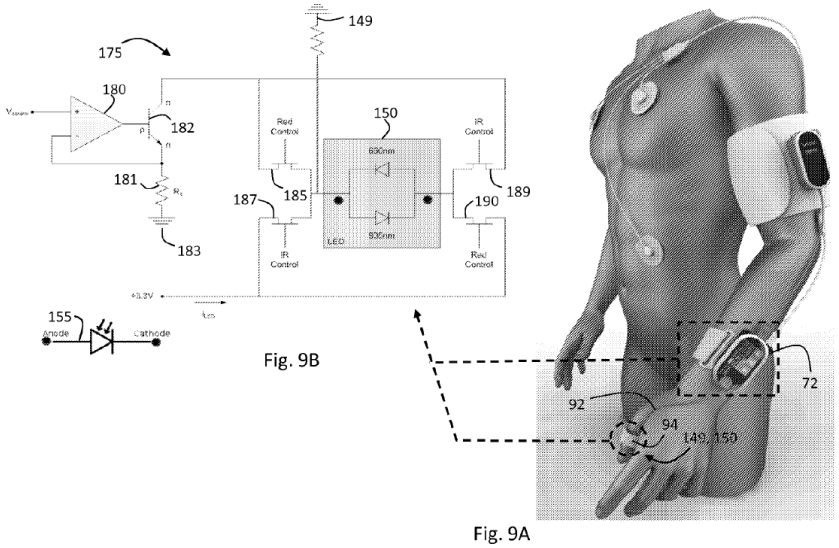 Fig. 9B Fig. 9A Moon at Fig. 9A **The optical sensor 94, described in detail with reference to FIGS. 9A,B, features two LEDs and a single photodetector that collectively measure a time-dependent PPG waveform 62 corresponding to each of the LEDs.** The sensor and algorithms for processing the PPG waveforms are described in detail in the following co-pending patent application, the contents of which are fully incorporated herein by reference: BODY-WORN PULSE OXIMETER (U.S. Ser. No. 61/218,062; filed Jun. 17, 2009). **The waveform 62 represents a time-dependent volumetric change in vasculature (e.g. arteries and capillaries) that is irradiated with the sensor's optical components.** Volumetric changes are induced by a pressure pulse launched by each heartbeat that travels from the heart 148 to arteries and capillaries in the thumb according to the above-describe arterial pathway. Moon at [0065] The **body-worn monitor 10 features a wrist-worn transceiver 72** with a touch panel interface 73 that displays numerical values for all the vital signs. A wrist strap 90 affixes the transceiver 72 to the patient’s wrist like a conventional wristwatch. **A five-wire cable 92 connects the transceiver 72 to an optical sensor 94 that wraps around the base of the patient’s thumb. During a measurement, the optical**

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	sensor 94 generates a time-dependent PPG which is processed along with an ECG to measure cNIBP and SpO2, as described above. Moon at [0073] In other embodiments, PTT can be calculated from time-dependent waveforms other than the ECG and PPG, and then processed to determine blood pressure. In general, PTT can be calculated by measuring a temporal separation between features in two or more time-dependent waveforms measured from the human body. For example, **PTT can be calculated from two separate PPGs measured by different optical sensors disposed on the patient's fingers, wrist, arm, chest, or virtually any other location where an optical signal can be measured using a transmission or reflection-mode optical configuration**. Moon at [0015] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Moon, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Moon, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[a]. a wearable device for measuring one or more physiological parameters, the wearable device adapted to be placed on a wrist of a user;	Moon discloses or renders obvious a wearable device for measuring one or more physiological parameters, the wearable device adapted to be placed on a wrist of a user.

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	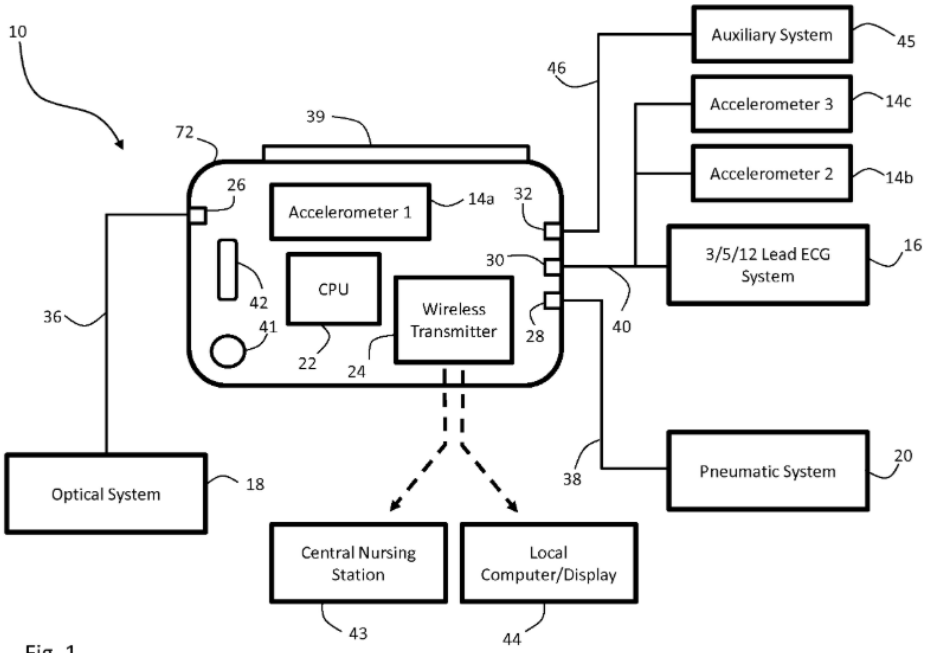 Fig. 1 Moon at Fig.1 **FIG. 1 shows a schematic drawing of a body-worn monitor 10 according to the invention featuring a wrist-worn transceiver 72 that continuously determines vital signs (e.g. blood pressure, SpO2, heart rate, respiratory rate, and temperature) and motion-related properties (e.g. posture, arm height, activity level, and degree of motion) for an ambulatory patient in a hospital.** The monitor 10 is small, lightweight, and comfortably worn on the patient's body during their stay in the hospital; its form factor is described in detail below. A medical professional can apply the monitor, for example, to a recently admitted patient waiting in the ED, and the same monitor can provide continuous monitoring during their stay in the hospital. For example, the patient can wear the monitor in their hospital room, as they receive specific procedures or tests, during transport to other rooms, and even during surgery. The monitor 10 provides continuous monitoring, and features a software framework that determines alarms/alerts if the patient begins to decompensate. The framework processes both the patient's motion and their vital sign information with algorithms that reduce the occurrence of false alarms.

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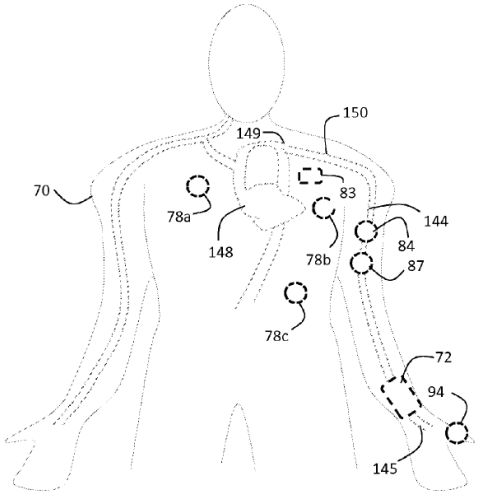
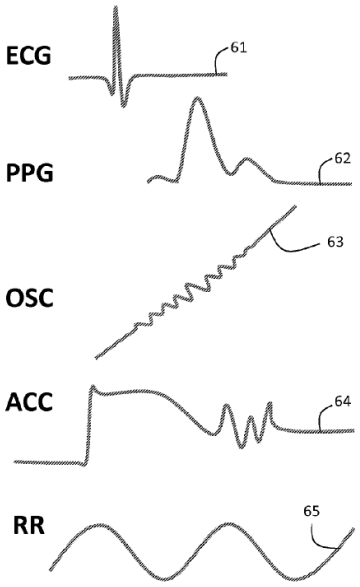
	Moon at [0054]  Fig. 2  Fig. 3 Moon at Figs. 2, 3 **FIGS. 2 and 3 show how a network of sensors 78 a-c, 83, 84, 87, 94 within the body-worn monitor 10** connect to a patient 70 to characterize them within a hospital. **During a measurement, the sensors 78 a-c, 83, 84, 87, 94 measure signals that are processed by the monitor 10 to generate time-dependent ECG 61, PPG 62, OSC 63, ACC 64, and RR 65 waveforms**. These, in turn, yield the patient's vital signs and motion parameters. Each waveform 61-65 relates to a unique physiological characteristic of the patient 70. Moon at [0063]

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	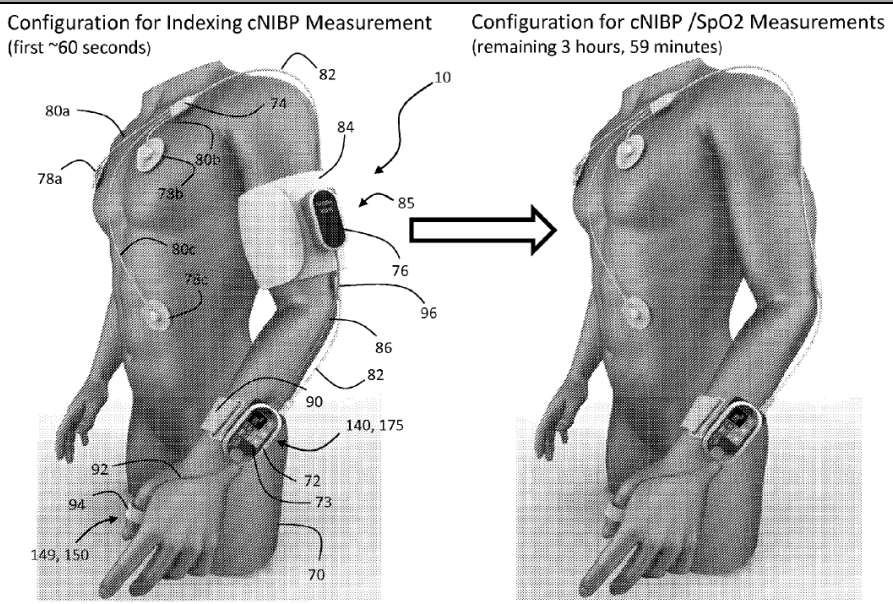 Fig. 4A Fig. 4B Moon at Figs. 4A, 4B **FIGS. 4A and 4B shows the specific form factor of the exemplary body-worn monitor 10** described in FIGS. 1 and 2, and how the monitor 10 attaches to a patient 70. Two configurations of the system are shown with these figures: FIG. 4A shows the system used during the pressure-dependent indexing portion of the Composite Technique, and includes a pneumatic, cuff-based system 85 attached to the patient's bicep; FIG. 4B shows the system used for subsequent SpO2 and cNIBP measurements, which rely solely on PTT. The indexing measurement typically takes about 60 seconds, and is typically performed once at the beginning of a measurement, and every 4-8 hours afterwards. Once the indexing measurement is complete the cuff-based system 85 is typically removed from the patient. The remainder of the time the monitor 10 measures other vital signs and cNIBP according to the Composite Technique. **The body-worn monitor 10 features a wrist-worn transceiver 72** with a touch panel interface 73 that displays numerical values for all the vital signs. **A wrist strap 90 affixes the transceiver 72 to the patient's wrist like a conventional wristwatch.** A five-wire cable 92 connects the transceiver 72 to an optical sensor 94 that wraps around the base of the patient's thumb. During a measurement, the optical

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	sensor 94 generates a time-dependent PPG which is processed along with an ECG to measure cNIBP and SpO2, as described above. Moon at [0072]-[0073] **The body-worn monitor features a series of sensors that attach to the patient to measure time-dependent PPG, ECG, accelerometer-based motion (ACC), oscillometric (OSC), respiratory rate (RR), and impedance pneumography (IP) waveforms.** A microprocessor (CPU) within the monitor continuously processes these waveforms to determine the patient's vital signs, degree of motion, posture and activity level. **Sensors that measure these signals typically send digitized information to a wrist-worn transceiver through a serial interface, or bus, operating on a controlled area network (CAN) protocol**. The CAN bus is typically used in the automotive industry, which allows different electronic systems to effectively and robustly communicate with each other with a small number of dropped packets, even in the presence of electrically noisy environments. This is particularly advantageous for ambulatory patients that may generate signals with large amounts of motion-induced noise. Moon at [0013] **Blood pressure, a vital sign that is particularly useful for characterizing a patient's condition, is typically calculated from a PTT value determined from the PPG and ECG waveforms. Once determined, blood pressure and other vital signs can be further processed, typically with a server within a hospital, to alert a medical professional if the patient begins to decompensate**. Moon at [0014] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Moon, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Moon, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[b]. the wearable device including a light source	Moon discloses or renders obvious the wearable device including a light source comprising a plurality of semiconductor diodes that are configured to generate an output optical light having one or more optical

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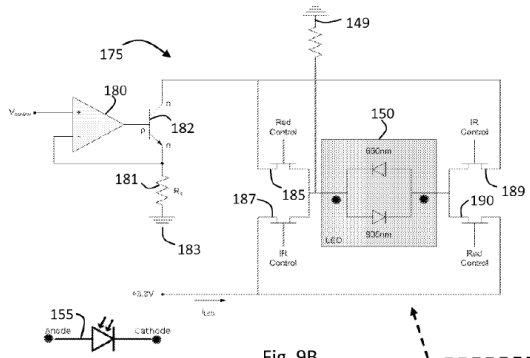
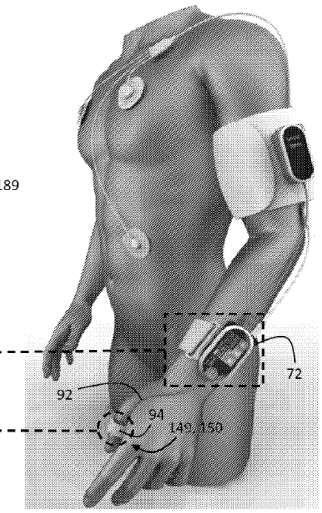
comprising a plurality of semiconductor diodes that are configured to generate an output optical light having one or more optical wavelengths, wherein at least a portion of the one or more optical wavelengths is a near-infrared wavelength between 700 nanometers and 2500 nanometers;	wavelengths, wherein at least a portion of the one or more optical wavelengths is a near-infrared wavelength between 700 nanometers and 2500 nanometers.  Fig. 9B  Fig. 9A Moon at Figs. 9A, 9B **FIGS. 9A,B show an exemplary optical sensor 94 that measures PPG signals from both red and infrared LEDs which the wrist-worn transceiver 72 processes to determine cNIBP and SpO2. The sensor 94 includes a dual LED 150 operating at 660 and 905 nm**, depending on the direction of bias, a photodetector 155 for detecting radiation from the LED 150 after it passes through a portion of the patient's thumb, and a laser-trimmed resistor 149 indicating the specific wavelength of the red portion of the dual LED 150, as described below. Powering these components is a circuit 175 within the wrist-worn transceiver that generates time-dependent current pulses to drive the LEDs. The circuit 175 features an operational amplifier 180 that receives a control voltage (Vcontrol) on its gating pin. The amplifier 180 is connected to a transistor 182 and resistor 181 that, along with a supply voltage of 3.3V (typically from a Li:ion battery), generate the current pulses used to drive the dual LED 150. To select the biasing direction of the LED, and thus choose the wavelength that is emitted, the circuit 175 features red control lines 185, 190 and infrared control lines 187, 189 that connect directly to 110 lines in the CPU within the wrist-worn transceiver. During a measurement, current pulses flow from the 3.3V supply voltage, across one direction of the LED 150, and ultimately through the transistor 182 and resistor 181 to ground

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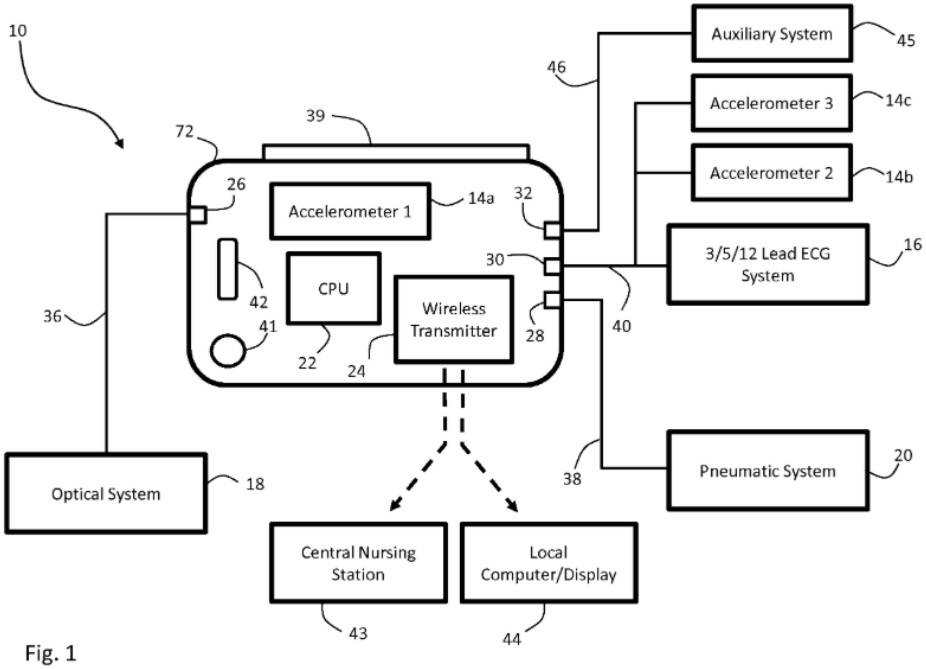
	183. The LED 150 is biased in a forward direction when control lines 185, 190 are toggled closed, thereby supplying a drive current pulse of iLED=Vcontrol/R1 to the LED 150 to generate red radiation. **Voltage flowing across the LED 150 is also decreased because it is a diode.** In this case the control lines 187, 189 for infrared radiation are left open. This configuration persists for 100 μs, after which the red control lines 185, 190 are switched closed, and the infrared control lines 187, 189 are switched open. This biases the LED 150 in a backwards direction to generate infrared radiation according to the above-described drive current. The alternating process is repeated at 500 Hz. Moon at [0089]  Fig. 1 Moon at Fig. 1 To determine blood pressure, the transceiver 72 processes ECG and PPG waveforms measured, respectively, by the ECG 16 and optical 18 systems. **The optical system 18 features a thumb-worn sensor that includes LEDs operating in the red (λ˜660 nm) and infrared (λ˜900 nm) spectral**

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	regions, and a photodetector that detects their radiation after it passes through arteries within the patient's thumb. The ECG waveform, as described above, is digitized and sent over the CAN interface to the wrist-worn transceiver 72, while the PPG waveform is transmitted in an analog form and digitized by an analog-to-digital converter within the transceiver's circuit board. The pneumatic system 20 provides a digitized pressure waveform and oscillometric blood pressure measurements (SYS, DIA, and MAP) through the CAN interface; these are processed by the CPU 22 to make cuff-based ‘indexing’ blood pressure measurements according to the Composite Technique. The indexing measurement typically only takes about 40-60 seconds, after which the pneumatic system 20 is unplugged from its connector 28 so that the patient can move within the hospital without wearing an uncomfortable cuff-based system. Moon at [0060] **The optical sensor 94, described in detail with reference to FIGS. 9A,B, features two LEDs and a single photodetector that collectively measure a time-dependent PPG waveform 62 corresponding to each of the LEDs.** The sensor and algorithms for processing the PPG waveforms are described in detail in the following co-pending patent application, the contents of which are fully incorporated herein by reference: BODY-WORN PULSE OXIMETER (U.S. Ser. No. 61/218,062; filed Jun. 17, 2009). The waveform 62 represents a time-dependent volumetric change in vasculature (e.g. arteries and capillaries) that is irradiated with the sensor's optical components. Volumetric changes are induced by a pressure pulse launched by each heartbeat that travels from the heart 148 to arteries and capillaries in the thumb according to the above-describe arterial pathway. Pressure from the pressure pulse forces a bolus of blood into this vasculature, causing it to expand and increase the amount of radiation absorbed, and decrease the transmitted radiation at the photodetector. **The pulse shown in the PPG waveform 62 therefore represents the inverse of the actual radiation detected at the photodetector. It follows the QRS complex in the ECG waveform 61, typically by about one to two hundred milliseconds. The temporal difference between the peak of the QRS complex and the foot of the pulse in the PPG waveform 62 is the PTT, which as described in detail below is used to determine blood pressure according to the Composite Technique. PPG waveforms generated by both the red and infrared LEDs are also processed by the CPU within the wrist-worn transceiver to determine SpO2, as is described in detail in the above-mentioned patent application. PTT-based measurements made from the thumb yield excellent correlation to blood pressure measured with a femoral arterial line. This provides an accurate representation of blood pressure in the central regions of the patient's body.**

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	Moon at [0065] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Moon, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Moon, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[c]. the wearable device comprising one or more lenses[JS1] configured to receive at least a portion of the output optical light and to deliver a lens output light to tissue comprising skin;	Moon discloses or renders obvious the wearable device comprising one or more lenses configured to receive at least a portion of the output optical light and to deliver a lens output light to tissue comprising skin. **FIG. 1 shows a schematic drawing of a body-worn monitor 10 according to the invention featuring a wrist-worn transceiver 72 that continuously determines vital signs (e.g. blood pressure, SpO2, heart rate, respiratory rate, and temperature) and motion-related properties (e.g. posture, arm height, activity level, and degree of motion) for an ambulatory patient in a hospital. The monitor 10 is small, lightweight, and comfortably worn on the patient's body during their stay in the hospital; its form factor is described in detail below. A medical professional can apply the monitor, for example, to a recently admitted patient waiting in the ED, and the same monitor can provide continuous monitoring during their stay in the hospital. For example, the patient can wear the monitor in their hospital room, as they receive specific procedures or tests, during transport to other rooms, and even during surgery. The monitor 10 provides continuous monitoring, and features a software framework that determines alarms/alerts if the patient begins to decompensate.** The framework processes both the patient's motion and their vital sign information with algorithms that reduce the occurrence of false alarms. Moon at [0054]

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	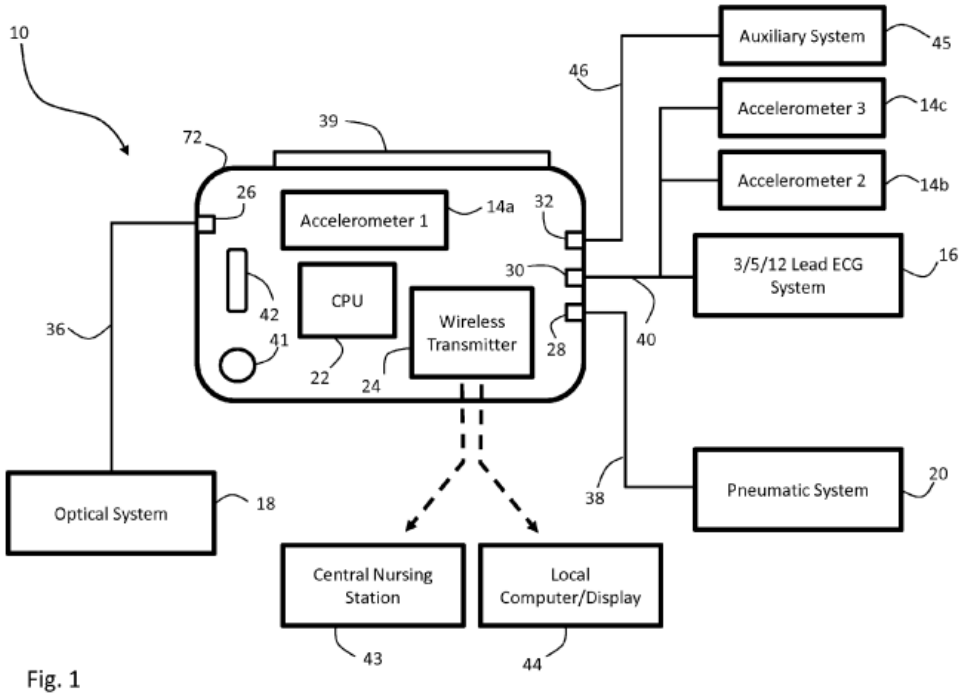 Fig. 1 Moon at Fig. 1 **A combination of features makes the body-worn monitor 10 ideal for ambulatory patients within the hospital. For example, its wrist-worn transceiver 72 features a wireless transmitter 24 that communicates through a hospital network to a computer (e.g. a portable tablet computer) at a central nursing station 43, and to a local computer 44 (e.g. a hand-held PDA) through a peer-to-peer connection. The specific mode of communication can be determined automatically (using, e.g., a signal strength associated with the wireless connection), or manually through an icon on the GUI.** Moon at [0055] The optical sensor 94, described in detail with reference to FIGS. 9A,B, features two LEDs and a single photodetector that collectively measure a time-dependent PPG waveform 62 corresponding to each of the LEDs. The sensor and algorithms for processing the PPG waveforms are described in detail in the

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	following co-pending patent application, the contents of which are fully incorporated herein by reference: BODY-WORN PULSE OXIMETER (U.S. Ser. No. 61/218,062; filed Jun. 17, 2009). The waveform 62 represents a time-dependent volumetric change in vasculature (e.g. arteries and capillaries) that is irradiated with the sensor's optical components. Volumetric changes are induced by a pressure pulse launched by each heartbeat that travels from the heart 148 to arteries and capillaries in the thumb according to the above-describe arterial pathway. Pressure from the pressure pulse forces a bolus of blood into this vasculature, causing it to expand and increase the amount of radiation absorbed, and decrease the transmitted radiation at the photodetector. The pulse shown in the PPG waveform 62 therefore represents the inverse of the actual radiation detected at the photodetector. It follows the QRS complex in the ECG waveform 61, typically by about one to two hundred milliseconds. The temporal difference between the peak of the QRS complex and the foot of the pulse in the PPG waveform 62 is the PTT, which as described in detail below is used to determine blood pressure according to the Composite Technique. **PPG waveforms generated by both the red and infrared LEDs are also processed by the CPU within the wrist-worn transceiver to determine SpO2, as is described in detail in the above-mentioned patent application. PTT-based measurements made from the thumb yield excellent correlation to blood pressure measured with a femoral arterial line. This provides an accurate representation of blood pressure in the central regions of the patient's body.** Moon at [0065] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Moon, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Moon, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[d]. the wearable device further comprising a detection system configured to receive at least a portion of the lens output light reflected from the tissue and to generate an output signal	Moon discloses or renders obvious the wearable device further comprising a detection system configured to receive at least a portion of the lens output light reflected from the tissue and to generate an output signal having a signal-to-noise ratio, wherein the detection system is configured to be synchronized to the light source. In other embodiments, PTT can be calculated from time-dependent waveforms other than the ECG and PPG, and then processed to determine blood pressure. In general, PTT can be calculated by measuring a

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having a signal-to-noise ratio, wherein the detection system is configured to be synchronized to the light source[JS2];	temporal separation between features in two or more time-dependent waveforms measured from the human body. For example, **PTT can be calculated from two separate PPGs measured by different optical sensors disposed on the patient's fingers, wrist, arm, chest, or virtually any other location where an optical signal can be measured using a transmission or reflection-mode optical configuration**. Moon at [0015] **The optical sensor 94, described in detail with reference to FIGS. 9A,B, features two LEDs and a single photodetector that collectively measure a time-dependent PPG waveform 62 corresponding to each of the LEDs**. The sensor and algorithms for processing the PPG waveforms are described in detail in the following co-pending patent application, the contents of which are fully incorporated herein by reference: BODY-WORN PULSE OXIMETER (U.S. Ser. No. 61/218,062; filed Jun. 17, 2009). The waveform 62 represents a time-dependent volumetric change in vasculature (e.g. arteries and capillaries) that is irradiated with the sensor's optical components. Volumetric changes are induced by a pressure pulse launched by each heartbeat that travels from the heart 148 to arteries and capillaries in the thumb according to the above-describe arterial pathway. Pressure from the pressure pulse forces a bolus of blood into this vasculature, causing it to expand and increase the amount of radiation absorbed, and decrease the transmitted radiation at the photodetector. The pulse shown in the PPG waveform 62 therefore represents the inverse of the actual radiation detected at the photodetector. It follows the QRS complex in the ECG waveform 61, typically by about one to two hundred milliseconds. The temporal difference between the peak of the QRS complex and the foot of the pulse in the PPG waveform 62 is the PTT, which as described in detail below is used to determine blood pressure according to the Composite Technique. **PPG waveforms generated by both the red and infrared LEDs are also processed by the CPU within the wrist-worn transceiver to determine SpO2, as is described in detail in the above-mentioned patent application. PTT-based measurements made from the thumb yield excellent correlation to blood pressure measured with a femoral arterial line. This provides an accurate representation of blood pressure in the central regions of the patient's body.** Moon at [0065]

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	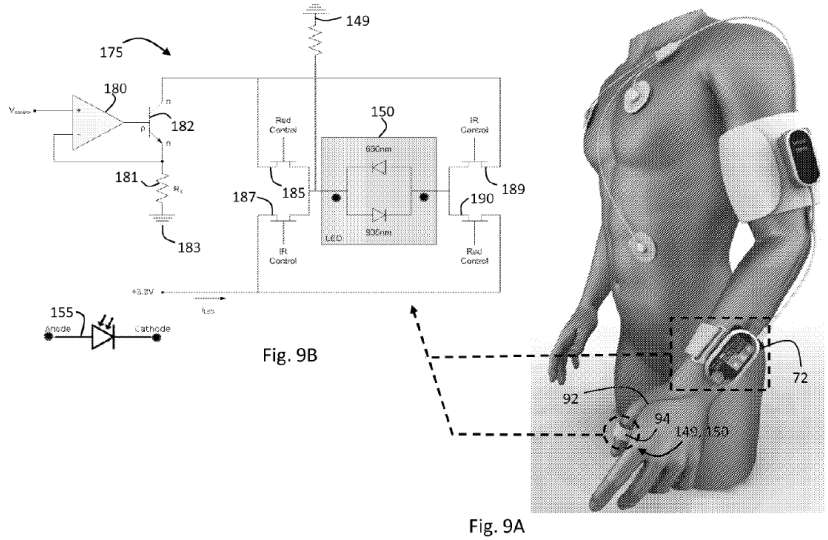 Fig. 9B Fig. 9A Moon at Figs. 9A, 9B **FIGS. 9A,B show an exemplary optical sensor 94 that measures PPG signals from both red and infrared LEDs which the wrist-worn transceiver 72 processes to determine cNIBP and SpO2. The sensor 94 includes a dual LED 150 operating at 660 and 905 nm, depending on the direction of bias, a photodetector 155 for detecting radiation from the LED** 150 after it passes through a portion of the patient's thumb, and a laser-trimmed resistor 149 indicating the specific wavelength of the red portion of the dual LED 150, as described below. Powering these components is a circuit 175 within the wrist-worn transceiver that generates time-dependent current pulses to drive the LEDs. The circuit 175 features an operational amplifier 180 that receives a control voltage (Vcontrol) on its gating pin. The amplifier 180 is connected to a transistor 182 and resistor 181 that, along with a supply voltage of 3.3V (typically from a Li:ion battery), generate the current pulses used to drive the dual LED 150. To select the biasing direction of the LED, and thus choose the wavelength that is emitted, the circuit 175 features red control lines 185, 190 and infrared control lines 187, 189 that connect directly to 110 lines in the CPU within the wrist-worn transceiver. During a measurement, current pulses flow from the 3.3V supply voltage, across one direction of the LED 150, and ultimately through the transistor 182 and resistor 181 to ground 183. The LED 150 is biased in a forward direction when control lines 185, 190 are toggled closed, thereby supplying a drive current pulse of iLED=Vcontrol/R1 to the LED 150 to generate red radiation. Voltage flowing across the LED 150 is also decreased because it is a diode. In this case the

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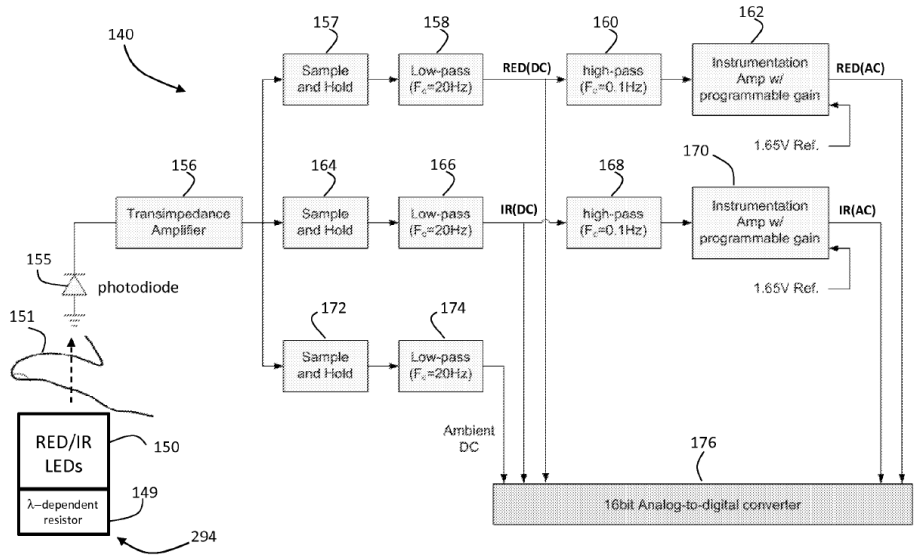
	control lines 187, 189 for infrared radiation are left open. This configuration persists for 100 μs, after which the red control lines 185, 190 are switched closed, and the infrared control lines 187, 189 are switched open. This biases the LED 150 in a backwards direction to generate infrared radiation according to the above-described drive current. The alternating process is repeated at 500 Hz. Moon at [0081]  Fig. 10 Moon at Fig. 10 **The amplifier circuit 140 features separate channels for amplifying and filtering signals corresponding to red radiation, infrared radiation, and ambient light detected by the photodiode 155 when the LED is not biased to generate radiation. This occurs, for example, during the time periods when neither the red or infrared LED is driven. Once detected, the degree of ambient light can be subtracted from both the red and infrared signals to improve their resultant signal-to-noise ratio.** The amplifier channel corresponding to red radiation is activated by a sample-and-hold integrated circuit 157 that is controlled by the same control lines 185, 190 that drive the red LED, as shown in FIG. 9B. When the red LED is driven, the sample-and-hold circuit 157 is switched on, while similar components 164, 172 corresponding to the infrared signals and ambient light are switched off. The

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	sample-and-hold circuit 157 samples and maintains an analog voltage from the transimpedance amplifier 156, which then passes through a low-pass filter 158 characterized by a 20 Hz cutoff. This filter removes any high-frequency noise (e.g. 60 Hz electrical noise) that is not related to the PPG waveform, and yields a preliminary waveform that is digitized with an analog-to-digital converter 176, and processed as described above to generate a DC portion of the PPG. The preliminary waveform then passes through a high-pass filter 160 with a cutoff of 0.1 Hz to remove the DC portion and leave only the AC portion, which typically represents about 0.5-1% of the total signal magnitude. The AC portion is further amplified with a standard instrumentation amplifier 162 featuring a programmable gain that is controlled with a 1.65 reference voltage and a digital potentiometer (not shown in the figure; this component may be included directly in the instrumentation amplifier) featuring a variable resistance controlled by the CPU within the wrist-worn transceiver. The CPU selects the resistance (according to a predetermined command) and corresponding gain to maximize the dynamic range of the analog-to-digital converter 176. This process results in an amplified version of the AC portion of the red PPG waveform, which is then digitized with the analog-to-digital converter 176 and then processed as described above. Moon at [0091] The transceiver 72 features a CPU 22 that communicates through a digital CAN interface, or bus, to external systems featuring ECG 16, external accelerometers 14 b-c, pneumatic 20, and auxiliary 45 sensors. Each sensor 16, 14 b-c, 20, 45 is ‘distributed’ on the patient to minimize the bulk and weight normally associated with conventional vital sign monitors, which typically incorporate all electronics associated with measuring vital signs in a single plastic box**. Moreover, each of these sensors 16, 14 b-c, 20, 45 generate digital signals close to where they actually attach to the patient, as opposed to generating an analog signal and sending it through a relatively long cable to a central unit for processing. This can reduce noise due to cable motion which is often mapped onto analog signals**. Cables 40, 38, 46 used in the body-worn monitor 10 to transmit packets over the CAN bus typically include 5 separate wires bundled together with a single protective cladding: the wires supply power and ground to the remote ECG system 16, accelerometers 14 b-c, pneumatic 20, and auxiliary systems 45; provide high/low signal transmission lines for data transmitted over the CAN protocol; and provide a grounded electrical shield for each of these four wires. There are several advantages to this approach. First, a single pair of transmission lines in the cable (i.e. the high/low signal transmission lines) can transmit multiple digital waveforms generated by completely different sensors. This includes multiple ECG waveforms (corresponding, e.g., to vectors associated with three, five, and twelve-lead ECG systems) from the ECG circuit, along with ACC waveforms associated with the x, y, and z axes of

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	accelerometers within the body-worn monitor 10. The same two wires, for example, can transmit up to twelve ECG waveforms (measured by a 12-lead ECG system), and six ACC waveforms (measured by the accelerometers 14 b-c). Limiting the transmission line to a pair of conductors reduces the number of wires attached to the patient, thereby decreasing the weight and any cable-related clutter. Second, cable motion induced by an ambulatory patient can change the electrical properties (e.g. electrical impendence) of its internal wires. This, in turn, can add noise to an analog signal and ultimately the vital sign calculated from it. A digital signal, in contrast, is relatively immune to such motion-induced artifacts. Moon at [0056] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Moon, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Moon, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[e]. wherein the detection system comprises a plurality of detectors that are spatially separated[JS3] from each other, and wherein at least one analog to digital converter is coupled to at least one of the plurality of detectors;	Moon discloses or renders obvious the detection system comprises a plurality of detectors that are spatially separated from each other, and wherein at least one analog to digital converter is coupled to at least one of the plurality of detectors.

