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

THE RESEARCH FOUNDATION FOR THE STATE UNIVERSITY OF NEW YORK, UNIVERSITY OF CONNECTICUT, AND WORCESTER POLYTECHNIC INSTITUTE, Plaintiffs, v. XIAOMI CORPORATION, XIAOMI H.K. LTD., XIAOMI COMMUNICATIONS CO., LTD., XIAOMI, INC., and ZEPP HEALTH CORPORATION, Defendants.	**CASE NO.: 2:23-cv-00353-RWS-RSP** **JURY TRIAL DEMANDED**

DEFENDANTS' INVALIDITY CONTENTIONS

Pursuant to Local Patent Rules 3-3 and 3-4 and the Court's Order Granting Defendants' Unopposed Motion to Amend the Docket Control Order (Dkt. 70), Defendants Xiaomi Corporation, Xiaomi H.K. Ltd., Xiaomi Communications Co., Ltd., Xiaomi, Inc., and Zepp Health Corporation (collectively, "Defendants") provide these Invalidity Contentions and accompanying document productions to Plaintiffs, The Research Foundation for the State University of New York ("SUNY"), University of Connecticut ("UConn"), and Worcester Polytechnic Institute ("WPI") (collectively, "Plaintiffs").

I. Overview

In this action, Plaintiffs asserted in its P.R. 3-1 and 3-2 Disclosures of August 12, 2024 ("Infringement Contentions") that Defendants infringe claims 1-15 of U.S. Patent No. 8,417,326 (the "'326 Patent"), claims 1-20 of U.S. Patent No. 9,408,576 (the "'576 Patent"), claims 1-11, 15-30, 32-40, 42-46 of U.S. Patent No. 9,713,428 (the "'428 Patent"), claims 1-15 of U.S. Patent

Exhibit 2012
IPR2025-00521

No. 9,986,921 (the "'921 Patent"), claims 1-75 of U.S. Patent No. 10,278,647 (the "'647 Patent"), claims 1-5 of U.S. Patent No. 10,285,601 (the "'601 Patent"), and claims 1-20 of U.S. Patent No. 10,653,362 (the "'362 Patent") (collectively, the "Patents-in-Suit" and the "Asserted Claims").

This Court has not yet construed any of the terms in the Patents-in-Suit. Defendants' Invalidity Contentions are based on Defendants' present understanding of Plaintiffs' apparent interpretation of the Asserted Claims, as advanced by Plaintiffs in its Complaint and Infringement Contentions, and Defendants' own understanding of the scope of the Asserted Claims. Defendants take no position on any matter of claim construction or interpretation in these contentions. Defendants' contentions herein are not, and should in no way be seen as, admissions about or adoptions of any particular claim scope or construction, or as any admission that any particular element is met in any particular way. Defendants object to any attempt to imply claim constructions from any identification or application of potential prior art. Any statement herein describing or tending to describe any claim element is provided solely for the purpose of understanding the relevant prior art. By including prior art that anticipates or renders obvious claims based on Plaintiffs' apparent claim construction, Defendants do not thereby adopt Plaintiffs' apparent claim construction.

Moreover, nothing herein should be construed as an admission that Defendants agree with Plaintiffs' claim interpretations or that Plaintiffs have a plausible basis to allege infringement. Similarly, nothing herein shall be construed as an admission regarding the application of the Asserted Claims to any of Defendants' accused products. Defendants do not agree with Plaintiffs' application of the claims to the accused products, and Defendants deny infringement. Furthermore, these contentions do not represent an agreement with Plaintiffs' views as to the

meaning, definiteness, written description support for, or enablement of any of the Asserted Claims. In fact, Defendants provide grounds for invalidity under § 112 below. Pursuant to the Court's Docket Control Order, Defendants reserve the right to include arguments directed to indefiniteness in their *Markman* briefing. Nothing stated herein shall be construed as a waiver of any argument available under 35 U.S.C. §§ 101, 102, 103, and/or 112. Defendants expressly reserve the right to propose alternative interpretations to those advocated by Plaintiffs and to rebut Plaintiffs' actual claim interpretation and infringement positions. Defendants reserve the right to modify or supplement these contentions in response to the Court's construction of the claim terms at issue.

Defendants also reserve the right to modify or supplement its invalidity contentions in response to Plaintiffs' supplementation of its infringement contentions (if any) under Section 3(a)(i) of the Discovery Order in this case. Plaintiffs' infringement contentions relied on DO 3(a)(i) to identify "software limitations" in many of the asserted claims and thereby avoid complying with P.R. 3-1. Indeed, in many instances Plaintiffs failed to map any elements of an asserted claim beyond the preamble and/or first claim element.

Prior art not included in this disclosure may also become relevant. Defendants are currently unaware of the extent, if any, to which Plaintiffs may contend that certain limitations of the Asserted Claims are not disclosed in the prior art identified by Defendants. Defendants reserve the right to identify other relevant prior art with respect to such allegedly missing limitation(s).

Defendants' invalidity claim charts attached hereto cite to exemplary portions, teachings, and disclosures of the prior art as applied to limitations of the Asserted Claims. Persons skilled in the art, however, would recognize these as exemplary and may view an item of prior art in

the context of other publications, literature, products, and understanding. Again, this is because the cited portions of prior art identified herein are exemplary only. The citations and discussion in the charts are organized by claim (and claim limitation) for convenience, but each limitation or claim section applies to the larger context of each claim, to any related dependent or independent claims, as well as all claims containing similar limitations or elements in the particularly asserted patent or other related patents also being asserted by Plaintiffs. For example, citations as to any recited limitation, step, or component in the claims apply wherever each such limitation, step, or component is repeated elsewhere in the claim of that patent or other related patent also being asserted by Plaintiffs. Any and all citations to particular figures in the attached charts or elsewhere in these contentions shall be deemed to wholly incorporate the figure by reference, and include the figure as if it had been inserted into the chart itself, as well as any text discussing the figure. Similarly, where Defendants cite to particular text in a prior art reference concerning a drawing or figure, the citation encompasses that drawing or figure as well as any other associated information in the prior art reference. Defendants may therefore rely on the entirety of the prior art references listed herein, including uncited portions of those prior art references, as well as additional information including products, documents, materials, and expert testimony.

The references cited herein disclose the limitations of the Asserted Claims explicitly or inherently, and/or they may be relied upon to demonstrate how the state of the art in the relevant time frame invalidates each asserted patent claim. In the context of the knowledge of a person of ordinary skill in the art, each reference's disclosure applies in the context of both anticipation and obviousness. Therefore, any suggested single reference obviousness positions and obviousness combinations are provided in the alternative to Defendants' anticipation

contentions and are not to be construed to suggest that any reference included in the combinations is somehow deficient or is not by itself anticipatory. Further, the combinations listed herein are exemplary and not exhaustive. There are many possible invalidating combinations of the references listed herein, and it is not practical, at this early stage, to identify and list all potentially relevant combinations without the benefit of further factual investigation, Plaintiffs' supplementation of its contentions (if any) under DO 3(a)(i), and the Court's claim construction.

In addition to the positions and prior art identified below, and the accompanying invalidity claim charts, Defendants also incorporate by reference all invalidity contentions, prior art, 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 enablement positions) that have been or will be disclosed in any other action involving any of the Patents-in-Suit, including but not limited to *The Research Foundation for The State University of New York et al v. Huawei Device Co., Ltd*., 2-23-cv-00553 (EDTX) and *The Research Foundation for The State University of New York et al v. Samsung Electronics Co., Ltd, et al*, 2-23-cv-00141 (EDTX) (the "Samsung Case"), as well as any U.S. Patent and Trademark Office (USPTO) proceeding involving any of the Patents-in-Suit and that have or will be disclosed in any pending USPTO proceeding involving related patents. Such art and positions would have been obvious to combine with the prior art and combinations identified in these Invalidity Contentions. To the extent Plaintiffs or the Board puts forth an argument in any USPTO proceedings contrary to the positions in the litigation, Defendants reserve the right to raise and/or address such argument or position in this litigation.

Defendants expect to rely on testimony of one or more expert witnesses and materials

referenced by those expert witnesses in support of these contentions and incorporate those forthcoming expert reports as if fully set forth herein. Subsequent expert statements—including deposition and trial testimony, declarations, and reports—related to invalidity, interrogatory responses, and other discovery or pleadings may expand and elaborate upon the positions contained in these Invalidity Contentions as originally prepared or subsequently amended, and Defendants reserve the right to incorporate such by reference. Defendants may further rely on any inventor admissions concerning the scope of the prior art relevant to the Patents-in-Suit found in, *inter alia*: the patent prosecution histories for the Patents-in-Suit and related patents, patent applications, and/or re-examinations; deposition testimony of the named inventors listed on the Patents-in-Suit; and the papers and any evidence submitted by Plaintiffs in these actions.

Discovery has only just begun, and Defendants' investigation into prior art—including third-party prior art, and related evidence, documents, and knowledgeable witnesses—remains ongoing. Moreover, prior art may become relevant depending on the claim interpretations and/or validity positions Plaintiffs or its expert witness(es) may assert, Plaintiffs' supplementation of its contentions (if any) under DO 3(a)(i), Defendants' further understanding of Plaintiffs' Infringement Contentions, and any findings as to the priority date of the Asserted Claims. Accordingly, Defendants reserve the right to supplement or modify these Invalidity Contentions based on further discovery and in a manner consistent with the Federal Rules of Civil Procedure and the Court's rules and schedule. To the extent Plaintiffs contend that any prior art presented in these contentions does not qualify as prior art to one or more Asserted Patents, the prior art remains relevant as evidence of simultaneous development as an indicia of obviousness. *See George M. Martin Co. v. Alliance Mach. Sys. Int'l LLC,* 618 F.3d 1294, 1305 (Fed. Cir. 2010) ("Independently made, simultaneous inventions … are persuasive evidence that the claimed

apparatus was the product only of ordinary mechanical or engineering skill.”).

As set forth in detail below, and in the claim charts which accompany these Invalidity Contentions as Exhibits 326Pat_1 to 326Pat_11 (including supplement exhibits), 576Pat_1 to 576Pat_7 (including supplement exhibits), 428Pat_1 to 428Pat_9 (including supplement exhibits), 921Pat_1 to 921Pat_9 (including supplement exhibits), 647Pat_1 to 647Pat_13 (including supplement exhibits), 601Pat_1 to 601Pat_9 (including supplement exhibits), and 362Pat_1 to 362Pat_14 (including supplement exhibits), the Asserted Claims of the Patents-in-suit are invalid under pre-AIA 35 U.S.C. §§ 102 and/or 103 and their post-AIA counterparts.[1]

Regarding the obviousness of certain claims under 35 U.S.C. § 103, one or more of the principles enumerated by the United States Supreme Court in *KSR International Co. v. Teleflex Inc.*, 550 U.S. 398 (2007) apply to the Asserted Claims of the Patents-in-Suit, including, for example:

(a) combining various claimed elements known in the prior art according to known methods to yield a predictable result;

(b) making a simple substitution of one or more known elements for another to obtain a predictable result;

(c) using a known technique to improve a similar device or method in the same way;

(d) applying a known technique, known device or method ready for improvement to yield a predictable result;

(e) choosing from a finite number of identified, predictable solutions with a reasonable expectation of success or, in other words, the solution was one which was “obvious

[1] Defendants also incorporate here by reference all of the relevant invalidity contentions (including invalidity claim charts) served in the Samsung Case, which provide further grounds and arguments in support of finding the Asserted Claims to be invalid.

to try";

(f) a known work in one field of endeavor prompting variations of it for use either in the same field or a different based on given design incentives or other market forces in which the variations were predictable to one of ordinary skill in the art; and/or

(g) a teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill in the art to modify the prior art reference or to combine the teachings of various prior art references to arrive at the claimed invention.

The above criteria may be collectively referred to herein as the "*KSR* Criteria."

Based on these considerations, as further detailed below and/or in the attached exhibits, one of ordinary skill in the art would have combined the teachings of the prior art references discussed and charted in those exhibits. The combinations of these references would have rendered obvious to one of ordinary skill in the art the subject matter of the Asserted Claims. The references identified in the attached exhibits for the respective Asserted Claims are analogous prior art to the subject matter of the Asserted Claims and, for at least the reasons set forth below and/or in the claim chart exhibits, are properly combinable. Because many, if not all, of these prior art references exist within a single field of art, particularly one in which individuals in the field often shared and/or collaborated on their work, it would have been obvious for one of ordinary skill in the art to look from one piece of prior art to another in order to find any missing functionality they desired to implement. The art is replete with instances of skilled artisans looking to the same field or related fields for purposes of implementing signal processing techniques for health monitoring. Therefore, these references provide interrelated teachings and one of ordinary skill would have looked to the concepts in any of these references when seeking to solve the problems purportedly addressed by the Patents-in-Suit.