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	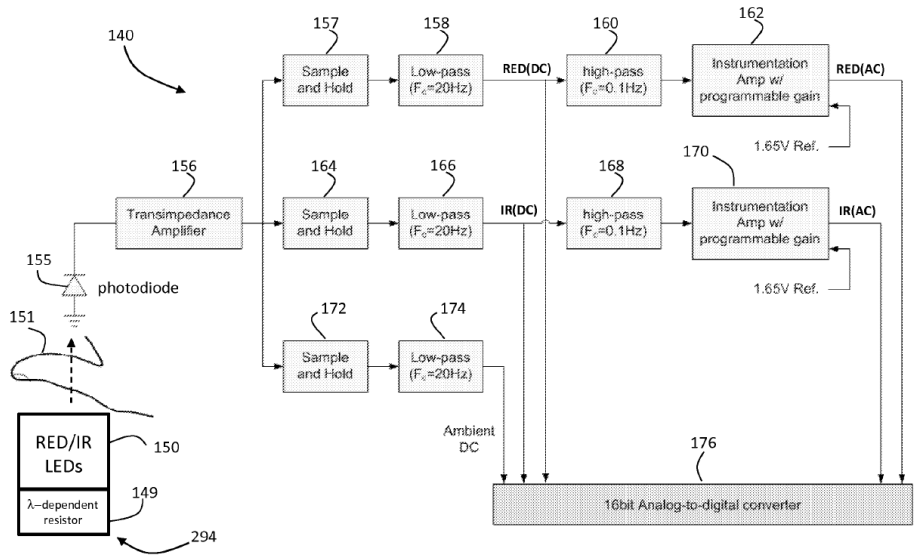 Fig. 10 Moon, Fig. 10 The amplifier circuit 140 features separate channels for amplifying and filtering signals corresponding to red radiation, infrared radiation, and ambient light detected by the photodiode 155 when the LED is not biased to generate radiation. This occurs, for example, during the time periods when neither the red or infrared LED is driven. Once detected, the degree of ambient light can be subtracted from both the red and infrared signals to improve their resultant signal-to-noise ratio. The amplifier channel corresponding to red radiation is activated by a sample-and-hold integrated circuit 157 that is controlled by the same control lines 185, 190 that drive the red LED, as shown in FIG. 9B. When the red LED is driven, the sample-and-hold circuit 157 is switched on, while similar components 164, 172 corresponding to the infrared signals and ambient light are switched off. **The sample-and-hold circuit 157 samples and maintains an analog voltage from the transimpedance amplifier 156, which then passes through a low-pass filter 158 characterized by a 20 Hz cutoff. This filter removes any high-frequency noise (e.g. 60 Hz electrical noise) that is not related to the PPG waveform, and yields a preliminary waveform that is digitized with an analog-to-digital converter 176, and processed as described above to generate a DC portion of the PPG.** The preliminary waveform then passes through a high-pass filter 160 with a cutoff of 0.1 Hz to remove the DC portion and leave only the AC portion, which typically represents about 0.5-1% of the total signal magnitude. The AC portion is further

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	amplified with a standard instrumentation amplifier 162 featuring a programmable gain that is controlled with a 1.65 reference voltage and a digital potentiometer (not shown in the figure; this component may be included directly in the instrumentation amplifier) featuring a variable resistance controlled by the CPU within the wrist-worn transceiver. **The CPU selects the resistance (according to a predetermined command) and corresponding gain to maximize the dynamic range of the analog-to-digital converter 176. This process results in an amplified version of the AC portion of the red PPG waveform, which is then digitized with the analog-to-digital converter 176 and then processed as described above.** Moon at [0091] To determine blood pressure, the transceiver 72 processes ECG and PPG waveforms measured, respectively, by the ECG 16 and optical 18 systems. **The optical system 18 features a thumb-worn sensor that includes LEDs operating in the red (λ˜660 nm) and infrared (λ˜900 nm) spectral regions, and a photodetector that detects their radiation after it passes through arteries within the patient's thumb**. **The ECG waveform, as described above, is digitized and sent over the CAN interface to the wrist-worn transceiver 72, while the PPG waveform is transmitted in an analog form and digitized by an analog-to-digital converter within the transceiver's circuit board.** The pneumatic system 20 provides a digitized pressure waveform and oscillometric blood pressure measurements (SYS, DIA, and MAP) through the CAN interface; these are processed by the CPU 22 to make cuff-based ‘indexing’ blood pressure measurements according to the Composite Technique. The indexing measurement typically only takes about 40-60 seconds, after which the pneumatic system 20 is unplugged from its connector 28 so that the patient can move within the hospital without wearing an uncomfortable cuff-based system. Moon at [0060] SpO2 is typically measured with a bandage or clothespin-shaped sensor that clips to a patient's finger and includes optical systems operating in both the red and infrared spectral regions. **A photodetector measures radiation emitted from the optical systems that transmits through the patient's finger. Other body sites, e.g., the ear, forehead, and nose, can also be used in place of the finger. During a measurement, a microprocessor analyses both red and infrared radiation detected by the photodetector to determine the patient's blood oxygen saturation level and a time-dependent waveform called a photoplethysmograph (PPG). Time-dependent features of the PPG indicate**

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	both pulse rate and a volumetric absorbance change in an underlying artery caused by the propagating pressure pulse. Moon at [0008] **The optical sensor 94, described in detail with reference to FIGS. 9A,B, features two LEDs and a single photodetector that collectively measure a time-dependent PPG waveform 62 corresponding to each of the LEDs.** The sensor and algorithms for processing the PPG waveforms are described in detail in the following co-pending patent application, the contents of which are fully incorporated herein by reference: BODY-WORN PULSE OXIMETER (U.S. Ser. No. 61/218,062; filed Jun. 17, 2009). The waveform 62 represents a time-dependent volumetric change in vasculature (e.g. arteries and capillaries) that is irradiated with the sensor's optical components. Volumetric changes are induced by a pressure pulse launched by each heartbeat that travels from the heart 148 to arteries and capillaries in the thumb according to the above-describe arterial pathway. **Pressure from the pressure pulse forces a bolus of blood into this vasculature, causing it to expand and increase the amount of radiation absorbed, and decrease the transmitted radiation at the photodetector. The pulse shown in the PPG waveform 62 therefore represents the inverse of the actual radiation detected at the photodetector. It follows the QRS complex in the ECG waveform 61, typically by about one to two hundred milliseconds. The temporal difference between the peak of the QRS complex and the foot of the pulse in the PPG waveform 62 is the PTT, which as described in detail below is used to determine blood pressure according to the Composite Technique. PPG waveforms generated by both the red and infrared LEDs are also processed by the CPU within the wrist-worn transceiver to determine SpO2, as is described in detail in the above-mentioned patent application. PTT-based measurements made from the thumb yield excellent correlation to blood pressure measured with a femoral arterial line. This provides an accurate representation of blood pressure in the central regions of the patient's body.** Moon at [0065] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Moon, it would

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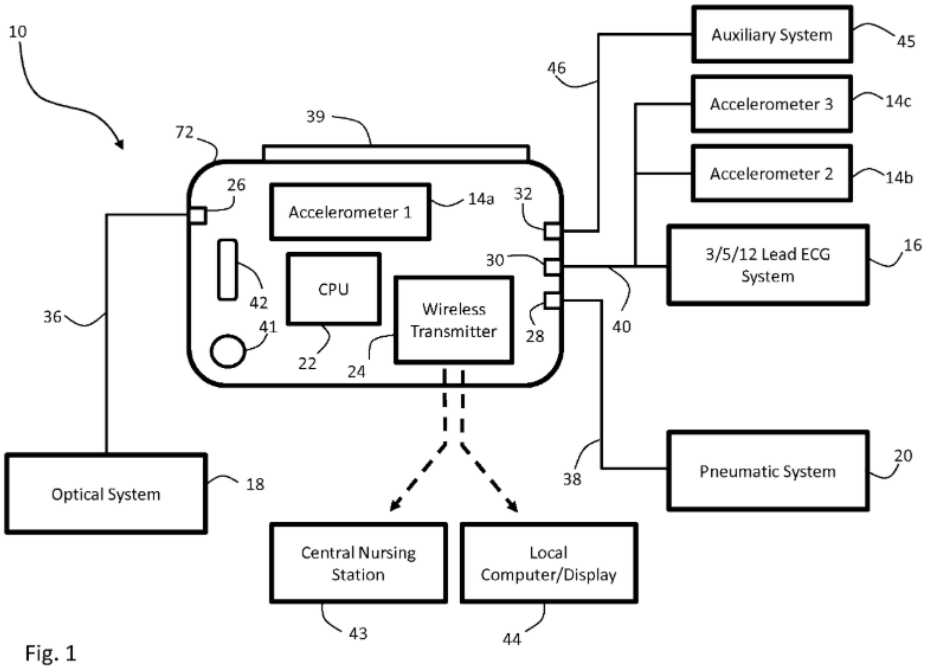
	have been obvious to one of ordinary skill in the art to combine, with the teachings of Moon, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[f]. wherein the output signal is indicative of the one or more of the physiological parameters;	Moon discloses or renders obvious the output signal is indicative of the one or more of the physiological parameters.  Fig. 1 Moon at Fig.1 **FIG. 1 shows a schematic drawing of a body-worn monitor 10 according to the invention featuring a wrist-worn transceiver 72 that continuously determines vital signs (e.g. blood pressure, SpO2, heart rate, respiratory rate, and temperature) and motion-related properties (e.g. posture, arm height, activity level, and degree of motion) for an ambulatory patient in a hospital.** The monitor 10 is small, lightweight, and comfortably worn on the patient's body during their stay in the hospital; its form factor is described in detail below. A medical professional can apply the monitor, for example, to a recently admitted patient waiting in the ED, and the same monitor can provide continuous monitoring

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	during their stay in the hospital. For example, the patient can wear the monitor in their hospital room, as they receive specific procedures or tests, during transport to other rooms, and even during surgery. The monitor 10 provides continuous monitoring, and features a software framework that determines alarms/alerts if the patient begins to decompensate. The framework processes both the patient's motion and their vital sign information with algorithms that reduce the occurrence of false alarms. Moon at [0054] **The body-worn monitor features a series of sensors that attach to the patient to measure time-dependent PPG, ECG, accelerometer-based motion (ACC), oscillometric (OSC), respiratory rate (RR), and impedance pneumography (IP) waveforms.** A microprocessor (CPU) within the monitor continuously processes these waveforms to determine the patient's vital signs, degree of motion, posture and activity level. **Sensors that measure these signals typically send digitized information to a wrist-worn transceiver through a serial interface, or bus, operating on a controlled area network (CAN) protocol**. The CAN bus is typically used in the automotive industry, which allows different electronic systems to effectively and robustly communicate with each other with a small number of dropped packets, even in the presence of electrically noisy environments. This is particularly advantageous for ambulatory patients that may generate signals with large amounts of motion-induced noise. Moon at [0013] **Blood pressure, a vital sign that is particularly useful for characterizing a patient's condition, is typically calculated from a PTT value determined from the PPG and ECG waveforms. Once determined, blood pressure and other vital signs can be further processed, typically with a server within a hospital, to alert a medical professional if the patient begins to decompensate**. Moon at [0014] Typically the optical signal is generated with an optical sensor configured to be worn around the patient's thumb. PTT is typically calculated from a time difference separating a QRS complex in the ECG waveform and a foot of a PPG waveform. In other embodiments the same optical sensor used to measure the optical waveform features a first LED operating in the red spectral range, and a second LED operating in the infrared spectral range. Optical waveforms measured with these LEDs can additionally be processed to determine SpO2, as is described in detail below.

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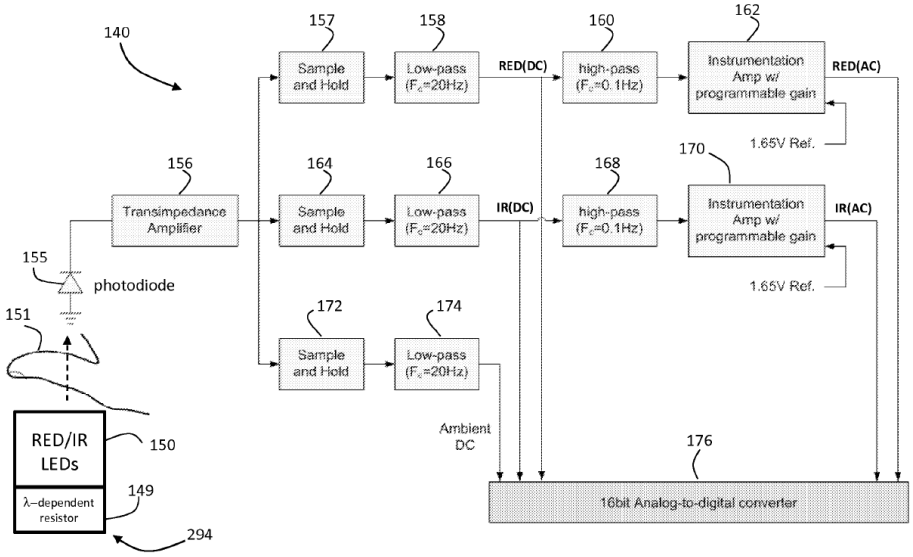
	Moon at [0023] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Moon, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Moon, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[g]. the wearable device configured to increase the signal-to-noise ratio by increasing light intensity[JS4] of at least one of the plurality of semiconductor diodes from an initial light intensity; and	Moon discloses or renders obvious the wearable device configured to increase the signal-to-noise ratio by increasing light intensity of at least one of the plurality of semiconductor diodes from an initial light intensity.  Fig. 10 Moon at Fig. 10 **The amplifier circuit 140 features separate channels for amplifying and filtering signals corresponding to red radiation, infrared radiation, and ambient light detected by the photodiode**

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	155 when the LED is not biased to generate radiation. This occurs, for example, during the time periods when neither the red or infrared LED is driven. Once detected, the degree of ambient light can be subtracted from both the red and infrared signals to improve their resultant signal-to-noise ratio. The amplifier channel corresponding to red radiation is activated by a sample-and-hold integrated circuit 157 that is controlled by the same control lines 185, 190 that drive the red LED, as shown in FIG. 9B. When the red LED is driven, the sample-and-hold circuit 157 is switched on, while similar components 164, 172 corresponding to the infrared signals and ambient light are switched off. The sample-and-hold circuit 157 samples and maintains an analog voltage from the transimpedance amplifier 156, which then passes through a low-pass filter 158 characterized by a 20 Hz cutoff. This filter removes any high-frequency noise (e.g. 60 Hz electrical noise) that is not related to the PPG waveform, and yields a preliminary waveform that is digitized with an analog-to-digital converter 176, and processed as described above to generate a DC portion of the PPG. The preliminary waveform then passes through a high-pass filter 160 with a cutoff of 0.1 Hz to remove the DC portion and leave only the AC portion, which typically represents about 0.5-1% of the total signal magnitude. The AC portion is further amplified with a standard instrumentation amplifier 162 featuring a programmable gain that is controlled with a 1.65 reference voltage and a digital potentiometer (not shown in the figure; this component may be included directly in the instrumentation amplifier) featuring a variable resistance controlled by the CPU within the wrist-worn transceiver. The CPU selects the resistance (according to a predetermined command) and corresponding gain to maximize the dynamic range of the analog-to-digital converter 176. This process results in an amplified version of the AC portion of the red PPG waveform, which is then digitized with the analog-to-digital converter 176 and then processed as described above. Moon at [0091] The transceiver 72 features a CPU 22 that communicates through a digital CAN interface, or bus, to external systems featuring ECG 16, external accelerometers 14 b-c, pneumatic 20, and auxiliary 45 sensors. Each sensor 16, 14 b-c, 20, 45 is ‘distributed’ on the patient to minimize the bulk and weight normally associated with conventional vital sign monitors, which typically incorporate all electronics associated with measuring vital signs in a single plastic box**. Moreover, each of these sensors 16, 14 b-c, 20, 45 generate digital signals close to where they actually attach to the patient, as opposed to generating an analog signal and sending it through a relatively long cable to a central unit for processing. This can reduce noise due to cable motion which is often mapped onto analog signals**. Cables 40, 38, 46 used in the body-worn monitor 10 to transmit packets over the CAN bus typically include 5 separate wires bundled together with a single protective cladding: the wires supply power and

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	ground to the remote ECG system 16, accelerometers 14 b-c, pneumatic 20, and auxiliary systems 45; provide high/low signal transmission lines for data transmitted over the CAN protocol; and provide a grounded electrical shield for each of these four wires. There are several advantages to this approach. First, a single pair of transmission lines in the cable (i.e. the high/low signal transmission lines) can transmit multiple digital waveforms generated by completely different sensors. This includes multiple ECG waveforms (corresponding, e.g., to vectors associated with three, five, and twelve-lead ECG systems) from the ECG circuit, along with ACC waveforms associated with the x, y, and z axes of accelerometers within the body-worn monitor 10. The same two wires, for example, can transmit up to twelve ECG waveforms (measured by a 12-lead ECG system), and six ACC waveforms (measured by the accelerometers 14 b-c). Limiting the transmission line to a pair of conductors reduces the number of wires attached to the patient, thereby decreasing the weight and any cable-related clutter. Second, cable motion induced by an ambulatory patient can change the electrical properties (e.g. electrical impendence) of its internal wires. This, in turn, can add noise to an analog signal and ultimately the vital sign calculated from it. A digital signal, in contrast, is relatively immune to such motion-induced artifacts. Moon at [0056] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Moon, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Moon, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[h]. the detection system further configured to: generate a first signal responsive to light received while the semiconductor diodes are off,	Moon discloses or renders obvious the detection system further configured to: generate a first signal responsive to light received while the semiconductor diodes are off.

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	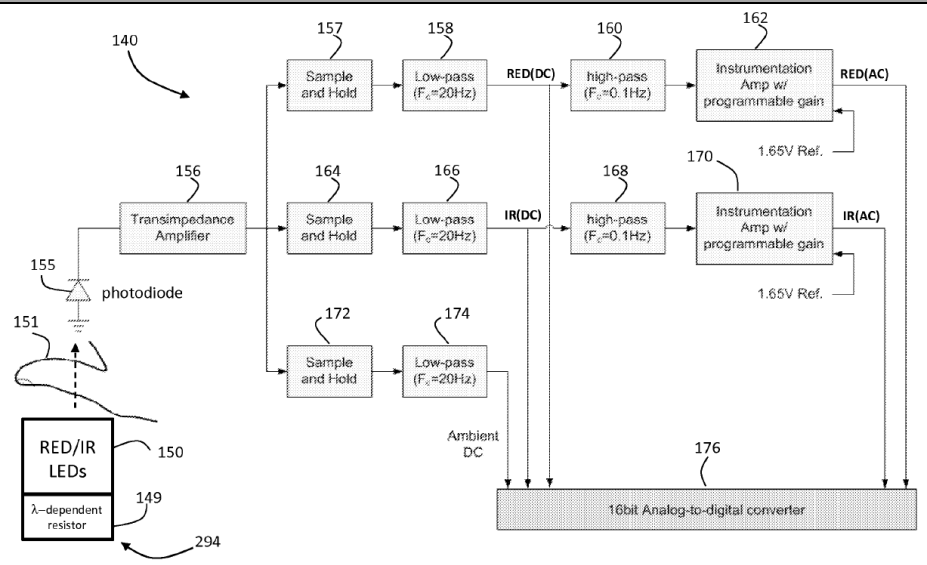 Fig. 10 Moon at Fig. 10 **The amplifier circuit 140 features separate channels for amplifying and filtering signals corresponding to red radiation, infrared radiation, and ambient light detected by the photodiode 155 when the LED is not biased to generate radiation. This occurs, for example, during the time periods when neither the red or infrared LED is driven. Once detected, the degree of ambient light can be subtracted from both the red and infrared signals to improve their resultant signal-to-noise ratio**. The amplifier channel corresponding to red radiation is activated by a sample-and-hold integrated circuit 157 that is controlled by the same control lines 185, 190 that drive the red LED, as shown in FIG. 9B. When the red LED is driven, the sample-and-hold circuit 157 is switched on, while similar components 164, 172 corresponding to the infrared signals and ambient light are switched off. The sample-and-hold circuit 157 samples and maintains an analog voltage from the transimpedance amplifier 156, which then passes through a low-pass filter 158 characterized by a 20 Hz cutoff. This filter removes any high-frequency noise (e.g. 60 Hz electrical noise) that is not related to the PPG waveform, and yields a preliminary waveform that is digitized with an analog-to-digital converter 176, and processed as described above to generate a DC portion of the PPG. The preliminary waveform then passes through a high-pass filter 160 with a cutoff of 0.1 Hz to remove the DC portion and leave only the AC portion, which typically represents about 0.5-1% of the total signal magnitude. The AC portion is further

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	amplified with a standard instrumentation amplifier 162 featuring a programmable gain that is controlled with a 1.65 reference voltage and a digital potentiometer (not shown in the figure; this component may be included directly in the instrumentation amplifier) featuring a variable resistance controlled by the CPU within the wrist-worn transceiver. The CPU selects the resistance (according to a predetermined command) and corresponding gain to maximize the dynamic range of the analog-to-digital converter 176. This process results in an amplified version of the AC portion of the red PPG waveform, which is then digitized with the analog-to-digital converter 176 and then processed as described above. Moon at [0091] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Moon, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Moon, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[i]. generate a second signal responsive to light received while at least one of the semiconductor diodes is on, and	Moon discloses or renders obvious the detection system further configured to: generate a second signal responsive to light received while at least one of the semiconductor diodes is on.

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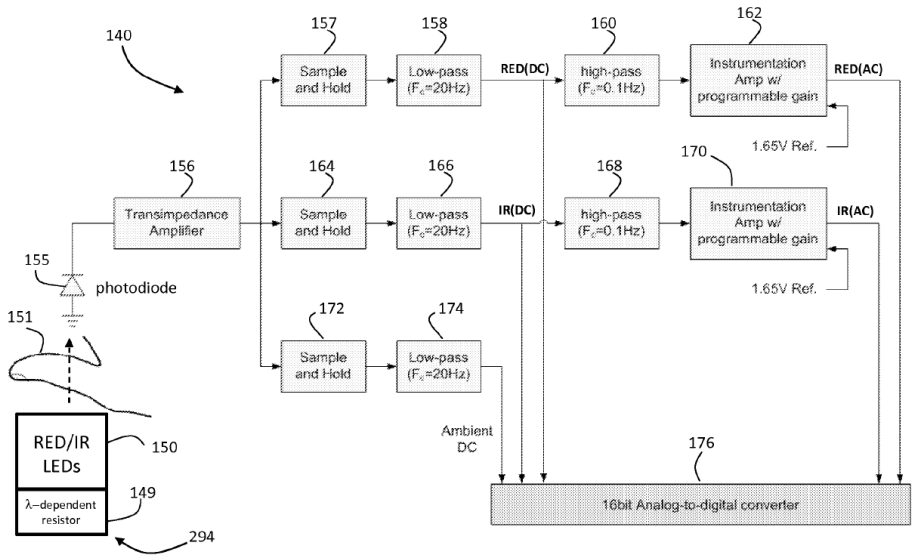
’790 Patent	Moon
	 Fig. 10 Moon at Fig. 10 The amplifier circuit 140 features separate channels for amplifying and filtering signals corresponding to red radiation, infrared radiation, and ambient light detected by the photodiode 155 when the LED is not biased to generate radiation. This occurs, for example, during the time periods when neither the red or infrared LED is driven. Once detected, the degree of ambient light can be subtracted from both the red and infrared signals to improve their resultant signal-to-noise ratio. **The amplifier channel corresponding to red radiation is activated by a sample-and-hold integrated circuit 157 that is controlled by the same control lines 185, 190 that drive the red LED, as shown in FIG. 9B. When the red LED is driven, the sample-and-hold circuit 157 is switched on, while similar components 164, 172 corresponding to the infrared signals and ambient light are switched off.** The sample-and-hold circuit 157 samples and maintains an analog voltage from the transimpedance amplifier 156, which then passes through a low-pass filter 158 characterized by a 20 Hz cutoff. This filter removes any high-frequency noise (e.g. 60 Hz electrical noise) that is not related to the PPG waveform, and yields a preliminary waveform that is digitized with an analog-to-digital converter 176, and processed as described above to generate a DC portion of the PPG. The preliminary waveform then passes through a high-pass filter 160 with a cutoff of 0.1 Hz to remove the DC portion and leave only the AC portion, which typically represents about 0.5-1% of the total signal magnitude. The AC portion is further

’790 Patent	Moon
	amplified with a standard instrumentation amplifier 162 featuring a programmable gain that is controlled with a 1.65 reference voltage and a digital potentiometer (not shown in the figure; this component may be included directly in the instrumentation amplifier) featuring a variable resistance controlled by the CPU within the wrist-worn transceiver. The CPU selects the resistance (according to a predetermined command) and corresponding gain to maximize the dynamic range of the analog-to-digital converter 176. This process results in an amplified version of the AC portion of the red PPG waveform, which is then digitized with the analog-to-digital converter 176 and then processed as described above. Moon at [0091] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Moon, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Moon, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[j]. increase the signal-to-noise ratio by comparing the first signal and the second signal; and	Moon discloses or renders obvious the detection system further configured to: increase the signal-to-noise ratio by comparing the first signal and the second signal.

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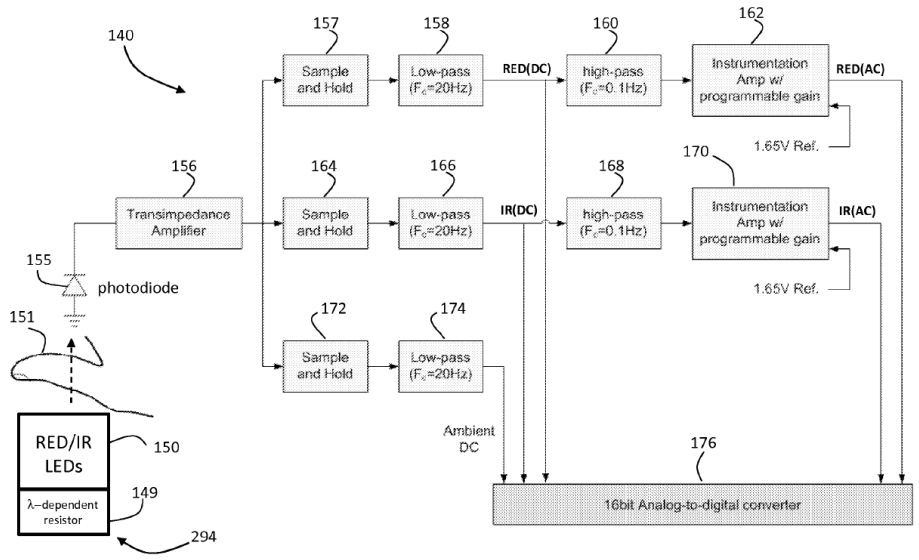
’790 Patent	Moon
	 Fig. 10 Moon at Fig. 10 **The amplifier circuit 140 features separate channels for amplifying and filtering signals corresponding to red radiation, infrared radiation, and ambient light detected by the photodiode 155 when the LED is not biased to generate radiation. This occurs, for example, during the time periods when neither the red or infrared LED is driven. Once detected, the degree of ambient light can be subtracted from both the red and infrared signals to improve their resultant signal-to-noise ratio.** The amplifier channel corresponding to red radiation is activated by a sample-and-hold integrated circuit 157 that is controlled by the same control lines 185, 190 that drive the red LED, as shown in FIG. 9B. When the red LED is driven, the sample-and-hold circuit 157 is switched on, while similar components 164, 172 corresponding to the infrared signals and ambient light are switched off. The sample-and-hold circuit 157 samples and maintains an analog voltage from the transimpedance amplifier 156, which then passes through a low-pass filter 158 characterized by a 20 Hz cutoff. This filter removes any high-frequency noise (e.g. 60 Hz electrical noise) that is not related to the PPG waveform, and yields a preliminary waveform that is digitized with an analog-to-digital converter 176, and processed as described above to generate a DC portion of the PPG. The preliminary waveform then passes through a high-pass filter 160 with a cutoff of 0.1 Hz to remove the DC portion and leave only the AC portion, which typically represents about 0.5-1% of the total signal magnitude. The AC portion is further

’790 Patent	Moon
	amplified with a standard instrumentation amplifier 162 featuring a programmable gain that is controlled with a 1.65 reference voltage and a digital potentiometer (not shown in the figure; this component may be included directly in the instrumentation amplifier) featuring a variable resistance controlled by the CPU within the wrist-worn transceiver. The CPU selects the resistance (according to a predetermined command) and corresponding gain to maximize the dynamic range of the analog-to-digital converter 176. This process results in an amplified version of the AC portion of the red PPG waveform, which is then digitized with the analog-to-digital converter 176 and then processed as described above. Moon at [0091] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Moon, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Moon, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[k]. wherein the wearable device is at least in part configured to identify an object.	Moon discloses or renders obvious the wearable device is at least in part configured to identify an object.

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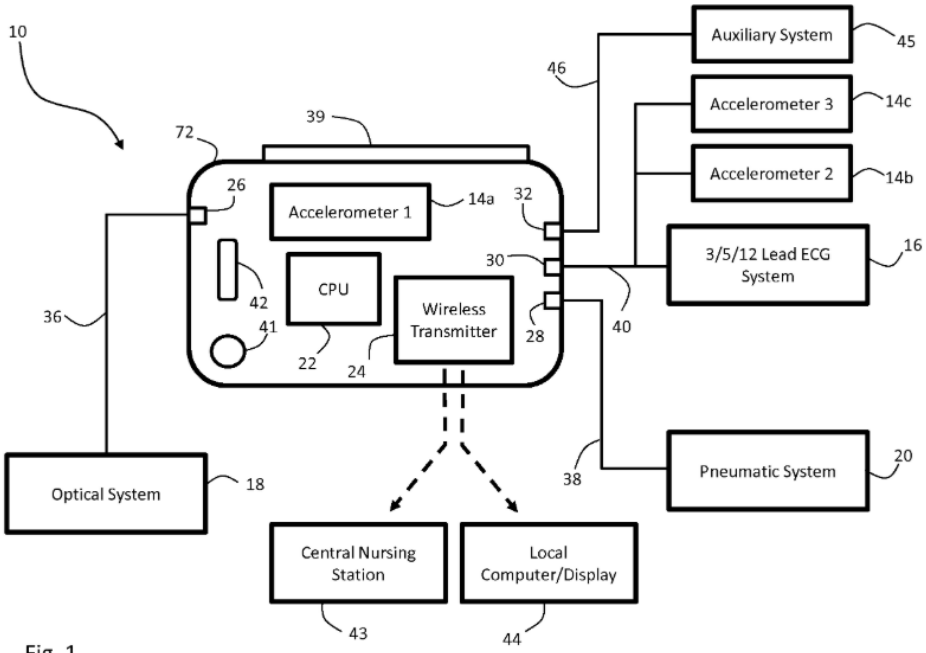
’790 Patent	Moon
	 Fig. 1 Moon at Fig. 1 **FIG. 1 shows a schematic drawing of a body-worn monitor 10 according to the invention featuring a wrist-worn transceiver 72 that continuously determines vital signs (e.g. blood pressure, SpO2, heart rate, respiratory rate, and temperature) and motion-related properties (e.g. posture, arm height, activity level, and degree of motion) for an ambulatory patient in a hospital.** The monitor 10 is small, lightweight, and comfortably worn on the patient's body during their stay in the hospital; its form factor is described in detail below. A medical professional can apply the monitor, for example, to a recently admitted patient waiting in the ED, and the same monitor can provide continuous monitoring during their stay in the hospital. For example, the patient can wear the monitor in their hospital room, as they receive specific procedures or tests, during transport to other rooms, and even during surgery. The monitor 10 provides continuous monitoring, and features a software framework that determines alarms/alerts if the patient begins to decompensate. The framework processes both the patient's motion and their vital sign information with algorithms that reduce the occurrence of false alarms.

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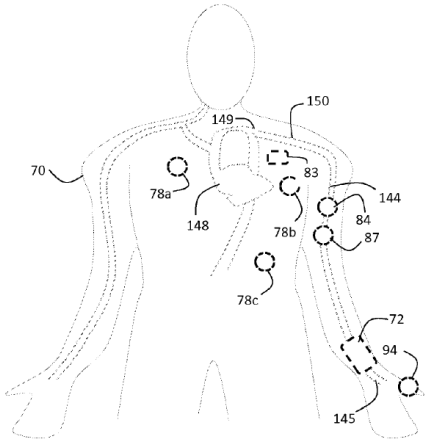
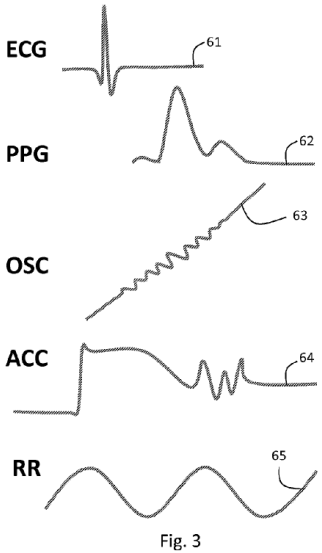
	Moon at [0054]  Fig. 2  Fig. 3 Moon at Figs. 2, 3 **FIGS. 2 and 3 show how a network of sensors 78 a-c, 83, 84, 87, 94 within the body-worn monitor 10** connect to a patient 70 to characterize them within a hospital. **During a measurement, the sensors 78 a-c, 83, 84, 87, 94 measure signals that are processed by the monitor 10 to generate time-dependent ECG 61, PPG 62, OSC 63, ACC 64, and RR 65 waveforms**. These, in turn, yield the patient's vital signs and motion parameters. Each waveform 61-65 relates to a unique physiological characteristic of the patient 70. Moon at [0063] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Moon, it would

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	have been obvious to one of ordinary skill in the art to combine, with the teachings of Moon, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.

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EXHIBIT F10

U.S. Pat. No. 12,193,790 in view of U.S. Patent No. 2005/0049468 to Sven-Erik Carlson ("Carlson")

As described in detail below, Carlson (individually or collectively) anticipates and/or renders obvious Claim 7 ("Asserted Claim") of U.S. Patent No. 12,193,790 (the "'790 Patent") under 35 U.S.C. §102 and/or §103, either alone in combination with the knowledge of a person of ordinary skill, and/or additional prior art references discussed in discussed in Exhibits F1-F14, the contents of which are hereby incorporated by reference into this chart. One of ordinary skill in the art, as of the priority date of the '790 Patent, would have known to combine the prior art elements disclosed by the foregoing references using known methods, and to use these elements according to their established functions in order to achieve a known and predictable result. This invalidity claim chart is based on Defendants' present understanding of the Asserted Claim and Plaintiff's apparent construction of the Asserted Claim in its Preliminary Infringement Contentions ("Infringement Contentions").

The following invalidity chart includes references to the structure, function, operation, and/or features of the technology described in Carlson. The cited portions of Carlson are merely illustrative, and Defendant reserves the right to rely on alternative or additional evidence, including uncited portions of Carlson. Where a particular figure is cited, the citation should be understood to encompass the caption and description of the figure as well as any text relating to or describing the figure. Conversely, where particular text referring to a figure is cited, the citation should be understood to include the figure as well. Although the documentation collectively evidences prior knowledge, use, or sale, Defendant reserves the right to rely upon individual documents as printed publications. Where the chart below states that Carlson "describes" or "provides for" a limitation, such disclosure may be express, inherent, or implicit. To the extent it is found Carlson does not expressly disclose certain limitations in the Asserted Claim, such limitations are inherent. Defendant reserves the right to present direct evidence of the structure, function, operation, and/or features of the technology described in Carlson (including product samples, source code, and/or witness testimony) and/or its prior art status, and to present alternative or additional documents concerning the same as evidence that the technology described in Carlson anticipates and/or renders obvious the Asserted Claim of the '790 Patent

This chart is subject to all reservations, objections, and disclaimers in Defendants' Invalidity Contentions and any amendment, supplement, or modification thereof, which are incorporated herein by reference in their entirety. Nothing stated herein shall be treated as an admission or suggestion that Defendant agrees with Plaintiff regarding the scope of the Asserted Claim, Plaintiff's apparent claim constructions, or the accuracy of any particular claim construction. Defendant reserves all rights to challenge any of the claim terms herein under 35 U.S.C. § 112, including by arguing that they are indefinite, are not supported by the written description, and/or are not enabled. Defendant further reserves all rights to amend this invalidity claim chart without leave of court pursuant to the Court's Docket Control Order, or upon a showing of good cause.

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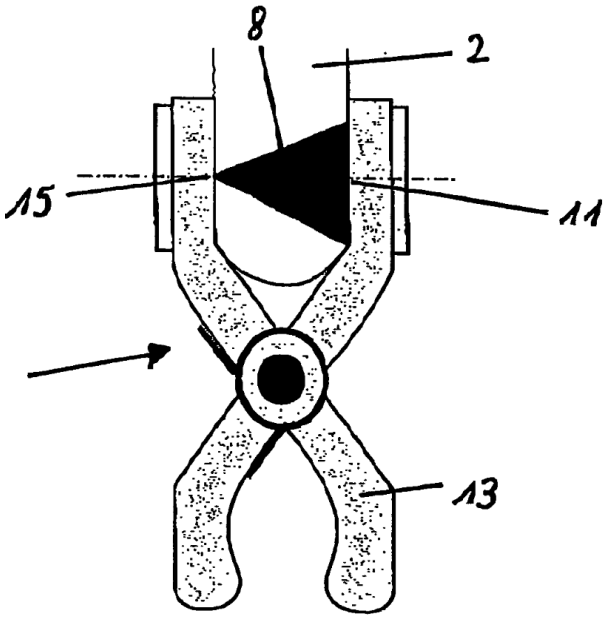
Claim 7	
7[pre]. An optical system, comprising:	By providing this disclosure, the Defendant does not take a position on whether the preamble is limiting. Carlson discloses or renders obvious an optical system. Proposed is a configuration for the acquisition and/or monitoring of medical data, in particular the state of the cardiovascular and pulmonary system, blood values or blood composition, characterised by at least one measuring sensor for the acquisition of the medical data such as the state of the cardiovascular system, etc. of a person comprising at least one light source which can emit light at least at two wavelengths, as well as at least one light receiver for determining the light transmitted and/or reflected through a tissue portion of a person or an animal further comprising means in order to increase the optical Signal-to-Noise and/or Signal-to-Background ratio. Carlson at Abstract  Figure 2

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	Carlson at Fig. 2 In FIG. 2, **the ear clip 1 is shown in cross section where it can specifically be seen that the sensor is designed in form on a clip 13. The sensor or ear clip 13 furthermore includes a light source 15 which emits a light beam 8 to a light receiver 11. The light is guided or emitted through the ear skin or earlobe 2.** Carlson at [0049] As already mentioned in the introduction**, the sensor is working according to the oximetric principal which is known best out of the state of the art. Optical pulsoximetry is used for non-invasive measurement, e.g. for pulsation and oxygen saturation in the human body.** The light source is emitting light at two wavelengths, at 660 nm and a second wavelength within the range of 800 to 1000 nm, which means in the present case at 890 nm. Therefore, it is of course also possible to have two light emitting sources arranged, which means two LEDs. The light receiver is determining the light transmitted through the earlobe, which means through the tissue portion of a person to be surveyed. Carlson at [0050] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants’ Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Carlson, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Carlson, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[a]. a wearable device for measuring one or more physiological parameters, the wearable device adapted to be placed on a wrist of a user;	Carlson discloses or renders obvious a wearable device for measuring one or more physiological parameters, the wearable device adapted to be placed on a wrist of a user.

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	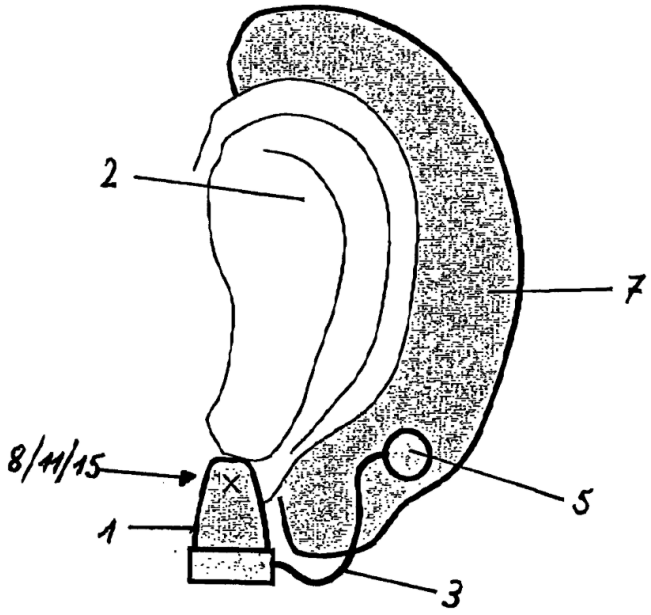 Figure 1 Carlson at Fig. 1 **FIG. 1 shows schematically the arrangement of an ear sensor 1 which can be arranged in form of an ear clip. This sensor 1 can be arranged e.g. at an earlobe of ear 2.** Furthermore, the sensor or ear clip is connected via a wire 3 and the connection 5 with the main unit 7 including e.g. a power source, like a battery, and measuring and/or monitoring electronics. Carlson at [0048] As already mentioned in the introduction**, the sensor is working according to the oximetric principal which is known best out of the state of the art. Optical pulsoximetry is used for non-invasive measurement, e.g. for pulsation and oxygen saturation in the human body.** The light source is emitting light at two wavelengths, at 660 nm and a second wavelength within the range of 800 to 1000 nm, which means in the present case at 890 nm. Therefore, it is of course also possible to have two light

’790 Patent	Carlson
	emitting sources arranged, which means two LEDs. The light receiver is determining the light transmitted through the earlobe, which means through the tissue portion of a person to be surveyed. Carlson at [0050] FIG. 7 a shows a spectrum of physiological signals, such as pulsation frequency, breathing frequency, etc. The frequency of physiological events is within the range of approximately 0.5 Hz (30 heartbeats in one minute) up to approximately 3 Hz (180 heartbeats in one minute) that can be even higher and therefore is supposed to go up to 5 Hz. Carlson at [0066] The frequency spectrum of ambient light is schematically shown in diagram 7 b. Sunlight is at 0 Hz, while artificial light, such as e.g. electrical in-house light, is going up to approximately 120 Hz (USA). In other words, within the range of frequencies of physiological signals, we have high influence of frequencies of sunlight and ambient light. A corresponding combined frequency spectrum is shown in Fig. c, which would be detected by a photo diode without the use of any means as described above in relation to FIGS. 1 to 6. FIG. 7 c shows a basic signal contribution due to physiological signal and additional signal contribution due to ambient light. In other words, the influence of ambient light is quite substantial, and therefore the deviations of the measured values compared to the real values can be dramatic. Carlson at [0067] Comparing the clip mechanism according to FIGS. 1 and 2 and the frame 61 as shown in FIG. 10 a, it is obvious that in using a frame it is not easy to arrange or remove the pulsoximetric sensor to or from an earlobe of an ear, if required, e.g. if a person wearing the pulsoximetric sensor is taking a bath, a shower, etc. Therefore, it is proposed, as shown schematically in FIG. 10 b, to use a snap-in mechanism 71, which means that the clamp mechanism 63 holding the LED 15 can be rotated e.g. in direction ot dashed line 73 around an axis 69 and removed from the frame 61 or vice versa can be arranged at the frame 61 by arranging within the axis 69 and within the snap mechanism 71. Therefore, the LSD 15 has not to be rotated within the screw connection 65 between the clamp mechanism 63 for removing the frame 61 from an earlobe of an ear.

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	Carlson at [0074] The invention, as described with reference to FIG. 1 to 10, is of course not limited to the examples as shown in FIG. 1 to 9, but can be differently designed combined with other features, etc. E.g. **pulsoximetric measurements can also be done at other parts of the body like e.g. fingers or toes.** In addition, not only one light source can be used for the measurement, but also two or even more light emitting sources. It is understood that also one, two, or more light receiving detectors can be used. All the various above mentioned and proposed means for improving the pulsoximetric monitoring to survey the health condition are not restricted to the measurement of transmitted light through a human or animal tissue. All the proposed means according to the present invention can be used, of course, also by measuring reflected light or as a combination of measuring reflected and transmitted light through a human or animal tissue. Carlson at [0075] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants’ Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Carlson, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Carlson, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[b]. the wearable device including a light source comprising a plurality of semiconductor diodes that are configured to generate an output optical light having one or more optical wavelengths, wherein at least a portion of the one or more optical wavelengths is a near-infrared wavelength	Carlson discloses or renders obvious the wearable device including a light source comprising a plurality of semiconductor diodes that are configured to generate an output optical light having one or more optical wavelengths, wherein at least a portion of the one or more optical wavelengths is a near-infrared wavelength between 700 nanometers and 2500 nanometers.

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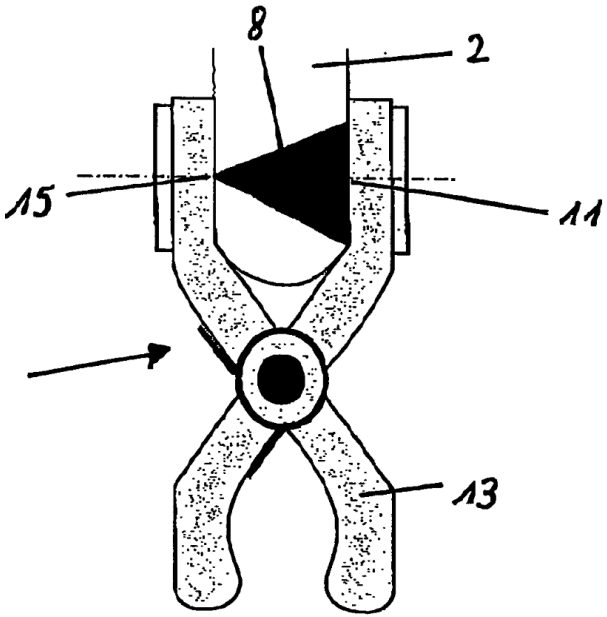
between 700 nanometers and 2500 nanometers;	 Figure 2 Carlson at Fig. 2 In FIG. 2, **the ear clip 1 is shown in cross section where it can specifically be seen that the sensor is designed in form on a clip 13. The sensor or ear clip 13 furthermore includes a light source 15 which emits a light beam 8 to a light receiver 11. The light is guided or emitted through the ear skin or earlobe 2.** Carlson at [0049] As already mentioned in the introduction**,** the sensor is working according to the oximetric principal which is known best out of the state of the art. Optical pulsoximetry is used for non-invasive measurement, e.g. for pulsation and oxygen saturation in the human body. **The light source is emitting light at two wavelengths, at 660 nm and a second wavelength within the range of 800 to 1000 nm,**

'790 Patent	Carlson
	which means in the present case at 890 nm. Therefore, it is of course also possible to have two light emitting sources arranged, which means two LEDs. The light receiver is determining the light transmitted through the earlobe, which means through the tissue portion of a person to be surveyed. Carlson at [0050] Therefore, it is proposed, as shown in FIG. 4, **to use beam shaping optics 20 to direct the emitted optical radiation 8 emitted from the two LEDs 15 to the middle of the earlobe. As it is shown clearly in FIG. 4, using the beam shaping optics 21, the two initial light beams 8 are guided in form of bundled beams 12 to a relatively small area within the middle ear 2.** By using the beam shaping optics 21, of course the influence of environmental light or noise, respectively, can be reduced substantially by increasing the S/B ratio. First or all, the light beam is bundled and, in addition, the optical signal power can be increased Carlson at [0054] The frequency spectrum of ambient light is schematically shown in diagram 7 b. Sunlight is at 0 Hz, while artificial light, such as e.g. electrical in-house light, is going up to approximately 120 Hz (USA). In other words, within the range of frequencies of physiological signals, we have high influence of frequencies of sunlight and ambient light. A corresponding combined frequency spectrum is shown in Fig. c, which would be detected by a photo diode without the use of any means as described above in relation to FIGS. 1 to 6. FIG. 7 c shows a basic signal contribution due to physiological signal and additional signal contribution due to ambient light. In other words, the influence of ambient light is quite substantial, and therefore the deviations of the measured values compared to the real values can be dramatic. Carlson at [0067] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants' Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Carlson, it

’790 Patent	Carlson
	would have been obvious to one of ordinary skill in the art to combine, with the teachings of Carlson, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[c]. the wearable device comprising one or more lenses configured to receive at least a portion of the output optical light and to deliver a lens output light to tissue comprising skin;	Carlson discloses or renders obvious the wearable device comprising one or more lenses configured to receive at least a portion of the output optical light and to deliver a lens output light to tissue comprising skin. The basic idea therefore is to use a beam-shaping element, such as e.g. diffractive or refractive lenses, to direct the emitted optical radiation of, e.g., the LED light source into the human or animal tissue and the photon detecting element in order to increase the optical signal power, detected by the pulsoximeter sensor, and thus increasing the Signal/Noise—and signal/Background ratio. The increase of the S/B ratio is estimated e.g. to a factor 5. Carlson at [0014] FIG. 6 c an oximetric sensor in perspective view, containing optical lenses, filters and geometrical baffles Carlson at [0041]

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	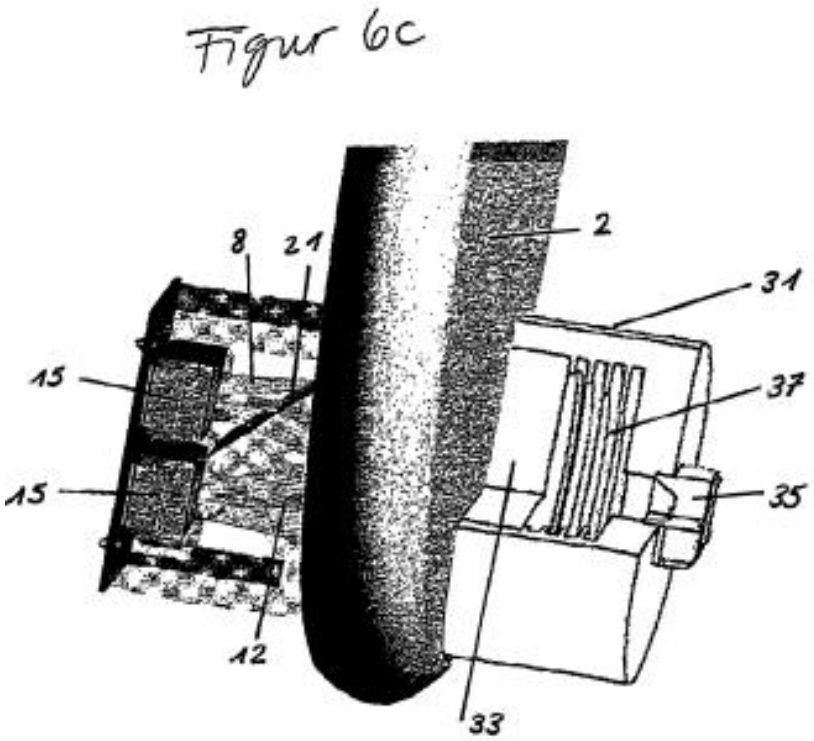 Carlson at Fig. 6c According to the preferred embodiment of the invention, the various described optical and geometric means, such as the beam shaping element as shown in FIG. 4, the wavelength filters, the sensor architecture, and the mentioned baffles, can be combined as shown in principle and perspective view in FIG. 6 c. Again, **light is emitted from the two LEDs 15 and is shaped by the two beam shaping elements or lenses 21 to be guided as beams 12 through the earlobe 2.** After the earlobe, the double pass filter 33 is arranged to guarantee that only light in the range of approximately 660 nm and in the range of approximately 890 nm is transmitted through the filter. After the filter, any stray light, entered the sensor e.g. trough the earlobe from the side, will be trapped within the baffles 37 which are arranged in circumferential direction. Finally, a photo detecting element 35 is arranged with specific spectrum sensitivity.

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’790 Patent	Carlson
	Carlson at [0062] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants’ Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Carlson, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Carlson, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[d]. the wearable device further comprising a detection system configured to receive at least a portion of the lens output light reflected from the tissue and to generate an output signal having a signal-to-noise ratio, wherein the detection system is configured to be synchronized to the light source;	Carlson discloses or renders obvious the wearable device further comprising a detection system configured to receive at least a portion of the lens output light reflected from the tissue and to generate an output signal having a signal-to-noise ratio, wherein the detection system is configured to be synchronized to the light source. Proposed is a configuration for the acquisition and/or monitoring of medical data, in particular the state of the cardiovascular and pulmonary system, blood values or blood composition, characterised by at least one measuring sensor for the acquisition of the medical data such as the state of the cardiovascular system, etc. of a person comprising at least one light source which can emit light at least at two wavelengths, as well as at least one light receiver for determining the light transmitted and/or reflected through a tissue portion of a person or an animal further comprising means in order to increase the optical Signal-to-Noise and/or Signal-to-Background ratio. Carlson at Abstract It is therefore an object of the present invention to define optical and/or electronic means for increasing the Signal-to-Noise ratio (S/N) and Signal-to-Background ratio (S/B) of a pulsoximeter sensor for robust application of pulsoximetry in telemedicine- and near patient testing applications in rough (optical) environmental conditions, e.g. at changing light influences, such as sunlight, shadow, artificial light, etc. Carlson at [0010] According to the preferred embodiment of the invention, the various described optical and geometric means, such as the beam shaping element as shown in FIG. 4, the wavelength filters, the sensor

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	architecture, and the mentioned baffles, can be combined as shown in principle and perspective view in FIG. 6 c. Again, **light is emitted from the two LEDs 15 and is shaped by the two beam shaping elements or lenses 21 to be guided as beams 12 through the earlobe 2.** After the earlobe, the double pass filter 33 is arranged to guarantee that only light in the range of approximately 660 nm and in the range of approximately 890 nm is transmitted through the filter. After the filter, any stray light, entered the sensor e.g. trough the earlobe from the side, will be trapped within the baffles 37 which are arranged in circumferential direction. Finally, a photo detecting element 35 is arranged with specific spectrum sensitivity. Carlson at [0062] Therefore, it is proposed, as shown in FIG. 4, to use beam shaping optics 20 to direct the emitted optical radiation 8 emitted from the two LEDs 15 to the middle of the earlobe. As it is shown clearly in FIG. 4, using the beam shaping optics 21, the two initial light beams 8 are guided in form of bundled beams 12 to a relatively small area within the middle ear 2**. By using the beam shaping optics 21, of course the influence of environmental light or noise, respectively, can be reduced substantially by increasing the S/B ratio.** First or all, the light beam is bundled and, in addition, the optical signal power can be increased. Carlson at [0054] **The basic idea of using AC-Coupling or Lock-In Amplification (synchronous detection), is to temporarily modulate the optical radiation of the LED at the carrier frequency fc in order to shift the power spectrum of the pulsoximeter signals into a higher frequency range where environmental optical radiation is unlikely and electronic band pass filtering is technologically less stringent**. AC-Coupling or Lock-In Amplification is well known out of the state of the art and is described in literature 3. Carlson at [0065] The frequency spectrum of ambient light is schematically shown in diagram 7 b. Sunlight is at 0 Hz, while artificial light, such as e.g. electrical in-house light, is going up to approximately 120 Hz (USA). In other words, within the range of frequencies of physiological signals, we have high influence of frequencies of sunlight and ambient light. **A corresponding combined frequency spectrum is shown**

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	in Fig. c, which would be detected by a photo diode without the use of any means as described above in relation to FIGS. 1 to 6. FIG. 7 c shows a basic signal contribution due to physiological signal and additional signal contribution due to ambient light. In other words, the influence of ambient light is quite substantial, and therefore the deviations of the measured values compared to the real values can be dramatic. Carlson at [0067] Coming back to the fixing system, which means a clip as shown in FIGS. 1 and 2, it has to be mentioned that when using a clip for fixing a pulsoximetric sensor, problems could occur due to strong movements of the human or animal individual or due to swelling or contracting of the human or animal tissue during the measurement with the pulsoximetric sensor. In other words, if e.g. an earlobe of an ear 2, as shown in FIG. 2, would swell, than the distance between the LED 15 and the photo detector 11 would increase and, what is even more critical, the beam path could divert substantially from the optical axis of the LED and the photo detector. Therefore, it is preferred to further provide means for stabilizing the signal guiding and detecting and to provide means for the beam path to be co-linear with the optical axis of the LED and the photo detector. Because of that, according to FIGS. 10 a and 10 b, it is proposed to use a frame 61 which is stable and does not change its dimensions due to strong movements or an individual carrying the pulsoximetric sensor or due to swelling or contracting of the tissue to be monitored by the pulsoximetric sensor. In this case, of course, other means have to be provided, so that the distance between the LED 15 and the photo detector 11 can be adjusted or adapted to the thickness of the tissue to be monitored. Therefore, according to FIG. 10 a, it is proposed that the LED 15 is arranged within a clamping mechanism 63 and that between the clamping mechanism 63 and the LED a screw connection 65 is arranged, so that the LED 15 can be moved into the clamping mechanism or out of the clamping mechanism 63. In other words, the distance between the LED 15 and the photo detector 11 can be adjusted along the optical axis 67 which guarantees that the beam path has always been co-linear with the optical axis 67 of the LED and the photo detector. Carlson at [0073] The invention, as described with reference to FIG. 1 to 10, is of course not limited to the examples as shown in FIG. 1 to 9, but can be differently designed combined with other features, etc. E.g. pulsoximetric measurements can also be done at other parts of the body like e.g. fingers or toes. In addition, not only one light source can be used for the measurement, but also two or even more light

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	emitting sources. It is understood that also one, two, or more light receiving detectors can be used. All the various above mentioned and proposed means for improving the pulsoximetric monitoring to survey the health condition are not restricted to the measurement of transmitted light through a human or animal tissue. All the proposed means according to the present invention can be used, of course, also by measuring reflected light or as a combination of measuring reflected and transmitted light through a human or animal tissue. Carlson at [0075] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants’ Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Carlson, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Carlson, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[e]. wherein the detection system comprises a plurality of detectors that are spatially separated from each other, and wherein at least one analog to digital converter is coupled to at least one of the plurality of detectors;	Carlson discloses or renders obvious the detection system comprises a plurality of detectors that are spatially separated from each other, and wherein at least one analog to digital converter is coupled to at least one of the plurality of detectors. The invention, as described with reference to FIG. 1 to 10, is of course not limited to the examples as shown in FIG. 1 to 9, but can be differently designed combined with other features, etc. E.g. pulsoximetric measurements can also be done at other parts of the body like e.g. fingers or toes. In addition, not only one light source can be used for the measurement, but also two or even more light emitting sources. **It is understood that also one, two, or more light receiving detectors can be used**. All the various above mentioned and proposed means for improving the pulsoximetric monitoring to survey the health condition are not restricted to the measurement of transmitted light through a human or animal tissue. All the proposed means according to the present invention can be used, of course, also by measuring reflected light or as a combination of measuring reflected and transmitted light through a human or animal tissue. Carlson at [0075]

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	One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants' Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Carlson, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Carlson, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[f]. wherein the output signal is indicative of the one or more of the physiological parameters;	Carlson discloses or renders obvious the output signal is indicative of the one or more of the physiological parameters. As already mentioned in the introduction**, the sensor is working according to the oximetric principal which is known best out of the state of the art. Optical pulsoximetry is used for non-invasive measurement, e.g. for pulsation and oxygen saturation in the human body.** The light source is emitting light at two wavelengths, at 660 nm and a second wavelength within the range of 800 to 1000 nm, which means in the present case at 890 nm. Therefore, it is of course also possible to have two light emitting sources arranged, which means two LEDs. The light receiver is determining the light transmitted through the earlobe, which means through the tissue portion of a person to be surveyed. Carlson at [0050] **FIG. 7 a shows a spectrum of physiological signals, such as pulsation frequency, breathing frequency, etc.** The frequency of physiological events is within the range of approximately 0.5 Hz (30 heartbeats in one minute) up to approximately 3 Hz (180 heartbeats in one minute) that can be even higher and therefore is supposed to go up to 5 Hz. Carlson at [0066] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants' Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Carlson, it

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	would have been obvious to one of ordinary skill in the art to combine, with the teachings of Carlson, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[g]. the wearable device configured to increase the signal-to-noise ratio by increasing light intensity of at least one of the plurality of semiconductor diodes from an initial light intensity; and	Carlson discloses or renders obvious the wearable device configured to increase the signal-to-noise ratio by increasing light intensity of at least one of the plurality of semiconductor diodes from an initial light intensity. **The basic idea therefore is to use a beam-shaping element, such as e.g. diffractive or refractive lenses, to direct the emitted optical radiation of, e.g., the LED light source into the human or animal tissue and the photon detecting element in order to increase the optical signal power, detected by the pulsoximeter sensor, and thus increasing the Signal/Noise—and signal/Background ratio.** The increase of the S/B ratio is estimated e.g. to a factor 5. Carlson at [0014] 1. **Configuration for the acquisition and/or monitoring of medical data, in particular the state of the cardiovascular and pulmonary system, blood values or blood composition, characterised by at least one measuring sensor for the acquisition of the medical data such as the stare of the cardiovascular system, etc. of a person comprising at least one light source which can emit light at least at two wavelengths, as well as at least one light receiver for determining the light transmitted and/or reflected through a tissue portion of a person or an animal further comprising means in order to increase the optical Signal-to-Noise and/or Signal-to-Background ratio.** Carlson at Claim 1 Therefore, it is proposed, as shown in FIG. 4, to use beam shaping optics 20 to direct the emitted optical radiation 8 emitted from the two LEDs 15 to the middle of the earlobe. As it is shown clearly in FIG. 4, using the beam shaping optics 21, the two initial light beams 8 are guided in form of bundled beams 12 to a relatively small area within the middle ear 2. **By using the beam shaping optics 21, of course the influence of environmental light or noise, respectively, can be reduced substantially by increasing the S/B ratio. First or all, the light beam is bundled and, in addition, the optical signal power can be increased.** Carlson at [0054]

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	One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants’ Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Carlson, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Carlson, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[h]. the detection system further configured to: generate a first signal responsive to light received while the semiconductor diodes are off,	Carlson discloses or renders obvious the detection system further configured to: generate a first signal responsive to light received while the semiconductor diodes are off. **As a consequence, it is therefore proposed to emit light by the LEDs not as current or continuous light but as pulsed light. The frequency is chosen in such a way that it is outside the frequency spectrum of sunlight and of ambient light which, according to FIG. 7 b, is in the range of above approximately 1000 Hz. Thus, the pulsoximeter signals are readily discriminated from electronic and parasitic contributions of environmental optical radiation outside the frequency fc+/−5 Hz increasing significantly the Signal-to-Noise and Signal-to-Background ratio.** FIG. 8 shows the shift spectrum of signal to a region where there is little influence, e.g. of ambient light. F0 is the chosen frequency of the emitted light to operate the pulsoximeter sensor and the range between f0−5 Hz and f0+5 Hz is the consequence of the influence of the frequency due to physiological signal. Therefore, as shown in FIG. 8, the frequency spectrum of signal at the photo diode does have a basic signal contribution due to physiological signal. The signal contribution which is shown at the top of the signal contribution due to physiological signal and which is due to ambient light, is very small and as a consequence is approximately neglectable. Any noise or sunlight within the range of 0 to 120 Hz, while the light beam for the pulsoximetric measurement is within the range of approximately f0−5 Hz to f0+5 Hz, will not influence the measurement of the pulsoximetric sensor. F0 could be e.g., as mentioned, 1000 Hz which of course is a frequency far outside of any indoor light source, as e.g. halogen light, conventional light, etc. f0 of course can be chosen at any other frequency, as e.g. 2000 Hz or even higher. By using light source modulation, it is even possible to use an additional filter removing a certain frequency spectrum. Looking e.g. at FIG. 9, it is possible to arrange a filter band pass 51 which is e.g. removing any frequencies in the range of 0 to 120 Hz. The respective filter is shown in form of the dashed line 51. As a result, we end up by a diagram according to FIG. 9 b only showing any measurements in the range of f0−5 Hz to f0+5 Hz. Carlson at [0069]

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7[i]. generate a second signal responsive to light received while at least one of the semiconductor diodes is on, and	Carlson discloses or renders obvious the detection system further configured to: generate a second signal responsive to light received while at least one of the semiconductor diodes is on. **As a consequence, it is therefore proposed to emit light by the LEDs not as current or continuous light but as pulsed light. The frequency is chosen in such a way that it is outside the frequency spectrum of sunlight and of ambient light which, according to FIG. 7 b, is in the range of above approximately 1000 Hz. Thus, the pulsoximeter signals are readily discriminated from electronic and parasitic contributions of environmental optical radiation outside the frequency fc+/−5 Hz increasing significantly the Signal-to-Noise and Signal-to-Background ratio.** FIG. 8 shows the shift spectrum of signal to a region where there is little influence, e.g. of ambient light. F0 is the chosen frequency of the emitted light to operate the pulsoximeter sensor and the range between f0−5 Hz and f0+5 Hz is the consequence of the influence of the frequency due to physiological signal. Therefore, as shown in FIG. 8, the frequency spectrum of signal at the photo diode does have a basic signal contribution due to physiological signal. The signal contribution which is shown at the top of the signal contribution due to physiological signal and which is due to ambient light, is very small and as a consequence is approximately neglectable. Any noise or sunlight within the range of 0 to 120 Hz, while the light beam for the pulsoximetric measurement is within the range of approximately f0−5 Hz to f0+5 Hz, will not influence the measurement of the pulsoximetric sensor. F0 could be e.g., as mentioned, 1000 Hz which of course is a frequency far outside of any indoor light source, as e.g. halogen light, conventional light, etc. f0 of course can be chosen at any other frequency, as e.g. 2000 Hz or even higher. By using light source modulation, it is even possible to use an additional filter removing a certain frequency spectrum. Looking e.g. at FIG. 9, it is possible to arrange a filter band pass 51 which is e.g. removing any frequencies in the range of 0 to 120 Hz. The respective filter is shown in form of the dashed line 51. As a result, we end up by a diagram according to FIG. 9 b only showing any measurements in the range of f0−5 Hz to f0+5 Hz.

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7[j]. increase the signal-to-noise ratio by comparing the first signal and the second signal; and	Carlson discloses or renders obvious the detection system further configured to: increase the signal-to-noise ratio by comparing the first signal and the second signal. **As a consequence, it is therefore proposed to emit light by the LEDs not as current or continuous light but as pulsed light. The frequency is chosen in such a way that it is outside the frequency spectrum of sunlight and of ambient light which, according to FIG. 7 b, is in the range of above approximately 1000 Hz. Thus, the pulsoximeter signals are readily discriminated from electronic and parasitic contributions of environmental optical radiation outside the frequency fc+/−5 Hz increasing significantly the Signal-to-Noise and Signal-to-Background ratio.** FIG. 8 shows the shift spectrum of signal to a region where there is little influence, e.g. of ambient light. F0 is the chosen frequency of the emitted light to operate the pulsoximeter sensor and the range between f0−5 Hz and f0+5 Hz is the consequence of the influence of the frequency due to physiological signal. Therefore, as shown in FIG. 8, the frequency spectrum of signal at the photo diode does have a basic signal contribution due to physiological signal. **The signal contribution which is shown at the top of the signal contribution due to physiological signal and which is due to ambient light, is very small and as a consequence is approximately neglectable. Any noise or sunlight within the range of 0 to 120 Hz, while the light beam for the pulsoximetric measurement is within the range of approximately f0−5 Hz to f0+5 Hz, will not influence the measurement of the pulsoximetric sensor.** F0 could be e.g., as mentioned, 1000 Hz which of course is a frequency far outside of any indoor light source, as e.g. halogen light, conventional light, etc. f0 of course can be chosen at any other frequency, as e.g. 2000 Hz or even higher. By using light source modulation, it is even possible to use an additional filter removing a certain frequency spectrum. Looking e.g. at FIG. 9, it is possible to arrange a filter band pass 51 which is e.g. removing any frequencies in the range of 0 to 120 Hz. The respective filter is shown in form of the dashed line 51. As a result, we end up by a diagram according to FIG. 9 b only showing any measurements in the range of f0−5 Hz to f0+5 Hz.

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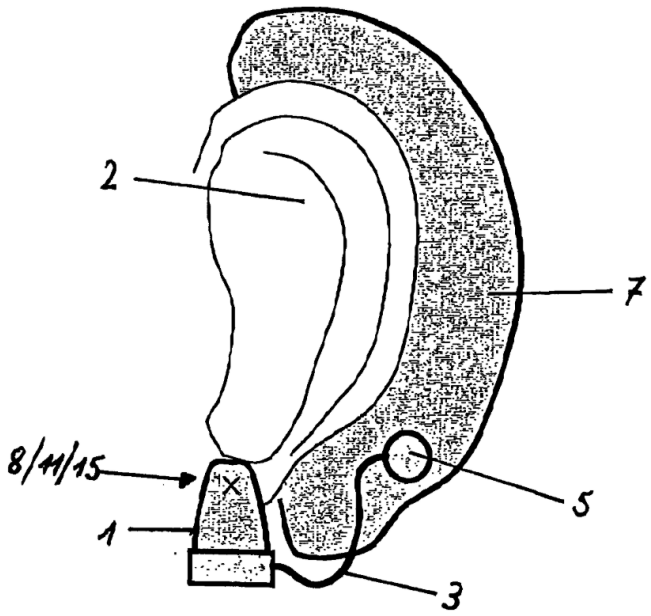
	Carlson at [0069] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants’ Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Carlson, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Carlson, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[k]. wherein the wearable device is at least in part configured to identify an object.	Carlson discloses or renders obvious the wearable device is at least in part configured to identify an object.  Figure 1 Carlson at Fig. 1

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	FIG. 1 shows schematically the arrangement of an ear sensor 1 which can be arranged in form of an ear clip. This sensor 1 can be arranged e.g. at an earlobe of ear 2. Furthermore, the sensor or ear clip is connected via a wire 3 and the connection 5 with the main unit 7 including e.g. a power source, like a battery, and measuring and/or monitoring electronics. Carlson at [0048] As already mentioned in the introduction**, the sensor is working according to the oximetric principal which is known best out of the state of the art. Optical pulsoximetry is used for non-invasive measurement, e.g. for pulsation and oxygen saturation in the human body.** The light source is emitting light at two wavelengths, at 660 nm and a second wavelength within the range of 800 to 1000 nm, which means in the present case at 890 nm. Therefore, it is of course also possible to have two light emitting sources arranged, which means two LEDs. The light receiver is determining the light transmitted through the earlobe, which means through the tissue portion of a person to be surveyed. Carlson at [0050] The invention, as described with reference to FIG. 1 to 10, is of course not limited to the examples as shown in FIG. 1 to 9, but can be differently designed combined with other features, etc. E.g. **pulsoximetric measurements can also be done at other parts of the body like e.g. fingers or toes.** In addition, not only one light source can be used for the measurement, but also two or even more light emitting sources. It is understood that also one, two, or more light receiving detectors can be used. All the various above mentioned and proposed means for improving the pulsoximetric monitoring to survey the health condition are not restricted to the measurement of transmitted light through a human or animal tissue. All the proposed means according to the present invention can be used, of course, also by measuring reflected light or as a combination of measuring reflected and transmitted light through a human or animal tissue. Carlson at [0075] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references

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	identified in Defendants’ Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Carlson, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Carlson, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.

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EXHIBIT F11

U.S. Pat. No. 12,193,790 B2 in view of U.S. Patent Publication No. 20080242958 to Ammar Al-Ali ("Al-Ali")

As described in detail below, Al-Ali (individually or collectively) anticipates and/or renders obvious claim 7 ("Asserted Claim") of U.S. Patent No. 12,193,790 B2 (the "'790 Patent") under 35 U.S.C. §102 and/or §103, either alone in combination with the knowledge of a person of ordinary skill, and/or additional prior art references discussed in discussed in Exhibits F1-F14, the contents of which are hereby incorporated by reference into this chart. One of ordinary skill in the art, as of the priority date of the '790 Patent, would have known to combine the prior art elements disclosed by the foregoing references using known methods, and to use these elements according to their established functions in order to achieve a known and predictable result. This invalidity claim chart is based on Defendants' present understanding of the Asserted Claim and Plaintiff's apparent construction of the Asserted Claim in its Preliminary Infringement Contentions ("Infringement Contentions").

The following invalidity chart includes references to the structure, function, operation, and/or features of the technology described in Al-Ali. The cited portions of Al-Ali are merely illustrative, and Defendants reserve the right to rely on alternative or additional evidence, including uncited portions of Al-Ali. Where a particular figure is cited, the citation should be understood to encompass the caption and description of the figure as well as any text relating to or describing the figure. Conversely, where particular text referring to a figure is cited, the citation should be understood to include the figure as well. Although the documentation collectively evidences prior knowledge, use, or sale, Defendants reserve the right to rely upon individual documents as printed publications. Where the chart below states that Al-Ali "describes" or "provides for" a limitation, such disclosure may be express, inherent, or implicit. To the extent it is found Al-Ali does not expressly disclose certain limitations in the Asserted Claim, such limitations are inherent. Defendants reserve the right to present direct evidence of the structure, function, operation, and/or features of the technology described in Al-Ali (including product samples, source code, and/or witness testimony) and/or its prior art status, and to present alternative or additional documents concerning the same as evidence that the technology described in Al-Ali anticipates and/or renders obvious the Asserted Claim of the '790 Patent

This chart is subject to all reservations, objections, and disclaimers in Defendants' Invalidity Contentions and any amendment, supplement, or modification thereof, which are incorporated herein by reference in their entirety. Nothing stated herein shall be treated as an admission or suggestion that Defendants agree with Plaintiff regarding the scope of the Asserted Claim, Plaintiff's apparent claim constructions, or the accuracy of any particular claim construction. Defendants reserve all rights to challenge any of the claim terms herein under 35 U.S.C. § 112, including by arguing that they are indefinite, are not supported by the written description, and/or are not enabled. Defendants further reserve all rights to amend this invalidity claim chart without leave of court pursuant to the Court's Docket Control Order, or upon a showing of good cause.

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EXHIBIT F11

’790 Patent	Al-Ali
Claim 7	
7[pre]. An optical system, comprising:	By providing this disclosure, Defendants do not take a position on whether the preamble is limiting. Al-Ali discloses or renders obvious an optical system. A multiple wavelength optical sensor has an emitter configured to radiate light having a plurality of wavelengths into a tissue site. The emitter comprises a plurality of LEDs configured in an array and connected within an electrical grid. A detector is configured to receive the light after absorption by pulsatile blood flow within the tissue site. The detector generates a sensor signal capable of being processed by a patient monitor so as to derive oxygen saturation, carboxyhemoglobin, methemoglobin and total hemoglobin. Al-Ali at Abstract

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	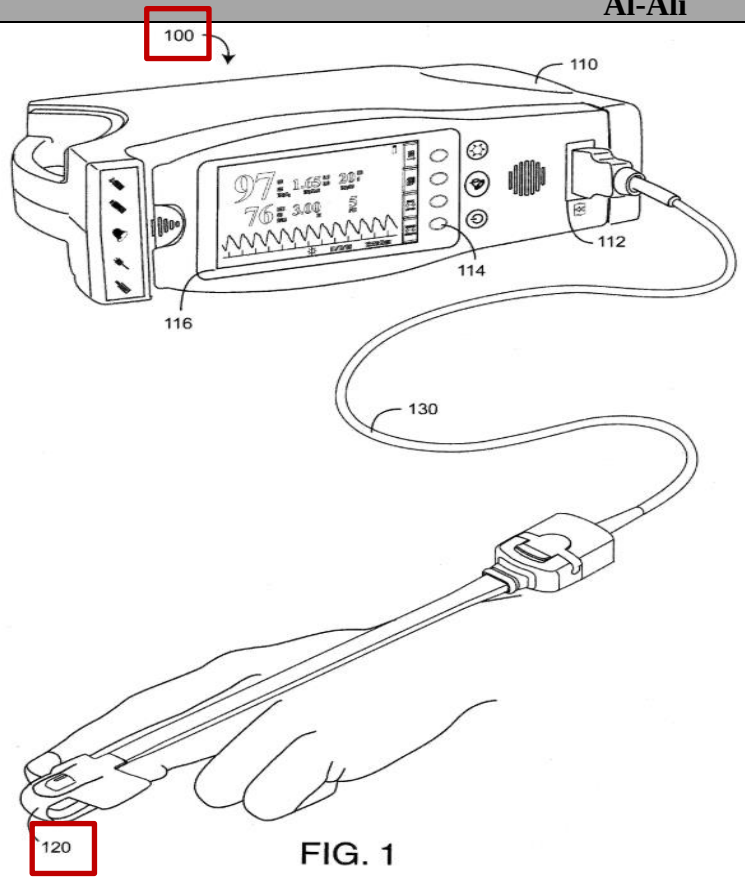 FIG. 1 Al-Ali at Fig. 1 **FIG. 1 illustrates a physiological measurement system 100 having a monitor 110 and a multiple wavelength optical sensor 120 with enhanced measurement capabilities as compared with conventional pulse oximetry. In particular, the multiple wavelength optical sensor 120 allows the measurement of various blood constituents and related parameters in addition to oxygen saturation and pulse rate. Alternatively, the multiple wavelength optical sensor 120 allows the measurement of oxygen saturation and pulse rate with increased accuracy or robustness as compared with conventional pulse oximetry**.

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	Al-Ali at [0039] In one embodiment, **the optical sensor 120 is configured to plug into a monitor sensor port 112 via a patient cable 130. Monitor keys 114 provide control over operating modes and alarms, to name a few. A display 116 provides readouts of measured parameters, such as oxygen saturation, pulse rate, HbCO, HbMet and Hbt to name a few. Other blood parameters that may be measured to provide important clinical information are fractional oxygen saturation, bilirubin and blood glucose, to name a few**. Al-Ali at [0040] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Al-Ali, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Al-Ali, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[a]. a wearable device for measuring one or more physiological parameters, the wearable device adapted to be placed on a wrist of a user;	Al-Ali discloses or renders obvious a wearable device for measuring one or more physiological parameters, the wearable device adapted to be placed on a wrist of a user.