Numerous prior art references and/or systems, including in the attached exhibits, reflect common knowledge and the state of the prior art before the earliest effective priority date of the Patents-in-Suit. As it would be unduly burdensome to create detailed claim charts for all of the invalidating combinations, for at least the reasons described in these Invalidity 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 identified in the attached exhibits, to meet the limitations of the Asserted Claims. Defendants' inclusion of exemplary combinations, in view of the factors and motivations identified here, does not preclude Defendants from identifying other invalidating combinations and/or motivations as appropriate. No showing of a specific motivation to combine prior art is required to combine the references disclosed above and in the attached charts, because 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*, 127 S. Ct. at 1739-40 (rejecting the Federal Circuit's "rigid" application of the teaching, suggestion, or motivation to combine test, instead espousing an "expansive and flexible" approach). That said, the Supreme Court's rationale, 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," applies equally here. *Id.* at 1742.

Additional evidence that there would have been a motivation or reason to combine the prior art references identified herein includes but is not limited to the interrelated teachings of multiple prior art references; 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; the existence of a known need or problem in the field of endeavor at the time of the alleged inventions;

and the background knowledge that would have been possessed by one of ordinary skill in the art. For example, the prior art references are generally directed to the same problems. Thus, a skilled artisan seeking to solve these problems would look to these cited references in combination.

Defendants contend there are no secondary considerations of non-obviousness evidencing the validity of any of the Asserted Claims. If Plaintiffs present any alleged evidence of secondary considerations of non-obviousness, Defendants reserve their right to respond to any such alleged evidence. Further, to the extent Plaintiffs identify any product as allegedly practicing the claims and having been successful, there is no nexus between the claimed invention and the products' success and Defendants reserve their right to respond to any such alleged evidence.

II. P.R. 3-3(a): Identification of Prior Art

Pursuant to Patent Rule 3-3 and subject to Defendants' reservations of rights in these Invalidity Contentions, Defendants identify the following prior art that anticipates and/or renders obvious one or more Asserted Claims of the Patents-in-Suit as detailed in the claim chart exhibits and elsewhere in these Invalidity Contentions. Below are tables identifying individual items of prior art. The prior art references, systems, and products listed below and in the accompanying claim chart exhibits may be relied upon for certain limitations, state of the art, and background of the art; indicia of obviousness; as evidence of the level of skill in the art at the time of the filing of the Patents-in-Suit; and/or in support of assertions that it is proper to combine certain prior art references in certain ways.

Defendants also incorporate by reference each and every prior art reference of record in the prosecution of the Patents-in-Suit and patents or patent applications related to the Patents-in- Suit, as well as the prior art referred to in the specifications of the Patents-in-Suit. In these Invalidity Contentions, Defendants have identified each item of prior art, based on currently

available information, including:

(1) each patent, constituting prior art under pre-AIA 35 U.S.C. §§ 102(a), (b), and/or (e) or under AIA 35 U.S.C. §§ 102(a)(1) and/or (a)(2), by its patent number, country of origin, and date of issue;

(2) each non-patent publication, constituting prior art under pre-AIA 35 U.S.C. §§ 102(a) and/or (b) or under AIA 35 U.S.C. §§ 102(a)(1) and/or (a)(2), by its title, date of publication, and, where feasible, author and publisher;

(3) sales or public disclosures, constituting prior art under pre-AIA 35 U.S.C. § 102(a) and/or (b) or under AIA 35 U.S.C. § 102(a)(1), by the item offered for sale or publicly used or known, the date the offer or use took place or the information became known, and the identity of the person or entity which made the use or which made and received the offer, or the person or entity which made the information known or to whom it was made known;

(4) prior art under pre-AIA 35 U.S.C. § 102(f), by the name of the person(s) from whom and the circumstances under which the invention or any part of it was derived; and

(5) prior art under pre-AIA 35 U.S.C. § 102(g), by the identities of the person(s) or entities involved in and the circumstances surrounding the making of the invention before the patent applicant(s).

Defendants' identification of patents and publications as prior art herein and in the attached invalidity claim charts includes the publications themselves as well as the use of the products and systems described therein. Defendants' investigation continues, but information available to date indicates that such products and systems were (1) known or used in the country

before the alleged invention(s) of the claimed subject matter of the Asserted Claims, (2) were in public use and/or on sale in this country more than one year before the filing date of the Patents-in-Suit, and/or (3) were invented by another who did not abandon, suppress, or conceal, before the alleged invention(s) of the claimed subject matter of the Asserted Claims. Upon information and belief, these prior art products and systems and their associated references anticipate and/or render obvious one or more of the Asserted Claims of the Patents-in-Suit.

A. Prior Art Patents, Patent Applications, and Publications

Table 1: Prior Art Patents and Patent Applications

Country	Patent/ Application/ Publication No.	Date of Filing	Date of Issue/ Publication	Inventor(s)	Bates Range
CN	101528126	November 28, 2007	September 9, 2009	Zhang et al.	SAM-SNY_00024236-SAM-SNY_00024624
CN	102551708	October 13, 2011	July 11, 2012	Katoh et al.	SAM-SNY_00019050-SAM-SNY_00019075
CN	102063180	October 29, 2010	July 4, 2012	Guanghua et al.	SAM-SNY_00016789-SAM-SNY_00016804
CN	102697492	May 25, 2012	October 3, 2012	Liang et al.	SAM-SNY_00018532-SAM-SNY_00018554
CN	102930870	September 27, 2012	February 13, 2013	Xin et al.	SAM-SNY_00020576-SAM-SNY_00020595
CN	103110417	February 28, 2013	May 22, 2013	Liping et al.	SAM-SNY_00020493-SAM-SNY_00020512
CN	103932693	March 27, 2014	July 23, 2014	Sun et al.	SAM-SNY_00022297-SAM-SNY_00022303
CN	101017201	February 14, 2007	August 15, 2007	Sun	SAM-SNY_00016688-SAM-SNY_00016704
CN	101259016	March 6, 2007	September 10, 2008	Xiaoli et al.	SAM-SNY_00020242-SAM-SNY_00020259
CN	101496716	February 26, 2009	August 5, 2009	Hongjian et al.	SAM-SNY_00023021-SAM-SNY_00023035
CN	101782895	January 11, 2010	July 21, 2010	Shunhua et al.	SAM-SNY_00017583-SAM-SNY_00017616
CN	104218973	September 15, 2014	December 17, 2014	Yan et al.	SAM-SNY_00019432-SAM-SNY_00019445
CN	1850007	May 16, 2006	October 25, 2006	Chen et al.	SAM-SNY_00016511-

					SAM-SNY_00016525
DE	10243265	September 17, 2002	March 25, 2004	Nuske et al.	SAM-SNY_00018343-SAM-SNY_00018355
EP	1322223	September 20, 2001	May 23, 2007	Glass et al.	SAM-SNY_00023265-SAM-SNY_00023287
EP	1366428	February 11, 2002	December 3, 2003	Logier et al.	SAM-SNY_00022075-SAM-SNY_00022108
EP	2430975	September 14, 2011	March 21, 2012	Romero	SAM-SNY_00033682-SAM-SNY_00033709
EP	2453792	July 6, 2010	May 17, 2017	Veen et al.	SAM-SNY_00019141-SAM-SNY_00019197
EP	3028629	January 21, 2015	August 6, 2016	Pamula	SAM-SNY_00032789-SAM-SNY_00032804
JP	5724338	December 3, 2010	May 27, 2015	Yasuhiro et al.	SAM-SNY_00021903-SAM-SNY_00021926
JP	63-35229	May 12, 1987	February 15, 1988	Chishio	SAM-SNY_00019133-SAM-SNY_00019140
JP	2005-514099	December 3, 2002	May 19, 2005	Starobin et al.	SAM-SNY_00023771-SAM-SNY_00023811
JP	2007-501099	May 28, 2004	January 25, 2007	Gust et al.	SAM-SNY_00024311-SAM-SNY_00024359
JP	2007-517553	January 14, 2005	July 5, 2007	David	SAM-SNY_00020441-SAM-SNY_00020492
JP	2008-538936	April 25, 2006	November 13, 2008	Richard et al.	SAM-SNY_00022512-SAM-SNY_00022539
JP	2013-504387	September 10, 2010	February 7, 2013	Harinath et al.	SAM-SNY_00018808-SAM-SNY_00018855
KR	10-1514151	November 27, 2013	April 21, 2015	Kwon et al.	SAM-SNY_00024301-SAM-SNY_00024310
KR	10-2012-0116213	April 12, 2011	October 22, 2012	Soong et al.	SAM-SNY_00018856-SAM-SNY_18874
TW	2007-27863	January 20, 2006	August 1, 2007	Chen	SAM-SNY_00021577-SAM-SNY_00021609

US	3,779,237	April 13, 1971	December 18, 1973	Goeltz et al.	SAM-SNY_00019288- SAM-SNY_00019313
US	4,368,510	October 20, 1980	January 11, 1983	Anderson	SAM-SNY_00016501- SAM-SNY_00016510
US	4,510,944	December 30, 1982	April 16, 1985	Porges	SAM-SNY_00027688- SAM-SNY_00027708
US	5,117,833	November 13, 1990	June 2, 1992	Albert et al	SAM-SNY_00018287- SAM-SNY_00018294
US	5,291,400	Apr. 9, 1992	Mar. 1, 1994	Gilham	SAM-SNY_00017285- SAM-SNY_00017326
US	5,439,004	December 23, 1993	August 8, 1995	Duong-Van et al.	SAM-SNY_00019333- SAM-SNY_00019341
US	5,868,680	September 23, 1997	February 9, 1999	Steiner et al.	SAM-SNY_00018678- SAM-SNY_00018704
US	5,921,940	November 4, 1997	July 13, 1999	Verrier et al.	SAM-SNY_00038382- SAM-SNY_00038429
US	6,308,094	August 17, 1999	October 23, 2001	Shusterman et al.	SAM-SNY_00024190- SAM-SNY_00024211
US	6,597,943	December 26, 2000	June 22, 2003	Taha et al.	SAM-SNY_00022022- SAM-SNY_00022034
US	6,656,125	November 28, 2001	December 2, 2003	Misczynski et al.	MONEBO_0000005- MONEBO_0000038 Being produced concurrently
US	6,701,182	April 6, 2001	March 2, 2004	Baker et al.	SAM-SNY_00035612- SAM-SNY_00035619
US	6,743,225	March 27, 2001	June 1, 2004	Sanchez et al.	SAM-SNY_00021500- SAM-SNY_00021531
US	6,775,571	December 12, 2001	August 10, 2004	Kroll	SAM-SNY_00018375- SAM-SNY_00018389
US	6,826,419	December 20, 2002	November 30, 2004	Diab et al.	SAM-SNY_00018750- SAM-SNY_00018785

US	6,871,089	June 5, 2002	March 22, 2005	Korzinov et al.	SAM-SNY_00016561- SAM-SNY_00016576
US	6,905,470	April 15, 2003	June 14, 2005	Lee et al.	SAM-SNY_00018400- SAM-SNY_00018419 Being produced concurrently
US	6,931,269	August 27, 2004	August 16, 2005	Terry	SAM-SNY_00022230- SAM-SNY_00022248
US	6,937,887	October 18, 2002	August 30, 2005	Bock	SAM-SNY_00021947- SAM-SNY_00021960
US	6,942,626	July 22, 2004	September 13, 2005	Salisbury et al.	SAM-SNY_00018432- SAM-SNY_00018437
US	6,993,377	February 22, 2002	January 31, 2006	Flick et al.	SAM-SNY_00019342- SAM-SNY_00019396
US	7,001,337	March 2, 2004	February 21, 2006	Dekker	SAM-SNY_00022625- SAM-SNY_00022666
US	7,025,729	September 14, 2001	April 11, 2006	de Chazal et al.	SAM-SNY_00018656- SAM-SNY_00018677
US	7,031,765	November 11, 2002	4/18/206	Ritscher et al.	SAM-SNY_00021735- SAM-SNY_00021766
US	7,054,454	March 29, 2002	May 30, 2006	Causevic et al.	SAM-SNY_00019233- SAM-SNY_00019287
US	7,072,702	June 22, 2004	July 4, 2006	Edgar, Jr. et al.	SAM-SNY_00021927- SAM-SNY_00021946
US	7,085,342	April 22, 2004	August 1, 2006	Younis et al.	SAM-SNY_00020513- SAM-SNY_00020546
US	7,117,031	January 16, 2004	October 3, 2006	Lohman et al.	SAM-SNY_00035499 SAM-SNY_00035520
US	7,144,375	September 3, 2003	December 5, 2006	Kosuda	SAM-SNY_00021475- SAM-SNY_00021499
US	7,146,206	March 6, 2003	December 5, 2006	Glass et al.	SAM-SNY_00018217- SAM-SNY_00018238

US	7,164,941	December 22, 2004	January 16, 2007	Misczynski et al.	MONEBO_0000039-MONEBO_0000054 Being produced concurrently
US	7,184,815	February 26, 2004	February 27, 2007	Kim et al.	SAM-SNY_00021185-SAM-SNY_00021211
US	7,236,819	December 19, 2003	June 26, 2007	Brockway et al.	SAM-SNY_00022035-SAM-SNY_00022061
US	7,254,439	December 22, 2004	August 7, 2007	Misczynski et al.	MONEBO_0000055-MONEBO_0000074 Being produced concurrently
US	7,274,810	April 10, 2001	September 25, 2007	Reeves et al.	SAM-SNY_00019836-SAM-SNY_00019932
US	7,289,844	September 10, 2003	October 30, 2007	Misczynski et al.	MONEBO_0000075-MONEBO_0000107 Being produced concurrently
US	7,386,340	March 26, 2003	June 10, 2008	Schlegel et al.	SAM-SNY_00018311-SAM-SNY_00018342
US	7,460,901	November 18, 2004	December 2, 2008	Kettunen et al.	SAM-SNY_00037686-SAM-SNY_00037706
US	7,467,009	April 20, 2005	December 16, 2008	Palreddy et al.	SAM-SNY_00026290-SAM-SNY_00026311
US	7,499,744	May 10, 2006	March 3, 2009	Carlson et al.	SAM-SNY_00018013-SAM-SNY_00018025
US	7,499,750	December 17, 2003	March 3, 2009	Haefner et al.	SAM-SNY_00038106-SAM-SNY_00038141
US	7,537,569	December 29, 2005	May 26, 2009	Sarkur et al.	SAM-SNY_00023503-SAM-SNY_00023538