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	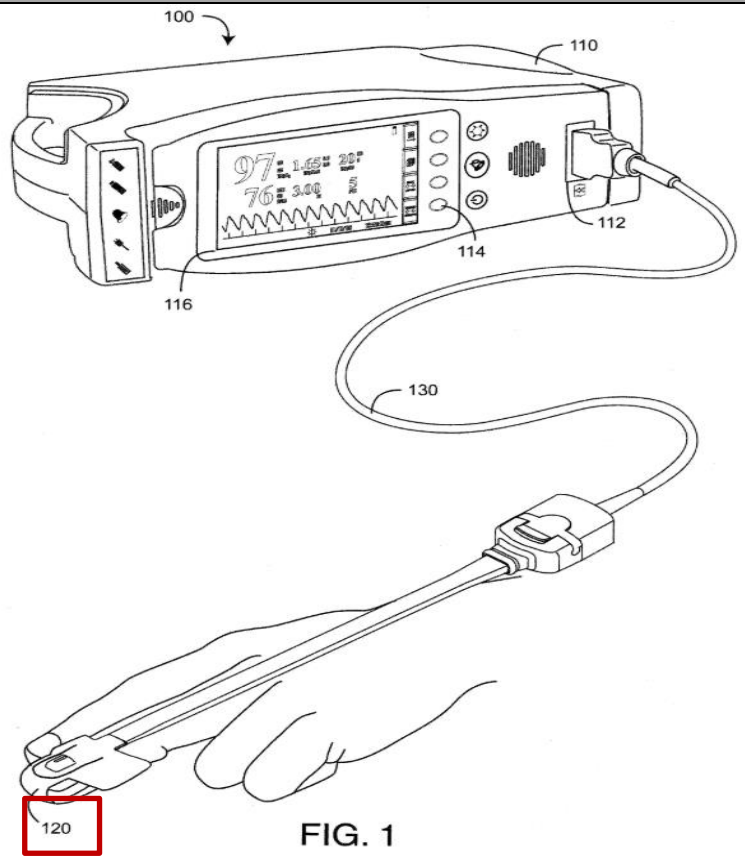 FIG. 1 Al-Ali at Fig. 1 **FIG. 1 illustrates a physiological measurement system 100 having a monitor 110 and a multiple wavelength optical sensor 120 with enhanced measurement capabilities as compared with conventional pulse oximetry. In particular, the multiple wavelength optical sensor 120 allows the measurement of various blood constituents and related parameters in addition to oxygen saturation and pulse rate. Alternatively, the multiple wavelength optical sensor 120 allows the measurement of oxygen saturation and pulse rate with increased accuracy or robustness as compared with conventional pulse oximetry**. Al-Ali at [0039]

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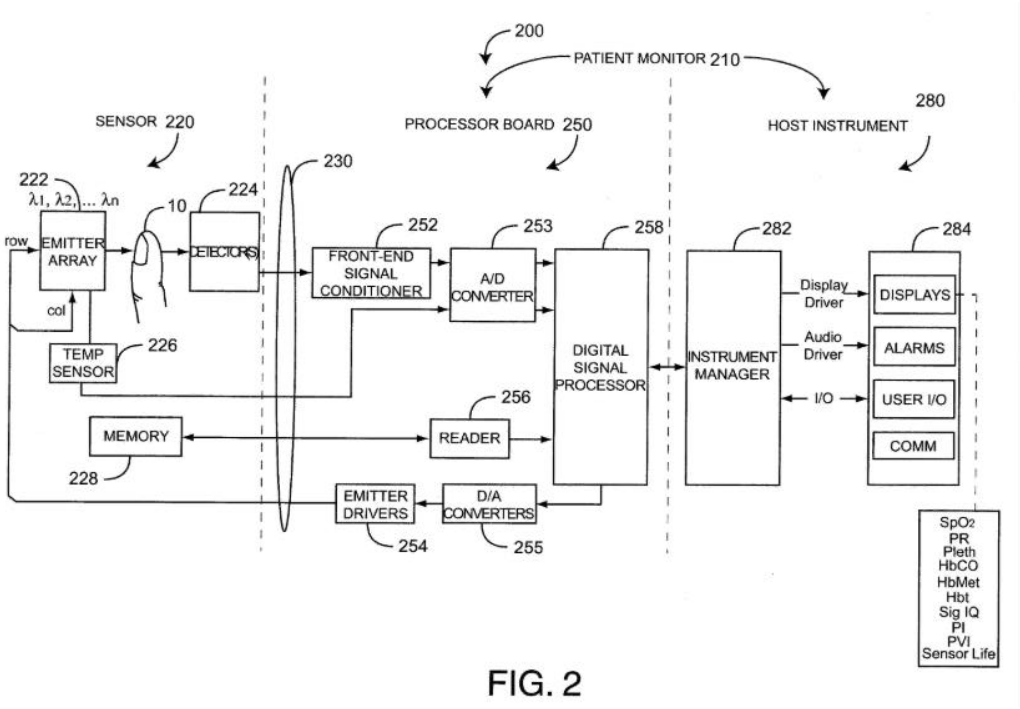
	In one embodiment, **the optical sensor 120 is configured to plug into a monitor sensor port 112 via a patient cable 130. Monitor keys 114 provide control over operating modes and alarms, to name a few. A display 116 provides readouts of measured parameters, such as oxygen saturation, pulse rate, HbCO, HbMet and Hbt to name a few. Other blood parameters that may be measured to provide important clinical information are fractional oxygen saturation, bilirubin and blood glucose, to name a few**. Al-Ali at [0040]  FIG. 2 Al-Ali at Fig. 2 In an embodiment, **the optical sensor 220 includes an emitter array 222, at least one detector 224, a temperature sensor 226 and a memory 228. The emitter array 222 irradiates a tissue site 10 with multiple wavelength light. One or more detectors 224 detect the light after attenuation by the tissue**

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	site 10. The temperature sensor 226 is located so as to detect the bulk temperature of the emitters within the emitter array, so as to accurately determine emitter wavelengths, as described below. The memory 228 can include any of a wide variety of memory devices known to an artisan from the disclosure herein, including an EPROM, an EEPROM, a flash memory, a ROM, a non-volatile RAM and a two-terminal serial memory device, to name a few, and combinations of the same. The memory 228 can advantageously store a wide variety of sensor-related information, including sensor type, manufacturer information, sensor characteristics including wavelengths emitted, wavelength correction data, emitter drive requirements, demodulation data, calculation mode data, calibration data and sensor life data to name a few. The memory can also store software such as scripts and executable code, encryption information, monitor and algorithm upgrade instructions and enabled parameters. Al-Ali at [0043] Although described herein with respect to various disposable sensor embodiments, a sensor may be reusable, resposable (partially reusable/partially disposable), adhesive or non-adhesive, or a transmittance, reflectance or transflectance sensor. Further, **a sensor may be configured for a variety of tissue sites such as a finger, hand, foot, forehead or ear or for attachment to multiple tissue sites, including multiple-head sensors capable of simultaneous multi-site measurements.** Al-Ali at [0044] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Al-Ali, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Al-Ali, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[b]. the wearable device including a light source comprising a plurality of semiconductor diodes that are configured to generate an	Al-Ali discloses or renders obvious the wearable device including a light source comprising a plurality of semiconductor diodes that are configured to generate an output optical light having one or more optical wavelengths, wherein at least a portion of the one or more optical wavelengths is a near-infrared wavelength between 700 nanometers and 2500 nanometers.

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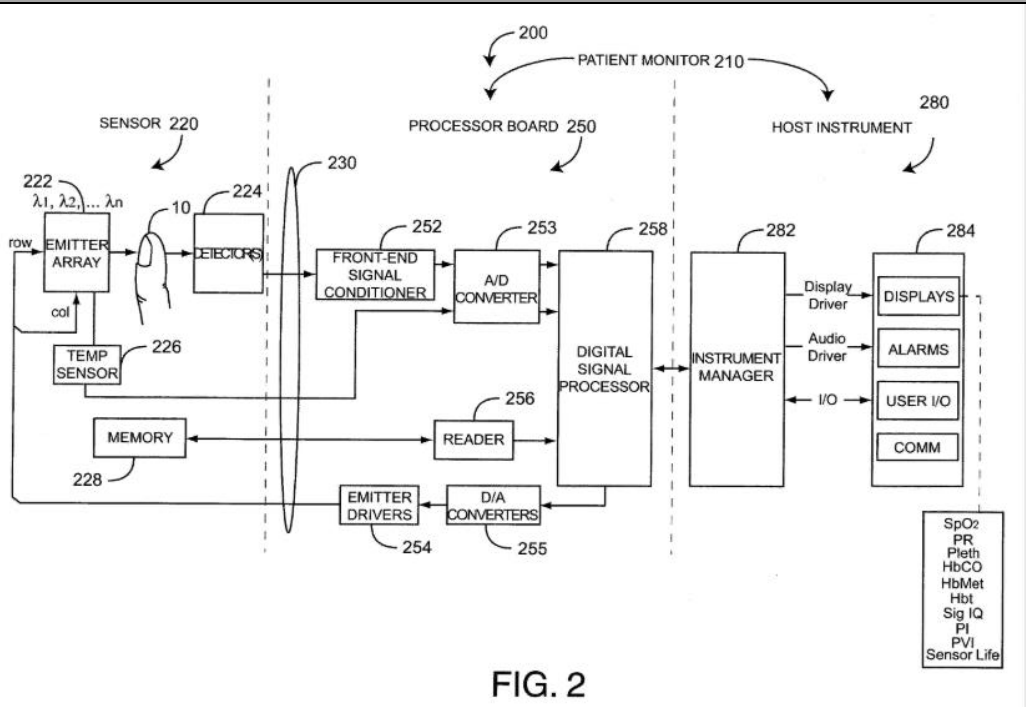
output optical light having one or more optical wavelengths, wherein at least a portion of the one or more optical wavelengths is a near-infrared wavelength between 700 nanometers and 2500 nanometers;	 FIG. 2 Al-Ali at Fig. 2 In an embodiment, **the optical sensor 220 includes an emitter array 222, at least one detector 224, a temperature sensor 226 and a memory 228. The emitter array 222 irradiates a tissue site 10 with multiple wavelength light.** One or more detectors 224 detect the light after attenuation by the tissue site 10. The temperature sensor 226 is located so as to detect the bulk temperature of the emitters within the emitter array, so as to accurately determine emitter wavelengths, as described below. The memory 228 can include any of a wide variety of memory devices known to an artisan from the disclosure herein, including an EPROM, an EEPROM, a flash memory, a ROM, a non-volatile RAM and a two-terminal serial memory device, to name a few, and combinations of the same. The memory 228 can advantageously store a wide variety of sensor-related information, including sensor type, manufacturer information, sensor characteristics including wavelengths emitted, wavelength correction data, emitter drive requirements, demodulation data, calculation mode data, calibration data and sensor life data to name a few. The memory can also store software such as scripts and executable code, encryption information, monitor and algorithm upgrade instructions and enabled parameters.

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	Al-Ali at [0043] One aspect of a physiological sensor is an emitter that emits light having a plurality of wavelengths. A detector generates an output signal responsive to the emitted light after absorption by tissue. An attachment assembly removably attaches the emitter and the detector to tissue. A spacer provides a predetermined gap between the emitter and tissue when the emitter is attached to tissue. A light scattering medium is disposed in a optical path between the emitter and tissue. The spacer and the light scattering medium provide at least a substantially uniform illumination of tissue by the emitted light for each of the wavelengths. In various embodiments, the light scattering medium comprises glass beads mixed with an encapsulant disposed proximate the spacer. The light scattering medium comprises microspheres mixed with an epoxy disposed proximate the emitter. The emitter comprises an array of at least eight light emitting diodes emitting light generally centered around eight unique wavelengths. **The emitter comprises an array of at least thirteen light emitting diodes emitting light generally centered around at least twelve unique wavelengths. The detector comprises at least one Si photodiode and at least one InGaAs photodiode connected in parallel. The detector comprises two Si photodiodes and four InGaAs photodiodes all connected in parallel. The light emitting diodes emit light within a first range of about 620-905 nm and within a second range of about 1040-1270 nm.** Al-Ali at [0008] Another aspect of a physiological sensor comprising an emitter configured to radiate light having a plurality of wavelengths into a tissue site. **The emitter comprises a plurality of LEDs disposed within an emitter ceramic substrate.** A detector is configured to receive the light after absorption by pulsatile blood flow within the tissue site. The detector generates a sensor signal capable of being processed by a patient monitor so as to derive total hemoglobin (Hbt). **The detector comprises a plurality of photodiodes disposed within a detector ceramic substrate. A first set of the photodiodes is responsive to a first set of the wavelengths and a second set of the photodiodes is responsive to a second set of the wavelengths. In various embodiments a diffuser scatters the radiated light so that a tissue site is uniformly illuminated across all of the wavelengths.** A first encapsulate containing glass beads is mounted in a spacer proximate the emitter ceramic substrate. A second encapsulate mixed with microspheres is disposed on the LEDs within the emitter ceramic substrate. The photodiodes comprise at least one Si photodiode and at least one InGaAs photodiode connected in parallel. The LEDs radiate light generally centered around at least twelve unique wavelengths. The LEDs are mounted in an

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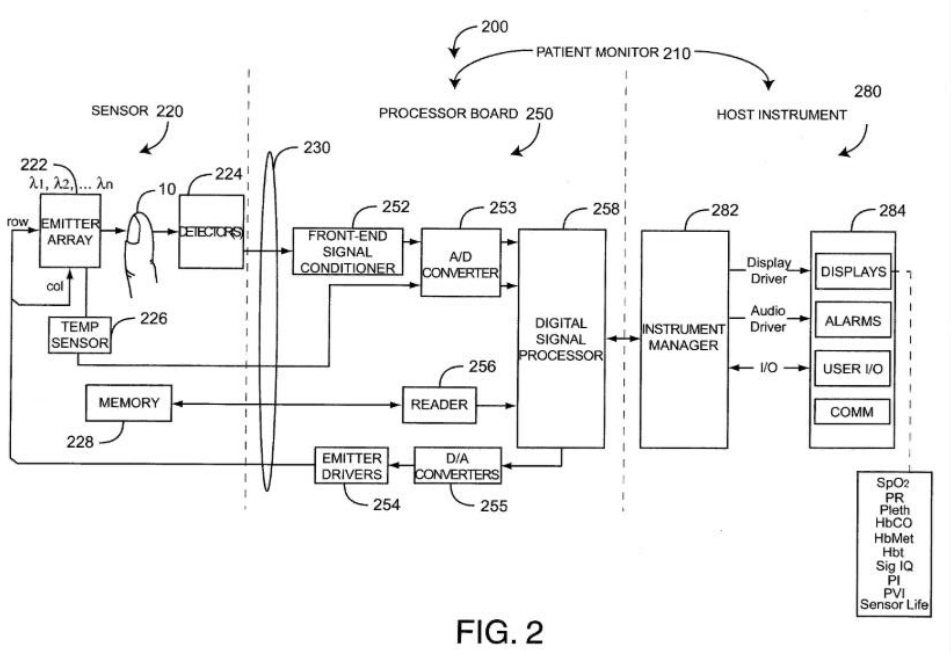
	array of at least thirteen LEDs connected within an electrical grid. **The twelve unique wavelengths comprise eight wavelengths within a first range of about 620-905 nm. and four wavelengths within a second range of about 1040-1270 nm**. Al-Ali at [0009] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Al-Ali, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Al-Ali, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[c]. the wearable device comprising one or more lenses configured to receive at least a portion of the output optical light and to deliver a lens output light to tissue comprising skin;	Al-Ali discloses or renders obvious the wearable device comprising one or more lenses configured to receive at least a portion of the output optical light and to deliver a lens output light to tissue comprising skin.  FIG. 2

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	Al-Ali at Fig. 2 In an embodiment, **the optical sensor 220 includes an emitter array 222, at least one detector 224, a temperature sensor 226 and a memory 228. The emitter array 222 irradiates a tissue site 10 with multiple wavelength light. One or more detectors 224 detect the light after attenuation by the tissue site 10.** The temperature sensor 226 is located so as to detect the bulk temperature of the emitters within the emitter array, so as to accurately determine emitter wavelengths, as described below. The memory 228 can include any of a wide variety of memory devices known to an artisan from the disclosure herein, including an EPROM, an EEPROM, a flash memory, a ROM, a non-volatile RAM and a two-terminal serial memory device, to name a few, and combinations of the same. The memory 228 can advantageously store a wide variety of sensor-related information, including sensor type, manufacturer information, sensor characteristics including wavelengths emitted, wavelength correction data, emitter drive requirements, demodulation data, calculation mode data, calibration data and sensor life data to name a few. The memory can also store software such as scripts and executable code, encryption information, monitor and algorithm upgrade instructions and enabled parameters. Al-Ali at [0043] Although described herein with respect to various disposable sensor embodiments, a sensor may be reusable, resposable (partially reusable/partially disposable), adhesive or non-adhesive, or a transmittance, reflectance or transflectance sensor. Further, **a sensor may be configured for a variety of tissue sites such as a finger, hand, foot, forehead or ear or for attachment to multiple tissue sites, including multiple-head sensors capable of simultaneous multi-site measurements.** Al-Ali at [0044] FIGS. 19A-B illustrate a detector 1900 having a detector component 1700 and a shield 1910. **The shield 1910 has a conductive surface 1920 defining windows 1930. The windows 1930 can be any shape appropriate to the passage of light and the blocking of electromagnetic noise. In an embodiment, the windows 1930 are large rectangles with minimal interconnect so as to allow for a substantial passage of emitted light to the photodiodes 1720**. In an embodiment, the shield 1910 is soldered to the ceramic substrate 1710 on at least the four corners, electrically and mechanically coupling the shield 1910 to the ceramic substrate 1710 and allowing the shield to form one side of a Faraday cage. Mechanical coupling can be, for example, gluing, welding, soldering, screwing, snap fitting, or other

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	suitable fastening. Electrical coupling can be, for example, soldering, wire bonding, die bonding, or other suitable forms of electrical connection. In an embodiment, the ceramic substrate 1710 is printed with shielding material to complete the Faraday cage. Additional shielding material can be attached to or plated on the ceramic substrate 1710. Al-Ali at [0071] Another aspect of a physiological sensor comprising an emitter configured to radiate light having a plurality of wavelengths into a tissue site. **The emitter comprises a plurality of LEDs disposed within an emitter ceramic substrate.** A detector is configured to receive the light after absorption by pulsatile blood flow within the tissue site. The detector generates a sensor signal capable of being processed by a patient monitor so as to derive total hemoglobin (Hbt). **The detector comprises a plurality of photodiodes disposed within a detector ceramic substrate. A first set of the photodiodes is responsive to a first set of the wavelengths and a second set of the photodiodes is responsive to a second set of the wavelengths. In various embodiments a diffuser scatters the radiated light so that a tissue site is uniformly illuminated across all of the wavelengths.** A first encapsulate containing glass beads is mounted in a spacer proximate the emitter ceramic substrate. A second encapsulate mixed with microspheres is disposed on the LEDs within the emitter ceramic substrate. The photodiodes comprise at least one Si photodiode and at least one InGaAs photodiode connected in parallel. The LEDs radiate light generally centered around at least twelve unique wavelengths. The LEDs are mounted in an array of at least thirteen LEDs connected within an electrical grid. **The twelve unique wavelengths comprise eight wavelengths within a first range of about 620-905 nm. and four wavelengths within a second range of about 1040-1270 nm**. Al-Ali at [0009] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Al-Ali, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Al-Ali, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.

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7[d]. the wearable device further comprising a detection system configured to receive at least a portion of the lens output light reflected from the tissue and to generate an output signal having a signal-to-noise ratio, wherein the detection system is configured to be synchronized to the light source;	Al-Ali discloses or renders obvious the wearable device further comprising a detection system configured to receive at least a portion of the lens output light reflected from the tissue and to generate an output signal having a signal-to-noise ratio, wherein the detection system is configured to be synchronized to the light source. Another aspect of a physiological sensor comprising an emitter configured to radiate light having a plurality of wavelengths into a tissue site. **The emitter comprises a plurality of LEDs disposed within an emitter ceramic substrate.** A detector is configured to receive the light after absorption by pulsatile blood flow within the tissue site. The detector generates a sensor signal capable of being processed by a patient monitor so as to derive total hemoglobin (Hbt). **The detector comprises a plurality of photodiodes disposed within a detector ceramic substrate. A first set of the photodiodes is responsive to a first set of the wavelengths and a second set of the photodiodes is responsive to a second set of the wavelengths. In various embodiments a diffuser scatters the radiated light so that a tissue site is uniformly illuminated across all of the wavelengths.** A first encapsulate containing glass beads is mounted in a spacer proximate the emitter ceramic substrate. A second encapsulate mixed with microspheres is disposed on the LEDs within the emitter ceramic substrate. The photodiodes comprise at least one Si photodiode and at least one InGaAs photodiode connected in parallel. The LEDs radiate light generally centered around at least twelve unique wavelengths. The LEDs are mounted in an array of at least thirteen LEDs connected within an electrical grid. **The twelve unique wavelengths comprise eight wavelengths within a first range of about 620-905 nm. and four wavelengths within a second range of about 1040-1270 nm**. Al-Ali at [0009] **A physiological sensor comprising:** **an emitter that emits light having a plurality of wavelengths;** **a detector that generates an output signal responsive to the emitted light after absorption by tissue;** an attachment assembly that removably attaches the emitter and the detector to tissue; a spacer that provides a predetermined gap between the emitter and tissue when the emitter is attached to tissue; and a light scattering medium disposed in a optical path between the emitter and tissue; the spacer and the light scattering medium providing at least a substantially uniform illumination of tissue by the emitted light for each of the wavelengths.

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	Al-Ali at claim 1 In an embodiment, **the optical sensor 220 includes an emitter array 222, at least one detector 224, a temperature sensor 226 and a memory 228. The emitter array 222 irradiates a tissue site 10 with multiple wavelength light. One or more detectors 224 detect the light after attenuation by the tissue site 10.** The temperature sensor 226 is located so as to detect the bulk temperature of the emitters within the emitter array, so as to accurately determine emitter wavelengths, as described below. The memory 228 can include any of a wide variety of memory devices known to an artisan from the disclosure herein, including an EPROM, an EEPROM, a flash memory, a ROM, a non-volatile RAM and a two-terminal serial memory device, to name a few, and combinations of the same. The memory 228 can advantageously store a wide variety of sensor-related information, including sensor type, manufacturer information, sensor characteristics including wavelengths emitted, wavelength correction data, emitter drive requirements, demodulation data, calculation mode data, calibration data and sensor life data to name a few. The memory can also store software such as scripts and executable code, encryption information, monitor and algorithm upgrade instructions and enabled parameters. Al-Ali at [0043] FIGS. 19A-B illustrate a detector 1900 having a detector component 1700 and a shield 1910. **The shield 1910 has a conductive surface 1920 defining windows 1930. The windows 1930 can be any shape appropriate to the passage of light and the blocking of electromagnetic noise. In an embodiment, the windows 1930 are large rectangles with minimal interconnect so as to allow for a substantial passage of emitted light to the photodiodes 1720**. In an embodiment, the shield 1910 is soldered to the ceramic substrate 1710 on at least the four corners, electrically and mechanically coupling the shield 1910 to the ceramic substrate 1710 and allowing the shield to form one side of a Faraday cage. Mechanical coupling can be, for example, gluing, welding, soldering, screwing, snap fitting, or other suitable fastening. Electrical coupling can be, for example, soldering, wire bonding, die bonding, or other suitable forms of electrical connection. In an embodiment, the ceramic substrate 1710 is printed with shielding material to complete the Faraday cage. Additional shielding material can be attached to or plated on the ceramic substrate 1710. Al-Ali at [0071]

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	Pulse oximeters capable of reading through motion induced noise are disclosed in at least U.S. Pat. Nos. 6,770,028, 6,658,276, 6,650,917, 6,157,850, 6,002,952, 5,769,785, and 5,758,644; low noise pulse oximetry sensors are disclosed in at least U.S. Pat. Nos. 6,088,607 and 5,782,757; all of which are assigned to Masimo Corporation, Irvine, Calif. (“Masimo”) and are incorporated by reference herein. Al-Ali at [0004] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Al-Ali, it would ha9ve been obvious to one of ordinary skill in the art to combine, with the teachings of Al-Ali, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[e]. wherein the detection system comprises a plurality of detectors that are spatially separated from each other, and wherein at least one analog to digital converter is coupled to at least one of the plurality of detectors;	Al-Ali discloses or renders obvious the detection system comprises a plurality of detectors that are spatially separated from each other, and wherein at least one analog to digital converter is coupled to at least one of the plurality of detectors.

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	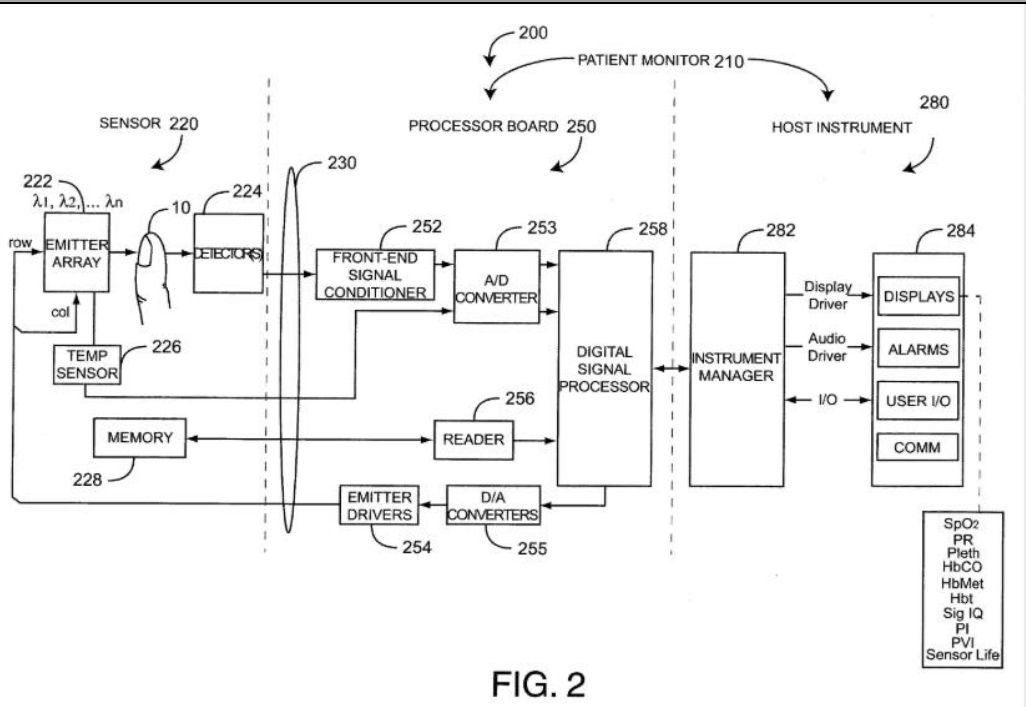 FIG. 2 Al-Ali at Fig. 2 In an embodiment, **the optical sensor 220 includes an emitter array 222, at least one detector 224, a temperature sensor 226 and a memory 228**. **The emitter array 222 irradiates a tissue site 10 with multiple wavelength light. One or more detectors 224 detect the light after attenuation by the tissue site 10.** The temperature sensor 226 is located so as to detect the bulk temperature of the emitters within the emitter array, so as to accurately determine emitter wavelengths, as described below. The memory 228 can include any of a wide variety of memory devices known to an artisan from the disclosure herein, including an EPROM, an EEPROM, a flash memory, a ROM, a non-volatile RAM and a two-terminal serial memory device, to name a few, and combinations of the same. The memory 228 can advantageously store a wide variety of sensor-related information, including sensor type, manufacturer information, sensor characteristics including wavelengths emitted, wavelength correction data, emitter drive requirements, demodulation data, calculation mode data, calibration data and sensor life data to name a few. The memory can also store software such as scripts and executable code, encryption information, monitor and algorithm upgrade instructions and enabled parameters.

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	Al-Ali at [0043] As shown in FIG. 2, **the processor board 250 includes a front end signal conditioner 252, an analog-to-digital (A/D) converter 253, a digital signal processor (DSP) 258, a memory reader 256, emitter drivers 254 and digital-to-analog (D/A) converters 255. In general, the drivers 254 convert digital control signals into analog drive signals capable of activating the emitter array 222. The front-end 252 and A/D converter 253 transform composite analog intensity signal(s) from light sensitive detector(s) 224 into digital data input to the DSP 258**. In an embodiment, the DSP 258 is adapted to communicate via a reader 256 with one or more information elements such as the memory 228. Al-Ali at [0045] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Al-Ali, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Al-Ali, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[f]. wherein the output signal is indicative of the one or more of the physiological parameters;	Al-Ali discloses or renders obvious the output signal is indicative of the one or more of the physiological parameters.

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	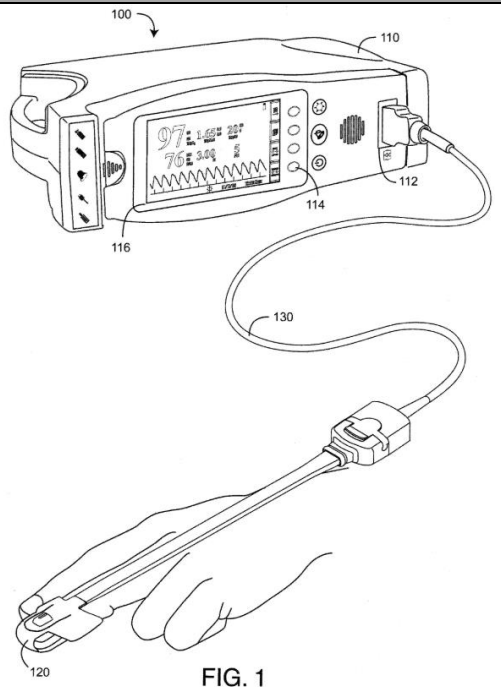 FIG. 1 Al-Ali at Fig. 1 **FIG. 1 illustrates a physiological measurement system 100 having a monitor 110 and a multiple wavelength optical sensor 120 with enhanced measurement capabilities as compared with conventional pulse oximetry. In particular, the multiple wavelength optical sensor 120 allows the measurement of various blood constituents and related parameters in addition to oxygen saturation and pulse rate. Alternatively, the multiple wavelength optical sensor 120 allows the measurement of oxygen saturation and pulse rate with increased accuracy or robustness as compared with conventional pulse oximetry**. Al-Ali at [0039] In one embodiment, **the optical sensor 120 is configured to plug into a monitor sensor port 112 via a patient cable 130. Monitor keys 114 provide control over operating modes and alarms, to name a few. A display 116 provides readouts of measured parameters, such as oxygen saturation, pulse**

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	rate, HbCO, HbMet and Hbt to name a few. Other blood parameters that may be measured to provide important clinical information are fractional oxygen saturation, bilirubin and blood glucose, to name a few. Al-Ali at [0040] **FIG. 2 illustrates a block diagram a physiological measurement system 200. This measurement system includes a monitor 210 and an optical sensor 220 communicating via a patient cable 230. The monitor 210 has one or more processor boards 250 communicating with a host instrument 280. Generally, the processor board 250 communicates with the sensor 220 so as to control the emission of light into a tissue site 10.** Also the processor board 250 receives and processes a corresponding sensor signal responsive to the emitted light after scattering and absorption by tissue site constituents. Accordingly, **the processor board 250 derives physiological parameters relating to pulsatile blood flow within the tissue site and communicates values for those parameters to the host instrument 280. Generally, the host instrument 280 provides user I/O and communications with external devices so as to define operating conditions and communicate those conditions to the processor board 250. The host instrument 280 also transfers parameter values from the processor board for display and for triggering alarms.** Al-Ali at [0042] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Al-Ali, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Al-Ali, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[g]. the wearable device configured to increase the signal-to-noise ratio by increasing light intensity of at least one of the plurality of	Al-Ali discloses or renders obvious the wearable device configured to increase the signal-to-noise ratio by increasing light intensity of at least one of the plurality of semiconductor diodes from an initial light intensity. As shown in FIGS. 15A-B, an LED array 1520 is connected within an electrical grid of n rows and m columns totaling n+m LED drive lines where n and m are integers greater than one. **The electrical grid**

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semiconductor diodes from an initial light intensity; and	**advantageously minimizes the number of drive lines required to activate the LEDs 1520 while preserving flexibility to selectively activate individual LEDs 1520 in any sequence and multiple LEDs 1520 simultaneously. The electrical grid also facilitates setting LED currents so as to control intensity at each LED wavelength, determining operating wavelengths and monitoring total grid current so as to limit power dissipation. The LED array 1520 is physically configured in rows, which facilitates clustering LEDs according to wavelength so as to minimize pathlength variations and which facilitates equalization of LED intensities.** In an embodiment the LED array 1520 comprises up to sixteen LEDs configured in an electrical grid of four rows and four columns. Each of four row drive lines provide a common anode connection to four LEDs, and each of four column drive lines provide a common cathode connection to four LEDs. Thus, sixteen LEDs are advantageously driven with only eight wires, including four anode drive lines and four cathode drive lines. In an embodiment, an LED array is partially populated with eight LEDs having nominal wavelengths as shown in TABLE 1. In an embodiment, the LED array is partially populated with thirteen LEDs having nominal wavelengths as shown in TABLE 2. Advantageously, LED array and the corresponding LED wavelengths are adapted to measure total hemoglobin (Hbt) in addition to SpO2, pulse rate, HbCO and HbMet, among other physiological parameters. In an embodiment, LEDs D1-D5 are encapsulated with an attenuating epoxy 1660 (FIGS. 16B, F) so as to equalize LED intensities. In an embodiment, a clear fill epoxy 1670 (FIGS. 16B, F) mixed with 1-20 μm microspheres is dispersed and cured over the LEDs. An LED array and corresponding drivers for an electrical grid are disclosed in U.S. patent application Ser. No. 11/367,013, filed Mar. 1, 2006, titled Multiple Wavelength Sensor Emitters, incorporated by reference herein. Al-Ali at [0067] **Pulse oximeters capable of reading through motion induced noise are disclosed in at least U.S. Pat. Nos. 6,770,028, 6,658,276, 6,650,917, 6,157,850, 6,002,952, 5,769,785, and 5,758,644; low noise pulse oximetry sensors are disclosed in at least U.S. Pat. Nos. 6,088,607 and 5,782,757; all of which are assigned to Masimo Corporation, Irvine, Calif. (“Masimo”) and are incorporated by reference herein.** Al-Ali at [0004] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the

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	art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant's Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Al-Ali, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Al-Ali, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[h]. the detection system further configured to: generate a first signal responsive to light received while the semiconductor diodes are off,	Al-Ali discloses or renders obvious the detection system further configured to: generate a first signal responsive to light received while the semiconductor diodes are off. The current meter 2870 outputs a current measure 2872 that indicates the total LED current driving the LED array. The current limiter 2880 is responsive to the current measure 2872 and limits specified by the command register 2810 so as to prevent excessive power dissipation by the LED array. The current limiter 2880 provides an enable 2882 output to the anode selector 2820. A Hi Limit 2812 input specifies the higher of two preset current limits. The current limiter 2880 latches the enable 2882 output in an off condition when the current limit is exceeded, disabling the anode selector 2820. A trip reset 2814 input resets the enable 2882 output to re-enable the anode selector 2820. Al-Ali at [0083] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant's Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Al-Ali, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Al-Ali, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[i]. generate a second signal responsive to light received while at least one of the semiconductor diodes is on, and	Al-Ali discloses or renders obvious the detection system further configured to: generate a second signal responsive to light received while at least one of the semiconductor diodes is on. FIGS. 21A-B illustrate additional embodiments of a multiple wavelength optical sensor 2100. In particular, disposable sensors include an adult/pediatric sensor 2101 and an infant/pediatric sensor 2102. Each sensor 2100 has a tape end 2110 and an opposite connector end 2120 electrically and mechanically interconnected via a cable 2130. The tape end 2110 attaches an emitter and detector to a tissue site**. An emitter, described below, emits transmits light into the tissue site and a detector, also described**

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	below, generates a sensor signal responsive to the emitted light after tissue absorption. The sensor signal is communicated via the cable 2130 to the connector 2120. The connector 2120 mates with a patient cable (not shown) that communicates the sensor signal to a monitor (not shown). The relative spacing between the emitter and detector are selected to obtain a desired alignment of the emitter and detector when the sensor is attached to the body tissue of a patient. Al-Ali at [0073] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant's Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Al-Ali, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Al-Ali, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[j]. increase the signal-to-noise ratio by comparing the first signal and the second signal; and	Al-Ali discloses or renders obvious the detection system further configured to: increase the signal-to-noise ratio by comparing the first signal and the second signal. **Pulse oximeters capable of reading through motion induced noise are disclosed in at least U.S. Pat. Nos. 6,770,028, 6,658,276, 6,650,917, 6,157,850, 6,002,952, 5,769,785, and 5,758,644; low noise pulse oximetry sensors are disclosed in at least U.S. Pat. Nos. 6,088,607 and 5,782,757; all of which are assigned to Masimo Corporation, Irvine, Calif. ("Masimo") and are incorporated by reference herein.** Al-Ali at [0004] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant's Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Al-Ali, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Al-Ali, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.

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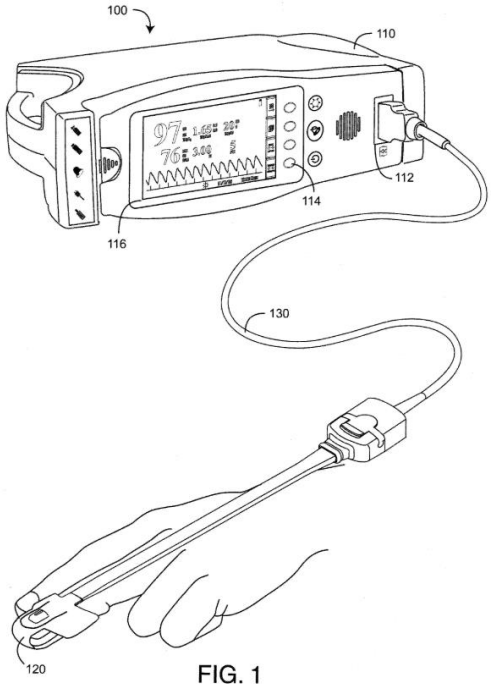
7[k]. wherein the wearable device is at least in part configured to identify an object.	Al-Ali discloses or renders obvious the wearable device is at least in part configured to identify an object.  FIG. 1 Al-Ali at Fig. 1 **FIG. 1 illustrates a physiological measurement system 100 having a monitor 110 and a multiple wavelength optical sensor 120 with enhanced measurement capabilities as compared with conventional pulse oximetry. In particular, the multiple wavelength optical sensor 120 allows the measurement of various blood constituents and related parameters in addition to oxygen saturation and pulse rate. Alternatively, the multiple wavelength optical sensor 120 allows the measurement of oxygen saturation and pulse rate with increased accuracy or robustness as compared with conventional pulse oximetry**. Al-Ali at [0039]

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	Although described herein with respect to various disposable sensor embodiments, a sensor may be reusable, resposable (partially reusable/partially disposable), adhesive or non-adhesive, or a transmittance, reflectance or transflectance sensor. Further, **a sensor may be configured for a variety of tissue sites such as a finger, hand, foot, forehead or ear or for attachment to multiple tissue sites, including multiple-head sensors capable of simultaneous multi-site measurements.** Al-Ali at [0044] One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendant’s Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Al-Ali, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Al-Ali, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.

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EXHIBIT F12

U.S. Pat. No. 12,193,790 in view of Plug-and-Play, Single-Chip Photoplethysmography to Deepak Chandrasekar ("Chandrasekar")

As described in detail below, Chandrasekar (individually or collectively) anticipates and/or renders obvious claim 7 ("Asserted Claim") of U.S. Patent No. 12,193,790 (the "'790 Patent") under 35 U.S.C. §102 and/or §103, either alone in combination with the knowledge of a person of ordinary skill, and/or additional prior art references discussed in discussed in Exhibits F1-F14, the contents of which are hereby incorporated by reference into this chart. One of ordinary skill in the art, as of the priority date of the '790 Patent, would have known to combine the prior art elements disclosed by the foregoing references using known methods, and to use these elements according to their established functions in order to achieve a known and predictable result. This invalidity claim chart is based on Defendants' present understanding of the Asserted Claim and Plaintiff's apparent construction of the Asserted Claim in its Preliminary Infringement Contentions ("Infringement Contentions").

The following invalidity chart includes references to the structure, function, operation, and/or features of the technology described in Chandrasekar. The cited portions of Chandrasekar are merely illustrative, and Defendants reserve the right to rely on alternative or additional evidence, including uncited portions of Chandrasekar. Where a particular figure is cited, the citation should be understood to encompass the caption and description of the figure as well as any text relating to or describing the figure. Conversely, where particular text referring to a figure is cited, the citation should be understood to include the figure as well. Although the documentation collectively evidences prior knowledge, use, or sale, Defendants reserve the right to rely upon individual documents as printed publications. Where the chart below states that Chandrasekar "describes" or "provides for" a limitation, such disclosure may be express, inherent, or implicit. To the extent it is found Chandrasekar does not expressly disclose certain limitations in the Asserted Claim, such limitations are inherent. Defendants reserve the right to present direct evidence of the structure, function, operation, and/or features of the technology described in Chandrasekar (including product samples, source code, and/or witness testimony) and/or its prior art status, and to present alternative or additional documents concerning the same as evidence that the technology described in Chandrasekar anticipates and/or renders obvious the Asserted Claim of the '790 Patent

This chart is subject to all reservations, objections, and disclaimers in Defendants' Invalidity Contentions and any amendment, supplement, or modification thereof, which are incorporated herein by reference in their entirety. Nothing stated herein shall be treated as an admission or suggestion that Defendants agree with Plaintiff regarding the scope of the Asserted Claim, Plaintiff's apparent claim constructions, or the accuracy of any particular claim construction. Defendants reserve all rights to challenge any of the claim terms herein under 35 U.S.C. § 112, including by arguing that they are indefinite, are not supported by the written description, and/or are not enabled. Defendants further reserve all rights to amend this invalidity claim chart without leave of court pursuant to the Court's Docket Control Order, or upon a showing of good cause.

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Claim 7	
7[pre]. An optical system, comprising:	By providing this disclosure, Defendants do not take a position on whether the preamble is limiting. Chandrasekar discloses or renders obvious an optical system. **In this paper, we show how a digital OPS can be used as a high-performance, reflectance-mode PPG sensor (Figure 2). The OPS is placed in direct contact with the skin near a capillary bed, such as the fingertip, earlobe, or forehead. A transparent protective overlay can be added if desired. The IR LED emits light into the tissue, where it experiences diffuse reflection from the tissue and capillary bed.** This establishes a baseline reflectance signal which is detected at the PD. **When a pulse wave propagates through the capillary bed, the reflectance signal falls slightly (0.5-5%) due to light scattering. The change is detected by the PD and processed by embedded amplification and signal processing circuitry.** **Integrated IR LED and visible light blocking filter. OPS LEDs typically emit at near infrared wavelengths (850-950 nm), which is ideal for PPG [3]. The integrated visible light filter reduces the impact of ambient light.** Chandrasekar at Page 02. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants’ Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Chandrasekar, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Chandrasekar, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[a]. a wearable device for measuring one or more physiological parameters, the wearable device adapted to be placed on a wrist of a user;	Chandrasekar discloses or renders obvious a wearable device for measuring one or more physiological parameters, the wearable device adapted to be placed on a wrist of a user. **In this paper, we show how a digital OPS can be used as a high-performance, reflectance-mode PPG sensor (Figure 2). The OPS is placed in direct contact with the skin near a capillary bed, such as the fingertip, earlobe, or forehead. A transparent protective overlay can be added if desired. The IR LED emits light into the tissue, where it experiences diffuse reflection from the tissue and**

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	capillary bed. This establishes a baseline reflectance signal which is detected at the PD. **When a pulse wave propagates through the capillary bed, the reflectance signal falls slightly (0.5-5%) due to light scattering. The change is detected by the PD and processed by embedded amplification and signal processing circuitry.** **Integrated IR LED and visible light blocking filter. OPS LEDs typically emit at near infrared wavelengths (850-950 nm), which is ideal for PPG [3]. The integrated visible light filter reduces the impact of ambient light.** Chandrasekar at Page 02. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants' Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Chandrasekar, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Chandrasekar, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[b]. the wearable device including a light source comprising a plurality of semiconductor diodes that are configured to generate an output optical light having one or more optical wavelengths, wherein at least a portion of the one or more optical wavelengths is a near-infrared wavelength between 700 nanometers and 2500 nanometers;	Chandrasekar discloses or renders obvious the wearable device including a light source comprising a plurality of semiconductor diodes that are configured to generate an output optical light having one or more optical wavelengths, wherein at least a portion of the one or more optical wavelengths is a near-infrared wavelength between 700 nanometers and 2500 nanometers. **Optical proximity sensors, also called light beam sensors, detect distance by measuring the magnitude of light reflected from an object. They are widely used for non-contact distance measurement in a variety of applications, including smartphones (touch screen dimming), factory robotics (motion control), lavatories (touchless switches), vending machines, and home entertainment. Recent studies have also used OPS for the recognition of hand and tongue gestures [5-7].** Chandrasekar at Page 02

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	An OPS consists of an infrared light emitting diode (IR LED), a photodiode (PD), a visible light blocking filter, an optical barrier for reducing lateral light leakage, and an integrated circuit for amplification, signal conditioning, and digitization. Some OPS systems also include a 2nd photodiode for visible light detection and ambient noise cancellation. Digital OPS, which have recently become available, are highly integrated devices which include all the above components in a surface mount package typically a few mm in size. They also provide a bidirectional digital interface to a microcontroller for data transmission and device configuration. Chandrasekar at Page 02. **In this paper, we show how a digital OPS can be used as a high-performance, reflectance-mode PPG sensor (Figure 2). The OPS is placed in direct contact with the skin near a capillary bed, such as the fingertip, earlobe, or forehead. A transparent protective overlay can be added if desired. The IR LED emits light into the tissue, where it experiences diffuse reflection from the tissue and capillary bed.** This establishes a baseline reflectance signal which is detected at the PD. **When a pulse wave propagates through the capillary bed, the reflectance signal falls slightly (0.5-5%) due to light scattering. The change is detected by the PD and processed by embedded amplification and signal processing circuitry.** **Integrated IR LED and visible light blocking filter. OPS LEDs typically emit at near infrared wavelengths (850-950 nm), which is ideal for PPG [3]. The integrated visible light filter reduces the impact of ambient light.** Chandrasekar at Page 02 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants’ Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Chandrasekar, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Chandrasekar, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.

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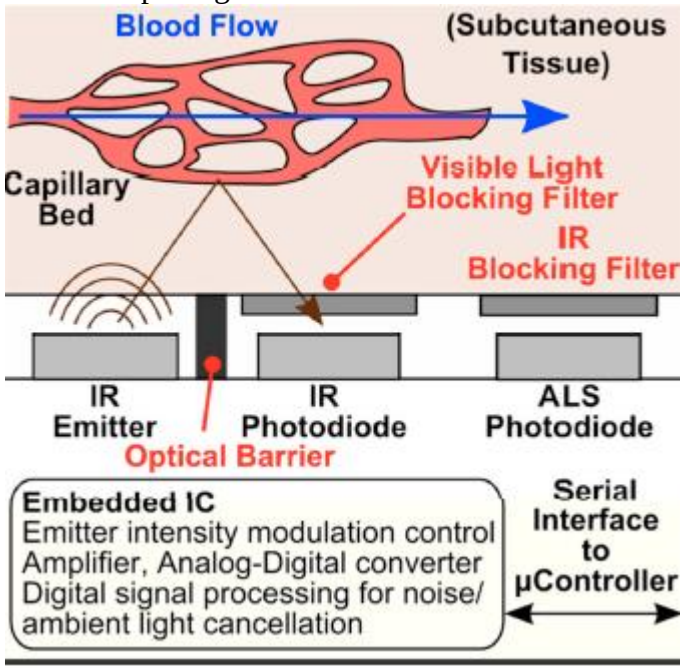
7[c]. the wearable device comprising one or more lenses configured to receive at least a portion of the output optical light and to deliver a lens output light to tissue comprising skin;	Chandrasekar discloses or renders obvious the wearable device comprising one or more lenses configured to receive at least a portion of the output optical light and to deliver a lens output light to tissue comprising skin.  Chandrasekar at Fig. 2 **Optical proximity sensors, also called light beam sensors, detect distance by measuring the magnitude of light reflected from an object. They are widely used for non-contact distance measurement in a variety of applications, including smartphones (touch screen dimming), factory robotics (motion control), lavatories (touchless switches), vending machines, and home entertainment. Recent studies have also used OPS for the recognition of hand and tongue gestures [5-7].** Chandrasekar at Page 02

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	An OPS consists of an infrared light emitting diode (IR LED), a photodiode (PD), a visible light blocking filter, an optical barrier for reducing lateral light leakage, and an integrated circuit for amplification, signal conditioning, and digitization. Some OPS systems also include a 2nd photodiode for visible light detection and ambient noise cancellation. Digital OPS, which have recently become available, are highly integrated devices which include all the above components in a surface mount package typically a few mm in size. They also provide a bidirectional digital interface to a microcontroller for data transmission and device configuration. Chandrasekar at Page 02 **In this paper, we show how a digital OPS can be used as a high-performance, reflectance-mode PPG sensor (Figure 2). The OPS is placed in direct contact with the skin near a capillary bed, such as the fingertip, earlobe, or forehead. A transparent protective overlay can be added if desired. The IR LED emits light into the tissue, where it experiences diffuse reflection from the tissue and capillary bed.** This establishes a baseline reflectance signal which is detected at the PD. **When a pulse wave propagates through the capillary bed, the reflectance signal falls slightly (0.5-5%) due to light scattering. The change is detected by the PD and processed by embedded amplification and signal processing circuitry.** **Integrated IR LED and visible light blocking filter. OPS LEDs typically emit at near infrared wavelengths (850-950 nm), which is ideal for PPG [3]. The integrated visible light filter reduces the impact of ambient light.** Chandrasekar at Page 02 **Remote patient monitoring (RPM) relies on lowcost, low-power, wearable sensors for continuous physiological assessment.** Photoplethysmographic (PPG) sensors generally require >10 components, occupy an area >300 mm2, consume >10 mW power, and cost >$20 USD**.** Although the principle of PPG sensing is straightforward, in practice, a robust implementation requires a careful design including optical alignment, analog circuits, ambient light cancellation, and power management. **This paper reports the first use of digital optical proximity sensors (OPS) for “plugand- play” PPG. OPS have traditionally been used for distance sensing in smartphones and factory automation. Here we show that a digital OPS can perform PPG functions in a single 4x4 mm package which also provides a direct digital interface to a microcontroller.** By exploiting its key features, a digital OPS can provide

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	substantial performance advantages over existing state-of-the-art PPGs, including: i) 10X lower power consumption (200 μW) due to pulse operation; ii) high signal to noise ratio (>90), as a result of built-in optical barriers, filters, and ambient light cancellation; iii) 10X lower cost ($2 USD); and iv) 12X smaller area. **We show single wavelength PPG measurements in multiple anatomical locations, including fingertips and earlobes. The results suggest that a digital OPS can provide an elegant solution for battery-powered, wearable physiological monitors. To the authors' knowledge, this is the smallest and lowest power PPG sensor reported to date.** Chandrasekar at Abstract One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants' Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Chandrasekar, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Chandrasekar, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[d]. the wearable device further comprising a detection system configured to receive at least a portion of the lens output light reflected from the tissue and to generate an output signal having a signal-to-noise ratio, wherein the detection system is configured to be synchronized to the light source;	Chandrasekar discloses or renders obvious the wearable device further comprising a detection system configured to receive at least a portion of the lens output light reflected from the tissue and to generate an output signal having a signal-to-noise ratio, wherein the detection system is configured to be synchronized to the light source.

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	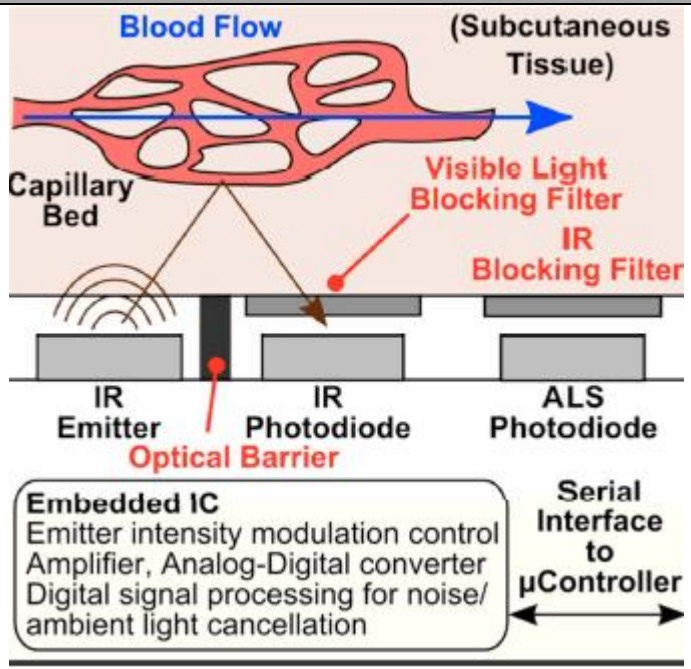 Chandrasekar at Fig. 2 **Remote patient monitoring (RPM) relies on lowcost, low-power, wearable sensors for continuous physiological assessment.** Photoplethysmographic (PPG) sensors generally require >10 components, occupy an area >300 mm2, consume >10 mW power, and cost >$20 USD**.** Although the principle of PPG sensing is straightforward, in practice, a robust implementation requires a careful design including optical alignment, analog circuits, ambient light cancellation, and power management. **This paper reports the first use of digital optical proximity sensors (OPS) for “plugand- play” PPG.** OPS have traditionally been used for distance sensing in smartphones and factory automation. Here we show that a digital OPS can perform PPG functions in a single 4x4 mm package which also provides a direct digital interface to a microcontroller. By exploiting its key features, a digital **OPS can provide substantial performance advantages over existing state-of-the-art PPGs, including: i) 10X lower power consumption (200 µW) due to pulse operation; ii) high signal to noise ratio (>90), as a result of built-in optical barriers, filters, and ambient light cancellation; iii) 10X lower cost ($2 USD); and iv) 12X smaller area. We show single wavelength PPG measurements in multiple anatomical**

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	locations, including fingertips and earlobes. The results suggest that a digital OPS can provide an elegant solution for battery-powered, wearable physiological monitors. To the authors’ knowledge, this is the smallest and lowest power PPG sensor reported to date. Chandrasekar at Abstract **Photoplethsymography (PPG) is a ubiquitous monitoring technique for measuring heart rate and oxygen saturation. PPG sensors detect blood volume pulsations by timeresolved analysis of optical radiation either absorbed or scattered by a capillary bed [3]. In principle, PPGs are considered simple devices; however, in practice, implementation requires a careful design involving optics (multiple paths, alignments, leakage barriers) and mixed signal electronics (transimpedance amplifiers, analog digital conversion, drivers, modulators, filters). A robust PPG sensor must also consider power consumption, ambient light rejection, sensitivity, dynamic range, signal to noise ratio, motion artifacts, calibration, size, and cost [4].** As a result, designing a robust PPG sensor requires a engineering effort and investment. A complete sensor typically requires 10-20 components, 1.5-10mW power, and costs >$20 USD. Chandrasekar at Page 01 This paper reports the use of **digital optical proximity sensors (OPS) for PPG. OPS provide a plug-and-play, single chip solution for high performance single-wavelength PPG.** To our knowledge, it is the smallest reported PPG sensor, with a size of 4x4 mm (Figure 1). Moreover**, it provides substantial improvements in power consumption (5X), signal to noise ratio (2-5X), and cost (10X) compared to existing reflectance-mode PPG sensors. Section II describes the features of OPS sensors which make them well suited for PPG. Section III describes experimental setup.** Section IV discusses experimental results, and compares sensor performance with the state of the art. Chandrasekar at Page 01-02 Improved sensitivity due to small PD-LED spacing. One of the challenges in reflectance mode PPG is that <5% of the light is backscattered to the detector. **The intensity of the backscattered light, which forms a concentric ring around the excitation LED [4,8], falls off as the square of the distance (Figure 3). Therefore, it is critical to maintain a small distance between the LED and PD. In a**

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	digital OPS, the distance is <1-2 mm, compared to >5mm in a typical PPG [9-10]. This increases the reflected light (and therefore, signal to noise ratio) by a factor of 5-25x. Chandrasekar at Page 02 Reduced background due to optical barrier. A drawback of a small LED-PD spacing is light leakage, which increases the baseline PPG signal. **Digital OPS include an optical barrier between the LED and PD which substantially reduces light leakage [9] and thereby improves SNR**. This is particularly important in “zero-distance detection” where the skin is in direct contact with the sensor [10]. Chandrasekar at Page 02 Electronic noise and offset cancellation. Conventional PPGs require a bandpass filter to avoid 60/120 Hz noise from ambient light. **This can limits the bandwidth of the sensor, making it difficult to resolve high frequency features of the pressure pulse. In a digital OPS, the LED emitter is pulsed at a high frequency (>1 MHz) which is an integer multiple of 60 Hz. The signal processing circuitry utilizes a demodulation scheme, similar to lock-in-detection [11], which eliminates ambient light artifacts and 1/f noise. This enables fast measurement rates while maintaining low noise**. Chandrasekar at Page 03 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants’ Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Chandrasekar, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Chandrasekar, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[e]. wherein the detection system comprises a plurality of detectors that are spatially separated from each other, and wherein at least one	Chandrasekar discloses or renders obvious the detection system comprises a plurality of detectors that are spatially separated from each other, and wherein at least one analog to digital converter is coupled to at least one of the plurality of detectors.

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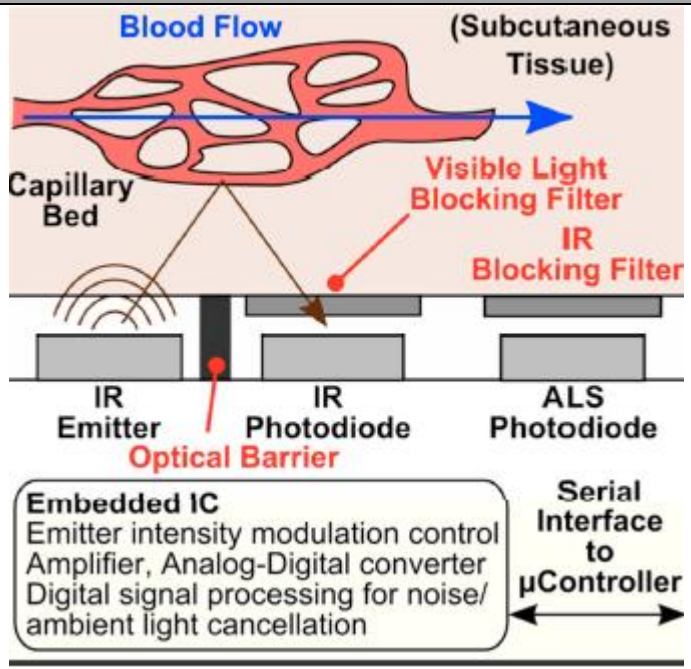
analog to digital converter is coupled to at least one of the plurality of detectors;	 Chandrasekar at Fig. 2 **Photoplethsymography (PPG) is a ubiquitous monitoring technique for measuring heart rate and oxygen saturation. PPG sensors detect blood volume pulsations by timeresolved analysis of optical radiation either absorbed or scattered by a capillary bed** [3]. In principle, **PPGs are considered simple devices; however, in practice, implementation requires a careful design involving optics (multiple paths, alignments, leakage barriers) and mixed signal electronics (transimpedance amplifiers, analog digital conversion, drivers, modulators, filters).** A robust PPG sensor must also consider power consumption, ambient light rejection, sensitivity, dynamic range, signal to noise ratio, motion artifacts, calibration, size, and cost [4]. As a result, designing a robust PPG sensor requires a engineering effort and investment. A complete sensor typically requires 10-20 components, 1.5-10mW power, and costs >$20 USD. Chandrasekar at Page 01

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	High sensitivity and dynamic range due to highresolution ADC. PPG sensors must be able to detect a small pulsation (AC) superimposed on a large baseline (DC) signal. The perfusion index (PI) is defined as the ratio of the AC to DC component. Conventional PPGs extract the AC component using a 0.5-5Hz bandpass filter and multiple amplifiers. Modern digital OPS include a high resolution analog to digital converter (ADC) which can resolve PIs without filters. For example, a 16 bit ADC can resolve a PI as little as 1/216, or 15 ppm. The advantage of this approach is that both DC and AC components of the PPG signal can be simultaneously measured. This is useful for calculating the PI, and for detecting saturation of the light detector. Chandrasekar at Page 02-03 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants’ Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Chandrasekar, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Chandrasekar, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[f]. wherein the output signal is indicative of the one or more of the physiological parameters;	Chandrasekar discloses or renders obvious the output signal is indicative of the one or more of the physiological parameters. **Remote patient monitoring (RPM) relies on lowcost, low-power, wearable sensors for continuous physiological assessment. Photoplethysmographic (PPG) sensors generally require >10 components, occupy an area >300 mm2, consume >10 mW power, and cost >$20 USD.** Although the principle of PPG sensing is straightforward, in practice, a robust implementation requires a careful design including optical alignment, analog circuits, ambient light cancellation, and power management. **This paper reports the first use of digital optical proximity sensors (OPS) for “plugand- play” PPG. OPS have traditionally been used for distance sensing in smartphones and factory automation. Here we show that a digital OPS can perform PPG functions in a single 4x4 mm package which also provides a direct digital interface to a microcontroller.** By exploiting its key features, a digital OPS can provide substantial performance advantages over existing state-of-the-art PPGs, including: i) 10X lower power consumption (200 μW) due to pulse operation; ii) high signal to noise ratio (>90), as a result of built-in optical barriers, filters, and ambient light cancellation; iii) 10X lower cost ($2 USD);

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	and iv) 12X smaller area. We show single wavelength PPG measurements in multiple anatomical locations, including fingertips and earlobes. **The results suggest that a digital OPS can provide an elegant solution for battery-powered, wearable physiological monitors. To the authors’ knowledge, this is the smallest and lowest power PPG sensor reported to date.** Chandrasekar at Abstract The physician-centric health care model, where patient assessment occurs intermittently during clinic visits, is often an inefficient approach for managing chronic illness. **Remote patient monitoring (RPM), a rapidly emerging paradigm in chronic disease management [1], relies on ambulatory biosensors to assess patients’ physiological indicators on a continual basis. RPM can provide early diagnosis, encourage preventative health and treatment compliance, increase connectedness between patient and doctor, promote evidenced-based decision making, and improve overall patient satisfaction [2].** Chandrasekar at Page 01 **Optical proximity sensors, also called light beam sensors, detect distance by measuring the magnitude of light reflected from an object. They are widely used for non-contact distance measurement in a variety of applications, including smartphones (touch screen dimming), factory robotics (motion control), lavatories (touchless switches), vending machines, and home entertainment. Recent studies have also used OPS for the recognition of hand and tongue gestures [5-7].** Chandrasekar at Page 02 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants’ Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Chandrasekar, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Chandrasekar, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.

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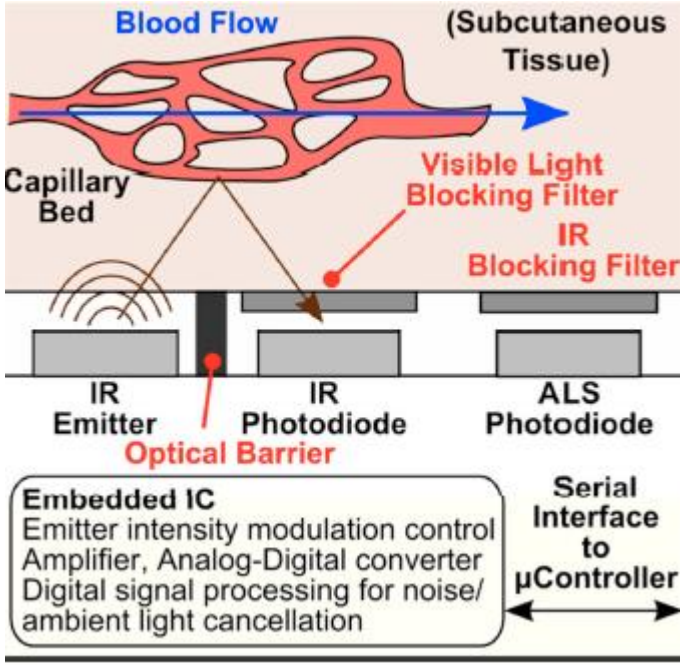
7[g]. the wearable device configured to increase the signal-to-noise ratio by increasing light intensity of at least one of the plurality of semiconductor diodes from an initial light intensity; and	Chandrasekar discloses or renders obvious the wearable device configured to increase the signal-to-noise ratio by increasing light intensity of at least one of the plurality of semiconductor diodes from an initial light intensity.  Chandrasekar at Fig. 2 **Remote patient monitoring (RPM) relies on lowcost, low-power, wearable sensors for continuous physiological assessment.** Photoplethysmographic (PPG) sensors generally require >10 components, occupy an area >300 mm2, consume >10 mW power, and cost >$20 USD**.** Although the principle of PPG sensing is straightforward, in practice, a robust implementation requires a careful design including optical alignment, analog circuits, ambient light cancellation, and power management. **This paper reports the first use of digital optical proximity sensors (OPS) for “plugand- play” PPG.** OPS have traditionally been used for distance sensing in smartphones and factory automation. Here we show that a digital OPS can perform PPG functions in a single 4x4 mm package which also provides a direct digital interface to a microcontroller. By exploiting its key features, a digital **OPS can provide substantial**

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	performance advantages over existing state-of-the-art PPGs, including: i) 10X lower power consumption (200 µW) due to pulse operation; ii) high signal to noise ratio (>90), as a result of built-in optical barriers, filters, and ambient light cancellation; iii) 10X lower cost ($2 USD); and iv) 12X smaller area. We show single wavelength PPG measurements in multiple anatomical locations, including fingertips and earlobes. The results suggest that a digital OPS can provide an elegant solution for battery-powered, wearable physiological monitors. To the authors’ knowledge, this is the smallest and lowest power PPG sensor reported to date. Chandrasekar at Abstract **Photoplethsymography (PPG) is a ubiquitous monitoring technique for measuring heart rate and oxygen saturation. PPG sensors detect blood volume pulsations by timeresolved analysis of optical radiation either absorbed or scattered by a capillary bed [3]. In principle, PPGs are considered simple devices; however, in practice, implementation requires a careful design involving optics (multiple paths, alignments, leakage barriers) and mixed signal electronics (transimpedance amplifiers, analog digital conversion, drivers, modulators, filters). A robust PPG sensor must also consider power consumption, ambient light rejection, sensitivity, dynamic range, signal to noise ratio, motion artifacts, calibration, size, and cost [4].** As a result, designing a robust PPG sensor requires a engineering effort and investment. A complete sensor typically requires 10-20 components, 1.5-10mW power, and costs >$20 USD. Chandrasekar at Page 01 This paper reports the use of **digital optical proximity sensors (OPS) for PPG. OPS provide a plug-and-play, single chip solution for high performance single-wavelength PPG.** To our knowledge, it is the smallest reported PPG sensor, with a size of 4x4 mm (Figure 1). Moreover**, it provides substantial improvements in power consumption (5X), signal to noise ratio (2-5X), and cost (10X) compared to existing reflectance-mode PPG sensors. Section II describes the features of OPS sensors which make them well suited for PPG. Section III describes experimental setup.** Section IV discusses experimental results, and compares sensor performance with the state of the art. Chandrasekar at Page 01-02

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	Improved sensitivity due to small PD-LED spacing. One of the challenges in reflectance mode PPG is that <5% of the light is backscattered to the detector. **The intensity of the backscattered light, which forms a concentric ring around the excitation LED [4,8], falls off as the square of the distance (Figure 3). Therefore, it is critical to maintain a small distance between the LED and PD. In a digital OPS, the distance is <1-2 mm, compared to >5mm in a typical PPG [9-10]. This increases the reflected light (and therefore, signal to noise ratio) by a factor of 5-25x.** Chandrasekar at Page 02. Reduced background due to optical barrier. A drawback of a small LED-PD spacing is light leakage, which increases the baseline PPG signal. **Digital OPS include an optical barrier between the LED and PD which substantially reduces light leakage [9] and thereby improves SNR**. This is particularly important in “zero-distance detection” where the skin is in direct contact with the sensor [10]. Chandrasekar at Page 02 Electronic noise and offset cancellation. Conventional PPGs require a bandpass filter to avoid 60/120 Hz noise from ambient light. **This can limits the bandwidth of the sensor, making it difficult to resolve high frequency features of the pressure pulse. In a digital OPS, the LED emitter is pulsed at a high frequency (>1 MHz) which is an integer multiple of 60 Hz. The signal processing circuitry utilizes a demodulation scheme, similar to lock-in-detection [11], which eliminates ambient light artifacts and 1/f noise. This enables fast measurement rates while maintaining low noise**. Chandrasekar at Page 03 **Intensity control. To maximize the signal to noise ratio in PPG, the LED intensity should be made as large as possible without saturating the detector. In a digital OPS, the LED intensity is programmable through the serial interface, allowing closed loop control to prevent detector saturation.** Chandrasekar at Page 03 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the

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	art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants’ Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Chandrasekar, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Chandrasekar, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[h]. the detection system further configured to: generate a first signal responsive to light received while the semiconductor diodes are off,	Chandrasekar discloses or renders obvious the detection system further configured to: generate a first signal responsive to light received while the semiconductor diodes are off. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants’ Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Chandrasekar, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Chandrasekar, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[i]. generate a second signal responsive to light received while at least one of the semiconductor diodes is on, and	Chandrasekar discloses or renders obvious the detection system further configured to: generate a second signal responsive to light received while at least one of the semiconductor diodes is on. **In this paper, we show how a digital OPS can be used as a high-performance, reflectance-mode PPG sensor (Figure 2). The OPS is placed in direct contact with the skin near a capillary bed, such as the fingertip, earlobe, or forehead. A transparent protective overlay can be added if desired. The IR LED emits light into the tissue, where it experiences diffuse reflection from the tissue and capillary bed.** This establishes a baseline reflectance signal which is detected at the PD. **When a pulse wave propagates through the capillary bed, the reflectance signal falls slightly (0.5-5%) due to light scattering. The change is detected by the PD and processed by embedded amplification and signal processing circuitry.** Chandrasekar at Page 02 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references

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	identified in Defendants' Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Chandrasekar, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Chandrasekar, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[j]. increase the signal-to-noise ratio by comparing the first signal and the second signal; and	Chandrasekar discloses or renders obvious the detection system further configured to: increase the signal-to-noise ratio by comparing the first signal and the second signal. **Table 1 further compares the performance of the digital OPS reported in this paper with state-of-the art PPG sensors reported in both the research and commercial sectors. It is notable that the OPS-based device provides better performance in most categories, particularly those of interest in wearable sensors. These include substantial improvements in power (10X), size (12X), cost (5-10X), and signal to noise ratio (2-3X).** To the authors' knowledge, this is the smallest and lowest power single-wavelength PPG sensor currently available. Another advantage is that the sensor provides an industry standard I2C digital interface to a microcontroller. **This link allows for device configuration and data transfer, thus making it simple to integrate a high performance, single-chip PPG sensor into a microcontrollerbased embedded system. These features, along with the low cost ($2 USD), make the sensor well-suited for wearable and mobile health monitoring.** Chandrasekar at Page 04 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants' Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Chandrasekar, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Chandrasekar, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[k]. wherein the wearable device is at least in part configured to identify an object.	Chandrasekar discloses or renders obvious the wearable device is at least in part configured to identify an object. **In this paper, we show how a digital OPS can be used as a high-performance, reflectance-mode PPG sensor (Figure 2). The OPS is placed in direct contact with the skin near a capillary bed, such**

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	as the fingertip, earlobe, or forehead. A transparent protective overlay can be added if desired. The IR LED emits light into the tissue, where it experiences diffuse reflection from the tissue and capillary bed. This establishes a baseline reflectance signal which is detected at the PD. **When a pulse wave propagates through the capillary bed, the reflectance signal falls slightly (0.5-5%) due to light scattering. The change is detected by the PD and processed by embedded amplification and signal processing circuitry.** **Integrated IR LED and visible light blocking filter. OPS LEDs typically emit at near infrared wavelengths (850-950 nm), which is ideal for PPG [3]. The integrated visible light filter reduces the impact of ambient light.** Chandrasekar at Page 02 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants' Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Chandrasekar, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Chandrasekar, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.

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EXHIBIT F13

U.S. Pat. No. 12,193,790 in view of
US Patent No. 8,923,918 to Kevin Kreger ("Kreger")

As described in detail below, Kreger (individually or collectively) anticipates and/or renders obvious claim 7 ("Asserted Claim") of U.S. Patent No. 12,193,790 (the "'790 Patent") under 35 U.S.C. §102 and/or §103, either alone in combination with the knowledge of a person of ordinary skill, and/or additional prior art references discussed in discussed in Exhibits F1-F14, the contents of which are hereby incorporated by reference into this chart. One of ordinary skill in the art, as of the priority date of the '790 Patent, would have known to combine the prior art elements disclosed by the foregoing references using known methods, and to use these elements according to their established functions in order to achieve a known and predictable result. This invalidity claim chart is based on Defendants' present understanding of the Asserted Claim and Plaintiff's apparent construction of the Asserted Claim in its Preliminary Infringement Contentions ("Infringement Contentions").

The following invalidity chart includes references to the structure, function, operation, and/or features of the technology described in Kreger. The cited portions of Kreger are merely illustrative, and Defendants reserve the right to rely on alternative or additional evidence, including uncited portions of Kreger. Where a particular figure is cited, the citation should be understood to encompass the caption and description of the figure as well as any text relating to or describing the figure. Conversely, where particular text referring to a figure is cited, the citation should be understood to include the figure as well. Although the documentation collectively evidences prior knowledge, use, or sale, Defendants reserve the right to rely upon individual documents as printed publications. Where the chart below states that Kreger "describes" or "provides for" a limitation, such disclosure may be express, inherent, or implicit. To the extent it is found Kreger does not expressly disclose certain limitations in the Asserted Claim, such limitations are inherent. Defendants reserve the right to present direct evidence of the structure, function, operation, and/or features of the technology described in Kreger (including product samples, source code, and/or witness testimony) and/or its prior art status, and to present alternative or additional documents concerning the same as evidence that the technology described in Kreger anticipates and/or renders obvious the Asserted Claim of the '790 Patent.

This chart is subject to all reservations, objections, and disclaimers in Defendants' Invalidity Contentions and any amendment, supplement, or modification thereof, which are incorporated herein by reference in their entirety. Nothing stated herein shall be treated as an admission or suggestion that Defendants agree with Plaintiff regarding the scope of the Asserted Claim, Plaintiff's apparent claim constructions, or the accuracy of any particular claim construction. Defendants reserve all rights to challenge any of the claim terms herein under 35 U.S.C. § 112, including by arguing that they are indefinite, are not supported by the written description, and/or are not enabled. Defendants further reserve all rights to amend this invalidity claim chart without leave of court pursuant to the Court's Docket Control Order, or upon a showing of good cause.

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Claim 7	
7[pre]. An optical system, comprising:	By providing this disclosure, the Defendant does not take a position on whether the preamble is limiting. Kreger discloses or renders obvious an optical system. **The present invention acts as an interface apparatus for various biosensors to utilize the electrical connectors of a mobile, such as a smart phone, so that the mobile becomes the heart of the biosensor monitoring system, either for sports/fitness or medical applications. Thus, the interface device receives at least one biosensor signal and has one or more mating connectors which mate with the mobile's electrical connectors. The electrical connector has a plurality of conductors with one or more of the conductors providing an input in communication with a mobile's processor. The interface device transforms the received biosensor signals to compatible electrical signals for the connectors' inputs.** Kreger at 1:58-2:2. In one aspect of another embodiment**, the biosensor interface apparatus further includes one or more biosensors. The biosensors may be electrodes including ECG electrodes, a photo plethysmograph (PPG), a pulse oximeter, a sphygmomanometer (inflatable blood pressure cuff), a thermometer/temperature sensor, a pedometer, a capnograph, a respiratory movement sensor, a respiratory flow sensor, a transdermal blood alcohol sensor, and a blood sugar sensor (glucometer). Thus it is an object to provide for a wide range of common medical and sport/fitness biosensors in a single compact interface apparatus**. Kreger at 3:24-34. In one aspect of another embodiment, **the biosensor interface apparatus further includes one or more biosensor connectors capable of receiving a biosensor signal. Thus it is an object to provide an interface apparatus that supports biosensors' industry standard and manufacturer specified probe connectors, thereby improving the invention's usability and promoting reuse of existing biosensor probes**. Kreger at 3:35-41.

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	In one aspect of another embodiment, **the biosensor interface apparatus further includes at least one connector capable of receiving a biosensor signal, wherein the biosensor signal is an electrical signal, a chemical signal, a gas signal, or a force signal. Thus, it is one object to provide for transmission of gas, chemical compounds, or force such as through a tube in order to measure, for example, end-tidal CO2 (ETCO2), respiratory rate (RR), or respiratory flow with a capnograph. It is another object to provide for the transmission of an electrical signal such as from an ECG or pulse oximeter. In addition vibrations and other audible and inaudible force may be detected by a force sensor that could be in communication with a stethoscope or accelerometer.** Kreger at 3:42-54.

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	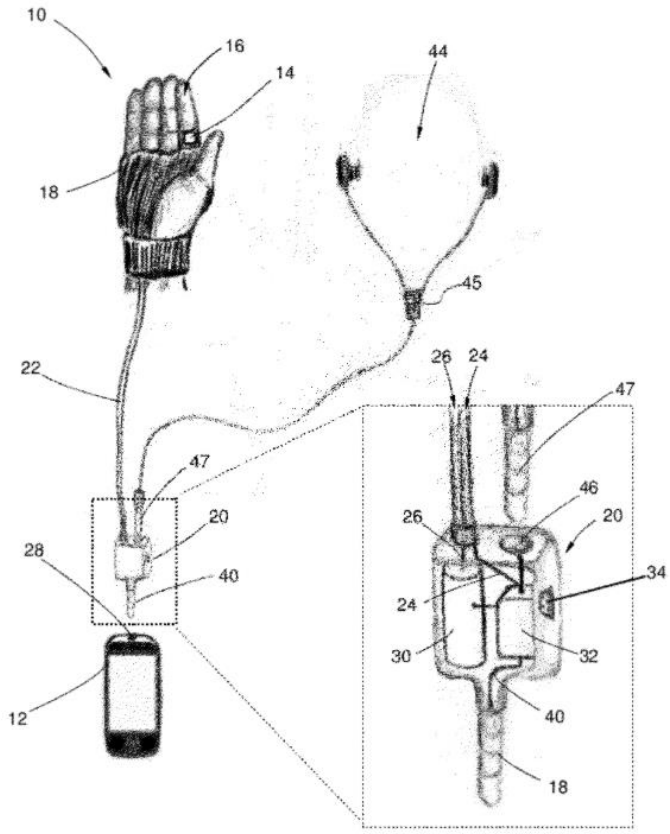 FIG. 1 Kreger at Fig. 1. **With reference to FIG. 1, there is shown a first embodiment of the biosensor interface apparatus for use with a mobile communication device 10. The biosensor 14 produces one or more biosensor signals transmitted via cable 22 and received by interface device 20. The interface device transforms the biosensor signals so that they can be conducted via electrical connector 28 and compatibly received by the mobile communications device shown as smart phone 12.** Kreger at 5:40-47.

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	Continuing with FIG. 1, the biosensor is shown as a pulse oximeter 14 in communication with finger 16. The pulse oximeter may provide a pulse signal to calculate BPM, a SPO2 reading, or a diagnostic cardiac waveform. The pulse oximeter 14 may be retained against the base of finger 16 using a mounting device that may be worn on the finger or hand, shown as gauntlet 18. Alternatively, the pulse oximeter may be worn on the fingertip, ear, forehead, or nasal septum using various mounting devices such as rings, clips, elastic straps, and adhesive pads. Kreger at 5:54-63. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants’ Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Kreger, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kreger, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[a]. a wearable device for measuring one or more physiological parameters, the wearable device adapted to be placed on a wrist of a user;	Kreger discloses or renders obvious a wearable device for measuring one or more physiological parameters, the wearable device adapted to be placed on a wrist of a user.