US	7,578,793	November 22, 2004	August 25, 2009	Todros et al.	SAM-SNY_00017396-SAM-SNY_00017404 Being produced concurrently
US	7,580,747	July 13, 2005	August 25, 2009	Farazi et al.	SAM-SNY_00019076-SAM-SNY_00019097
US	7,623,911	December 29, 2005	November 24, 2009	Sarkar et al.	SAM-SNY_00017102-SAM-SNY_00017130
US	7,630,756	October 19, 2005	December 8, 2009	Linker	SAM-SNY_00038200-SAM-SNY_00038224
US	7,693,569	October 12, 2004	April 6, 2010	Brittain et al.	SAM-SNY_00020547-SAM-SNY_00020562
US	7,706,868	June 24, 2008	April 27, 2010	Wiesel et al.	SAM-SNY_00037762-SAM-SNY_00037774
US	7,729,752	June 13, 2006	June 1, 2010	Harlev et al.	SAM-SNY_00016880-SAM-SNY_00016921
US	7,778,699	April 26, 2007	August 17, 2010	Ferrise et al.	SAM-SNY_00017556-SAM-SNY_00017582
US	7,907,996	April 23, 2007	March 15, 2011	Prystowsky et al.	SAM-SNY_00035838-SAM-SNY_00035849
US	7,941,207	February 12, 2007	May 10, 2011	Korzinov	SAM-SNY_00017340-SAM-SNY_00017356 Being produced concurrently
US	7,952,425	June 22, 2009	May 31, 2011	Zhang et al.	SAM-SNY_00018420-SAM-SNY_00018431
US	7,991,448	April 21, 2006	August 2, 2011	Edgar, Jr. et al.	SAM-SNY_00019314-SAM-SNY_00019332 Being produced concurrently

US	7,991,589	July 12, 2006	August 2, 2011	Pinnegar	SAM-SNY_00024432-SAM-SNY_00024449
US	8,055,333	August 20, 2007	November 8, 2011	Duann et al.	SAM-SNY_00018705-SAM-SNY_00018727
US	8,073,516	January 30, 2006	December 6, 2011	Scharf et al.	SAM-SNY_00017016-SAM-SNY_00017037 Being produced concurrently
US	8,086,304	November 26, 2008	December 27, 2011	Brockway et al.	SAM-SNY_00022599-SAM-SNY_00022624
US	8,172,759	April 24, 2009	May 8, 2012	Bukhman	MONEBO_0000108-MONEBO_0000137 Being produced concurrently
US	8,233,972	October 7, 2010	July 31, 2012	Zhang	SAM-SNY_00024748-SAM-SNY_00024761
US	8,308,646	April 17, 2009	November 13, 2012	Belohlavek et al.	SAM-SNY_00017004-SAM-SNY_00017015
US	8,321,002	February 15, 2011	November 27, 2012	Zhang et al.	SAM-SNY_00024450-SAM-SNY_00024498
US	8,380,293	February 15, 2011	February 19, 2013	Zhang et al.	SAM-SNY_00024499-SAM-SNY_00024541
US	8,388,542	April 28, 2010	March 5, 2013	Zhang	SAM-SNY_00020260-SAM-SNY_00020275
US	8,396,541	October 20, 2008	March 12, 2013	Zhang	SAM-SNY_00016775-SAM-SNY_0016788
US	8,417,326	February 2, 2010	April 9, 2013	Chon et al.	SAM-SNY_00018496-SAM-SNY_00018509
US	8,433,395	January 29, 2011	April 30, 2013	Brockway et al.	SAM-SNY_00020609-SAM-SNY_00020638
US	8,456,229	March 7, 2012	June 4, 2013	Takahashi	SAM-SNY_00019446-

					SAM-SNY_00019462
US	8,494,829	July 12, 2011	July 23, 2013	Teixeira	SAM-SNY_00016734-SAM-SNY_00016774
US	8,560,044	May 16, 2007	October 15, 2013	Kurzweil et al.	SAM-SNY_00019209-SAM-SNY_00019232
US	8,594,773	September 28, 2010	November 26, 2013	Koertge et al.	SAM-SNY_00022498-SAM-SNY_00022511
US	8,597,196	December 28, 2012	December 3, 2013	Kishi et al.	SAM-SNY_00019579-SAM-SNY_00019586
US	8,668,644	April 23, 2013	March 11, 2014	Ong et al.	SAM-SNY_00019970-SAM-SNY_00020023
US	8,718,753	October 12, 2011	May 6, 2014	Chon et al.	SAM-SNY_00016597-SAM-SNY_00016619
US	8,731,644	March 9, 2010	May 20, 2014	Mehrotra et al.	SAM-SNY_00017074-SAM-SNY_00017101
US	8,768,438	June 25, 2012	July 1, 2014	Mestha et al.	SAM-SNY_00019115-SAM-SNY_00019132
US	8,774,908	June 29, 2012	July 8, 2014	Stewart	SAM-SNY_00020596-SAM-SNY_00020608
US	8,790,272	May 24, 2007	July 29, 2014	Sackner et al.	SAM-SNY_00022000-SAM-SNY_00022021
US	8,798,399	March 26, 2009	August 5, 2014	Huang et al.	SAM-SNY_00017674-SAM-SNY_00017705
US	8,885,450	November 7, 2011	November 11, 2014	Hayashi	SAM-SNY_00020834-SAM-SNY_00020860
US	8,897,863	May 3, 2012	November 25, 2014	Linker	SAM-SNY_00036469-SAM-SNY_00036485
US	8,914,099	November 7, 2012	December 16, 2014	Yazicioglu et al.	SAM-SNY_00023721-SAM-SNY_00023729
US	8,945,017	June 3, 2014	February 3, 2015	Venkatraman et al.	SAM-SNY_00023060-SAM-SNY_00023133
US	8,996,124	August 26, 2008	March 31, 2015	Bornhoft et al.	SAM-SNY_00023592-SAM-SNY_00023604

US	9,026,190	November 16, 2011	May 5, 2015	Shenasa et al.	SAM-SNY_00018239-SAM-SNY_00018268
US	9,138,150	July 2, 2010	September 22, 2015	Boschetti Sacco et al.	SAM-SNY_00023669-SAM-SNY_00023676
US	9,148,567	September 21, 2012	September 29, 2015	Almaki et al.	SAM-SNY_00036230-SAM-SNY_00036245
US	9,155,478	September 11, 2012	October 13, 2015	Rodriguez-Llorente et al.	SAM-SNY_00021285-SAM-SNY_00021474
US	9,247,911	July 10, 2014	February 2, 2016	Galloway et al.	SAM-SNY_00018577-SAM-SNY_00018598
US	9,289,167	December 5, 2012	March 22, 2016	Diab et al.	SAM-SNY_00021127-SAM-SNY_00021184
US	9,294,074	January 15, 2014	March 22, 2016	Brockway	SAM-SNY_00038004-SAM-SNY_00038052
US	9,295,405	March 28, 2012	March 29, 2016	Emerson et al.	SAM-SNY_00020024-SAM-SNY_00020046
US	9,326,697	June 25, 2014	May 3, 2016	Linker	SAM-SNY_00019733-SAM-SNY_00019761
US	2008/0221633 A1	May 22, 2008	Sept 11, 2008	Linder	Being produced concurrently
US	9,364,160	March 12, 2013	June 14, 2016	Marziliano et al.	SAM-SNY_00022725-SAM-SNY_00022747
US	9,392,975	September 6, 2013	July 19, 2016	McGonigle et al.	SAM-SNY_00021212-SAM-SNY_00021244
US	9,402,554	September 23, 2011	August 2, 2016	Ochs et al.	SAM-SNY_00038053-SAM-SNY_00038105
US	9,408,549	August 4, 2015	August 9, 2016	Brockway et al.	SAM-SNY_00022138-SAM-SNY_00022197
US	9,408,576	May 1, 2014	August 9, 2016	Chon et al.	SAM-SNY_00024016-SAM-SNY_00024046
US	9,468,378	November 16, 2005	October 18, 2016	Lynn et al.	SAM-SNY_00021658-SAM-SNY_00021734

US	9,597,022	September 9, 2011	March 21, 2017	Addison et al.	SAM-SNY_00038545-SAM-SNY_00038594
US	9,636,029	March 14, 2013	May 2, 2017	Narasimhan et al.	SAM-SNY_00024360-SAM-SNY_00024377
US	9,636,033	March 14, 2012	May 2, 2017	Bashour et al.	SAM-SNY_00018640-SAM-SNY_00018655
US	9,706,956	May 2, 2016	July 18, 2017	Brockway et al.	SAM-SNY_00024727-SAM-SNY_00024747
US	9,713,428	January 20, 2012	July 25, 2017	Chon et al.	SAM-SNY_00016650-SAM-SNY_00016674
US	9,730,593	November 14, 2013	August 15, 2017	Felix et al.	SAM-SNY_00018356-SAM-SNY_00018374
US	9,788,794	February 27, 2015	October 17, 2017	LeBoeuf et al.	SAM-SNY_00017038-SAM-SNY_00017073
US	9,848,778	March 15, 2013	December 26, 2017	Soykan et al.	SAM-SNY_00036303-SAM-SNY_00036378
US	9,901,306	December 17, 2015	February 27, 2018	Adams et al.	SAM-SNY_00023628-SAM-SNY_00023668
US	9,943,266	December 17, 2015	April 17, 2018	Adams et al.	SAM-SNY_00021245-SAM-SNY_00021284
US	9,986,921	May 1, 2015	June 5, 2018	Chon et al.	SAM-SNY_00019665-SAM-SNY_00019691
US	10,061,891	April 14, 2014	August 28, 2018	Grundlehner et al.	SAM-SNY_00019762-SAM-SNY_00019793
US	10,123,722	September 14, 2009	November 13, 2018	Banet et al.	SAM-SNY_00022775-SAM-SNY_00022832
US	10,154,790	February 19, 2010	December 18, 2018	Heneghan et al.	SAM-SNY_00023576-SAM-SNY_00023591
US	10,178,973	August 24, 2016	January 15, 2019	Venkatraman et al.	SAM-SNY_00038256-SAM-SNY_00038333
US	10,201,286	August 22, 2014	February 12, 2019	Waydo	SAM-SNY_00027607-SAM-SNY_00027632
US	10,213,158	January 6, 2015	February 26, 2019	Fyfe et al.	SAM-SNY_00038169-

					SAM-SNY_00038199
US	10,285,601	May 22, 2018	May 14,2019	Chon et al.	SAM-SNY_00018510- SAM-SNY_00018531
US	10,349,844	December 24, 2012	July 16, 2019	Romesburg	SAM-SNY_00023605- SAM-SNY_00023627
US	10,390,767	June 4, 2014	August 27, 2019	Brumfield et al.	SAM-SNY_00017946- SAM-SNY_00017979
US	10,420,516	September 15, 2014	September 24, 2019	Swamy et al.	SAM-SNY_00038640- SAM-SNY_00038655
US	10,478,078	November 28, 2014	November 19, 2019	Haan	SAM-SNY_00017269- SAM-SNY_00017284
US	10,537,289	February 23, 2018	January 21, 2020	Ochs et al.	SAM-SNY_00038229- SAM-SNY_00038255
US	10,617,356	August 15, 2017	April 14, 2020	Wang et al.	SAM-SNY_00038595- SAM-SNY_00038615
US	10,653,362	January 29, 2016	May 16, 2020	Chon et al.	SAM-SNY_00018728- SAM-SNY_00018749
US	10,729,336	June 16 , 2017	August 4 , 2020	Tran	SAM-SNY_00016304- SAM-SNY_00016394
US	11,033,235	September 26, 2013	June 15, 2021	Tambe et al.	SAM-SNY_00017168- SAM-SNY_000171781
US	11,190,166	December 7, 2015	November 30, 2021	Ricci et al.	SAM-SNY_00038479- SAM-SNY_00038544
US	11,363,987	April 20, 2018	June 21, 2022	Romesburg	SAM-SNY_00019717- SAM-SNY_00019732
US	2002/0143265	February 1, 2001	October 3, 2002	Ackerman et al.	SAM-SNY_00017405- SAM-SNY_00017421
US	2002/0193838	August 13, 2002	December 19, 2002	Lovett	SAM-SNY_00020308- SAM-SNY_00020325
US	2003/0233048	May 14, 2003	Dec. 18, 2003	Silverman et al.	SAM-SNY_00038430- SAM-SNY_00038478
US	2004/0010201	June 5, 2002	January 15, 2004	Korzinov et al.	SAM-SNY_00024415- SAM-SNY_00024431

US	2004/0092836	November 11, 2002	May 13, 2004	Ritscher et al.	SAM-SNY_00022198-SAM-SNY_00022229
US	2004/0158295	December 4, 2003	August 12, 2004	Dyjach et al.	SAM-SNY_00023454-SAM-SNY_00023463
US	2004/0230105	October 3, 2003	Nov. 18, 2004	Geva et al.	SAM-SNY_00019587-SAM-SNY_00019664
US	2004/0230383	May 12, 2003	November 18, 2004	Bechhoefer et al.	SAM-SNY_00018129-SAM-SNY_00018216
US	2004/0243014	June 28, 2003	December 2, 2004	Lee et al.	SAM-SNY_00017182-SAM-SNY_00017207
US	2004/0260186	3/2/204	December 23, 2004	Dekker	SAM-SNY_00020326-SAM-SNY_00020366
US	2005/0033129	June 22, 2004	February 10, 2005	Edgar, Jr. et al.	SAM-SNY_00028752-SAM-SNY_00028771
US	2005/0171447	December 20, 2002	June 4, 2005	Esperer	SAM-SNY_00025426-SAM-SNY_00025440
US	2005/0222511	March 30, 2004	October 6, 2005	Hadley et al.	SAM-SNY_00017470-SAM-SNY_00017503
US	2005/0228300	October 18, 2004	October 13, 2005	Jaime et al.	SAM-SNY_00022540-SAM-SNY_00022553
US	2006/0161069	January 20, 2005	July 20, 2006	Li	SAM-SNY_00018956-SAM-SNY_00018997
US	2006/0195037	February 15, 2006	August 31, 2006	Wiesel	SAM-SNY_00018295-SAM-SNY_00018310
US	2006/0122476	June 28, 2005	June 8, 2006	Van Slyke	SAM-SNY_00016938-SAM-SNY_00016981
US	2006/0211930	January 30, 2006	September 21, 2006	Scharf et al.	SAM-SNY_00025737-SAM-SNY_00025759
US	2006/0281999	June 13, 2005	December 14, 2006	Li	SAM-SNY_00024070-SAM-SNY_00024092
US	2007/0021675	September 27, 2006	January 25, 2007	Childre et al.	SAM-SNY_00019505-SAM-SNY_00019536

					Being produced concurrently
US	2007/0032733	July 18, 2006	February 8, 2007	Burton	SAM-SNY_00018599-SAM-SNY_00018639
US	2007/0049974	August 23, 2005	March 1, 2007	Li et al.	SAM-SNY_00023690-SAM-SNY_00023709
US	2007/0073177	September 29, 2005	March 29, 2007	Kontothanassis et al.	SAM-SNY_00023710-SAM-SNY_00023720
US	2007/0093720	November 9, 2006 April 26, 2007	April 26, 2007	Fischell et al.	SAM-SNY_00017422-SAM-SNY_00017469
US	2007/0100246	October 31, 2006	May 3, 2007	Hyde	SAM-SNY_00025059-SAM-SNY_00025071
US	2007/0123787	October 5, 2006	May 31, 2007	Kitajima et al.	SAM-SNY_00016526-SAM-SNY_00016560 Being produced concurrently
US	2007/0129642	February 12, 2007	June 7, 2007	Korzinov	SAM-SNY_00016922-SAM-SNY_00016937
US	2007/0142737	December 20, 2005	June 21, 2007	Cazares et al.	SAM-SNY_00016577-SAM-SNY_00016596
US	2007/0219453	March 14, 2006	September 20, 2007	Kremliovsky et al.	SAM-SNY_00020417-SAM-SNY_00020440
US	2007/0260151	September 6, 2006	November 8, 2007	Clifford	SAM-SNY_00019098-SAM-SNY_00019114
US	2008/0004904	August 30, 2006	January 3, 2008	Tran	SAM-SNY_00016395-SAM-SNY_00016480
US	2008/0119705	October 31, 2007	May 22, 2008	Patel et al.	SAM-SNY_00019692-SAM-SNY_00019716
US	2008/0220734	March 5, 2007	September 11, 2008	Cohen	SAM-SNY_00016287-SAM-SNY_00016303
US	2008/0269626	April 30, 2007	October 30, 2008	Gallagher et al.	SAM-SNY_00020563-SAM-SNY_00020575

US	2008/0269628	July 31, 2007	October 30, 2008	Koertge et al.	SAM-SNY_00019198-SAM-SNY_00019208
US	2008/0306564	June 11, 2007	December 11, 2008	Wei et al.	SAM-SNY_00024709-SAM-SNY_00024726
US	2008/0319332	August 10, 2006	December 25, 2008	Sornmo et al.	SAM-SNY_00024762-SAM-SNY_00024782
US	2009/0054795	August 22, 2007	February 26, 2009	Miscynski et al.	MONEBO_0000138-MONEBO_0000150 Being produced concurrently
US	2009/0105556	September 29, 2008	4/223/2009	Fricke et al.	SAM-SNY_00021767-SAM-SNY_00021798 Being produced concurrently
US	2009/0209835	September 9, 2009	August 20, 2009	Diab et al.	SAM-SNY_00017980-SAM-SNY_00018012
US	2009/0275849	May 2, 2008	November 5, 2009	Stewart	SAM-SNY_00016675-SAM-SNY_00016687
US	2009/0281587	May 7, 2008	November 12, 2009	Pei	SAM-SNY_00022576-SAM-SNY_00022598
US	2009/0292180	April 18, 2007	November 26, 2009	Mirow	SAM-SNY_00021056-SAM-SNY_00021126
US	2009/0326401	January 26, 2009	December 31, 2009	Jonckheere et al.	SAM-SNY_00019397-SAM-SNY_00019431
US	2010/0049267	August 21, 2009	Feb. 25, 2010	Mollerus	SAM-SNY_00025227-SAM-SNY_00025245
US	2010/0106035	October 31, 2005	April 29, 2010	Van Dam et al.	SAM-SNY_00037775-SAM-SNY_00037788 Being produced concurrently

US	2010/0174205	September 23, 2009	July 8, 2010	Wegerif	SAM-SNY_00024160-SAM-SNY_00024189
US	2010/0176952	December 4, 2009	July 15, 2010	Bajcsy et al.	SAM-SNY_00037617-SAM-SNY_00037642
US	2010/0274141	April 15, 2010	October 28, 2010	Patangay et al.	SAM-SNY_00023375-SAM-SNY_00023397
US	2010/0274148	June 27, 2009	October 28, 2010	Zhang et al.	SAM-SNY_00016626-SAM-SNY_00016649
US	2010/0274308	June 24, 2009	October 28, 2010	Scott	SAM-SNY_00024564-SAM-SNY_00024590
US	2010/0280402	April 27, 2010	November 4, 2010	Dunbar et al.	SAM-SNY_00016620-SAM-SNY_16625 Being produced concurrently
US	2010/0298660	May 20, 2009	November 25, 2010	McCombie et al.	SAM-SNY_00021825-SAM-SNY_00021869
US	2011/0077484	September 30, 2009	March 31, 2011	Van Slyke et al.	SAM-SNY_00038142-SAM-SNY_00038168
US	2011/0098583	August 24, 2010	April 28, 2011	Pandia et al.	SAM-SNY_00024093-SAM-SNY_00024159
US	2011/0152957	December 21, 2009	June 23, 2011	Shaquer	SAM-SNY_00017230-SAM-SNY_11117268
US	2011/0166466	August 4, 2008	July 7, 2011	Chon et al.	SAM-SNY_00022062-SAM-SNY_00022074
US	2011/0172504	January 4, 2011	July 14, 2011	Wegerich	SAM-SNY_00017617-SAM-SNY_00017637 Being produced concurrently
US	2011/0208079	May 13, 2011	August 25, 2011	Babaeizadeh et al.	SAM-SNY_00037735-SAM-SNY_00037748
US	2011/0224565	March 14, 2011	September 15, 2011	Ong et al.	SAM-SNY_00028240-

					SAM-SNY_00028294
US	2011/0245628	March 31, 2010	October 6, 2011	Baker, Jr. et al.	SAM-SNY_00027595-SAM-SNY_00027606
US	2011/0257556	April 16, 2010	October 20, 2011	Guo et al.	SAM-SNY_00018269-SAM-SNY_00018286
US	2011/0270095	April 27, 2010	November 3, 2011	Bukhman	MONEBO_0000151-MONEBO_0000192 Being produced concurrently
US	2011/0295142	May 10, 2011	December 1, 2011	Chakravarthy et al.	SAM-SNY_00023036-SAM-SNY_00023059
US	2011/0306845	June 15, 2010	December 15, 2011	Osorio	SAM-SNY_00019537-SAM-SNY_00019578
US	2011/0319724	October 30, 2007	Dec. 29, 2011	Cox	SAM-SNY_00017638-SAM-SNY_00017673 Being produced concurrently
US	2012/0071730	September 16, 2011	March 22, 2012	Romero	SAM-SNY_00023749-SAM-SNY_00023770
US	2012/0101541	October 26, 2010	April 26, 2012	Corbucci et al.	SAM-SNY_00017357-SAM-SNY_00017385 Being produced concurrently
US	2012/0123232	December 16, 2009	May 17, 2012	Najarian et al.	SAM-SNY_00023134-SAM-SNY_00023252
US	2012/0190947	January 20, 2012	July 26, 2012	Chon et al.	SAM-SNY_00027284-SAM-SNY_00027307 Being produced concurrently

US	2012/0238891	March 17, 2011	September 20, 2012	Sarkar et al.	SAM-SNY_00025072-SAM-SNY_00025096
US	2012/0296219	October 20, 2010	November 22, 2012	Chon et al.	SAM-SNY_00018463-SAM-SNY_00018476 Being produced concurrently
US	2012/0310100	May 31, 2011	December 6, 2012	Galen et al.	SAM-SNY_00027529-SAM-SNY_00027557
US	2013/0041273	August 11, 2011	February 14, 2013	Houben et al.	SAM-SNY_00023539-SAM-SNY_00023575
US	2013/0060154	September 5, 2012	March 7, 2013	Morita	SAM-SNY_00024212-SAM-SNY_00024235
US	2013/0079606	September 23, 2011	March 28, 2013	McGonigle et al.	SAM-SNY_00024862-SAM-SNY_00024913 Being produced concurrently
US	2013/0190638	March 15, 2013	July 25, 2013	Chon et al.	SAM-SNY_00018786-SAM-SNY_00018807
US	2013/0191035	October 12, 2011	July 25, 2013	Chon et al.	SAM-SNY_00024542-SAM-SNY_00024563 Being produced concurrently
US	2013/0261414	March 29, 2012	October 3, 2013	Tal et al.	SAM-SNY_00024047-SAM-SNY_00024069

US	2013/0310909	July 29, 2013	November 21, 2013	Simon et al.	SAM-SNY_00021532-SAM-SNY_00021576
US	2014/0073861	September 11, 2012	March 13, 2014	Rodriguez-Llorente et al.	Being produced concurrently

US	2014/0073865	September 11, 2012	March 13, 2014	Rodriguez-Llorente et al.	SAM-SNY_00020861-SAM-SNY_00021055 Being produced concurrently
US	2014/0073887	May 14, 2012	March 13, 2014	Peterson et al.	SAM-SNY_00027453-SAM-SNY_00027482
US	2014/0100432	March 15, 2013	June 10, 2014	Golda et al.	SAM-SNY_00018998-SAM-SNY_00019020
US	2014/0149325	May 16, 2012	May 29, 2014	Clifton et al.	SAM-SNY_00023440-SAM-SNY_00023453
US	2014/0180144	April 26, 2012	June 26, 2014	Chen et al.	SAM-SNY_00022763-SAM-SNY_00022774
US	2014/0222350	June 7, 2012	August 7, 2014	Zheng et al.	SAM-SNY_00017327-SAM-SNY_00017339
US	2014/0296655	March 11, 2014	October 2, 2014	Akhbardeh et al.	SAM-SNY_00025453-SAM-SNY_00025484
US	2014/0275852	May 30, 2014	September 18, 2014	Hong et al.	SAM-SNY_00018875-SAM-SNY_00018955
US	2014/0276119	May 30, 2014	September 18, 2014	Venkatraman et al.	SAM-SNY_00016805-SAM-SNY_00016879
US	2014/0073898	September 11, 2012	March 13, 2014	Engelbrecht et al.	SAM-SNY_00022833-SAM-SNY_00022947 Being produced concurrently
US	2014/0073935	September 11, 2012	March 13, 2014	Rodriguez-Llorente et al.	SAM-SNY_00023812-SAM-SNY_00024005 Being produced concurrently