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	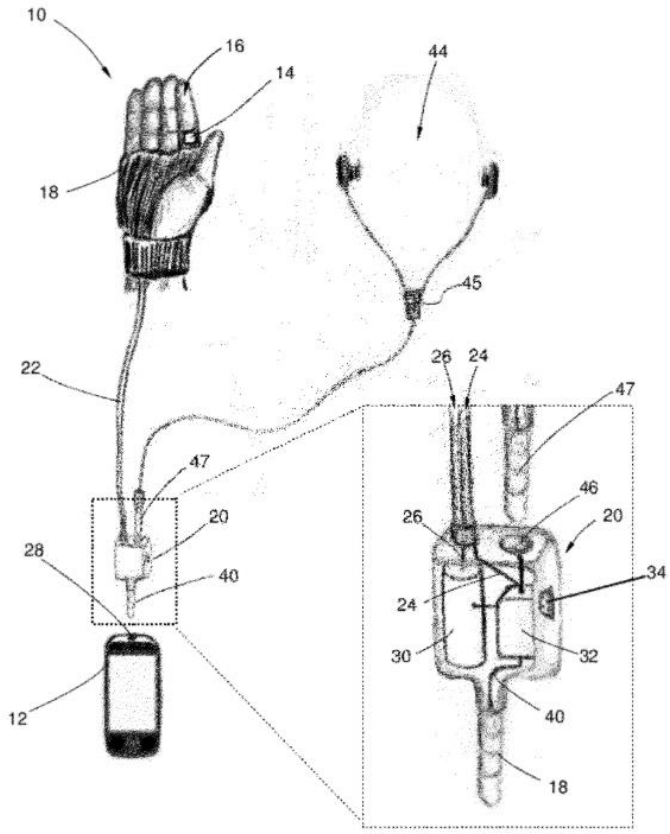 FIG. 1 Kreger at Fig. 1. **Continuing with FIG. 1, the biosensor is shown as a pulse oximeter 14 in communication with finger 16. The pulse oximeter may provide a pulse signal to calculate BPM, a SPO2 reading, or a diagnostic cardiac waveform. The pulse oximeter 14 may be retained against the base of finger 16 using a mounting device that may be worn on the finger or hand, shown as gauntlet 18. Alternatively, the pulse oximeter may be worn on the fingertip, ear, forehead, or nasal septum using various mounting devices such as rings, clips, elastic straps, and adhesive pads.**

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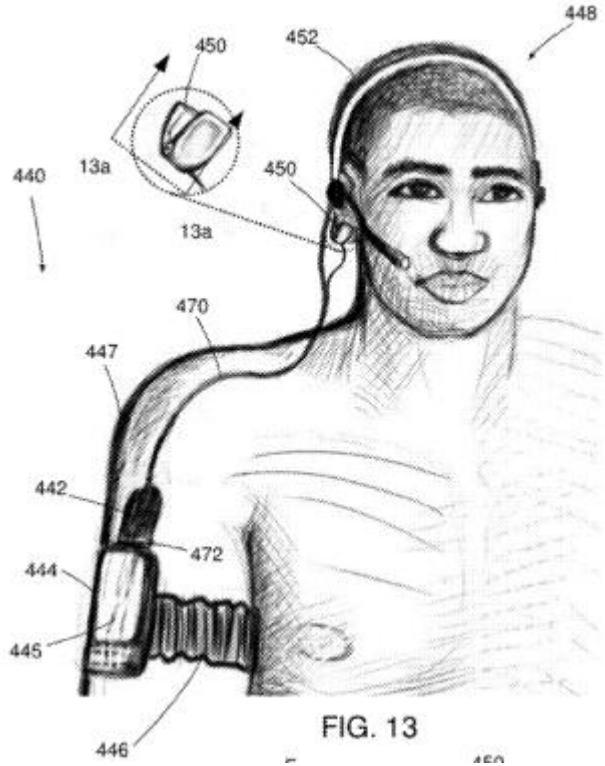
	Kreger at 5:54-63.  FIG. 13 Kreger at Fig.13. Turning now to FIG. 13, an embodiment of the interface apparatus 440 comprises an interface device 442 that may connect multiple medical or other biosensors to a mobile device such as smart phone 444 via electrical connector, for example 472. **The biosensors may include a sphygmomanometer such as inflatable blood pressure cuff 446 to measure or monitor the user's blood pressure. The blood pressure cuff 446 may be in communication with the user's arm 447 and may also house or otherwise carry mobile 444. The embodiment of interface apparatus 440 may also have an integral headset 448 worn by user 452, and a PPG 450, for example, attached to the user's earlobe.** Mobile device smart phone 444 may derive measurements and display plots of the biosensor data on its display 445. Smart phone 444 may also transmit the patient's biosensor data and measurements using one or

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	more internal RF transmitters, for example, over the mobile's data network, or as as modulated data, using frequency shift key (FSK), phase shift key (PSK) encoding or like modulation schemes over the mobile's voice network. In addition, the mobile 444 may transmit the data over a serial cable or an RF bluetooth channel, to a PC or other computing device, or via various other such wireless and wired interfaces, such as 3G, 4G, wired and wireless Ethernet and the like. Kreger at 12:5-28. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants’ Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Kreger, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kreger, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[b]. the wearable device including a light source comprising a plurality of semiconductor diodes that are configured to generate an output optical light having one or more optical wavelengths, wherein at least a portion of the one or more optical wavelengths is a near-infrared wavelength between 700 nanometers and 2500 nanometers;	Kreger discloses or renders obvious the wearable device including a light source comprising a plurality of semiconductor diodes that are configured to generate an output optical light having one or more optical wavelengths, wherein at least a portion of the one or more optical wavelengths is a near-infrared wavelength between 700 nanometers and 2500 nanometers. Referring to FIGS. 1 and 2, the biosensor 14 may be in communication with the interface device 20 via cable 22. The cable may contain one or more conductors 24, 26**. The cable 22 may transmit power to the pulse oximeter 14 via conductor 26, or may transmit biosensor signals, such as the two absorption light signals from the pulse oximeter 14, via conductor 24.** Kreger at 5:64-6:3.

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	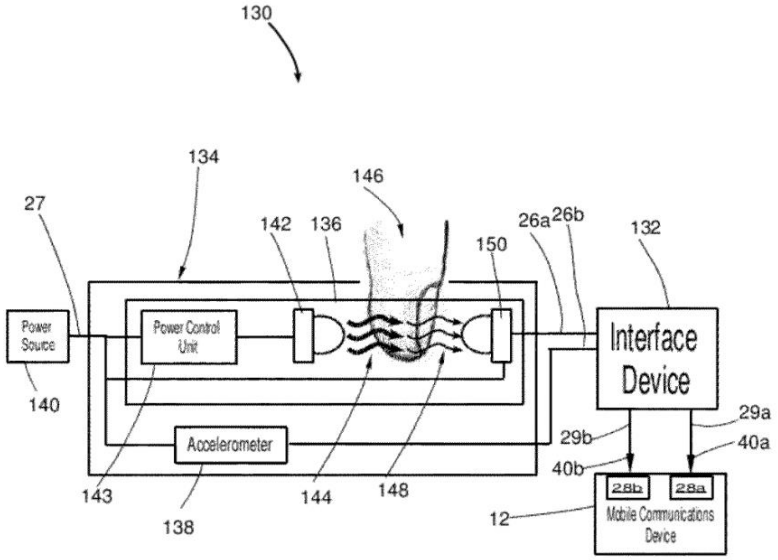 FIG. 5 Kreger at Fig. 5. **The sensor assembly 134 has a cardiac sensor shown as photo plethysmograph (“PPG”) 136, a movement sensor accelerometer 138, and an external power source 140 supplying power to both sensors via power connection 27. The PPG 136 works as follows: first, an infrared (“IR”) light emitting diode (“LED”) 142 has power applied by power control unit 143 thereby stimulating it to emit IR light 144, some of which is scattered, reflected or absorbed by a human tissue such as finger 146. Next, some light 148 emerges from finger 146 striking an infrared sensor such as photodiode 150. The photodiode electrical output (i.e. the PPG signal having pulsatile blood flow) is communicated to interface device 132 via connection 26 a, while one or more accelerometer signals are communicated to the interface device 132 via connection 26 b. Note that 26 a, 26 b may be hardwired as shown or releaseably connected to interface device with mating connectors (not shown).** Kreger at 8:9-25.

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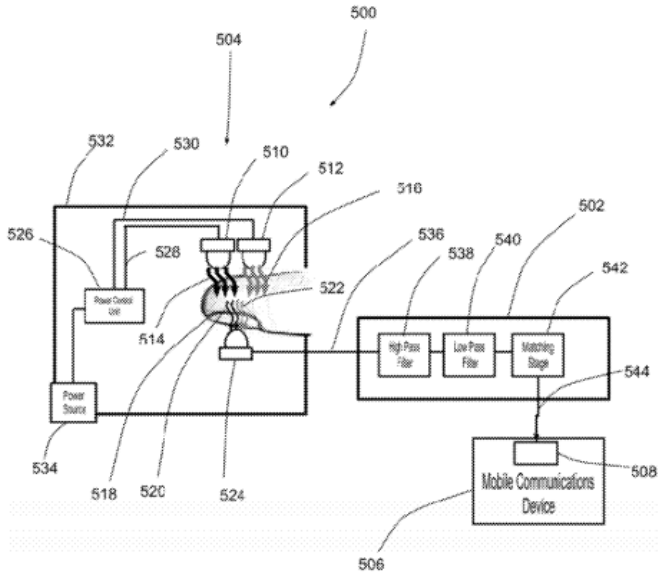
	The pulse oximeter output signal 558 may be multiplexed with accelerometer signal 560 by multiplexer 562. Recall that the LEDs 510, 512 may be turned on alternately and without overlapping with power control unit 526. Similarly, power control unit 564 may supply a signal to the multiplexor 562 to time multiplex the accelerometer and pulse oximeter signals 566 into a combined signal 567. Further processing of the signal to yield SPO2 must separate (demultiplex) the two signals combined in pulse ox output 558 and the accelerometer output 569 into their three individual components (and perhaps more for additional accelerometer outputs). The power control unit 564 may provide a synchronizing signal such as 568 to the mobile device 556 to demultiplex the pulse oximeter data and accelerometer data. The synchronizing signal 568 may be further combined with the sensor data by another multiplexer 576. Kreger at 14:33-48.  FIG. 17 Kreger at Fig.17.

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	Continuing with FIG. 17, **the pulse oximeter 504 has, for example, two LED light-emitting elements 510, 512 emitting two different frequencies of light, for example red light 514 with a wavelengths of substantially 660 nanometers, and infrared light 516 with wavelengths of substantially 940 nanometers. The light 514, 516 is partially transmitted through fingertip 518 and emerges as modulated light 520, 522 respectively, now having a cardiac signal and information about the saturated percentage of oxygen in the blood, referred to as SPO2. The user's heart rate and other information may be derived from the pulse oximeter signal as well. The information containing light 520,522 strikes light receiving device such as photo transistor 524 which transforms the photonic energy to a corresponding electrical signal transmitted via one or more conductors 536 to interface device 502.** Kreger at 13:36-50. Referring to FIGS. 17 and 18, **to determine SPO2 the LEDs 510, 512 may be turned on alternately and without overlapping with power control unit 526 and LED control lines 528, 530 as shown by voltage plots 529, 531 respectively. The information containing light 520, 522 has separate contributions shown in plots 523, 525. The alternating lights 520, 522 are received and combined (multiplexed) by a single receiver 524 as shown in plot 526.** Further processing of the signal to yield SPO2 must separate (demultiplex) the two signals into their individual components 523, 525. The signals 529, 531, and 533, or information derived therefrom may be supplied to the mobile device 506 to demultiplex the pulse oximeter data as well as other sensor data (see detailed description of FIG. 19 below). Kreger at 13:51-64. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants’ Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Kreger, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kreger, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.

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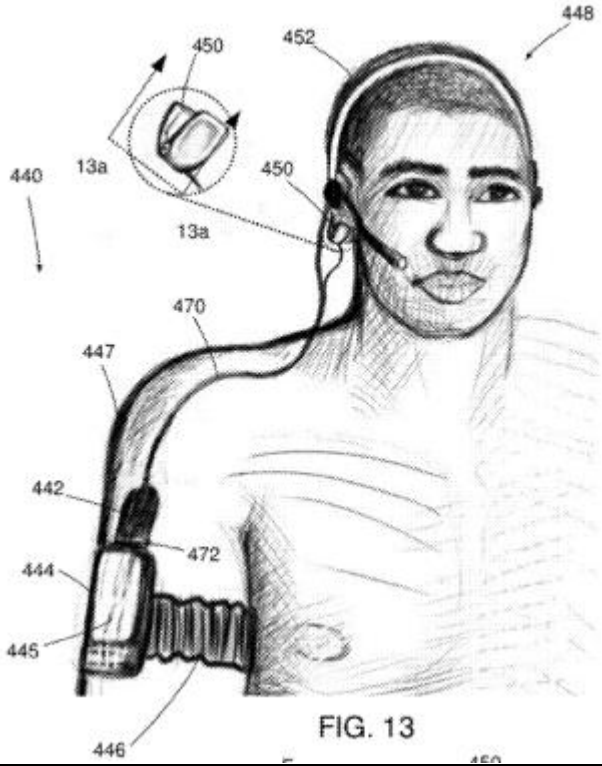
7[c]. the wearable device comprising one or more lenses configured to receive at least a portion of the output optical light and to deliver a lens output light to tissue comprising skin;	Kreger discloses or renders obvious the wearable device comprising one or more lenses configured to receive at least a portion of the output optical light and to deliver a lens output light to tissue comprising skin. **Continuing with FIG. 1, the biosensor is shown as a pulse oximeter 14 in communication with finger 16. The pulse oximeter may provide a pulse signal to calculate BPM, a SPO2 reading, or a diagnostic cardiac waveform. The pulse oximeter 14 may be retained against the base of finger 16 using a mounting device that may be worn on the finger or hand, shown as gauntlet 18. Alternatively, the pulse oximeter may be worn on the fingertip, ear, forehead, or nasal septum using various mounting devices such as rings, clips, elastic straps, and adhesive pads.** Kreger at 5:54-63.  FIG. 13

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	Kreger at Fig.13 Turning now to FIG. 13, an embodiment of the interface apparatus 440 comprises an interface device 442 that may connect multiple medical or other biosensors to a mobile device such as smart phone 444 via electrical connector, for example 472. **The biosensors may include a sphygmomanometer such as inflatable blood pressure cuff 446 to measure or monitor the user's blood pressure. The blood pressure cuff 446 may be in communication with the user's arm 447 and may also house or otherwise carry mobile 444. The embodiment of interface apparatus 440 may also have an integral headset 448 worn by user 452, and a PPG 450, for example, attached to the user's earlobe.** Mobile device smart phone 444 may derive measurements and display plots of the biosensor data on its display 445. Smart phone 444 may also transmit the patient's biosensor data and measurements using one or more internal RF transmitters, for example, over the mobile's data network, or as as modulated data, using frequency shift key (FSK), phase shift key (PSK) encoding or like modulation schemes over the mobile's voice network. In addition, the mobile 444 may transmit the data over a serial cable or an RF bluetooth channel, to a PC or other computing device, or via various other such wireless and wired interfaces, such as 3G, 4G, wired and wireless Ethernet and the like. Kreger at 12:5-28. **The sensor assembly 134 has a cardiac sensor shown as photo plethysmograph (“PPG”) 136, a movement sensor accelerometer 138, and an external power source 140 supplying power to both sensors via power connection 27. The PPG 136 works as follows: first, an infrared (“IR”) light emitting diode (“LED”) 142 has power applied by power control unit 143 thereby stimulating it to emit IR light 144, some of which is scattered, reflected or absorbed by a human tissue such as finger 146. Next, some light 148 emerges from finger 146 striking an infrared sensor such as photodiode 150.** The photodiode electrical output (i.e. the PPG signal having pulsatile blood flow) is communicated to interface device 132 via connection 26 a, while one or more accelerometer signals are communicated to the interface device 132 via connection 26 b. Note that 26 a, 26 b may be hardwired as shown or releaseably connected to interface device with mating connectors (not shown). Kreger at 8:9-25. Turning now to FIG. 13 a, **a cross section of photo plethysmograph 450 taken along axes 13 a is shown. The PPG 450 contains a light emitting element such as IR LED 452. The LED 452 emits a**

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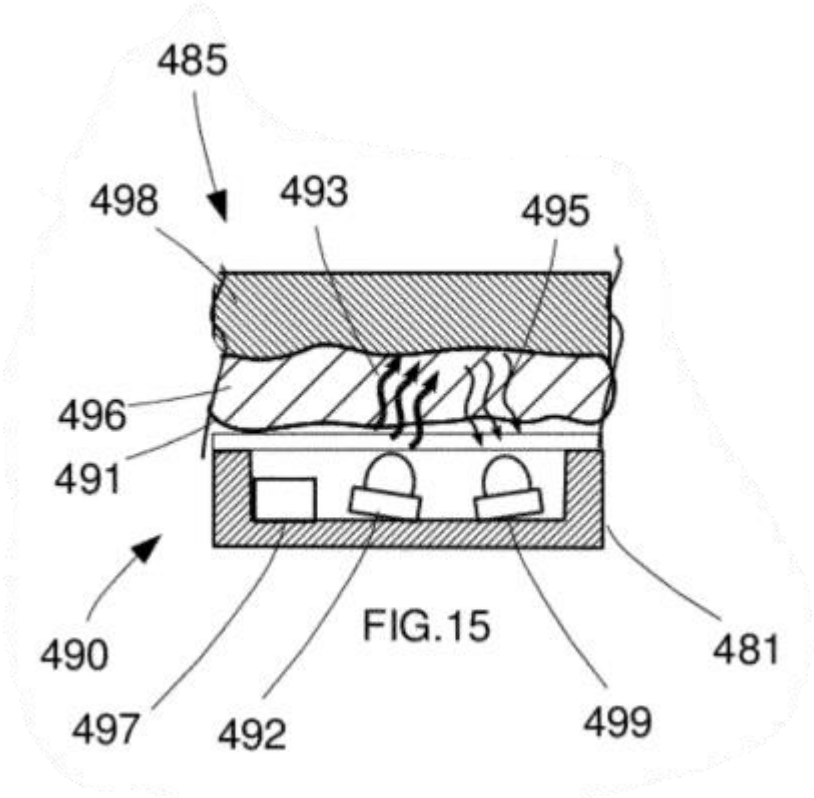
	light 453 when activated by power from a power control unit 454. The light 453 has a substantially distinct wavelength such as 880 nanometers or 920 nanometers. The light 453 enters the human tissue having a blood flow such as in earlobe 456. The light is partially absorbed, or otherwise filtered by the blood flowing in the earlobe 456 and emerges as light signal 455, carrying a blood flow signal. The light signal 455 is received by the light signal receiving device 458, which transforms the energy from the photons of the light signal 455 into a corresponding electrical signal. In one embodiment the light receiving device 458 is a photo diode, in another embodiment the receiving device 458 is a photo transistor, in yet another embodiment the light receiving device 458 has an internal amplifier for amplifying the output signal, for example, transmitted over conductor 460. Kreger at 12:29-47.  FIG.15

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	Kreger at Fig. 15. Turning now to FIG. 15, **a cross section of photo plethysmograph 490 taken along axes 15 is shown. Referring also to the PPG 490 shown in isometric view in FIGS. 14 and 16, the PPG 490 contains a light emitting element such IR LED 492. A light 493 is emitted from the LED 492 with a substantially distinct wavelength such as 880 nanometers or 920 nanometers. The light 493 enters the human tissue 496 having a blood flow such as forehead 485. The light is partially absorbed, or otherwise filtered by the blood flowing in the tissue 496, is reflected off bone 498, and emerges as light signal 495 carrying blood flow signal. The light signal 495 is received by the light signal receiving device 499, which transforms the energy from the photons of the light signal 455 into a corresponding electrical signal.** Biosensors may also include a temperature sensor 497 to measure the user's body temperature in thermal communication with the user's skin 491. The PPG 450 and temperature sensor 497 may be contained in sensors housing 481 which can be brought into communication with the user's forehead 456 by using a mounting or retaining device such as hat 483 worn by user 489. **Additionally, PPG 490 and thermal sensor 498 are connected via conductors 470 to interface device 482 which is mated to one or more electrical connectors on smart phone 484. Other embodiments may retain the sensors using a headband, a visor, a cap, other types of hats, adhesive bands, and so forth**. Kreger at 13:4-29. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants’ Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Kreger, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kreger, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[d]. the wearable device further comprising a detection system configured to receive at least a portion of the lens output light reflected from the tissue and	Kreger discloses or renders obvious the wearable device further comprising a detection system configured to receive at least a portion of the lens output light reflected from the tissue and to generate an output signal having a signal-to-noise ratio, wherein the detection system is configured to be synchronized to the light source.

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to generate an output signal having a signal-to-noise ratio, wherein the detection system is configured to be synchronized to the light source;	**The sensor assembly 134 has a cardiac sensor shown as photo plethysmograph (“PPG”) 136, a movement sensor accelerometer 138, and an external power source 140 supplying power to both sensors via power connection 27. The PPG 136 works as follows: first, an infrared (“IR”) light emitting diode (“LED”) 142 has power applied by power control unit 143 thereby stimulating it to emit IR light 144, some of which is scattered, reflected or absorbed by a human tissue such as finger 146. Next, some light 148 emerges from finger 146 striking an infrared sensor such as photodiode 150.** The photodiode electrical output (i.e. the PPG signal having pulsatile blood flow) is communicated to interface device 132 via connection 26 a, while one or more accelerometer signals are communicated to the interface device 132 via connection 26 b. Note that 26 a, 26 b may be hardwired as shown or releaseably connected to interface device with mating connectors (not shown). Kreger at 8:9-25. Turning now to FIG. 13 a, **a cross section of photo plethysmograph 450 taken along axes 13 a is shown. The PPG 450 contains a light emitting element such as IR LED 452. The LED 452 emits a light 453 when activated by power from a power control unit 454. The light 453 has a substantially distinct wavelength such as 880 nanometers or 920 nanometers. The light 453 enters the human tissue having a blood flow such as in earlobe 456. The light is partially absorbed, or otherwise filtered by the blood flowing in the earlobe 456 and emerges as light signal 455, carrying a blood flow signal. The light signal 455 is received by the light signal receiving device 458, which transforms the energy from the photons of the light signal 455 into a corresponding electrical signal.** In one embodiment the light receiving device 458 is a photo diode, in another embodiment the receiving device 458 is a photo transistor, in yet another embodiment the light receiving device 458 has an internal amplifier for amplifying the output signal, for example, transmitted over conductor 460. Kreger at 12:29-47.

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	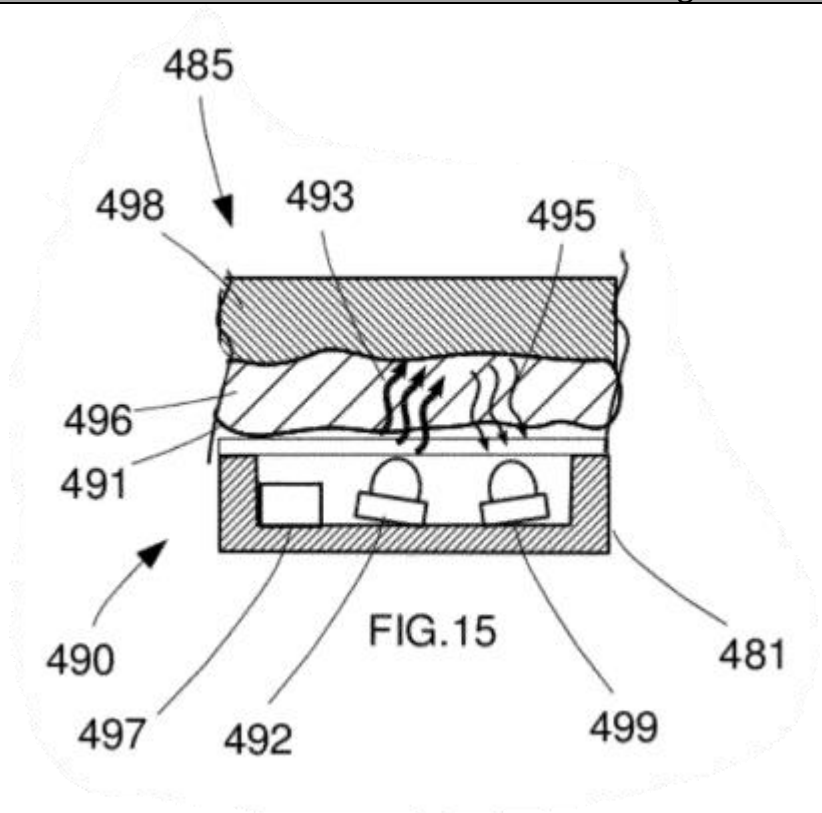 FIG.15 Kreger at Fig. 15. Turning now to FIG. 15, **a cross section of photo plethysmograph 490 taken along axes 15 is shown. Referring also to the PPG 490 shown in isometric view in FIGS. 14 and 16, the PPG 490 contains a light emitting element such IR LED 492. A light 493 is emitted from the LED 492 with a substantially distinct wavelength such as 880 nanometers or 920 nanometers. The light 493 enters the human tissue 496 having a blood flow such as forehead 485. The light is partially absorbed, or otherwise filtered by the blood flowing in the tissue 496, is reflected off bone 498, and emerges as light signal 495 carrying blood flow signal. The light signal 495 is received by the light signal receiving device 499, which transforms the energy from the photons of the light signal 455 into a corresponding electrical signal.** Biosensors may also include a temperature sensor 497 to measure the user's body temperature in thermal communication with the user's skin 491. The PPG 450 and

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	temperature sensor 497 may be contained in sensors housing 481 which can be brought into communication with the user's forehead 456 by using a mounting or retaining device such as hat 483 worn by user 489. **Additionally, PPG 490 and thermal sensor 498 are connected via conductors 470 to interface device 482 which is mated to one or more electrical connectors on smart phone 484. Other embodiments may retain the sensors using a headband, a visor, a cap, other types of hats, adhesive bands, and so forth**. Kreger at 13:4-29. Thus, it is another object to provide compatible signals to the **mobile's electrical connectors which may involve transforming the biosensor signals to match requisite impedance and signal levels, eliminate noise, cancel DC noise and drif**t, demultiplex or multiplex multiple measurements, provide electrical isolation, serialization, synchronization, and so forth. Kreger at 3:17-23. The interface device 20 may also provide a sensors interface circuit 42 which receives biosensor signals on input conductor 24 and transforms the signals to output electrical signals 43 that are output on electrical connector 28. **The interface circuit provides output electrical signals 43 signals that are electrically compatible, for example, with respect to impedance, voltage amplitude, noise levels**, and so forth such that the signals can be received by the mobile's processor via connector 24. Kreger at 6:22-30. Still referring to FIGS. 17 and 18, **the interface device 502 may receive pulse oximeter and other sensors signals on conductors 536 and perform various transformations on the signals. For example, high frequency noise may be reduced with high pass filter538, DC offsets and baseline wander can may be reduced with a low pass filter 440, These filters may be instrumental in creating a signal which is usable for examples as a diagnostic display, an SPO2 calculation, a BPM calculation, and so forth**. Internal mobile device filters, for example such as an anti-aliasing filter for recording inputs or a CODEC filter may be used. Alternatively, internal filters can be reconfigured or disabled to allow, for example, the reception of lower frequency signals by the mobile 12 CODEC 76 or AtoD converter 78.

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	Kreger at 14:4-17. Still referring to FIG. 19, the interface device 552 may receive pulse oximeter, other sensors signals, and synchronizing signals on conductors 567, 568 and perform various transformations on the signals**. For example, high frequency noise, DC offsets and baseline wander may be reduced with a band pass filter570. In addition, proper matching of the electrical characteristics of mobile's electrical connector may provided by matching stage 572, for example, as provided by matching stage 542 above.** Kreger at 14:49-57. **The photo plethysmograph output signal and temperature sensor signal may be communicated from sensors assembly 587 by separate (i.e. parallel) conductors 588, 590 to interface device 582. High frequency noise, DC offsets and baseline wander may be reduced with anti-alias filters592, 593.** The filtered signals are received by the serial AtoD converter 594, which converts them to digital values that are serialized for transmission to serial electrical connector 588 on mobile 586. Kreger at 14:65-15:5. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants’ Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Kreger, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kreger, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[e]. wherein the detection system comprises a plurality of detectors that are spatially separated from each other, and wherein at least one analog to digital converter is coupled to at least one of the plurality of detectors;	Kreger discloses or renders obvious the detection system comprises a plurality of detectors that are spatially separated from each other, and wherein at least one analog to digital converter is coupled to at least one of the plurality of detectors. In one aspect of another embodiment, **the biosensor interface apparatus further includes one or more biosensors. The biosensors may be electrodes including ECG electrodes, a photo plethysmograph (PPG), a pulse oximeter, a sphygmomanometer (inflatable blood pressure cuff), a thermometer/temperature sensor, a pedometer, a capnograph, a respiratory movement sensor, a**

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	respiratory flow sensor, a transdermal blood alcohol sensor, and a blood sugar sensor (glucometer). Thus it is an object to provide for a wide range of common medical and sport/fitness biosensors in a single compact interface apparatus Kreger at 3:24-34. Referring now to FIG. 8, **an embodiment of the biosensor interface apparatus 190 may be integrated into an emergency or pre-hospital critical care monitor having multiple biosensors.** The biosensors are arranged so that the patient 192 may be wearing an ECG electrode retaining device such as garment 193 that holds cloth or textile ECG electrodes 192, 194, 196, 198 in communication with the patient's skin. **There also may be an thermal sensor 202 for measuring the patient's body temperature (shown under the patient's arm), and a movement sensor accelerometer 204, which is in communication with the patient's thorax 206 measuring thoracic movement as a respiratory monitor. The interface device 208 receives the biosensor signals via electrical cable 210, processes the signals, and outputs them to the mobile communication device 212 via one or more electrical connectors. Various sensor signals and measurements may be displayed on the mobile's screen 214 such as electrocardiogram (ECG) 216, heart rate (BPM) 218, respiratory movement 220, respiratory rate (RR) 224, and body temperature (degrees Fahrenheit or Centigrade) 222. In another embodiment the connection of cable 210 to interface device 208 may have releasable connectors either for a single electrical cable such as 210, or as individual sensor connectors. In another embodiment one or more sensors communicate with the interface device 208 wirelessly such as with bluetooth-capable sensors. In another alternative embodiment, the patient is using adhesive ECG electrodes, and there is no retaining garment 193. In yet another embodiment the accelerometer 204 can be used to determine periods of activity, rest, and cessation of patient movement, as well as patient position. The movement sensor 204 can also track user 192 position, velocity and acceleration, either of a patient or a fitness user.** Kreger at 9:9-40. **Still referring to FIGS. 17 and 18, the interface device 502 may receive pulse oximeter and other sensors signals on conductors 536 and perform various transformations on the signals**. For example, high frequency noise may be reduced with high pass filter538, DC offsets and baseline wander can may be reduced with a low pass filter 440, These filters may be instrumental in creating a signal which is usable for examples as a diagnostic display, an SPO2 calculation, a BPM calculation, and so

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	forth. **Internal mobile device filters, for example such as an anti-aliasing filter for recording inputs or a CODEC filter may be used. Alternatively, internal filters can be reconfigured or disabled to allow, for example, the reception of lower frequency signals by the mobile 12 CODEC 76 or AtoD converter 78.** Kreger at 14:4-17. **The photo plethysmograph output signal and temperature sensor signal may be communicated from sensors assembly 587 by separate (i.e. parallel) conductors 588, 590 to interface device 582. High frequency noise, DC offsets and baseline wander may be reduced with anti-alias filters592, 593. The filtered signals are received by the serial AtoD converter 594, which converts them to digital values that are serialized for transmission to serial electrical connector 588 on mobile 586.** Kreger at 14:65-15:5. The biosensor signals 244 are received by mobile 212 through dock connector 246 which is in communication with an electrical connector on mobile 212 (not visible). The signals may be processed by the interface device dock 242 before being communicated to mobile 212. The biosensor signals may be further processed by the mobile 212 to produce measurements such as BPM 264 or for plotting signals for medical diagnosis such as ECG 266 and respiratory end-tidal CO2 (ETCO2) 267**. Biosensor signals may also be received by one or more RF receivers in the dock 246 (not shown) and communicated to the mobile 212 via wired electrical connector 246, for example, to allow the wireless sensor to utilize the features of the wired audio input's anti-alias filters and analog to digital converter as will be explained in detail below.** Kreger at 10:14-28. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants’ Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Kreger, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kreger, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.

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7[f]. wherein the output signal is indicative of the one or more of the physiological parameters;	Kreger discloses or renders obvious the output signal is indicative of the one or more of the physiological parameters. **Continuing to refer to FIG. 3, the microprocessor 74 receives one or more biosensor signals and may transform the data into a biosensor measurement such as BPM, or an otherwise useful signal such as a ECG signal suitable for medical diagnosis. The signals and measurements may be stored in memory 12 and may be used for plotting on display 94.** The signals and measurements may also be used to provide information such as a BPM via speaker 98 or via a headset or earpiece (not shown). In addition, biosensor data may be produced by the mobile's internal accelerometer 70 if it is in communication with a human body, thereby serving as a biosensor that may be used to determine the patient's position, respiratory movement, and so forth. Kreger at 7:26-38. **Referring now to FIGS. 4 a and 4 b and also to FIG. 3, the microprocessor 74 may drive a display 94 to display the biosensor signals and measurements derived there from. For example a movement sensor may be used to determine the speed 100 (strides per minute or SPM) or distance traveled 102 by an athlete during a workout. A cardiac sensor my provide an ECG signal 104 which can be used to calculate the heart rate 106.** The speed 100 can be used separately, but preferably in tandem, to perform a cardiac stress exam and determine a patient's stress level. Speed 100 and/or heart rate 106 may also be used to monitor and control an effort level 110, 112 in a workout. As well, effort level 114 may be a target that is set for the workout. Goals may be set and measurements may be displayed on, for example, a workout timer 112, which may show elapsed or remaining time and may have controls to set workout time. Moreover, other measurements such as Calories 116 may be displayed as “Calories elapsed” or “Calories remaining until goal”. Similarly for elapsed or remaining distance 102, a distance goal can be set, for example, in strides, miles, or kilometers. As well, for effort where an actual effort level 122 and a target effort level 120 can be shown graphically and the user may choose a certain effort profile or course such as Hill 124. Kreger at 7:47-8:2. In one aspect of another embodiment**, the biosensor interface apparatus further includes one or more biosensors. The biosensors may be electrodes including ECG electrodes, a photo plethysmograph (PPG), a pulse oximeter, a sphygmomanometer (inflatable blood pressure cuff), a**

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	thermometer/temperature sensor, a pedometer, a capnograph, a respiratory movement sensor, a respiratory flow sensor, a transdermal blood alcohol sensor, and a blood sugar sensor (glucometer). Thus it is an object to provide for a wide range of common medical and sport/fitness biosensors in a single compact interface apparatus. Kreger at 3:24-34. In one aspect of another embodiment, **the biosensor interface apparatus further includes at least one connector capable of receiving a biosensor signal, wherein the biosensor signal is an electrical signal, a chemical signal, a gas signal, or a force signal. Thus, it is one object to provide for transmission of gas, chemical compounds, or force such as through a tube in order to measure, for example, end-tidal CO2 (ETCO2), respiratory rate (RR), or respiratory flow with a capnograph. It is another object to provide for the transmission of an electrical signal such as from an ECG or pulse oximeter. In addition vibrations and other audible and inaudible force may be detected by a force sensor that could be in communication with a stethoscope or accelerometer.** Kreger at 3:42-54. **Continuing with FIG. 1, the biosensor is shown as a pulse oximeter 14 in communication with finger 16. The pulse oximeter may provide a pulse signal to calculate BPM, a SPO2 reading, or a diagnostic cardiac waveform. The pulse oximeter 14 may be retained against the base of finger 16 using a mounting device that may be worn on the finger or hand, shown as gauntlet 18. Alternatively, the pulse oximeter may be worn on the fingertip, ear, forehead, or nasal septum using various mounting devices such as rings, clips, elastic straps, and adhesive pads.** Kreger at 5:54-63. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants’ Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Kreger, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kreger, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.

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7[g]. the wearable device configured to increase the signal-to-noise ratio by increasing light intensity of at least one of the plurality of semiconductor diodes from an initial light intensity; and	Kreger discloses or renders obvious the wearable device configured to increase the signal-to-noise ratio by increasing light intensity of at least one of the plurality of semiconductor diodes from an initial light intensity. **The sensor assembly 134 has a cardiac sensor shown as photo plethysmograph (“PPG”) 136, a movement sensor accelerometer 138, and an external power source 140 supplying power to both sensors via power connection 27. The PPG 136 works as follows: first, an infrared (“IR”) light emitting diode (“LED”) 142 has power applied by power control unit 143 thereby stimulating it to emit IR light 144, some of which is scattered, reflected or absorbed by a human tissue such as finger 146. Next, some light 148 emerges from finger 146 striking an infrared sensor such as photodiode 150.** The photodiode electrical output (i.e. the PPG signal having pulsatile blood flow) is communicated to interface device 132 via connection 26 a, while one or more accelerometer signals are communicated to the interface device 132 via connection 26 b. Note that 26 a, 26 b may be hardwired as shown or releaseably connected to interface device with mating connectors (not shown). Kreger at 8:9-25. Turning now to FIG. 13 a, **a cross section of photo plethysmograph 450 taken along axes 13 a is shown. The PPG 450 contains a light emitting element such as IR LED 452. The LED 452 emits a light 453 when activated by power from a power control unit 454. The light 453 has a substantially distinct wavelength such as 880 nanometers or 920 nanometers. The light 453 enters the human tissue having a blood flow such as in earlobe 456. The light is partially absorbed, or otherwise filtered by the blood flowing in the earlobe 456 and emerges as light signal 455, carrying a blood flow signal. The light signal 455 is received by the light signal receiving device 458, which transforms the energy from the photons of the light signal 455 into a corresponding electrical signal.** In one embodiment the light receiving device 458 is a photo diode, in another embodiment the receiving device 458 is a photo transistor, in yet another embodiment the light receiving device 458 has an internal amplifier for amplifying the output signal, for example, transmitted over conductor 460. Kreger at 12:29-47.

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	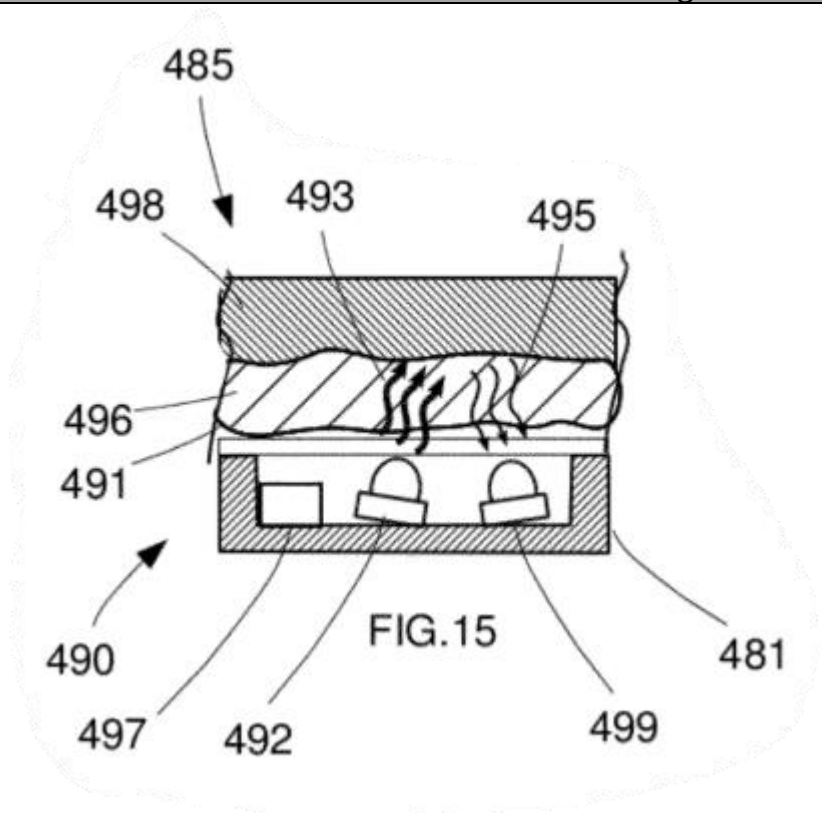 Kreger at Fig. 15. Turning now to FIG. 15, **a cross section of photo plethysmograph 490 taken along axes 15 is shown. Referring also to the PPG 490 shown in isometric view in FIGS. 14 and 16, the PPG 490 contains a light emitting element such IR LED 492. A light 493 is emitted from the LED 492 with a substantially distinct wavelength such as 880 nanometers or 920 nanometers. The light 493 enters the human tissue 496 having a blood flow such as forehead 485. The light is partially absorbed, or otherwise filtered by the blood flowing in the tissue 496, is reflected off bone 498, and emerges as light signal 495 carrying blood flow signal. The light signal 495 is received by the light signal receiving device 499, which transforms the energy from the photons of the light signal 455 into a corresponding electrical signal.** Biosensors may also include a temperature sensor 497 to measure the user's body temperature in thermal communication with the user's skin 491. The PPG 450 and

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	temperature sensor 497 may be contained in sensors housing 481 which can be brought into communication with the user's forehead 456 by using a mounting or retaining device such as hat 483 worn by user 489. **Additionally, PPG 490 and thermal sensor 498 are connected via conductors 470 to interface device 482 which is mated to one or more electrical connectors on smart phone 484. Other embodiments may retain the sensors using a headband, a visor, a cap, other types of hats, adhesive bands, and so forth**. Kreger at 13:4-29. Thus, it is another object to provide compatible signals to the **mobile's electrical connectors which may involve transforming the biosensor signals to match requisite impedance and signal levels, eliminate noise, cancel DC noise and drif**t, demultiplex or multiplex multiple measurements, provide electrical isolation, serialization, synchronization, and so forth. Kreger at 3:17-23. The interface device 20 may also provide a sensors interface circuit 42 which receives biosensor signals on input conductor 24 and transforms the signals to output electrical signals 43 that are output on electrical connector 28. **The interface circuit provides output electrical signals 43 signals that are electrically compatible, for example, with respect to impedance, voltage amplitude, noise levels**, and so forth such that the signals can be received by the mobile's processor via connector 24. Kreger at 6:22-30. Still referring to FIGS. 17 and 18, **the interface device 502 may receive pulse oximeter and other sensors signals on conductors 536 and perform various transformations on the signals. For example, high frequency noise may be reduced with high pass filter538, DC offsets and baseline wander can may be reduced with a low pass filter 440, These filters may be instrumental in creating a signal which is usable for examples as a diagnostic display, an SPO2 calculation, a BPM calculation, and so forth**. Internal mobile device filters, for example such as an anti-aliasing filter for recording inputs or a CODEC filter may be used. Alternatively, internal filters can be reconfigured or disabled to allow, for example, the reception of lower frequency signals by the mobile 12 CODEC 76 or AtoD converter 78.