US	2014/0073937	September 11, 2012	March 13, 2014	Rodriguez-Llorente et al.	SAM-SNY_00017706-SAM-SNY_00017899 Being produced concurrently
US	2014/0073957	September 11, 2012	March 13, 2014	Rodriguez-Llorente et al.	SAM-SNY_00022304-SAM-SNY_00022497 Being produced concurrently
US	2014/0073861	September 11, 2012	March 13, 2014	Rodriguez-Llorente et al.	SAM-SNY_00020639-SAM-SNY_00020833 Being produced concurrently
US	2014/0073940	September 11, 2012	March 13, 2014	Rodriguez-Llorente et al.	SAM-SNY_00020047-SAM-SNY_00020241 Being produced concurrently
US	2014/0288435	May 29, 2014	September 25, 2014	Richards et al.	SAM-SNY_00022948-SAM-SNY_00023020
US	2015/0045686	October 30, 2014	February 12, 2015	Lynn	SAM-SNY_00018050-SAM-SNY_00018128
US	2015/0133795	May 13, 2013	May 14, 2015	Tomaselli et al.	SAM-SNY_00019811-SAM-SNY_00019835
US	2015/0141859	November 19, 2013	May 21, 2015	Sandler et al.	SAM-SNY_00024914-SAM-SNY_00024937
US	2015/0148691	December 9, 2014	May 28, 2015	Moyer et al.	SAM-SNY_00024378-SAM-SNY_00024414 Being produced concurrently

US	2015/0196257	January 13, 2015	July 16, 2015	Yousefi et al.	SAM-SNY_00017504-SAM-SNY_00017555 Being produced concurrently
US	2015/0282768	November 4, 2014	October 8, 2015	Luna et al.	SAM-SNY_00036499-SAM-SNY_00036556
US	2015/0305684	June 1, 2015	October 29, 2015	Gross	SAM-SNY_00017900-SAM-SNY_00017908
US	2015/0313484	May 5, 2015	November 5, 2015	Burg et al.	SAM-SNY_00020367-SAM-SNY_00020416
US	2015/0342535	May 30, 2014	December 3, 2015	Chen	SAM-SNY_00016705-SAM-SNY_00016733
US	2015/0343233	March 28, 2014	December 3, 2015	Scheinowitz et al.	SAM-SNY_00018390-SAM-SNY_00018399
US	2016/0038045	August 7, 2014	February 11, 2016	Shapiro	SAM-SNY_00033962-SAM-SNY_00033990
US	2016/0089086	June 5, 2015	March 31, 2016	Lin et al.	SAM-SNY_00019794-SAM-SNY_00019810 Being produced concurrently
US	2016/0151023	November 11, 2015	June 2, 2016	Pamula	SAM-SNY_00022249-SAM-SNY_00022259
US	2016/0206247	January 15, 2016	July 21, 2016	Morland et al.	SAM-SNY_00016982-SAM-SNY_00017003
US	2021/0000347	September 21, 2020	January 7, 2021	Stump	SAM-SNY_00024783-SAM-SNY_00024861
US	2022/0183580	February 7, 2019	June 16, 2022	Safi-Harb et al.	SAM-SNY_00035601-SAM-SNY_00035609
WO	02/069178	February 11, 2002	September 6, 2002	Logier et al.	SAM-SNY_00022075-SAM-SNY_00022108

WO	99/32030	December 15, 1998	July 1, 1999	Smith et al.	SAM-SNY_00018026-SAM-SNY_00018049
WO	2004/071576	February 4, 2004	August 26, 2004	Fitts et al.	SAM-SNY_00027558-SAM-SNY_00027594
WO	2009/018570	August 4, 2008	February 5, 2009	Chon et al.	SAM-SNY_00025319-SAM-SNY_00025340 Being produced concurrently
WO	2009/094632	January 26, 2009	July 30, 2009	Stuppy	SAM-SNY_00024641-SAM-SNY_00024708
WO	2010/036894	September 25, 2009	April 1, 2010	Garudadri et al.	SAM-SNY_00023288-SAM-SNY_00023374
WO	2010/084211	May 28, 2009	July 29, 2010	Moreno et al.	SAM-SNY_00021610-SAM-SNY_00021657
WO	2011/007292	July 6, 2010	January 20, 2011	Veen et al.	SAM-SNY_00019141-SAM-SNY_00019197
WO	2014/155230	March 17, 2014	October 2, 2014	Wang et al.	SAM-SNY_00017208-SAM-SNY_00017229
WO	2015/190994	June 13, 2014	December 17, 2015	Shao et al.	SAM-SNY_00017131-SAM-SNY_00017167 Being produced concurrently
US	7,826,892	June 29, 2007	November 2, 2011	Riftine et al.	Being produced concurrently
US	6,122,535	March 10, 1998	Sept 19, 2000	Kaestle et al.	Being produced concurrently
US	2007/0276275	May 23, 2007	November 29, 2007	Proctor et al.	Being produced concurrently
US	7,104,959	August 26, 2003	September 12, 2006	Mitsuo et al.	Being produced concurrently

US	6,766,194	December 12, 2001	July 20, 2004	Kroll et al.	Being produced concurrently
WO	2005/096170	February 10, 2005	October 13, 2005	Stanley et al.	Being produced concurrently
KR	100493714B1	November 26, 2004	June 2, 2005	Lee Byung-chae et al.	Being produced concurrently
US	7,123,953	December 3, 2002	October 17, 2006	Starobin et al.	Being produced concurrently
US	11,172,835	Aug 11, 2008	Nov 16, 2021		
US	2007/0123787	October 5, 2006	May 31, 2007	Kazumi et al.	Being produced concurrently
US	2008/0045815	June 18, 2007	February 21, 2008	Derchak et al.	Being produced concurrently Being produced concurrently
WO	2008/055078	October 27, 2006	May 8, 2008	Derchak et al.	Being produced concurrently
US	7,146,206	March 6, 2003	December 5, 2006	Glass et al.	Being produced concurrently
US	2010/0056940	April 11, 2008	March 4, 2010	Moorman et al.	Being produced concurrently
US	2011/137192	February 15, 2011	June 9, 2011	Zhang et al.	Being produced concurrently
US	2012/0136264	July 18, 2011	May 31, 2012	Zhang et al.	Being produced concurrently Being produced concurrently
US	7,846,106	April 26, 2006	December 7, 2010	Andrews et al.	Being produced concurrently

					Being produced concurrently
US	7,559,903	March 28, 2007	July 14, 2009	Moussavi et al.	Being produced concurrently
US	2011/0112379	November 12, 2010	May 12, 2011	Li et al.	Being produced concurrently
WO	2008/103389	Feb 20, 2008	Aug 28, 2008	Lynn et al.	Being produced concurrently
WO	2012/149207	April 26, 2012	Nov 1, 2012	Chen et al.	Being produced concurrently
US	10,722,182	May 31, 2016	July 28, 2020	Li et al.	Being produced concurrently
US	2003/0176815	Dec 5, 2022	Sept 18, 2003	Baba et al.	Being produced concurrently
US	2012/0184826	Jan 27, 2012	July 19, 2012	Keenan et al.	Being produced concurrently
US	2016/0038045	Aug 7, 2014	Feb 11, 2016	Shapiro	Being produced concurrently
US	2016/0051158	Nov 21, 2014	Feb 25, 2016	Silva	Being produced concurrently
US	9,867,575	Aug 22, 2014	Jan 16, 2018	Maani et al.	Being produced concurrently
KR	KR100493714B1	Nov 26, 2004	June 2, 2005	Lee et al.	Being produced concurrently
WO	2015/086338	Nov 28, 2014	June 18, 2015	De Haan et al.	Being produced concurrently
WO	2016/038585	Sept 11, 2015	March 17, 2016	Devries et al.	Being produced concurrently
US	2011/0257536	Sept 15, 2008	Oct 20, 2011	Ser et al.	Being produced concurrently
US	2013/0006123	June 29, 2012	Jan 3, 2013	Aoshima	Being produced concurrently

US	8,478,418	April 13, 2012	July 2, 2013	Fahey	Being produced concurrently
US	8,548,740	Oct 7, 2010	Oct 1, 2013	Hesch et al.	Being produced concurrently
US	8,798,726	Oct 9, 2012	Aug 5, 2014	Kang et al.	Being produced concurrently
WO	2014/196119	April 17, 2014	Dec 11, 2014	Aoshima	Being produced concurrently
WO	2013/036718	Sept 7, 2012	March 14, 2013	Clifford et al.	Being produced concurrently
WO	2016/105275	Dec 23, 2014	June 30, 2016	Shao et al.	Being produced concurrently
CN	104218973A	Sept 15, 2014	Dec 17, 2014	Jin et al.	Being produced concurrently
JP	2013504387A	Sept 2010	Feb 7, 2013	GARUDADRI	Being produced concurrently
CN	101719881	Dec 7, 2009	Jan 23, 2013	Shi et al.	Being produced concurrently
EP	2829223A1	July 28, 2014	Jan 28, 2015	Visvanathan et al.	Being produced concurrently
WO	2016/054521 A1 (PCT/US2015/053747)	October 2, 2015	April 7, 2016	Laughner et al.	Being produced concurrently
WO	2015/131065 A1 (PCT/US2015/018049)	Feb 27, 2015	Sept 3, 2015	Leboeuf et al.	Being produced concurrently
WO	2014/123512 A1 (PCT/US2013/024770)	Feb 5, 2013	Aug 14, 2014	Brockway et al.	Being produced concurrently

CN	101176660A	Dec 6, 2007	May 14, 2008	Liu et al.	Being produced concurrently
KR	KR100493714B1	Nov 26, 2004	June 2, 2005	Lee et al.	Being produced concurrently
US	8,666,483	October 13, 2008	March 4, 2014	Zhang et al.	Being produced concurrently
WO	2008/000254 A1	June 26, 2006	Jan 3, 2008	Graff et al.	Being produced concurrently
WO	2008/055078 A2	Oct 26, 2007	May 8, 2008	Derchak et al.	Being produced concurrently
US	5,301,677	Feb 6, 1992	April 12, 1994	Hsung	Being produced concurrently
US	2008/0161873	Jan 3, 2008	July 3, 2008	Gunderson	Being produced concurrently
US	2007/0129642	Feb 12, 2007	June 7, 2007	Korzinov	Being produced concurrently
US	2011/0125206	Nov 24, 2009	May 26, 2011	Bornzin et al.	Being produced concurrently
US	2009/0281588	May 9, 2008	Nov 12, 2009	Pei	Being produced concurrently
US	2008/007236 A2	June 5, 2007	Jan 17, 2008	Schmidt et al.	Being produced concurrently
US	7,559,903	March 28, 2007	July 14, 2009	Moussavi et al.	Being produced concurrently
US	2008/0214946 A1	March 26, 2008	Sept 4, 2008	Miller et al.	Being produced concurrently
US	2009/0069703 A1	May 7, 2008	March 12, 2009	Takla et al.	Being produced concurrently
US	2009/0264783 A1	April 18, 2008	Oct 22, 2009	Xi et al.	Being produced concurrently
US	2009/0326871	Oct 3, 2008	Dec 31, 2009	Watson et al.	Being produced concurrently

US	6,931,269	Aug 27, 2004	Aug 16, 2005	Terry	Being produced concurrently
US	7,001,337	March 2, 2004	Feb 21, 2006	Dekker	Being produced concurrently
US	7,386,340	March 26, 2003	June 10, 2008	Schlegel et al.	Being produced concurrently
US	7,509,161	Oct 15, 2004	March 24, 2009	Viertio-Oja	Being produced concurrently
US	7,604,603	July 8, 2004	Oct 20, 2009	Sackner et al.	Being produced concurrently
US	7,733,224	June 30, 2006	June 8, 2010	Tran	Being produced concurrently
US	8,041,416	Sept 18, 2007	Oct 18, 2011	Hoium et al.	Being produced concurrently
US	8,050,751	July 31, 2008	Nov 1, 2011	Zhang et al.	Being produced concurrently
US	8,326,407	March 22, 2008	Dec 4, 2012	Linker	Being produced concurrently
WO	2005/067790 A1	Jan 14, 2005	July 28, 2005	Burton	Being produced concurrently
WO	2006/054306 A2	Nov 22, 2005	May 26, 2006	Todros et al.	Being produced concurrently
US	2017/0112447 A1	Oct 21, 2016	April 27, 2017	Aumer et al.	Being produced concurrently
US	2008/0287815 A1	May 16, 2007	Nov 20, 2008	Chon et al.	Being produced concurrently
US	2013/0172760 A1	Feb 27, 2013	July 4, 2013	Chon et al.	Being produced concurrently
US	8,858,450	Feb. 27, 2013	Oct 14, 2014	Chon et al.	Being produced concurrently
US	8,388,543	May 16, 2007	March 5, 2013	Chon et al.	Being produced concurrently

US	9,414,753	Aug 3, 2012	Aug 16, 2016	Chon et al.	Being produced concurrently
WO	2011/050066 A2	Oct 20, 2010	April 28, 2011	Chon et al.	Being produced concurrently
WO	2012/051300 A2	Oct 12, 2011	April 19, 2012	Chon et al.	Being produced concurrently
WO	2012/100175 A1	Jan 20, 2012	July 26, 2012	Chon et al.	Being produced concurrently
WO	2016/123484 A1	Jan 29, 2016	Aug 4, 2016	Chon et al.	Being produced concurrently
US	9,456,787	June 3, 2014	Oct 4, 2016	Venkatraman et al.	Being produced concurrently
US	9,918,666	Jan 13, 2015	March 20, 2018	Yousefi et al.	Being produced concurrently
US	8,942,777	May 25, 2007	Jan 27, 2015	Diab et al.	Being produced concurrently
US	2015/0238137	Feb 25, 2015	Aug 27, 2015	Eyal et al.	Being produced concurrently
WO	2016/022401 A1	July 31, 2015	Feb 11, 2016	Lerner et al.	Being produced concurrently
US	2016/0198965	Jan. 9, 2015	July 14, 2016	Mestha et al.	Being produced concurrently
US	7,515,949	June 29, 2005	April 7, 2009	Norris	Being produced concurrently
US	2012/0220247 A1	Feb 28, 2011	Aug 30, 2012	Ochs et al.	Being produced concurrently
US	2014/0073946 A1	Sept 11, 2012	March 13, 2014	Rodriguez-Llorente et al.	Being produced concurrently
WO	2006/134197	June 12, 2006	Dec 21, 2006	Silveria Martin et al.	Being produced concurrently
US	2006/0111635	Nov. 22, 2004	May 25, 2006	Todros et al.	Being produced concurrently

US	2010/0331716	June 26, 2009	Dec. 30, 2010	Watson et al.	Being produced concurrently
US	5,797,840	Feb. 28, 1997	Aug. 25, 1998	Akselrod et al.	Being produced concurrently
US	6,094,592	May 26, 1998	July 25, 2000	Yorkey et al.	Being produced concurrently
US	7,403,806	Oct 14, 2005	July 22, 2008	Norris	Being produced concurrently
US	7,412,283	June 11, 2004	Aug 12, 2008	Ginzburg et al.	Being produced concurrently
US	7,416,531	Oct 4, 2002	Aug 26, 2008	Mohler	Being produced concurrently
US	7,738,935	Dec 12, 2005	June 15, 2010	Turcott	Being produced concurrently
US	7,813,791	Aug 20, 2007	Oct 12, 2010	Gill et al.	Being produced concurrently
US	8,273,032	July 30, 2008	Sept 25, 2012	Carney et al.	Being produced concurrently
US	9,204,844	April 17, 2014	Dec 8, 2015	Li et al.	Being produced concurrently
US	9,820,680	May 15, 2012	Nov 21, 2017	Muzet	Being produced concurrently
US	9,931,081	Mar 17, 2014	April 3, 2018	Wang et al.	Being produced concurrently
US	10,758,164	Aug 1, 2014	Sept 1, 2020	Derkx	Being produced concurrently
US	10,799,139	Aug 19, 2015	Oct 13, 2020	Rudzinski et al.	Being produced concurrently
US	11,045,101	Dec 23, 2014	June 29, 2021	Shao et al.	Being produced concurrently
US	11,129,560	Dec 21, 2018	Sept 28, 2021	Tan et al.	Being produced concurrently

US	2010/0331716	June 26, 2009	Dec 30, 2010	Watson et al.	Being produced concurrently
US	2005/0038349	Aug 3, 2004	Feb 17, 2005	Choi et al.	Being produced concurrently
US	2010/0030088	July 30, 2008	Feb 4, 2010	Carney et al.	Being produced concurrently
US	2013/0066176	Sept 9, 2011	March 14, 2013	Addison et al.	Being produced concurrently
US	2014/0073933	Sept 11, 2012	March 13, 2014	Rodriguez-Llorente et al.	Being produced concurrently
US	2014/0073947	Sept 11, 2012	March 13, 2014	Rodriguez-Llorente et al.	Being produced concurrently
US	2016/0367198	Feb 26, 2015	Dec 22, 2016	Chon et al.	Being produced concurrently
US	2017/0014083	March 21, 2016	Jan 19, 2017	Diab et al.	Being produced concurrently
US	2017/0273585	Aug 19, 2015	Sept 28, 2017	Rudzinski et al.	Being produced concurrently
US	2024/0306990	May 23, 2024	Sept 19, 2024	Billi et al.	Being produced concurrently
US	9,603,542	July 6, 2010	March 28, 2017	Veen et al.	Being produced concurrently
US	7,509,154	Aug 20, 2007	March 24, 2009	Diab et al.	Being produced concurrently

Table 2: Non-Patent Publications

Title	Publication Date	Author(s)	Publisher	Bates Range
510(k) Summary for ECG Check	February 14, 2013	Cardiac Designs, LLC	Cardiac Designs, LLC	SAM-SNY_00035527-SAM-SNY_00035532
A 290 mV Sub-VT ASIC for Real-Time Atrial Fibrillation Detection	October 2014	Andersson et al.	IEEE Transactions On Biomedical Circuits and Systems, Vol. 9, No. 3, June 2015	SAM-SNY_00032485-SAM-SNY_00032494
A combined segmenting and non-segmenting approach to signal quality estimation for ambulatory photoplethysmography	November 2014	Wander et al.	Physiological Measurement	SAM-SNY_00030999-SAM-SNY_00031017
A computational system to optimise noise rejection in photoplethysmography signals during motion or poor perfusion states	January 2006	Foo et al.	Medical and Biological Engineering and Computing	SAM-SNY_00031097-SAM-SNY_00031102
A computer model of atrial fibrillation	February 1964	Moe et al.	American Heart Journal	SAM-SNY_00032946-SAM-SNY_00032966
A Detector for a Chronic Implantable Atrial Tachyarrhythmia Monitor	March 2008	Sarkar et al.	IEEE Transactions On Biomedical Engineering, Vol. 55, No. 3	SAM-SNY_00027447-SAM-SNY_00027452
A General Framework for Heart Rate Monitoring Using Wrist-Type Photoplethysmographic	February 2015	Zhang et al.	IEEE Transactions On Biomedical Engineering,	SAM-SNY_00032407-SAM-SNY_00032416

Signals During Intensive Physical Exercise			Vol. 62, No. 2	
A High Resolution Approach to Estimating Time-Frequency Spectra and Their Amplitudes	February 2006	Wang et al.	Annals of Biomedical Engineering, 34:2, 326-338	SAM-SNY_00032372-SAM-SNY_00032384 Being produced concurrently
A Method for Automatic Identification of Reliable Heart Rates Calculated From ECG and PPG Waveforms	May 2006	Yu et al.	Journal of the American Medical Informatics Association, 13:3, 309-19	SAM-SNY_00037718-SAM-SNY_00037729
A Method for Detection of Atrial Fibrillation Using RR Intervals	September 2000	Tateno et al.	Computers in Cardiology	SAM-SNY_00031251-SAM-SNY_00031254
A method for the time-varying nonlinear prediction of complex nonstationary biomedical signals	2008	Faes et al.	IEEE transactions on biomedical engineering 56 (2), 205-209	SAM-SNY_00030287-SAM-SNY_00030291
A Motion-Tolerant Adaptive Algorithm for Wearable Photoplethysmographic Biosensors	May 2013	Yousef et al.	IEEE Journal of Biomedical and Health Informatics (Volume: 18, Issue: 2, March 2014)	SAM-SNY_00029253-SAM-SNY_00029264
A Multi-Band Spectral Subtraction Method for Enhancing Speech Corrupted by Colored Noise	May 17, 2002	Kamath et al.	IEEE International Conference on Acoustics, Speech, and Signal Processing, IV-4164	SAM-SNY_00037707-SAM-SNY_00037710
A New Algorithm For Autoregression Moving Average Model Parameter	2001	Chon et al.	Annals of Biomedical Engineering 29, 92-	SAM-SNY_00032323-SAM-SNY_00032329

Estimation Using Group Method of Data Handling			98	
A new algorithm for linear and nonlinear ARMA model parameter estimation using affine geometry [and application to blood flow/pressure data]	2001	Lu et al.	IEEE Transactions on Biomedical Engineering 48 (10), 1116-1124	SAM-SNY_00029457-SAM-SNY_00029465
A new approach to closed-loop linear system identification via a vector autoregressive model	2002	Wang et al.	Annals of Biomedical Engineering 30, 1204-1214	SAM-SNY_00030276-SAM-SNY_00030286
A new method for detecting for detecting atrial fibrillation using R-R intervals	1983	Moody et al.	Computers in Cardiology	SAM-SNY_00025246-SAM-SNY_00025249
A new method for pulse oximetry possessing inherent insensitivity to artifact	April 2001	Hayes et al.	IEEE Transactions on Biomedical Engineering	SAM-SNY_00034005-SAM-SNY_00034014
A New Quality Measure in Electrocardiogram Signal	2004	Oh	A Thesis Presented to the Graduate School of the University of Florida in Partial Fulfillment of the Requirements for the Degree of Master of Science	SAM-SNY_00025345-SAM-SNY_00025425
A Novel Application for the Detection of an Irregular Pulse using an iPhone 4S in Patients with Atrial Fibrillation	December 2012	McManus et al.	Heart Rhythm. 2013 Mar; 10(3): 315–319	SAM-SNY_00032296-SAM-SNY_00032309 Being produced concurrently

A Novel Approach to Monitor Nonstationary Dynamics in Physiological Signals: Application to Blood Pressure, Pulse Oximeter, and Respiratory Data	November 2010	Yang et al.	Annals of biomedical engineering; Vol 38, No. 11; 3478-3488	SAM-SNY_00028856-SAM-SNY_00028866
A novel approach using time–frequency analysis of pulse-oximeter data to detect progressive hypovolemia in spontaneously breathing healthy subjects	2011	Selvaraj et al.	IEEE transactions on biomedical engineering 58 (8), 2272-2279	SAM-SNY_00029654-SAM-SNY_00029661
A Novel Method for Detecting R-peaks in Electrocardiogram (ECG) Signal	April 2011	Manikandan et al.	Biomedical Signal Processing and Control	SAM-SNY_00032395-SAM-SNY_00032405
A Novel Method to Detect Heart Beat Rate Using a Mobile Phone	August 31 – September 4, 2010	Pelegris et al.	32nd Annual International Conference of the IEEE EMBS, Buenose Aires, Argentina	SAM-SNY_00026285-SAM-SNY_00026289
A novel quantitative method for diabetic cardiac autonomic neuropathy assessment in type 1 diabetic mice	2014	Chon et al.	Journal of Diabetes Science and Technology 8 (6), 1157-1167	SAM-SNY_00030360-SAM-SNY_00030370
A Novel Time-Varying Spectral Filtering Algorithm for Reconstruction of Motion Artifact Corrupted Heart Rate Signals During	23 December	Salehizadeh et al.	Sensors 2016, 16, 10	SAM-SNY_00030965-SAM-SNY_00030984 Being produced

Intense Physical Activities Using a Wearable Photoplethysmogram Sensor	2015			concurrently
A portable, low-cost, battery-powered wireless monitoring system for obtaining varying physiologic parameters from multiple subjects	2006	Zhao et al.	2006 International Conference of the IEEE Engineering in Medicine and Biology Society	SAM-SNY_00030416-SAM-SNY_00030419
A Practical Guide to Support Vector Classification	April 2010	Hsu et al.	National Taiwan University	SAM-SNY_00027339-SAM-SNY_00027354
A robust time-varying identification algorithm using basis functions	July 2003	Zou et al.	Annals of biomedical engineering Volume 31; 840-853	SAM-SNY_00029662-SAM-SNY_00029676
A Significance Test for Time Series Analysis	1941	Wallis et al.	Journal of the American Statistical Association	SAM-SNY_00031124-SAM-SNY_00031133
A Simple Method to Detect Atrial Fibrillation Using RR Intervals	2011	Jie Lian et al.ssig,	Elsevier Inc.	SAM-SNY_00028788-SAM-SNY_00028791
A Simple Method to Detect Atrial Fibrillation Using RR Intervals	March 2011	Lian et al.	The American Journal of Cardiology	SAM-SNY_00037556-SAM-SNY_00037560
A statistical approach for accurate detection of atrial fibrillation and flutter	September 2009	Dash et al.	2009 36th Annual Computers in Cardiology Conference (CinC), 137-140	SAM-SNY_00029573-SAM-SNY_00029576 Being produced concurrently
A stochastic nonlinear autoregressive algorithm reflects nonlinear dynamics of	2002	Armoundas et al.	Annals of biomedical engineering 30, 192-201	SAM-SNY_00029466-SAM-SNY_00029476

heart-rate fluctuations				
A Study of x-ray tube voltage, tube current and dose rate depeding on temperature	2011	Chon et al.	Journal of Advanced Navigation Technology 15 (2), 264-272	SAM-SNY_00030109-SAM-SNY_00030117
A Study on Algorithm of Emotion Analysis using EEG and HRV	October 15, 2010	Chon et al.	Journal of the Korea society of computer and information 15 (10), 105-112	SAM-SNY_00030398-SAM-SNY_00030405
A study on the Muscle Activity and Fatigue between Quadriceps Femoris Muscle during the Mode Shift of Contraction	2011	Chon et al.	Journal of advanced navigation technology 15 (6), 1152-1162	SAM-SNY_00029613-SAM-SNY_00029623
A study on ubiquitous psychological state recognition model using bio-signals	2010	Chon et al.	The Journal of Korean Institute of Communications and Information Sciences	SAM-SNY_00029841-SAM-SNY_00029852
A Supervised Learning Approach for the Robust Detection of Heart Beat in Plethysmographic Data	2015	Grisan et al,	IEEE	SAM-SNY_00032633-SAM-SNY_00032636
A Wavelet-Based System for Event Detection in Online Real-time Sensor Data	2001	Varadharajan	Submitted to the Department of Civil and Environmental Engineering in partial fulfillment of the requirements for the Degree of Master of Science (Massachusetts	SAM-SNY_00031142-SAM-SNY_00031219