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	Kreger at 14:4-17. Still referring to FIG. 19, the interface device 552 may receive pulse oximeter, other sensors signals, and synchronizing signals on conductors 567, 568 and perform various transformations on the signals**. For example, high frequency noise, DC offsets and baseline wander may be reduced with a band pass filter570. In addition, proper matching of the electrical characteristics of mobile's electrical connector may provided by matching stage 572, for example, as provided by matching stage 542 above.** Kreger at 14:49-57. **The photo plethysmograph output signal and temperature sensor signal may be communicated from sensors assembly 587 by separate (i.e. parallel) conductors 588, 590 to interface device 582. High frequency noise, DC offsets and baseline wander may be reduced with anti-alias filters592, 593.** The filtered signals are received by the serial AtoD converter 594, which converts them to digital values that are serialized for transmission to serial electrical connector 588 on mobile 586. Kreger at 14:65-15:5. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants' Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Kreger, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kreger, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[h]. the detection system further configured to: generate a first signal responsive to light received while the semiconductor diodes are off,	Kreger discloses or renders obvious the detection system further configured to: generate a first signal responsive to light received while the semiconductor diodes are off. The sensor assembly 134 has a cardiac sensor shown as photo plethysmograph ("PPG") 136, a movement sensor accelerometer 138, and an external power source 140 supplying power to both sensors via power connection 27. The PPG 136 works as follows: first, an infrared ("IR") light emitting diode ("LED") 142 has power applied by power control unit 143 thereby stimulating it to emit IR light 144, some of which is scattered, reflected or absorbed by a human tissue such as finger 146. **Next, some light 148 emerges**

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	from finger 146 striking an infrared sensor such as photodiode 150. The photodiode electrical output (i.e. the PPG signal having pulsatile blood flow) is communicated to interface device 132 via connection 26 a, while one or more accelerometer signals are communicated to the interface device 132 via connection 26 b. Note that 26 a, 26 b may be hardwired as shown or releaseably connected to interface device with mating connectors (not shown). Kreger at 8:9-25 Referring now to FIG. 8, an embodiment of the biosensor interface apparatus 190 may be integrated into an emergency or pre-hospital critical care monitor having multiple biosensors. The biosensors are arranged so that the patient 192 may be wearing an ECG electrode retaining device such as garment 193 that holds cloth or textile ECG electrodes 192, 194, 196, 198 in communication with the patient's skin. There also may be an thermal sensor 202 for measuring the patient's body temperature (shown under the patient's arm), and a movement sensor accelerometer 204, which is in communication with the patient's thorax 206 measuring thoracic movement as a respiratory monitor. **The interface device 208 receives the biosensor signals via electrical cable 210, processes the signals, and outputs them to the mobile communication device 212 via one or more electrical connectors.** Various sensor signals and measurements may be displayed on the mobile's screen 214 such as electrocardiogram (ECG) 216, heart rate (BPM) 218, respiratory movement 220, respiratory rate (RR) 224, and body temperature (degrees Fahrenheit or Centigrade) 222. In another embodiment the connection of cable 210 to interface device 208 may have releasable connectors either for a single electrical cable such as 210, or as individual sensor connectors. In another embodiment one or more sensors communicate with the interface device 208 wirelessly such as with bluetooth-capable sensors. In another alternative embodiment, the patient is using adhesive ECG electrodes, and there is no retaining garment 193. In yet another embodiment the accelerometer 204 can be used to determine periods of activity, rest, and cessation of patient movement, as well as patient position. The movement sensor 204 can also track user 192 position, velocity and acceleration, either of a patient or a fitness user. Kreger at 9:9-40 The biosensor signals 244 are received by mobile 212 through dock connector 246 which is in communication with an electrical connector on mobile 212 (not visible). **The signals may be processed by the interface device dock 242 before being communicated to mobile 212. The biosensor signals may be further processed by the mobile 212 to produce measurements such as BPM 264 or for**

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	plotting signals for medical diagnosis such as ECG 266 and respiratory end-tidal CO2 (ETCO2) 267. Biosensor signals may also be received by one or more RF receivers in the dock 246 (not shown) and communicated to the mobile 212 via wired electrical connector 246, for example, to allow the wireless sensor to utilize the features of the wired audio input's anti-alias filters and analog to digital converter as will be explained in detail below. Kreger at 10:14-28 Turning now to FIG. 13 a, a cross section of photo plethysmograph 450 taken along axes 13 a is shown. The PPG 450 contains a light emitting element such as IR LED 452. The LED 452 emits a light 453 when activated by power from a power control unit 454. The light 453 has a substantially distinct wavelength such as 880 nanometers or 920 nanometers. The light 453 enters the human tissue having a blood flow such as in earlobe 456. The light is partially absorbed, or otherwise filtered by the blood flowing in the earlobe 456 and emerges as light signal 455, carrying a blood flow signal. **The light signal 455 is received by the light signal receiving device 458, which transforms the energy from the photons of the light signal 455 into a corresponding electrical signal. In one embodiment the light receiving device 458 is a photo diode, in another embodiment the receiving device 458 is a photo transistor, in yet another embodiment the light receiving device 458 has an internal amplifier for amplifying the output signal, for example, transmitted over conductor 460.** Kreger at 12:29-47 Turning now to FIG. 15, a cross section of photo plethysmograph 490 taken along axes 15 is shown. Referring also to the PPG 490 shown in isometric view in FIGS. 14 and 16, the PPG 490 contains a light emitting element such IR LED 492. A light 493 is emitted from the LED 492 with a substantially distinct wavelength such as 880 nanometers or 920 nanometers. The light 493 enters the human tissue 496 having a blood flow such as forehead 485. The light is partially absorbed, or otherwise filtered by the blood flowing in the tissue 496, is reflected off bone 498, and emerges as light signal 495 carrying blood flow signal. **The light signal 495 is received by the light signal receiving device 499, which transforms the energy from the photons of the light signal 455 into a corresponding electrical signal. Biosensors may also include a temperature sensor 497 to measure the user's body temperature in thermal communication with the user's skin 491.** The PPG 450 and temperature sensor 497 may be contained in sensors housing 481 which can be brought into communication with the user's forehead 456 by using a mounting or retaining device such as hat 483 worn by user 489. Additionally, PPG 490 and

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	thermal sensor 498 are connected via conductors 470 to interface device 482 which is mated to one or more electrical connectors on smart phone 484. Other embodiments may retain the sensors using a headband, a visor, a cap, other types of hats, adhesive bands, and so forth. Kreger at 13:4-29. Continuing with FIG. 17, the pulse oximeter 504 has, for example, two LED light-emitting elements 510, 512 emitting two different frequencies of light, for example red light 514 with a wavelengths of substantially 660 nanometers, and infrared light 516 with wavelengths of substantially 940 nanometers. The light 514, 516 is partially transmitted through fingertip 518 and emerges as modulated light 520, 522 respectively, now having a cardiac signal and information about the saturated percentage of oxygen in the blood, referred to as SPO2. **The user's heart rate and other information may be derived from the pulse oximeter signal as well. The information containing light 520,522 strikes light receiving device such as photo transistor 524 which transforms the photonic energy to a corresponding electrical signal transmitted via one or more conductors 536 to interface device 502.** Kreger at 13:36-50. Referring to FIGS. 17 and 18, to determine SPO2 the LEDs 510, 512 may be turned on alternately and without overlapping with power control unit 526 and LED control lines 528, 530 as shown by voltage plots 529, 531 respectively. The information containing light 520, 522 has separate contributions shown in plots 523, 525. **The alternating lights 520, 522 are received and combined (multiplexed) by a single receiver 524 as shown in plot 526. Further processing of the signal to yield SPO2 must separate (demultiplex) the two signals into their individual components 523, 525**. The signals 529, 531, and 533, or information derived therefrom may be supplied to the mobile device 506 to demultiplex the pulse oximeter data as well as other sensor data (see detailed description of FIG. 19 below). Kreger at 13:51-64. In one aspect of another embodiment (not shown), **the biosensor interface apparatus further includes at least on least one receiver capable of receiving a wireless biosensor signal.** The interface apparatus acts as an adapter for the wireless biosensor to utilize the capabilities of the mobile's electrical connectors. Importantly, wireless RF biosensors may need access to the mobile via its electrical connector, for example, with an iPhone® to avoid licensing issues.

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	Kreger at 16:6-13. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants’ Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Kreger, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kreger, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[i]. generate a second signal responsive to light received while at least one of the semiconductor diodes is on, and	Kreger discloses or renders obvious the detection system further configured to: generate a second signal responsive to light received while at least one of the semiconductor diodes is on. The sensor assembly 134 has a cardiac sensor shown as photo plethysmograph (“PPG”) 136, a movement sensor accelerometer 138, and an external power source 140 supplying power to both sensors via power connection 27. The PPG 136 works as follows: first, an infrared (“IR”) light emitting diode (“LED”) 142 has power applied by power control unit 143 thereby stimulating it to emit IR light 144, some of which is scattered, reflected or absorbed by a human tissue such as finger 146. **Next, some light 148 emerges from finger 146 striking an infrared sensor such as photodiode 150. The photodiode electrical output (i.e. the PPG signal having pulsatile blood flow) is communicated to interface device 132 via connection 26 a, while one or more accelerometer signals are communicated to the interface device 132 via connection 26 b.** Note that 26 a, 26 b may be hardwired as shown or releaseably connected to interface device with mating connectors (not shown). Kreger at 8:9-25 Referring now to FIG. 8, an embodiment of the biosensor interface apparatus 190 may be integrated into an emergency or pre-hospital critical care monitor having multiple biosensors. The biosensors are arranged so that the patient 192 may be wearing an ECG electrode retaining device such as garment 193 that holds cloth or textile ECG electrodes 192, 194, 196, 198 in communication with the patient's skin. There also may be an thermal sensor 202 for measuring the patient's body temperature (shown under the patient's arm), and a movement sensor accelerometer 204, which is in communication with the patient's thorax 206 measuring thoracic movement as a respiratory monitor. **The interface device 208 receives the biosensor signals via electrical cable 210, processes the signals, and outputs them to the mobile**

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	communication device 212 via one or more electrical connectors. Various sensor signals and measurements may be displayed on the mobile's screen 214 such as electrocardiogram (ECG) 216, heart rate (BPM) 218, respiratory movement 220, respiratory rate (RR) 224, and body temperature (degrees Fahrenheit or Centigrade) 222. In another embodiment the connection of cable 210 to interface device 208 may have releasable connectors either for a single electrical cable such as 210, or as individual sensor connectors. In another embodiment one or more sensors communicate with the interface device 208 wirelessly such as with bluetooth-capable sensors. In another alternative embodiment, the patient is using adhesive ECG electrodes, and there is no retaining garment 193. In yet another embodiment the accelerometer 204 can be used to determine periods of activity, rest, and cessation of patient movement, as well as patient position. The movement sensor 204 can also track user 192 position, velocity and acceleration, either of a patient or a fitness user. Kreger at 9:9-40 The biosensor signals 244 are received by mobile 212 through dock connector 246 which is in communication with an electrical connector on mobile 212 (not visible). **The signals may be processed by the interface device dock 242 before being communicated to mobile 212. The biosensor signals may be further processed by the mobile 212 to produce measurements such as BPM 264 or for plotting signals for medical diagnosis such as ECG 266 and respiratory end-tidal CO2 (ETCO2) 267. Biosensor signals may also be received by one or more RF receivers in the dock 246 (not shown) and communicated to the mobile 212 via wired electrical connector 246, for example, to** allow the wireless sensor to utilize the features of the wired audio input's anti-alias filters and analog to digital converter as will be explained in detail below. Kreger at 10:14-28 Turning now to FIG. 13 a, a cross section of photo plethysmograph 450 taken along axes 13 a is shown. The PPG 450 contains a light emitting element such as IR LED 452. The LED 452 emits a light 453 when activated by power from a power control unit 454. The light 453 has a substantially distinct wavelength such as 880 nanometers or 920 nanometers. The light 453 enters the human tissue having a blood flow such as in earlobe 456. The light is partially absorbed, or otherwise filtered by the blood flowing in the earlobe 456 and emerges as light signal 455, carrying a blood flow signal. **The light signal 455 is received by the light signal receiving device 458, which transforms the energy from the photons of the light signal 455 into a corresponding electrical signal. In one embodiment the light**

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	receiving device 458 is a photo diode, in another embodiment the receiving device 458 is a photo transistor, in yet another embodiment the light receiving device 458 has an internal amplifier for amplifying the output signal, for example, transmitted over conductor 460. Kreger at 12:29-47 Turning now to FIG. 15, a cross section of photo plethysmograph 490 taken along axes 15 is shown. Referring also to the PPG 490 shown in isometric view in FIGS. 14 and 16, the PPG 490 contains a light emitting element such IR LED 492. A light 493 is emitted from the LED 492 with a substantially distinct wavelength such as 880 nanometers or 920 nanometers. The light 493 enters the human tissue 496 having a blood flow such as forehead 485. The light is partially absorbed, or otherwise filtered by the blood flowing in the tissue 496, is reflected off bone 498, and emerges as light signal 495 carrying blood flow signal. **The light signal 495 is received by the light signal receiving device 499, which transforms the energy from the photons of the light signal 455 into a corresponding electrical signal. Biosensors may also include a temperature sensor 497 to measure the user's body temperature in thermal communication with the user's skin 491.** The PPG 450 and temperature sensor 497 may be contained in sensors housing 481 which can be brought into communication with the user's forehead 456 by using a mounting or retaining device such as hat 483 worn by user 489. Additionally, PPG 490 and thermal sensor 498 are connected via conductors 470 to interface device 482 which is mated to one or more electrical connectors on smart phone 484. Other embodiments may retain the sensors using a headband, a visor, a cap, other types of hats, adhesive bands, and so forth. Kreger at 13:4-29. Continuing with FIG. 17, the pulse oximeter 504 has, for example, two LED light-emitting elements 510, 512 emitting two different frequencies of light, for example red light 514 with a wavelengths of substantially 660 nanometers, and infrared light 516 with wavelengths of substantially 940 nanometers. The light 514, 516 is partially transmitted through fingertip 518 and emerges as modulated light 520, 522 respectively, now having a cardiac signal and information about the saturated percentage of oxygen in the blood, referred to as SPO2. **The user's heart rate and other information may be derived from the pulse oximeter signal as well. The information containing light 520,522 strikes light receiving device such as photo transistor 524 which transforms the photonic energy to a corresponding electrical signal transmitted via one or more conductors 536 to interface device 502.**

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	Kreger at 13:36-50. Referring to FIGS. 17 and 18, to determine SPO2 the LEDs 510, 512 may be turned on alternately and without overlapping with power control unit 526 and LED control lines 528, 530 as shown by voltage plots 529, 531 respectively. The information containing light 520, 522 has separate contributions shown in plots 523, 525. **The alternating lights 520, 522 are received and combined (multiplexed) by a single receiver 524 as shown in plot 526. Further processing of the signal to yield SPO2 must separate (demultiplex) the two signals into their individual components 523, 525**. The signals 529, 531, and 533, or information derived therefrom may be supplied to the mobile device 506 to demultiplex the pulse oximeter data as well as other sensor data (see detailed description of FIG. 19 below). Kreger at 13:51-64. In one aspect of another embodiment (not shown), **the biosensor interface apparatus further includes at least on least one receiver capable of receiving a wireless biosensor signal.** The interface apparatus acts as an adapter for the wireless biosensor to utilize the capabilities of the mobile's electrical connectors. Importantly, wireless RF biosensors may need access to the mobile via its electrical connector, for example, with an iPhone® to avoid licensing issues. Kreger at 16:6-13. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants’ Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Kreger, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kreger, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[j]. increase the signal-to-noise ratio by comparing the first signal and the second signal; and	Kreger discloses or renders obvious the detection system further configured to: increase the signal-to-noise ratio by comparing the first signal and the second signal.

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	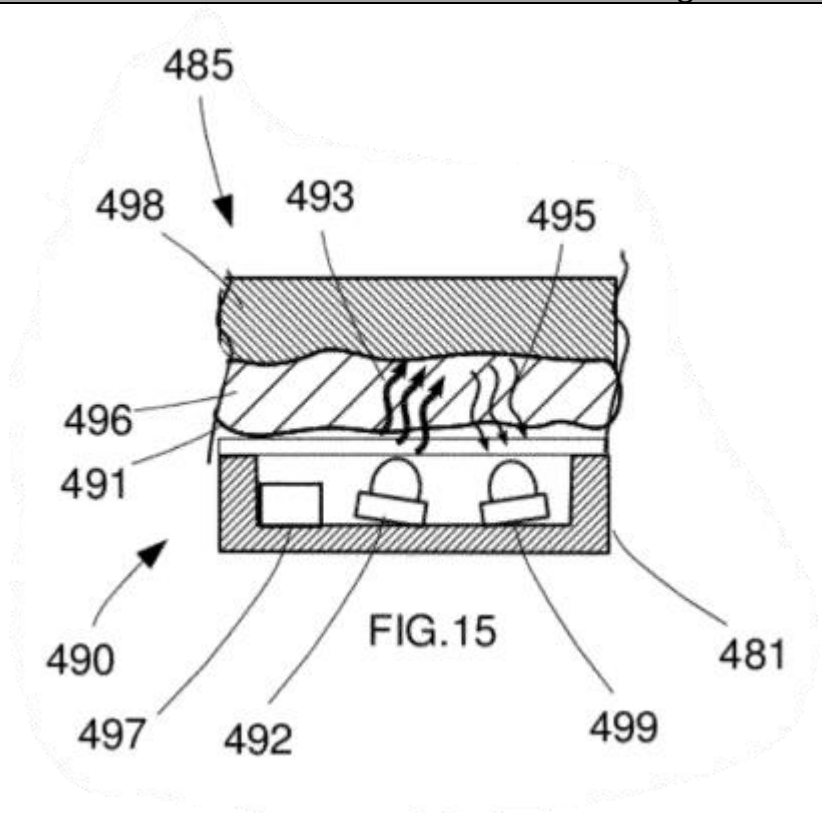 FIG.15 Kreger at Fig. 15. Turning now to FIG. 15, **a cross section of photo plethysmograph 490 taken along axes 15 is shown. Referring also to the PPG 490 shown in isometric view in FIGS. 14 and 16, the PPG 490 contains a light emitting element such IR LED 492. A light 493 is emitted from the LED 492 with a substantially distinct wavelength such as 880 nanometers or 920 nanometers. The light 493 enters the human tissue 496 having a blood flow such as forehead 485. The light is partially absorbed, or otherwise filtered by the blood flowing in the tissue 496, is reflected off bone 498, and emerges as light signal 495 carrying blood flow signal. The light signal 495 is received by the light signal receiving device 499, which transforms the energy from the photons of the light signal 455 into a corresponding electrical signal.** Biosensors may also include a temperature sensor 497 to measure the user's body temperature in thermal communication with the user's skin 491. The PPG 450 and

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	temperature sensor 497 may be contained in sensors housing 481 which can be brought into communication with the user's forehead 456 by using a mounting or retaining device such as hat 483 worn by user 489. **Additionally, PPG 490 and thermal sensor 498 are connected via conductors 470 to interface device 482 which is mated to one or more electrical connectors on smart phone 484. Other embodiments may retain the sensors using a headband, a visor, a cap, other types of hats, adhesive bands, and so forth**. Kreger at 13:4-29. Thus, it is another object to provide compatible signals to the **mobile's electrical connectors which may involve transforming the biosensor signals to match requisite impedance and signal levels, eliminate noise, cancel DC noise and drif**t, demultiplex or multiplex multiple measurements, provide electrical isolation, serialization, synchronization, and so forth. Kreger at 3:17-23. The interface device 20 may also provide a sensors interface circuit 42 which receives biosensor signals on input conductor 24 and transforms the signals to output electrical signals 43 that are output on electrical connector 28. **The interface circuit provides output electrical signals 43 signals that are electrically compatible, for example, with respect to impedance, voltage amplitude, noise levels**, and so forth such that the signals can be received by the mobile's processor via connector 24. Kreger at 6:22-30. Still referring to FIGS. 17 and 18, **the interface device 502 may receive pulse oximeter and other sensors signals on conductors 536 and perform various transformations on the signals. For example, high frequency noise may be reduced with high pass filter538, DC offsets and baseline wander can may be reduced with a low pass filter 440, These filters may be instrumental in creating a signal which is usable for examples as a diagnostic display, an SPO2 calculation, a BPM calculation, and so forth**. Internal mobile device filters, for example such as an anti-aliasing filter for recording inputs or a CODEC filter may be used. Alternatively, internal filters can be reconfigured or disabled to allow, for example, the reception of lower frequency signals by the mobile 12 CODEC 76 or AtoD converter 78.

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	Kreger at 14:4-17. Still referring to FIG. 19, the interface device 552 may receive pulse oximeter, other sensors signals, and synchronizing signals on conductors 567, 568 and perform various transformations on the signals**. For example, high frequency noise, DC offsets and baseline wander may be reduced with a band pass filter570. In addition, proper matching of the electrical characteristics of mobile's electrical connector may provided by matching stage 572, for example, as provided by matching stage 542 above.** Kreger at 14:49-57. **The photo plethysmograph output signal and temperature sensor signal may be communicated from sensors assembly 587 by separate (i.e. parallel) conductors 588, 590 to interface device 582. High frequency noise, DC offsets and baseline wander may be reduced with anti-alias filters592, 593.** The filtered signals are received by the serial AtoD converter 594, which converts them to digital values that are serialized for transmission to serial electrical connector 588 on mobile 586. Kreger at 14:65-15:5. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants’ Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Kreger, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kreger, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[k]. wherein the wearable device is at least in part configured to identify an object.	Kreger discloses or renders obvious the wearable device is at least in part configured to identify an object. **Continuing to refer to FIG. 3, the microprocessor 74 receives one or more biosensor signals and may transform the data into a biosensor measurement such as BPM, or an otherwise useful signal such as a ECG signal suitable for medical diagnosis. The signals and measurements may be stored in memory 12 and may be used for plotting on display 94.** The signals and measurements may also be used to provide information such as a BPM via speaker 98 or via a headset or earpiece (not shown). In addition, biosensor data may be produced by the mobile's internal accelerometer 70 if it is in

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	communication with a human body, thereby serving as a biosensor that may be used to determine the patient's position, respiratory movement, and so forth. Kreger at 7:26-38. **Referring now to FIGS. 4 a and 4 b and also to FIG. 3, the microprocessor 74 may drive a display 94 to display the biosensor signals and measurements derived there from. For example a movement sensor may be used to determine the speed 100 (strides per minute or SPM) or distance traveled 102 by an athlete during a workout. A cardiac sensor my provide an ECG signal 104 which can be used to calculate the heart rate 106.** The speed 100 can be used separately, but preferably in tandem, to perform a cardiac stress exam and determine a patient's stress level. Speed 100 and/or heart rate 106 may also be used to monitor and control an effort level 110, 112 in a workout. As well, effort level 114 may be a target that is set for the workout. Goals may be set and measurements may be displayed on, for example, a workout timer 112, which may show elapsed or remaining time and may have controls to set workout time. Moreover, other measurements such as Calories 116 may be displayed as “Calories elapsed” or “Calories remaining until goal”. Similarly for elapsed or remaining distance 102, a distance goal can be set, for example, in strides, miles, or kilometers. As well, for effort where an actual effort level 122 and a target effort level 120 can be shown graphically and the user may choose a certain effort profile or course such as Hill 124. Kreger at 7:47-8:2. In one aspect of another embodiment**, the biosensor interface apparatus further includes one or more biosensors. The biosensors may be electrodes including ECG electrodes, a photo plethysmograph (PPG), a pulse oximeter, a sphygmomanometer (inflatable blood pressure cuff), a thermometer/temperature sensor, a pedometer, a capnograph, a respiratory movement sensor, a respiratory flow sensor, a transdermal blood alcohol sensor, and a blood sugar sensor (glucometer). Thus it is an object to provide for a wide range of common medical and sport/fitness biosensors in a single compact interface apparatus**. Kreger at 3:24-34. **Continuing with FIG. 1, the biosensor is shown as a pulse oximeter 14 in communication with finger 16. The pulse oximeter may provide a pulse signal to calculate BPM, a SPO2 reading, or a**

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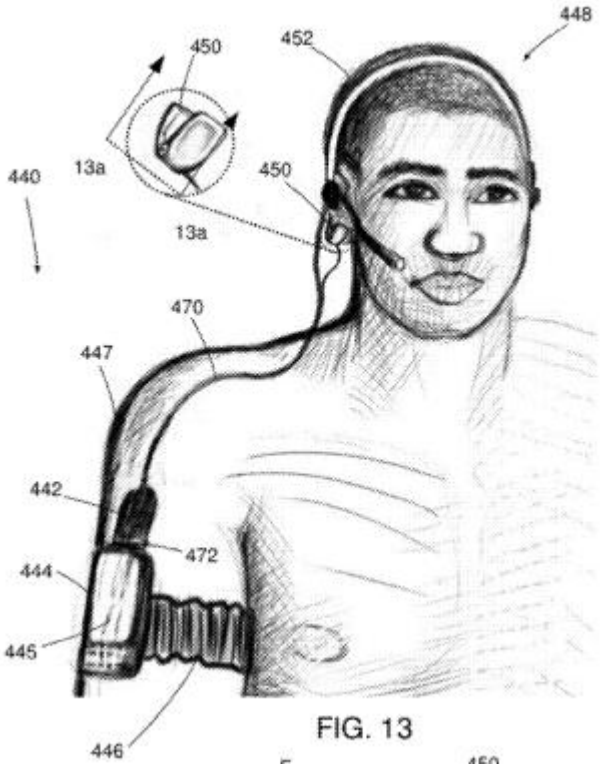
	diagnostic cardiac waveform. The pulse oximeter 14 may be retained against the base of finger 16 using a mounting device that may be worn on the finger or hand, shown as gauntlet 18. Alternatively, the pulse oximeter may be worn on the fingertip, ear, forehead, or nasal septum using various mounting devices such as rings, clips, elastic straps, and adhesive pads. Kreger at 5:54-63.  FIG. 13 Kreger at Fig.13. Turning now to FIG. 13, an embodiment of the interface apparatus 440 comprises an interface device 442 that may connect multiple medical or other biosensors to a mobile device such as smart phone 444 via electrical connector, for example 472. **The biosensors may include a sphygmomanometer such as inflatable blood pressure cuff 446 to measure or monitor the user's blood pressure. The blood**

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	pressure cuff 446 may be in communication with the user's arm 447 and may also house or otherwise carry mobile 444. The embodiment of interface apparatus 440 may also have an integral headset 448 worn by user 452, and a PPG 450, for example, attached to the user's earlobe. Mobile device smart phone 444 may derive measurements and display plots of the biosensor data on its display 445. Smart phone 444 may also transmit the patient's biosensor data and measurements using one or more internal RF transmitters, for example, over the mobile's data network, or as as modulated data, using frequency shift key (FSK), phase shift key (PSK) encoding or like modulation schemes over the mobile's voice network. In addition, the mobile 444 may transmit the data over a serial cable or an RF bluetooth channel, to a PC or other computing device, or via various other such wireless and wired interfaces, such as 3G, 4G, wired and wireless Ethernet and the like. Kreger at 12:5-28. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants’ Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Kreger, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Kreger, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.

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EXHIBIT F14

U.S. Pat. No. 12,193,790 in view of
U.S. Patent No. 7,507,207 to Kazuhiro Sakai ("Sakai")

As described in detail below, Sakai (individually or collectively) anticipates and/or renders obvious claim 7 ("Asserted Claim") of U.S. Patent No. 12,193,790 (the "'790 Patent") under 35 U.S.C. §102 and/or §103, either alone in combination with the knowledge of a person of ordinary skill, and/or additional prior art references discussed in discussed in Exhibits F1-F14, the contents of which are hereby incorporated by reference into this chart. One of ordinary skill in the art, as of the priority date of the '790 Patent, would have known to combine the prior art elements disclosed by the foregoing references using known methods, and to use these elements according to their established functions in order to achieve a known and predictable result. This invalidity claim chart is based on Defendants' present understanding of the Asserted Claim and Plaintiff's apparent construction of the Asserted Claim in its Preliminary Infringement Contentions ("Infringement Contentions").

The following invalidity chart includes references to the structure, function, operation, and/or features of the technology described in Sakai. The cited portions of Sakai are merely illustrative, and Defendants reserve the right to rely on alternative or additional evidence, including uncited portions of Sakai. Where a particular figure is cited, the citation should be understood to encompass the caption and description of the figure as well as any text relating to or describing the figure. Conversely, where particular text referring to a figure is cited, the citation should be understood to include the figure as well. Although the documentation collectively evidences prior knowledge, use, or sale, Defendants reserve the right to rely upon individual documents as printed publications. Where the chart below states that Sakai "describes" or "provides for" a limitation, such disclosure may be express, inherent, or implicit. To the extent it is found Sakai does not expressly disclose certain limitations in the Asserted Claim, such limitations are inherent. Defendants reserve the right to present direct evidence of the structure, function, operation, and/or features of the technology described in Sakai (including product samples, source code, and/or witness testimony) and/or its prior art status, and to present alternative or additional documents concerning the same as evidence that the technology described in Sakai anticipates and/or renders obvious the Asserted Claim of the '790 Patent

This chart is subject to all reservations, objections, and disclaimers in Defendants' Invalidity Contentions and any amendment, supplement, or modification thereof, which are incorporated herein by reference in their entirety. Nothing stated herein shall be treated as an admission or suggestion that Defendants agree with Plaintiff regarding the scope of the Asserted Claim, Plaintiff's apparent claim constructions, or the accuracy of any particular claim construction. Defendants reserve all rights to challenge any of the claim terms herein under 35 U.S.C. § 112, including by arguing that they are indefinite, are not supported by the written description, and/or are not enabled. Defendants further reserve all rights to amend this invalidity claim chart without leave of court pursuant to the Court's Docket Control Order, or upon a showing of good cause.

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’790 Patent	Sakai
Claim 7	
7[pre]. An optical system, comprising:	By providing this disclosure, the Defendant does not take a position on whether the preamble is limiting. Sakai discloses or renders obvious an optical system. **In a portable biological information monitor apparatus, a pulse wave detection signal obtained by light emission from a green LED and a body motion detection signal obtained by light emission from an infrared LED are detected as biological information.** This biological information is analyzed to compute various barometers. In a wake normal mode of a set generation mode, body motion and pulse are calculated as wake evaluation barometers for evaluation of a test subject's status in wake. In a wake steady state motion mode, body motion, pulse, and pitch are calculated as motion evaluation barometers for evaluation of the test subject's status in steady state motion. In a sleep mode, body motion, pulse, and autonomic nervous function are calculated as sleep evaluation barometers for evaluation of the test subject's status in sleep. Necessary barometers are thereby generated regardless of the test subject's action using the portable monitor apparatus alone. Sakai at [Abstract] **An operation button 3 a, a display panel 3 b, a light emission diode (LED) 3 c for operation check, and an LED 3 d for charging check are provided on the front surface of the main body 3. A detection window 3 e for transmitting light used in biological information detection and a connector 3 f for connection with the cable C extended from the charger 30 are provided on the back surface of the main body 3. Further, the main body 3 is water-proof coated such that the test subject can have a bath while wearing the monitor 1.** Sakai at 4:54-62. **The information detection unit 10 has an optical pulse wave and body motion sensor 11 having a green LED 11 a to emit green light (in the present embodiment, the wavelength is about 520 nm), an infrared LED 11 b to emit infrared light (in the present embodiment, the wavelength is about 950 nm), and a photo diode (PD) 11 c to receive reflected light from the LEDs 11 a and 11 b; a driver 12 which drives the LEDs 11 a and 11 b in accordance with instructions from the information processor 20; a detector 13 which drives the PD 11 c and generates a detection signal in correspondence with the intensity of reflected light; and an A/D converter 14 which converts the detection signal from the detector 13 into digital data.**

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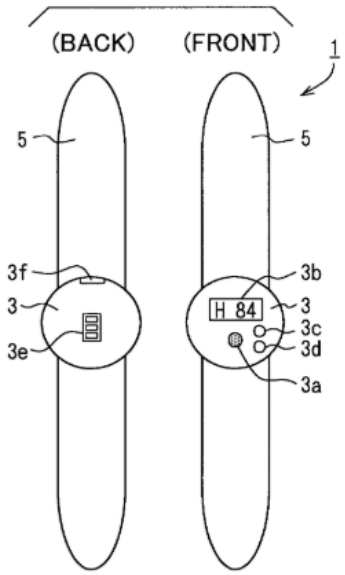
	Sakai at 5:13-24. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants’ Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Sakai, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Sakai, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[a]. a wearable device for measuring one or more physiological parameters, the wearable device adapted to be placed on a wrist of a user;	Sakai discloses or renders obvious a wearable device for measuring one or more physiological parameters, the wearable device adapted to be placed on a wrist of a user. FIG. 2A  Sakai at Fig. 2A.

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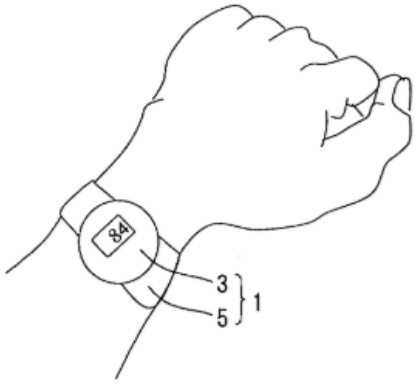
	FIGS. 2A and 2B are explanatory views showing the arrangement of the monitor and the monitor apparatus in use. As shown in FIG. 2A, the monitor 1 has a main body 3 formed to approximately have a size of wrist watch, and a belt-type attachment portion 5 integrally formed with the main body 3. Sakai at 4:49-53. FIG. 2B  Sakai at Fig. 2B. **As shown in FIG. 2B, the monitor 1 is fixed around the test subject's wrist or ankle with the attachment portion 5 when the monitor apparatus is used such that the detection window 3 e on the back surface of the main body 3 is in contact with the test subject's skin.** The attachment position is not limited to the wrist or ankle but may be set in any position from a finger tip to a root of all limbs. Further, the attachment portion 5 may be a supporter member in place of the belt. Sakai at 4:63-5:3. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the

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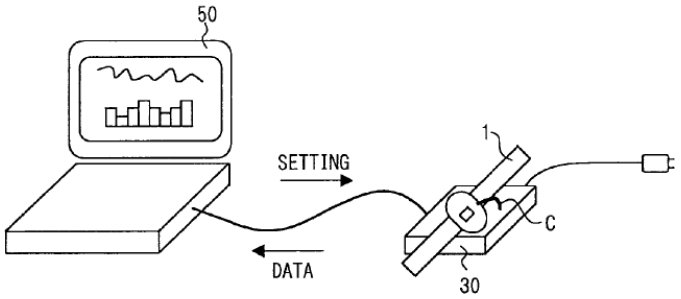
	art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants' Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Sakai, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Sakai, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[b]. the wearable device including a light source comprising a plurality of semiconductor diodes that are configured to generate an output optical light having one or more optical wavelengths, wherein at least a portion of the one or more optical wavelengths is a near-infrared wavelength between 700 nanometers and 2500 nanometers;	Sakai discloses or renders obvious the wearable device including a light source comprising a plurality of semiconductor diodes that are configured to generate an output optical light having one or more optical wavelengths, wherein at least a portion of the one or more optical wavelengths is a near-infrared wavelength between 700 nanometers and 2500 nanometers. FIG. 1  Sakai at Fig.1 **As shown in FIG. 1, the physical condition management system of the present embodiment has a portable biological information monitor apparatus 1 (hereinbelow, simply referred to as a "monitor") which is attached to a test subject as the subject of management** when **the apparatus is used; a charger 30 which charges the monitor 1 and interfaces communication with the monitor 1 via a cable C attachable to and removable from the monitor 1; and an information management unit 50 which performs communication with the monitor 1 via the charger 30 to thereby change internal settings of the monitor 1, and performs various processings based on data obtained from the monitor 1**. Sakai at 4:16-27

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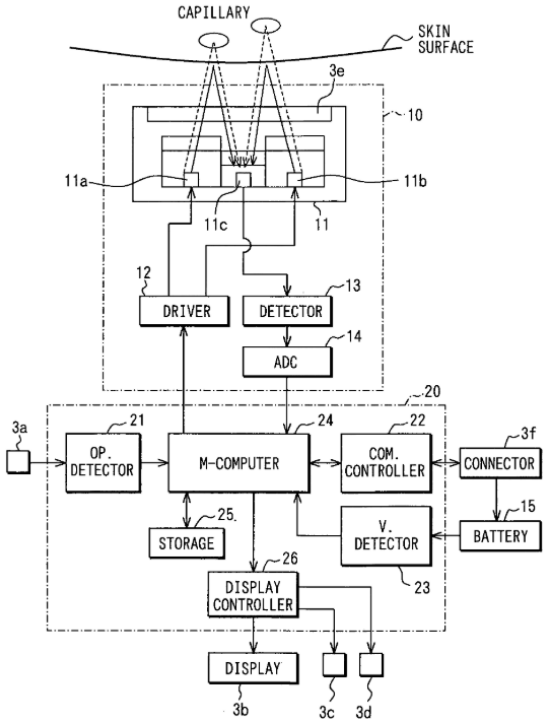
	FIG. 3  Sakai at Fig. 3. FIG. 3 is a block diagram showing the construction of the monitor 1. **As shown in FIG. 3, the monitor 1 has an information detection unit 10 which emits light via the detection window 3 e and receives reflected light to thereby detect biological information; an information processor 20 which processes the biological information detected by the information detection unit 10**; and a battery 15 chargeable via the cable connected to the connector 3 f, which supplies power to the respective elements of the apparatus. **The information detection unit 10 has an optical pulse wave and body motion sensor 11 having a green LED 11 a to emit green light (in the present embodiment, the wavelength is about 520 nm), an infrared LED 11 b to emit infrared light (in the present embodiment, the wavelength is about**

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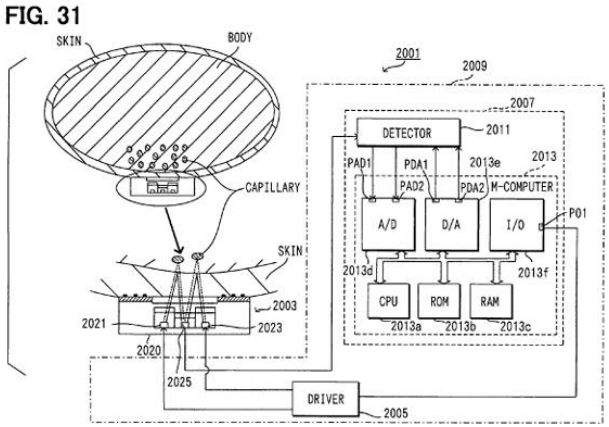
	950 nm), and a photo diode (PD) 11 c to receive reflected light from the LEDs 11 a and 11 b; a driver 12 which drives the LEDs 11 a and 11 b in accordance with instructions from the information processor 20; a detector 13 which drives the PD 11 c and generates a detection signal in correspondence with the intensity of reflected light; and an A/D converter 14 which converts the detection signal from the detector 13 into digital data. Sakai at 5:04-24  Sakai at Fig.31 **A pulse wave detection apparatus 2001 according to the present embodiment detects a human body's pulse rate. As shown in FIG. 31, the pulse wave detection apparatus 2001 has a pulse wave sensor 2003 including an infrared LED 2021 and a green LED 2023 as light emission devices; a photo diode (PD) 2025 as a photoreception device; a driver 2005 which drives the pulse wave sensor 2003 by outputting driving signals to the infrared LED 2021 and the green LED 2023 to emit light at different timings; and a data processing unit 2007 which processes a signal from the pulse wave sensor 2003 and controls the driver 2005**. Note that the driver 2005 and the data processing unit 2007 are accommodated in a casing of a pulse wave detection apparatus main body 2009.