			Institute of Technology)	
Acceptability of a Novel Smartphone Application for Rhythm Evaluation in Patients with Atrial Fibrillation	November 2014	Amante et al.	UMass Chan Medical School	SAM-SNY_00028772-SAM-SNY_00028773
Accuracy of dia gnosing atrial fibrillation on electrocardiogram by primary care practitioners and interpretative diagnostic software: analysis of data from screening for atrial fibrillation in the elderly (SAFE) trial	August 25, 2007	Mant et al.	BMJ	SAM-SNY_00035695-SAM-SNY_00035700
Accurate estimation of entropy in very short physiological time series: the problem of atrial fibrillation detection in implanted ventricular devices	October 29, 2010	Lake et al.	Am J Physiol Heart Circ Physiol 300	SAM-SNY_00037539-SAM-SNY_00037545
Accurate estimation of entropy in very short physiological time series: the problem of atrial fibrillation detection in implanted ventricular devices	2011	Lake et al.	Am J Physiol Heart Circ Physiol	SAM-SNY_00029199-SAM-SNY_00029205
Adaptive cancellation of motion artifact in wearable biosensors	August-September 2012	Yousefi et al.	2012 Annual International Conference of the IEEE Engineering in Medicine and Biology Society	SAM-SNY_00034119-SAM-SNY_00034123

Adaptive interference-aware multi-channel clustering algorithm in a ZigBee network in the presence of WLAN interference	2007	Kang et al.	2007 2nd International Symposium on Wireless Pervasive Computing	SAM-SNY_00030173-SAM-SNY_00030178
Adaptive Noise Cancelling of Motion Artifact in Stress ECG Signals Using Accelerometer	2002	Raya et al.	IEEE	SAM-SNY_00037646-SAM-SNY_00037647
ADAPTIVE REDUCTION OF MOTION ARTIFACT IN THE ELECTROCARDIOGRAM	2002	Tong et al.	IEEE	SAM-SNY_00037657-SAM-SNY_00037659
Algorithms for Real-time Detection of Motion Artifacts and Accurate Estimation of Respiratory Rates using Pulse Oximeter	2008	Selvaraj et al.	https://web.wpi.edu/Images/CMS/ECE/Selvaraj-Poster.pdf	SAM-SNY_00029477-SAM-SNY_00029477
AliveCor's Heart Monitor for iPhone Receives FDA Clearance	December 3, 2012	AliveCor, Inc.	AliveCor, Inc.	SAM-SNY_00036216-SAM-SNY_00036221
AliveCor Launches New App to Auto Detect Atrial Fibrillation in an ECG Recording	September 29, 2014	AliveCor, Inc.	AliveCor, Inc.	SAM-SNY_00035754-SAM-SNY_00035760
AliveCor Mobile ECG Device for Heart Rhythm Monitoring Now Available by Prescription	March 8, 2013	AliveCor, Inc.	AliveCor, Inc.	SAM-SNY_00035584-SAM-SNY_00035588
AliveCor Receives First FDA Clearance to Detect a Serious Heart Condition in an ECG on a Mobile Device	August 21, 2014	AliveCor, Inc.	AliveCor, Inc.	SAM-SNY_00036210-SAM-SNY_00036215

Alphabet will track health data of 10,000 volunteers to 'create a map of human health'	April 19, 2017	Farr	CNBC	SAM-SNY_00058252 SAM-SNY_00058257
Altered complexity and correlation properties of R-R interval dynamics before the spontaneous onset of paroxysmal atrial fibrillation	November 16, 1999	Vikman et al.	Circulation. 1999;100:2079 –2084	SAM-SNY_00030645- SAM-SNY_00030651
Alternans of Atrial Action Potentials During Atrial Flutter as a Precursor to Atrial Fibrillation	2002	Narayan et al.	Circulation	SAM-SNY_00032429- SAM-SNY_00032434
An autoregressive model-based particle filtering algorithms for extraction of respiratory rates as high as 90 breaths per minute from pulse oximeter	2010	Lee et al.	IEEE Transactions on Biomedical Engineering 57 (9), 2158-2167	SAM-SNY_00030147- SAM-SNY_00030156
An LZ Approach to ECG Compression	June 12, 1994	Horspool et al.	IEEE Symposium on Computer-Based Medical Systems (CBMS)	SAM-SNY_00032330- SAM-SNY_00032335
Analysis of csma/ca systems under carrier sensing error: Throughput, delay and sensitivity	2008	Chong et al.	IEEE Globecom 2008-2008 IEEE Global Telecommunications Conference, 1-6	SAM-SNY_00029708- SAM-SNY_00029713
Analysis of nonstationarity in renal autoregulation mechanisms using time-varying transfer and coherence functions	2008	Chon et al.	American Journal of Physiology-regulatory, Integrative and Comparative Physiology	SAM-SNY_00030026- SAM-SNY_00030059 Being produced concurrently

Analysis of R-R Intervals in Patients with Atrial Fibrillation at Rest and During Exercise	May 1970	Bootsma et al.	Circulation, Volume XLI	SAM-SNY_00031112-SAM-SNY_00031123
Analysis of surface electrocardiograms in atrial fibrillation: techniques, research, and clinical applications	2006	Bollmann et al.	Eurospace, 8:11, 911-26	SAM-SNY_00025183-SAM-SNY_00025198
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Smartphone-based screening for atrial fibrillation: a pragmatic randomized clinical trial	September 2022	Rizas et al.	Nature Medicine; vol. 28	SAM-SNY_00035706-SAM-SNY_00035729
Smartphone-Camera-Acquired Pulse Photoplethysmographic	May 25, 2014	Lázaro et al.	2014 8th Conference of the European Study Group on Cardiovascular	SAM-SNY_00028786-

Signal for Deriving Respiratory Rate			Oscillations (ESGCO) Pages 121-122; IEEE	SAM-SNY_00028787
Smartwatch Algorithm for Automated Detection of Atrial Fibrillation	2018	Bumgarner et al.	Journal of the American College of Cardiology	SAM-SNY_00034678-SAM-SNY_00034685
Smartwatch Performance for the Detection and Quantification of Atrial Fibrillation	June 2019	Wasserlauf et al.	Circulation: Arrhythm and Electrophysiology	SAM-SNY_00035620-SAM-SNY_00035628
Spatial and temporal organization during cardiac fibrillation	March 1998	Gray et al.	NATURE Vol. 392 Iss. 5	SAM-SNY_00032884-SAM-SNY_00032888
Spectral analysis of photoplethysmographic signals: The importance of preprocessing	January 2013	Akar et al.	Biomedical Signal Processing and Control 8 (2013) 16– 22	SAM-SNY_00031103-SAM-SNY_00031111
Statistical Analysis of Heart Rate and Heart Rate Variability Monitoring Through the Use of Smart Phone Cameras	August 28 – September 1, 2012	Bolkhovsky et al.	34th Annual International Conference of the IEEE EMBS	SAM-SNY_00029229-SAM-SNY_00029232
Statistical Analysis of RR Interval Irregularities for Detection of Atrial Fibrillation	2008	Ghodrati et al.	Computers in Cardiology, 2008. pp 1057-1060	SAM-SNY_00032421-SAM-SNY_00032424
Statistical approach for the detection of motion/noise artifacts in Photoplethysmogram	August 30, 2011	Selvaraj et al.	2011 Annual International Conference of the IEEE Engineering in Medicine and Biology Society	SAM-SNY_00029288-SAM-SNY_00029291 Being produced concurrently

Statistical Approach for the Detection of Motion/Noise Artifacts in Photoplethysmogram	2011	Selvaraj et al.	Proceedings of the 33rd Annual Int'l Conference of the IEEE EMBS	SAM-SNY_00028658-SAM-SNY_00028661 Being produced concurrently
Statistical approach to quantify the presence of phase coupling using the bispectrum	2008	Siu et al.	IEEE Transactions on Biomedical Engineering 55 (5), 1512-1520	SAM-SNY_00029946-SAM-SNY_00029954
Statistical Learning Theory: A Tutorial	2011	Kulkarni et al.	WIREs Computational Statistics	SAM-SNY_00028836-SAM-SNY_00028849 Being produced concurrently
Statistical modelling of the differences between successive R–R intervals	November 5, 2004	Mandrekar et al.	Statistics in Medicine	SAM-SNY_00030940-SAM-SNY_00030954
Statistical multiplexing-based hybrid FH-OFDMA system for OFDM-based UWB indoor radio access networks	2006	Chong et al.	IEEE transactions on microwave theory and techniques 54 (4), 1793-1801	SAM-SNY_00029955-SAM-SNY_00029963
Stroke Prevention: BIOTRONIK Announces FDA Approval of BioMonitor 2 Insertable Cardiac Monitor	April, 12, 2016	BIOTRONIK	BIOTRONIK	SAM-SNY_00034735-SAM-SNY_00034738
Study of Features Based on Nonlinear Dynamical Modeling in ECG Arrhythmia Detection and Classification	July 2002	Owis et al.	IEEE TRANSACTIONS ON BIOMEDICAL ENGINEERING, VOL. 49, NO. 7	SAM-SNY_00032611-SAM-SNY_00032614

Sub-channel Allocation Scheme for Multi-media Service in AMC-based OFDMA Systems	2009	Song et al.	Journal of Broadcast Engineering 14 (2), 178-188	SAM-SNY_00030098-SAM-SNY_00030108
Subthreshold stimulation of Purkinje fibers interrupts ventricular tachycardia in intact hearts. Experimental study with voltage-sensitive dyes and imaging techniques	1994	Salama et al.	Circulation	SAM-SNY_00032772-SAM-SNY_00032788
The autonomic effects of cardiopulmonary decompression sickness in swine using principal dynamic mode analysis	2013	Bai et al.	American Journal of Physiology-Regulatory, Integrative and Comparative Physiology	SAM-SNY_00030191-SAM-SNY_00030228
The ECG Manual An Evidence-Based Approach	2009	Gertsch	Springer	SAM-SNY_00037604-SAM-SNY_00037616
The Detection and Differentiation of Arrrhythmias [Sic] Using a Smartphone: a Clinical Study of Patients with Atrial Fibrillation, Premature Atrial and Premature Ventricular Contractions	December 11, 2009	Harrington et al.	Journal of American College of Cardiology. Presented at 62nd Annual Scientific Session & Expo.	SAM-SNY_00034004-SAM-SNY_00034004 Being produced concurrently
The detection and differentiation of arrrhythmias using a smartphone: A clinical study of patients with atrial fibrillation, premature atrial	March 12, 2013	Harrington et al.	Journal of the American College of Cardiology 61 (10S), E362-E362	SAM-SNY_00032406-SAM-SNY_00032406

and premature ventricular contractions				
The difference-sign runs length distribution in testing for serial independence	2009	Cammarota et al.	Journal of Applied Statistics	SAM-SNY_00036277-SAM-SNY_00036291
The Effect of Atrial Fibrillation Ablation on Heart Rate Variability at One Year Follow-up	May 13, 2010	Sekhar et al.	Heart Rhythm, Vol 7, No. 5, May Supplement 2010	SAM-SNY_00034230-SAM-SNY_00034231
The history of Zenicor	-	Zenicor	Zenicor	SAM-SNY_00036228-SAM-SNY_00036229
The Light–Tissue Interaction of Pulse Oximetry	2007	Mannheimer	International Anesthesia Research Society	SAM-SNY_00037660-SAM-SNY_00037667
The Mechanism and Graphic Registration of The Heart Beat	1920	Lewis	Paul B. Hoeber	SAM-SNY_00027709-SAM-SNY_00028196
The Mechanism and Graphic Registration of The Heart Beat	1925	Lewis	Shaw & Sons Ltd.	SAM-SNY_00032602-SAM-SNY_00032610
The mechanism and nature of ventricular fibrillation	October 1940	Wiggers	American Heart Journal Vol. 20 Iss. 4	SAM-SNY_00032537-SAM-SNY_00032537
The pulse in atrial fibrillation	July 1986	Meijler	British Heart Journal	SAM-SNY_00032865-SAM-SNY_00032867
The role of atrial ectopics in initiating paroxysmal atrial fibrillation	2001	JWaktare et al.	European Heart Journal	SAM-SNY_00030626-SAM-SNY_00030632

The Validation of Smartphone Applications for Heart Rate Measurement	November 17, 2018	Pipitprapat et al.	Annals of Medicine, 50:8, 721-727	SAM-SNY_00035593-SAM-SNY_00035600
Three different algorithms for identifying patients suffering from atrial fibrillation during atrial fibrillation free phases of the ECG	October 3, 2007	Kikillus et al.	Computers in Cardiology	SAM-SNY_00034489-SAM-SNY_00034492
Time Series Significance Tests Based on Signs of Differences	1943	Moore et al.	Journal of American Statistical Association, Vol. 38, 1942. Issue 222, 153-164	SAM-SNY_00034216-SAM-SNY_00034229
Time–frequency approaches for the detection of interactions and temporal properties in renal autoregulation	2013	Scully et al.	Annals of biomedical engineering 41, 172-184	SAM-SNY_00030385-SAM-SNY_00030397
Time-frequency representation of inspiratory motor output in anesthetized C57BL/6 mice in vivo	2004	O'Neal III et al.	Articles in PresS. J Neurophysiol (October 20, 2004)	SAM-SNY_00029478-SAM-SNY_00029532
Time-Series	1976	Kendall	Hafner Press	SAM-SNY_00027391-SAM-SNY_00027420
Time-varying autoregressive model-based multiple modes particle filtering algorithm for respiratory rate extraction from pulse oximeter	March 2011	Lee et al.	IEEE Transactions on Biomedical Engineering 58 (3), 790-794	SAM-SNY_00030347-SAM-SNY_00030351 Being produced concurrently