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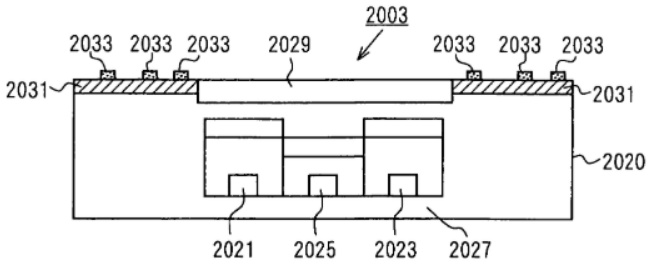
	FIG. 32A  Sakai at Fig. 32A. First, the **construction of the pulse wave sensor 2003 will be described with reference to FIGS. 32A and 32B. FIG. 32A is a cross-sectional view showing the structure of the pulse wave sensor 2003. FIG. 32B is a plan view showing the pulse wave sensor 2003 from the side in contact with human skin**. **The pulse wave sensor 2003 is fixed to human body's arm or the like when it is used. As shown in FIG. 32A, the pulse wave sensor is an optical reflective type sensor having the infrared LED 2021 to emit infrared light having a wavelength of about 940 nm, the green LED 2023 to emit green light having a wavelength of about 520 nm, and the PD 2025 to receive light and output a signal corresponding to the amount of received light (photoreception signal).** **The infrared LED 2021, the green LED 2023, and the PD 2025 are arrayed in a bottom 2027 of a casing 2020 of the pulse wave sensor 2003 such that the PD 2025 is positioned between the infrared LED 2021 and the green LED 2023**. Infrared light or green light is emitted to the human body via a light transmitting plate 2029. Sakai at 28:01-32 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants’ Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Sakai, it would

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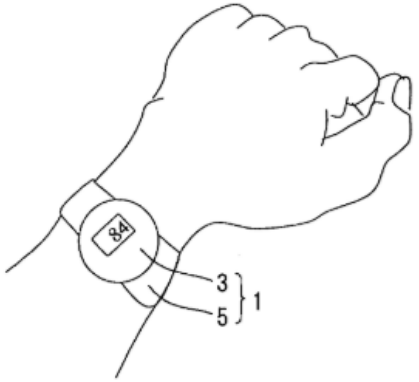
	have been obvious to one of ordinary skill in the art to combine, with the teachings of Sakai, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[c]. the wearable device comprising one or more lenses configured to receive at least a portion of the output optical light and to deliver a lens output light to tissue comprising skin;	Sakai discloses or renders obvious the wearable device comprising one or more lenses configured to receive at least a portion of the output optical light and to deliver a lens output light to tissue comprising skin. An operation button 3 a, a display panel 3 b, a light emission diode (LED) 3 c for operation check, and an LED 3 d for charging check are provided on the front surface of the main body 3. **A detection window 3 e for transmitting light used in biological information detection and a connector 3 f for connection with the cable C extended from the charger 30 are provided on the back surface of the main body 3.** Further, the main body 3 is water-proof coated such that the test subject can have a bath while wearing the monitor 1. Sakai at 4:54-62. FIG. 2B  Sakai at Fig. 2B.

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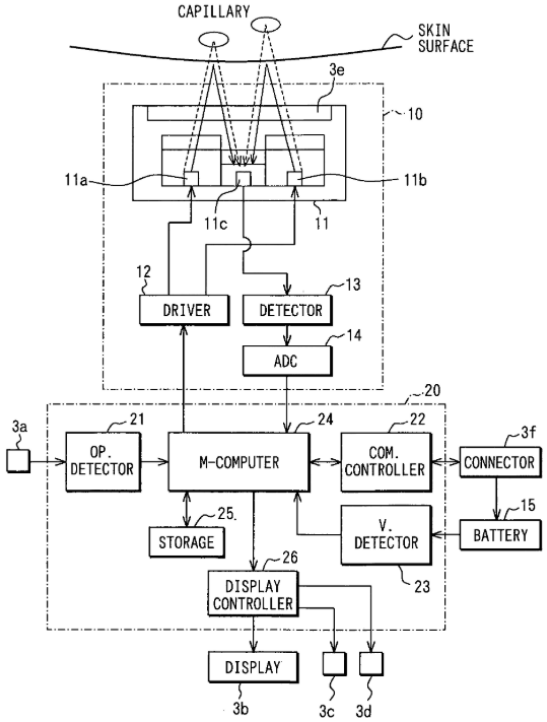
	As shown in FIG. 2B, **the monitor 1 is fixed around the test subject's wrist or ankle with the attachment portion 5 when the monitor apparatus is used such that the detection window 3 e on the back surface of the main body 3 is in contact with the test subject's skin.** The attachment position is not limited to the wrist or ankle but may be set in any position from a finger tip to a root of all limbs. Further, the attachment portion 5 may be a supporter member in place of the belt. Sakai at 4:63-5:3. FIG. 3  Sakai at Fig. 3.

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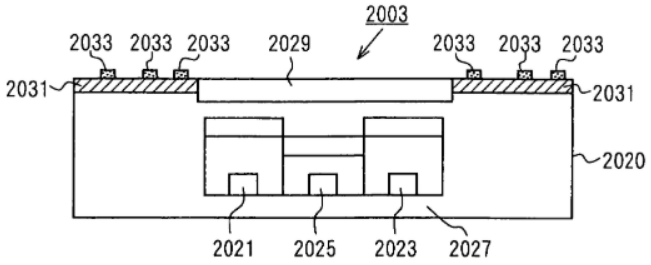
	FIG. 3 is a block diagram showing the construction of the monitor 1. As shown in FIG. 3, **the monitor 1 has an information detection unit 10 which emits light via the detection window 3 e and receives reflected light to thereby detect biological information; an information processor 20 which processes the biological information detected by the information detection unit 10**; and a battery 15 chargeable via the cable connected to the connector 3 f, which supplies power to the respective elements of the apparatus. Sakai at 5:4-12. FIG. 32A  Sakai at Fig. 32A. **The pulse wave sensor 2003 is fixed to human body's arm or the like when it is used. As shown in FIG. 32A, the pulse wave sensor is an optical reflective type sensor having the infrared LED 2021 to emit infrared light having a wavelength of about 940 nm, the green LED 2023 to emit green light having a wavelength of about 520 nm, and the PD 2025 to receive light and output a signal corresponding to the amount of received light (photoreception signal).** Sakai at 28:19-26. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants' Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Sakai, it would

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	have been obvious to one of ordinary skill in the art to combine, with the teachings of Sakai, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[d]. the wearable device further comprising a detection system configured to receive at least a portion of the lens output light reflected from the tissue and to generate an output signal having a signal-to-noise ratio, wherein the detection system is configured to be synchronized to the light source;	Sakai discloses or renders obvious the wearable device further comprising a detection system configured to receive at least a portion of the lens output light reflected from the tissue and to generate an output signal having a signal-to-noise ratio, wherein the detection system is configured to be synchronized to the light source. **The present embodiment has been made in view of this problem, and provides a pulse wave detection apparatus to eliminate the influence of sunlight and detect a pulse wave with high accuracy.** Sakai at 27:64-67. **As the human body's pulse wave can be detected in consideration of light component due to external light in photoreception signal upon light emission from the infrared LED 2021 or the green LED 2023, the influence of external light can be eliminated and the pulse wave can be detected with high accuracy.** Sakai at 33:50-55. Note that as the blood stream is also influenced by body motion, **the detection signal from the PD 11 c includes a body motion component synchronized with body motion as well as a pulse component synchronized with pulse (see FIG. 8).** Further, all the emitted light does not arrive at the capillary artery, and light reflected from the body surface (surface reflected light) is also received with the PD 11 c. The surface reflected light also includes a body motion component. Sakai at 17:59-67. When the driver 12 is started in accordance with a command from the information processor 20, the driver 12 drives the LEDs 11 a and 11 b alternately at different timings, by preset sampling interval (50 msec in the present embodiment). Further, **the A/D converter 14 operates in synchronization with the light emission timing of the driver 12, to thereby convert the pulse wave detection signal detected upon light emission from the green LED 11 a and the body motion detection signal detected upon**

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	light emission from the infrared LED 11 b into digital data, and provides these digital data, as biological information, to the information processor 20. Sakai at 5:66-6:9. The information detection unit 10 has an optical pulse wave and body motion sensor 11 having a green LED 11 a to emit green light (in the present embodiment, the wavelength is about 520 nm), an infrared LED 11 b to emit infrared light (in the present embodiment, the wavelength is about 950 nm), **and a photo diode (PD) 11 c to receive reflected light from the LEDs 11 a and 11 b; a driver 12 which drives the LEDs 11 a and 11 b in accordance with instructions from the information processor 20; a detector 13 which drives the PD 11 c and generates a detection signal in correspondence with the intensity of reflected light; and an A/D converter 14 which converts the detection signal from the detector 13 into digital data.** Sakai at 5:13-24. **Further, the A/D converter 1014 operates in synchronization with the light emission timing of the driver 1012 to thereby convert the pulse wave detection signal detected upon light emission from the green LED 1011 a and the body motion detection signal detected upon light emission from the infrared LED 1011 b into digital data. The A/D converter 1014 then provides the digital data, as biological information, to the information processor 1020.** Sakai at 18:42-49. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants’ Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Sakai, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Sakai, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[e]. wherein the detection system comprises a plurality of detectors that are spatially	Sakai discloses or renders obvious the detection system comprises a plurality of detectors that are spatially separated from each other, and wherein at least one analog to digital converter is coupled to at least one of the plurality of detectors.

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separated from each other, and wherein at least one analog to digital converter is coupled to at least one of the plurality of detectors;	The information detection unit 10 has an optical pulse wave and body motion sensor 11 having a green LED 11 a to emit green light (in the present embodiment, the wavelength is about 520 nm), an infrared LED 11 b to emit infrared light (in the present embodiment, the wavelength is about 950 nm), **and a photo diode (PD) 11 c to receive reflected light from the LEDs 11 a and 11 b; a driver 12 which drives the LEDs 11 a and 11 b in accordance with instructions from the information processor 20; a detector 13 which drives the PD 11 c and generates a detection signal in correspondence with the intensity of reflected light; and an A/D converter 14 which converts the detection signal from the detector 13 into digital data.** Sakai at 5:13-24. **Further, the A/D converter 1014 operates in synchronization with the light emission timing of the driver 1012 to thereby convert the pulse wave detection signal detected upon light emission from the green LED 1011 a and the body motion detection signal detected upon light emission from the infrared LED 1011 b into digital data. The A/D converter 1014 then provides the digital data, as biological information, to the information processor 1020.** Sakai at 18:42-49. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants’ Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Sakai, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Sakai, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[f]. wherein the output signal is indicative of the one or more of the physiological parameters;	Sakai discloses or renders obvious the output signal is indicative of the one or more of the physiological parameters. **In a portable biological information monitor apparatus, a pulse wave detection signal obtained by light emission from a green LED and a body motion detection signal obtained by light emission from an infrared LED are detected as biological information. This biological information is analyzed to compute various barometers. In a wake normal mode of a set generation mode, body**

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	motion and pulse are calculated as wake evaluation barometers for evaluation of a test subject's status in wake. In a wake steady state motion mode, body motion, pulse, and pitch are calculated as motion evaluation barometers for evaluation of the test subject's status in steady state motion. In a sleep mode, body motion, pulse, and autonomic nervous function are calculated as sleep evaluation barometers for evaluation of the test subject's status in sleep. Necessary barometers are thereby generated regardless of the test subject's action using the portable monitor apparatus alone. Sakai at [Abstract] Next, FIG. 13 is a block diagram showing the construction of the biological status detection apparatus. As shown in FIG. 13, **the biological status detection apparatus 1001 has an information detection unit 1010 which emits light via the light transmitting plate 1003 b and receives reflected light thereby detects biological information, an information processor 1020 which processes the biological information detected by the information detection unit 1010**, and a battery 1015 chargeable via the cable connected to the connector 1003 c, which supplies power to the respective elements of the apparatus. Sakai at 17:1-11. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants’ Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Sakai, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Sakai, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[g]. the wearable device configured to increase the signal-to-noise ratio by increasing light intensity of at least one of the plurality of semiconductor diodes from an initial light intensity; and	Sakai discloses or renders obvious the wearable device configured to increase the signal-to-noise ratio by increasing light intensity of at least one of the plurality of semiconductor diodes from an initial light intensity. **The present embodiment has been made in view of this problem, and provides a pulse wave detection apparatus to eliminate the influence of sunlight and detect a pulse wave with high accuracy**.

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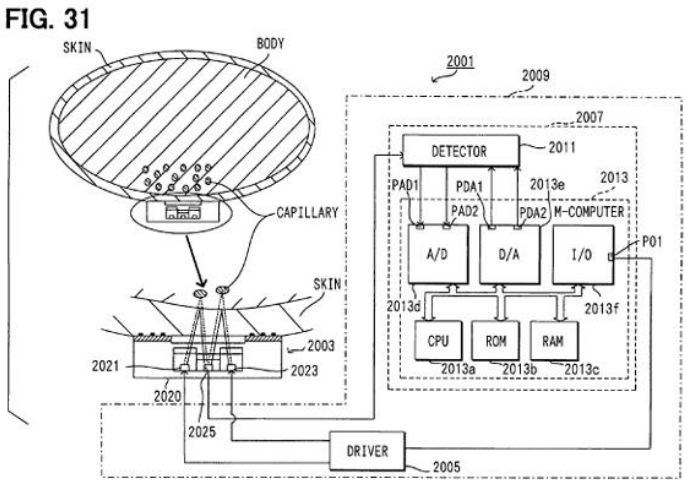
	Sakai at 27:64-67  Sakai at Fig.31 **A pulse wave detection apparatus 2001 according to the present embodiment detects a human body's pulse rate. As shown in FIG. 31, the pulse wave detection apparatus 2001 has a pulse wave sensor 2003 including an infrared LED 2021 and a green LED 2023 as light emission devices; a photo diode (PD) 2025 as a photoreception device; a driver 2005 which drives the pulse wave sensor 2003 by outputting driving signals to the infrared LED 2021 and the green LED 2023 to emit light at different timings; and a data processing unit 2007 which processes a signal from the pulse wave sensor 2003 and controls the driver 2005**. Note that the driver 2005 and the data processing unit 2007 are accommodated in a casing of a pulse wave detection apparatus main body 2009. Sakai at 28:01-13 **The direct current component is based on the changes in light amount accompanied by blood stream changes due to as follows: expansion and contraction of blood vessel (hereinbelow, referred to as "noise A"); the change of amount of light scattered on the skin surface accompanied by shift of the pulse wave sensor 2003 (hereinbelow, referred to as "noise B"); and the change of amount**

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	of light incident from the outside of the pulse wave sensor 2003 (e.g., sunlight) etc. The direct current component is cut with the detector 2011 using a method to be described later. Sakai at 29:49-58 As shown in FIG. 31, **the microcomputer 2013 has a CPU 2013 a which performs processing based on predetermined processing programs, a ROM 2013 b in which various control programs are stored, a RAM 2013 c in which various memories for storing various data are provided, an A/D converter 2013 d which converts a voltage value of analog signal into 10-bit digital value, a D/A converter 2013 e which converts the 10-bit digital data generated by the CPU 2013 a into an analog signal, and an input/output port 2013 f having multiple input ports to input various digital signals and multiple output ports to output various digital signals.** Note that as shown in FIG. 31, **the A/D converter 2013 d has the A/D ports PAD1 and PAD2 to input analog signals, and the D/A converter 2013 e has the D/A ports PDA1 and PDA2 to output analog signals**. Further, as shown in FIG. 31, **the input/output port 2013 f has an output port PO1. A driver 2007 is connected to the output port PO1**. **In the microcomputer 2013 having the above construction, the CPU 2013 a performs processing for outputting a signal having a component corresponding to the above noise A and noise B from the above-described direct current component signal, and processing for outputting a signal having a component corresponding to external light**. First, **the processing for outputting a signal having a component corresponding to the noise A and the noise B will be described. The frequency of voltage fluctuation of photoreception signal due to the noise A and the noise B is sufficiently low in comparison with a pulse component, and the voltage fluctuation due to these noises is small in a short period. Accordingly, the CPU 2013 a analyzes the voltage fluctuation of photoreception signal within each predetermined period (e.g., 10 seconds), thereby controls output values in the D/A ports PDA1 and PDA2 in correspondence with the voltage fluctuation due to the noise A and the noise B. Thus direct current component signal corresponding to the noise A and the noise B is outputted from the corrector 2043. That is, the voltage value of the direct current component can be controlled by each time**.

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	Next, external light control processing for outputting a signal having a component corresponding to the external light (hereinbelow, referred to as a “external light reception signal”) will be described with reference to FIG. 34. **FIG. 34 is a flowchart showing the external light control processing. The external light control processing is repeatedly performed upon each light emission from the infrared LED 2021 and the green LED 2023 while the CPU 2013 a is activated (power ON).** **In the external light control processing, first, at Step S2010, the CPU 2013 a obtains data on the voltage value of signal inputted in the A/D port PAD2. Then at Step S2020, it is determined whether or not the voltage value data obtained at Step S2010 is the same as the voltage value data previously obtained from the A/D port PAD2. When it is determined that the currently obtained voltage value data is the same as the previously obtained data (Step S2020: YES), the process proceeds to Step S2050. On the other hand, when it is determined that the currently obtained voltage value data is not the same as that previously obtained data (Step S2020: NO), the process proceeds to Step S2030**. **At Step S2030, the voltage fluctuation in the output from the D/A ports PDA1 and PDA2 is calculated based on a difference value between the voltage value obtained at Step S2010 and the previously obtained voltage value. Further, at Step S2040, present output values in the D/A ports PDA1 and PDA2 are controlled in correspondence with the voltage fluctuation calculated at Step S2030**. Thereafter, the process proceeds to Step S2050. **At Step S2050, light emission from the green LED 2023 is performed, and data on voltage value of signal inputted into the A/D port PAD1 is obtained. Further, at Step S2060, light emission from the infrared LED 2021 is performed, and data on voltage value of signal inputted into the A/D port PAD 1 is obtained, and the external light controlling processing ends.** **That is, in the external light control processing, a photoreception signal from the PD 2025 when the infrared LED 2021 and the green LED 2023 do not emit light is regarded as an external light reception signal, and voltage values of analog signals outputted from the D/A ports PDA1 and PDA2 are controlled in correspondence with the voltage value of the external light reception signal**. In **the pulse wave detection apparatus 2001 having the above construction, immediately before light emission from the green LED 2023, light received by the PD 2025 is detected as an external light reception signal (Step S2010), and the external light reception signal is outputted (Step S2020 to Step S2040). Then, light emission is performed in the green LED 2023 then in the infrared LED**

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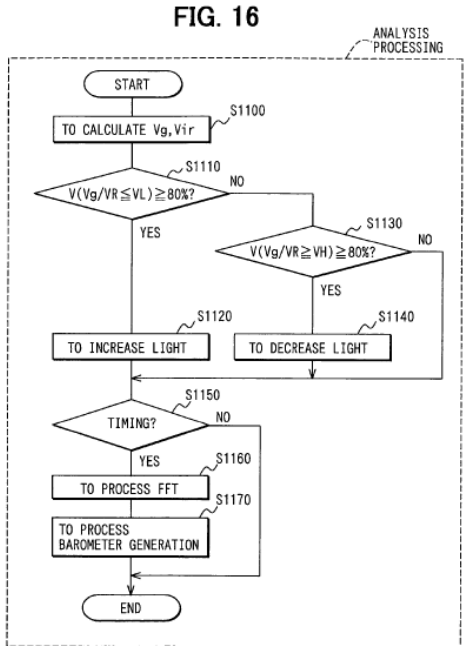
	2021. Then differentiation is performed between a photoreception signal, outputted from the PD 2025 upon light emission from the green LED 2023 or the infrared LED 2021, and the external light reception signal in the amplifier 2041, and a differentiated signal is obtained (Step S2050 to Step S2060); thereby, a pulse wave is detected. As **the human body's pulse wave can be detected in consideration of light component due to external light in photoreception signal upon light emission from the infrared LED 2021 or the green LED 2023, the influence of external light can be eliminated and the pulse wave can be detected with high accuracy**. Sakai at 32:23-33:55  Sakai at Fig. 16 Hereinbelow, the details of the analysis processing and the barometer generation processing according to the present embodiment will be described. **FIG. 16 is a flowchart showing the contents of the**

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	analysis processing. Note that when **the information detection unit 1010 has been started, the analysis processing is started by a preset time interval (in the present embodiment, 1 second). Further, upon starting of the information detection unit 1010, the driver 1012 is initialized to a setting to cause light emission from the LEDs 1011 a and 1011 b at a maximum intensity**. When **the process starts, with regard to the respective pulse wave detection signal and body motion detection signal, an amplitude Vg of the pulse wave detection signal and an amplitude Vir of the body motion detection signal are calculated based on digital data (in the present embodiment, 20 data) obtained within a unit section (i.e., 1 second) from the previous startup to the current time point (Step S1100)**. More particularly, as shown in FIG. 17A, **a maximum value and a minimum value in the digital data obtained in the unit section are extracted, and the difference is obtained as the amplitudes Vg and Vir**. Next, **with a voltage range where the pulse wave detection signal is detected as VR (see FIG. 17B), it is determined whether or not the percentage of unit sections, where Vg/VR is equal to or less than a lower limit value VL (in the present embodiment, 0.1) within a past preset period (in the present embodiment, 20 seconds), is equal to or higher than a predetermined percentage (in the present embodiment, 80%) (Step S1110). When the percentage is the predetermined or higher percentage, it is determined that the amount of light in the LEDs 1011 a and 1011 b are insufficient. Then a command to increase the light emission intensity is outputted to the driver 1012 (Step S1120)**. Sakai at 19:33-65 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants' Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Sakai, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Sakai, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[h]. the detection system further configured to:	Sakai discloses or renders obvious the detection system further configured to: generate a first signal responsive to light received while the semiconductor diodes are off.

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generate a first signal responsive to light received while the semiconductor diodes are off,	The information processor 20 has an operation detector 21 which detects an operation made with an operation button 3 a; a communication controller 22 which detects cable connection with and disconnection from the connector 3 f and controls communication with an external device via the cable connected to the connector 3 f; a voltage detector 23 which detects a voltage of the battery 15; a microcomputer 24 which performs processing for generating barometers from biological information detected by the information detection unit 10, monitoring of battery voltage via the voltage detector 23, communication processing for communication with the external device via the communication controller 22; **a storage unit 25 which holds the biological information detected by the information detection unit 10 and various information generated by the microcomputer 24 based on the biological information; and a display controller 26 which displays characters and figures on the display panel 3 b and turns on and off the LEDs 3 c and 3 d in accordance with instructions from the microcomputer 24.** Sakai at 6:10-28. **That is, in the external light control processing, a photoreception signal from the PD 2025 when the infrared LED 2021 and the green LED 2023 do not emit light is regarded as an external light reception signal, and voltage values of analog signals outputted from the D/A ports PDA1 and PDA2 are controlled in correspondence with the voltage value of the external light reception signal.** Sakai at 33:30-36. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants' Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Sakai, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Sakai, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[i]. generate a second signal responsive to light received while at least one of the semiconductor diodes is on, and	Sakai discloses or renders obvious the detection system further configured to: generate a second signal responsive to light received while at least one of the semiconductor diodes is on. The information processor 20 has an operation detector 21 which detects an operation made with an operation button 3 a; a communication controller 22 which detects cable connection with and

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	disconnection from the connector 3 f and controls communication with an external device via the cable connected to the connector 3 f; a voltage detector 23 which detects a voltage of the battery 15; a microcomputer 24 which performs processing for generating barometers from biological information detected by the information detection unit 10, monitoring of battery voltage via the voltage detector 23, communication processing for communication with the external device via the communication controller 22; **a storage unit 25 which holds the biological information detected by the information detection unit 10 and various information generated by the microcomputer 24 based on the biological information; and a display controller 26 which displays characters and figures on the display panel 3 b and turns on and off the LEDs 3 c and 3 d in accordance with instructions from the microcomputer 24.** Sakai at 6:10-28. Next, external light control processing for outputting a signal having a component corresponding to the external light (hereinbelow, referred to as a "external light reception signal") will be described with reference to FIG. 34. FIG. 34 is a flowchart showing the external light control processing. **The external light control processing is repeatedly performed upon each light emission from the infrared LED 2021 and the green LED 2023 while the CPU 2013 a is activated (power ON).** **In the external light control processing, first, at Step S2010, the CPU 2013 a obtains data on the voltage value of signal inputted in the A/D port PAD2.** Then at Step S2020, it is determined whether or not the voltage value data obtained at Step S2010 is the same as the voltage value data previously obtained from the A/D port PAD2. When it is determined that the currently obtained voltage value data is the same as the previously obtained data (Step S2020: YES), the process proceeds to Step S2050. On the other hand, when it is determined that the currently obtained voltage value data is not the same as that previously obtained data (Step S2020: NO), the process proceeds to Step S2030. Sakai at 32:62-33:15. Next, the main processing performed by the microcomputer 24 will be described in accordance with the flowchart of FIG. 4. **When the power is turned on and the present processing is started, first, it is determined based on an input from the operation detector 21 whether or not a mode setting operation has been made via the operation button 3 a (Step S100); then it is determined whether or not it is generation timing to analyze biological information detected by the information detection unit 10 and generate barometers (Step S120)**; then it is determined based on an input from

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	the communication controller 22 whether or not the cable is connected to the connector 3 f (Step S160); and it is determined based on an input from the voltage detector 23 whether or not the charging amount of the battery 15 is insufficient (Step S180). When the determinations are all negative (NO), these determinations are repeatedly performed as a stand-by status. Sakai at 6:44-59. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants’ Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Sakai, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Sakai, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[j]. increase the signal-to-noise ratio by comparing the first signal and the second signal; and	Sakai discloses or renders obvious the detection system further configured to: increase the signal-to-noise ratio by comparing the first signal and the second signal. **The present embodiment has been made in view of this problem, and provides a pulse wave detection apparatus to eliminate the influence of sunlight and detect a pulse wave with high accuracy**. Sakai at 27:64-67

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	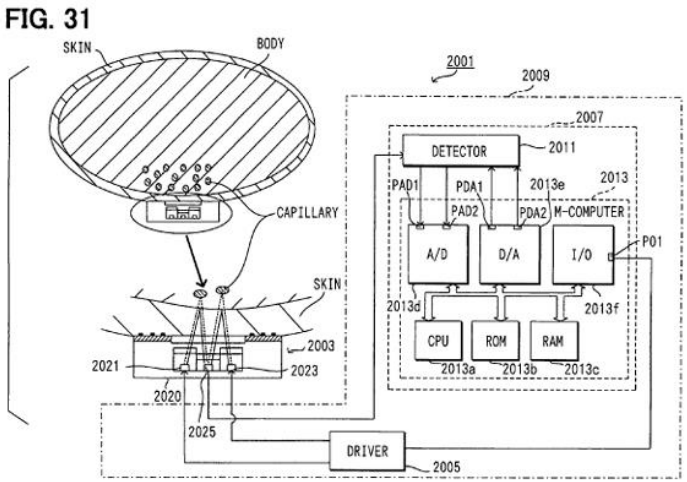 Sakai at Fig.31 **A pulse wave detection apparatus 2001 according to the present embodiment detects a human body's pulse rate. As shown in FIG. 31, the pulse wave detection apparatus 2001 has a pulse wave sensor 2003 including an infrared LED 2021 and a green LED 2023 as light emission devices; a photo diode (PD) 2025 as a photoreception device; a driver 2005 which drives the pulse wave sensor 2003 by outputting driving signals to the infrared LED 2021 and the green LED 2023 to emit light at different timings; and a data processing unit 2007 which processes a signal from the pulse wave sensor 2003 and controls the driver 2005**. Note that the driver 2005 and the data processing unit 2007 are accommodated in a casing of a pulse wave detection apparatus main body 2009. Sakai at 28:01-13 **The direct current component is based on the changes in light amount accompanied by blood stream changes due to as follows: expansion and contraction of blood vessel (hereinbelow, referred to as “noise A”); the change of amount of light scattered on the skin surface accompanied by shift of the pulse wave sensor 2003 (hereinbelow, referred to as “noise B”); and the change of amount of light incident from the outside of the pulse wave sensor 2003 (e.g., sunlight) etc**. The direct current component is cut with the detector 2011 using a method to be described later.

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	Sakai at 29:49-58 As shown in FIG. 31, **the microcomputer 2013 has a CPU 2013 a which performs processing based on predetermined processing programs, a ROM 2013 b in which various control programs are stored, a RAM 2013 c in which various memories for storing various data are provided, an A/D converter 2013 d which converts a voltage value of analog signal into 10-bit digital value, a D/A converter 2013 e which converts the 10-bit digital data generated by the CPU 2013 a into an analog signal, and an input/output port 2013 f having multiple input ports to input various digital signals and multiple output ports to output various digital signals.** Note that as shown in FIG. 31, **the A/D converter 2013 d has the A/D ports PAD1 and PAD2 to input analog signals, and the D/A converter 2013 e has the D/A ports PDA1 and PDA2 to output analog signals**. Further, as shown in FIG. 31, **the input/output port 2013 f has an output port PO1. A driver 2007 is connected to the output port PO1**. **In the microcomputer 2013 having the above construction, the CPU 2013 a performs processing for outputting a signal having a component corresponding to the above noise A and noise B from the above-described direct current component signal, and processing for outputting a signal having a component corresponding to external light**. First, **the processing for outputting a signal having a component corresponding to the noise A and the noise B will be described. The frequency of voltage fluctuation of photoreception signal due to the noise A and the noise B is sufficiently low in comparison with a pulse component, and the voltage fluctuation due to these noises is small in a short period. Accordingly, the CPU 2013 a analyzes the voltage fluctuation of photoreception signal within each predetermined period (e.g., 10 seconds), thereby controls output values in the D/A ports PDA1 and PDA2 in correspondence with the voltage fluctuation due to the noise A and the noise B. Thus direct current component signal corresponding to the noise A and the noise B is outputted from the corrector 2043. That is, the voltage value of the direct current component can be controlled by each time**. Next, external light control processing for outputting a signal having a component corresponding to the external light (hereinbelow, referred to as a “external light reception signal”) will be described with reference to FIG. 34. **FIG. 34 is a flowchart showing the external light control processing. The**

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	external light control processing is repeatedly performed upon each light emission from the infrared LED 2021 and the green LED 2023 while the CPU 2013 a is activated (power ON). **In the external light control processing, first, at Step S2010, the CPU 2013 a obtains data on the voltage value of signal inputted in the A/D port PAD2. Then at Step S2020, it is determined whether or not the voltage value data obtained at Step S2010 is the same as the voltage value data previously obtained from the A/D port PAD2. When it is determined that the currently obtained voltage value data is the same as the previously obtained data (Step S2020: YES), the process proceeds to Step S2050. On the other hand, when it is determined that the currently obtained voltage value data is not the same as that previously obtained data (Step S2020: NO), the process proceeds to Step S2030**. **At Step S2030, the voltage fluctuation in the output from the D/A ports PDA1 and PDA2 is calculated based on a difference value between the voltage value obtained at Step S2010 and the previously obtained voltage value. Further, at Step S2040, present output values in the D/A ports PDA1 and PDA2 are controlled in correspondence with the voltage fluctuation calculated at Step S2030**. Thereafter, the process proceeds to Step S2050. **At Step S2050, light emission from the green LED 2023 is performed, and data on voltage value of signal inputted into the A/D port PAD1 is obtained. Further, at Step S2060, light emission from the infrared LED 2021 is performed, and data on voltage value of signal inputted into the A/D port PAD 1 is obtained, and the external light controlling processing ends.** **That is, in the external light control processing, a photoreception signal from the PD 2025 when the infrared LED 2021 and the green LED 2023 do not emit light is regarded as an external light reception signal, and voltage values of analog signals outputted from the D/A ports PDA1 and PDA2 are controlled in correspondence with the voltage value of the external light reception signal**. In **the pulse wave detection apparatus 2001 having the above construction, immediately before light emission from the green LED 2023, light received by the PD 2025 is detected as an external light reception signal (Step S2010), and the external light reception signal is outputted (Step S2020 to Step S2040). Then, light emission is performed in the green LED 2023 then in the infrared LED 2021. Then differentiation is performed between a photoreception signal, outputted from the PD 2025 upon light emission from the green LED 2023 or the infrared LED 2021, and the external**

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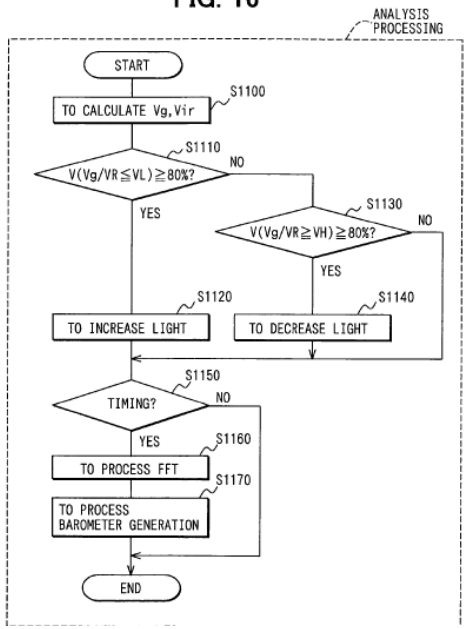
	light reception signal in the amplifier 2041, and a differentiated signal is obtained (Step S2050 to Step S2060); thereby, a pulse wave is detected. As **the human body's pulse wave can be detected in consideration of light component due to external light in photoreception signal upon light emission from the infrared LED 2021 or the green LED 2023, the influence of external light can be eliminated and the pulse wave can be detected with high accuracy**. Sakai at 32:23-33:55 FIG. 16  Sakai at Fig. 16 Hereinbelow, the details of the analysis processing and the barometer generation processing according to the present embodiment will be described. **FIG. 16 is a flowchart showing the contents of the analysis processing**. Note that when **the information detection unit 1010 has been started, the analysis processing is started by a preset time interval (in the present embodiment, 1 second).**

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	Further, upon starting of the information detection unit 1010, the driver 1012 is initialized to a setting to cause light emission from the LEDs 1011 a and 1011 b at a maximum intensity. When **the process starts, with regard to the respective pulse wave detection signal and body motion detection signal, an amplitude Vg of the pulse wave detection signal and an amplitude Vir of the body motion detection signal are calculated based on digital data (in the present embodiment, 20 data) obtained within a unit section (i.e., 1 second) from the previous startup to the current time point (Step S1100)**. More particularly, as shown in FIG. 17A, **a maximum value and a minimum value in the digital data obtained in the unit section are extracted, and the difference is obtained as the amplitudes Vg and Vir**. Next, **with a voltage range where the pulse wave detection signal is detected as VR (see FIG. 17B), it is determined whether or not the percentage of unit sections, where Vg/VR is equal to or less than a lower limit value VL (in the present embodiment, 0.1) within a past preset period (in the present embodiment, 20 seconds), is equal to or higher than a predetermined percentage (in the present embodiment, 80%) (Step S1110). When the percentage is the predetermined or higher percentage, it is determined that the amount of light in the LEDs 1011 a and 1011 b are insufficient. Then a command to increase the light emission intensity is outputted to the driver 1012 (Step S1120)**. Sakai at 19:33-65 One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants' Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Sakai, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Sakai, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.
7[k]. wherein the wearable device is at least in part configured to identify an object.	Sakai discloses or renders obvious the wearable device is at least in part configured to identify an object.

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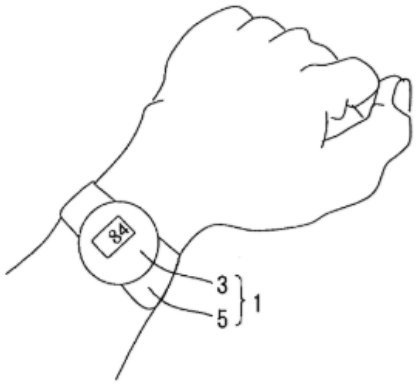
	FIG. 2B  Sakai at Fig. 2B. **As shown in FIG. 2B, the monitor 1 is fixed around the test subject's wrist or ankle with the attachment portion 5 when the monitor apparatus is used such that the detection window 3 e on the back surface of the main body 3 is in contact with the test subject's skin.** The attachment position is not limited to the wrist or ankle but may be set in any position from a finger tip to a root of all limbs. Further, the attachment portion 5 may be a supporter member in place of the belt. Sakai at 4:63-5:3. Next, FIG. 13 is a block diagram showing the construction of the biological status detection apparatus. As shown in FIG. 13, **the biological status detection apparatus 1001 has an information detection unit 1010 which emits light via the light transmitting plate 1003 b and receives reflected light thereby detects biological information, an information processor 1020 which processes the biological information detected by the information detection unit 1010**, and a battery 1015 chargeable via the cable connected to the connector 1003 c, which supplies power to the respective elements of the apparatus. Sakai at 17:1-11.

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	One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of the reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention, as evidenced, for example, by substantial other references identified in Defendants’ Invalidity Contentions. Rather than repeat those disclosures here, they are incorporated by reference into this chart. To the extent this limitation is not disclosed by Sakai, it would have been obvious to one of ordinary skill in the art to combine, with the teachings of Sakai, those elements, as known to them or as disclosed by other prior art identified in the cover pleading.

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