Time-Varying Coherence Function for Atrial Fibrillation Detection	October 2013	Lee et al.	IEEE TRANSACTIONS ON BIOMEDICAL ENGINEERING, VOL. 60, NO. 10, OCTOBER 2013	SAM-SNY_00034196-SAM-SNY_00034206
Time-varying properties of renal autoregulatory mechanisms	2002	Zou et al.	IEEE transactions on biomedical engineering 49 (10), 1112-1120	SAM-SNY_00029595-SAM-SNY_00029603
Time-varying surrogate data to assess nonlinearity in nonstationary time series: application to heart rate variability	2008	Faes et al.	IEEE transactions on biomedical engineering 56 (3), 685-695	SAM-SNY_00029735-SAM-SNY_00029745
Tracheal sounds acquisition using smartphones	2014	Reyes et al.	Sensors 14 (8), 13830-13850	SAM-SNY_00030303-SAM-SNY_00030323
Tubuloglomerular feedback-dependent modulation of renal myogenic autoregulation by nitric oxide	2006	Shi et al.	American Journal of Physiology-Regulatory, Integrative and Comparative Physiology	SAM-SNY_00029424-SAM-SNY_00029456
Two Discrete Oscillator Based Adaptive Notch Filters (OSC ANFs) for Noisy Sinusoids	February 2005	Liao	IEEE TRANSACTIONS ON SIGNAL PROCESSING, VOL. 53, NO. 2	SAM-SNY_00036379-SAM-SNY_00036389
Two-Stage Approach for Detection and Reduction of Motion Artifacts in Photoplethysmographic Data	August 2010	Krishnan et al.	IEEE TRANSACTIONS ON BIOMEDICAL ENGINEERING, VOL. 57, NO. 8	SAM-SNY_00032903-SAM-SNY_00032912 Being produced concurrently

Motion Artifact Reduction in Photopleythysmography Using Magnitude-based Frequency Domain Independent Component Analysis	2008	Krishnan et al.	IEEE	Being produced concurrently
Analysis and Detection of Motion Artifact in Photopleythysmographic Data Using Higher Order Statistics	2008	Krishnan et al.	IEEE	Being produced concurrently
Ubiquitous wearable computer (UWC)-aided coexistence algorithm in an overlaid network environment of WLAN and ZigBee networks	2007	Junget al.	2007 2nd International Symposium on Wireless Pervasive Computing	SAM-SNY_00030371-SAM-SNY_00030377
Understanding Atrial Fibrillation: The Signal Processing Contribution Part I	2008	Mainardi et al.	Springer	SAM-SNY_00030652-SAM-SNY_00030776
Understanding Electrocardiography	2003	Conover	Mosby	SAM-SNY_00036406-SAM-SNY_00036451
Unobtrusive Heart Rate Estimation during Physical Exercise using Photoplethysmographic and Acceleration Data	2015	Mullan et al.	IEEE	SAM-SNY_00033998-SAM-SNY_00034001
Use of a Noninvasive Continuous Monitoring Device in the Management of Atrial Fibrillation: A Pilot Study	March 2013	Rosenberg et al.	PACE, Vol. 36	SAM-SNY_00034650-SAM-SNY_00034655

Use of the Autocorrelation Function to Detect Atrial Fibrillatory Activity on the Surface Electrocardiogram	1991	Slocum	Annual International Conference of the IEEE Engineering In Medicine and Biology Society, Vol. 13, No. 2	SAM-SNY_00030633-SAM-SNY_00030634
User Guide LG G Watch R	-	LG	LG	SAM-SNY_00038334-SAM-SNY_00038381
Using a novel wireless system for monitoring patients after the atrial fibrillation ablation procedure: the iTransmit study	March 2015	Tarakji et al.	Heart Rhythm	SAM-SNY_00035657-SAM-SNY_00035662
Using Correntropy as a Cost Function in Linear Adaptive Filters	June 2009	Singh et al.	IEEE	SAM-SNY_00037561-SAM-SNY_00037566
Using time-frequency analysis of the photoplethysmographic waveform to detect the withdrawal of 900 mL of blood	2012	Scully et al.	Anesthesia & Analgesia 115 (1), 74-81	SAM-SNY_00030233-SAM-SNY_00030240
Validation and clinical use of a novel diagnostic device for screening of atrial fibrillation	September 2014	Tieleman et al.	Europace	SAM-SNY_00036196-SAM-SNY_00036200
Ventricular response in atrial fibrillation: random or deterministic?	1999	Stein et al.	American Physiological Society	SAM-SNY_00027322-SAM-SNY_00027328
Verification of humans using the electrocardiogram	February 8, 2007	Wubbeet al.	Elsevier	SAM-SNY_00030995-SAM-SNY_00030998
Wavelet-based AR–SVM for health monitoring of smart structures	2012	Kim et al.	Smart Materials and Structures 22 (1), 015003	SAM-SNY_00029933-SAM-SNY_00029945

Weekly maximum electric load forecasting for 104 weeks by seasonal ARIMA model	2014	Kim et al.	Journal of the Korean Institute of Illuminating and Electrical Installation Engineers	SAM-SNY_00030378-SAM-SNY_00030384
Yield of screening for atrial fibrillation in primary care with a hand-held, single-lead electrocardiogram device during influenza vaccination	February 6, 2016	Kaasenbrood et al.	Europace (2016) 18, 1514–1520	SAM-SNY_00058116-SAM-SNY_00058122
Zenicor Direct Tailored ECG interpretation services	-	Zenicor	Zenicor	SAM-SNY_00034837-SAM-SNY_00034840
Zenicor-ECG Product Sheet	-	Zenicor	Zenicor	SAM-SNY_00058246 SAM-SNY_00058249
Zenicor Flex Flexibel metod for kontinuerlight EKG	-	Zenicor	Zenicor	SAM-SNY_00035441-SAM-SNY_00035444
Zenicor One Handheld ECG for prolonged monitoring of arrhythmias	-	Zenicor	Zenicor	SAM-SNY_00035030-SAM-SNY_00035033
Zenicor News	-	Zenicor	Zenicor	SAM-SNY_00035761-SAM-SNY_00035764
Zenicor VIEW A web-based system solution for all types of arrhythmia investigations	-	Zenicor	Zenicor	SAM-SNY_00035174-SAM-SNY_00035177
Zio patch maker iRhythm filesfor $86M IPO	September 26, 2016	Comstock	MobiHealthNews	SAM-SNY_00034622-SAM-SNY_00034637
Heart rate variability: a review	November 17, 2006	Rajendra Acharya U, Paul Joseph K,	Med Biol Eng Comput	Being produced concurrently

		Kannathal N, Lim CM, Suri JS		
Implementation And Testing Of Atrial Fibrillation Detectors For A Mobile Phone Application,	April 22, 2013	Colloca	POLITECNICO DI MILANO	Being produced concurrently
A novel application for the detection of an irregular pulse using an iPhone 4S in patients with atrial fibrillation	March 2013	McManus, David D. et al.	Heart Rhythm, Volume 10, Issue 3, 315-319	Being produced concurrently
Atrial Fibrillation Detection By Heart Rate Variability In Poincare Plot	December 11, 2009			Being produced concurrently
Statistical Approach for The Detection of Motion/Noise Artifacts in Photoplethysmogram	August 30-September 3, 2011	Selvaraj et al.	Proceedings of the 33rd Annual International Conference of the IEEE EMBS, Boston, MA	Being produced concurrently
Atrial Fibrillation Detection Using Time-Varying Coherence Function and Shannon Entropy	August 30-September 3, 2011	Lee et al.	Proceedings of the 33rd Annual International Conference of the IEEE EMBS, Boston, MA	Being produced concurrently
Development of Computer Aided Prediction Technology for Paroxysmal Atrial Fibrillation in Mobile Healthcare	February 2012	Kim et al.	IntechOpen	Being produced concurrently
CARMA:AROBUSTMOTION ARTIFACTREDUCTIONALG ORITHMFORHEARTRATEM ONITORINGFROMPPGSIGN ALS	2015	Baca et al.	IEEE, 23rd European Signal Processing Conference (EUSIPCO)	Being produced concurrently

MotionArtifactReductioninPhotoplethysmographyUsingIndependentComponentAnalysis	2006	Kim et al.	IEEE, TRANSACTIONS ON BIOMEDICALENGINEERING	Being produced concurrently
Evaluation of the number of PPG harmonics to assess Smartphone effectiveness	2014	Polimeni et al.	IEEE	Being produced concurrently
A Novel Approach for Motion Artifact Reduction in PPG Signals Based on AS-LMS Adaptive Filter	May 2012	Ram et al.	IEEE, TRANSACTIONS ON INSTRUMENTATION AND MEASUREMENT	Being produced concurrently
Adaptive Filtering for Heart Rate Signals	Spring 2014	Jaafari et al.	SJSU ScholarWorks	Being produced concurrently
Artifact Characterization, Detection and Removal from Neural Signals	2015	Islam	NATIONAL UNIVERSITY OF SINGAPORE	Being produced concurrently
Empirical Mode Decomposition (EMD) of potential field data_airborne gravity data as an example	Jan 2008	Hassan et al.	CSEG RECORDER	Being produced concurrently
Signal Quality Analysis in Pulse Oximetry: Modelling and Detection of Motion Artifact	May 2015	Clarke	Carleton University	Being produced concurrently
Systolic Peak Detection in Acceleration Photoplethysmograms Measured from Emergency Responders in Tropical Conditions	October 2013	Elgendi	PLOS ONE	Being produced concurrently
Spectral- and time-domain analysis of heart rate variability	April 2014	Verma et al.	The University of Texas at El Paso	Being produced concurrently

signals from multiple photoplethysmographic (PPG) sensors				
Using the heart harmonics in the oscillometry to extract the blood pressure	2013	Barbe et al.	IEEE	Being produced concurrently
Wearable Photoplethysmographic Sensors—Past and Present	April 23, 2014	Tamura	MDPI	Being produced concurrently
Ambulatory Arrhythmia Monitoring Choosing the Right Device	October 19, 2010	Zimetbaum et al.	Contemporary Reviews in Cardiovascular Medicine	Being produced concurrently
Quantification of synchronization during atrial fibrillation by Shannon entropy: validation inpatients and computer model of atrial arrhythmias	2005	Mase et al.	INSTITUTE OF PHYSICS PUBLISHING	Being produced concurrently
Reduction of Motion Artifacts from Photoplethysmographic Recordings Using a Wavelet Denoising Approach	2003	Lee et al.	IEEE	Being produced concurrently
Unsupervised classification of atrial heart beats using a prematurity index and wave morphology features	2009	Rodriguze-Sotelo	International Federation for Medical and Biological Engineering	Being produced concurrently
Heart Rate Monitoring During Intense Physical Activities Using A Motion Artifact Corrupted Signal Reconstruction Algorithm in Wearable Electrocardiogram	2016	Salehizadeh et al.	2016 IEEE First Conference on Connected Health: Applications, Systems and Engineering	Being produced concurrently

Sensor			Technologies	
TROIKA: A General Framework for Heart Rate Monitoring Using Wrist-Type Photoplethysmographic Signals During Intensive Physical Exercise	Feb 2015	Zhang et al.	IEEE TRANSACTIONS ON BIOMEDICAL ENGINEERING	Being produced concurrently
Techniques for Clutter Suppression in the Presence of Body Movements during the Detection of Respiratory Activity through UWB Radars	Feb 2014	Lazaro et al.	MDPI	Being produced concurrently
A Novel Motion Artifact Removal Method Via Joint Basis Pursuit Linear Program to Accurately Monitor Heart Rate	July 11, 2019	Koneshlo et al.	IEEE Sensors Journal	Being produced concurrently
A Stimulus Artifact Removal Technique for SEMG Signal Processing During Functional Electrical Stimulation	February 2015	Qiu et al.	IEEE Trans Biomed Eng	Being produced concurrently
Wearable Wireless Sensor for Multi-Scale Physiological Monitoring	October 2014	Chon et al.	Worcester Polytechnic Institute	Being produced concurrently
Automatic Detection of Atrial Fibrillation and Atrial Flutter	April 21, 2011	Chon	Worcester Polytechnic Institute	Being produced concurrently
A methodology for validating artifact removal techniques for fNIRS	2011	Sweeney et al.	33rd Annual International Conference of the IEEE EMBS	Being produced concurrently
Artifact reduction in electrogastrogram based on empirical mode decomposition	2000	Liang et al.	Medical & Biological Engineering & Computing	Being produced concurrently

method				
Effect of pressure and padding on motion artifact of textile electrodes	2013	Comert et al.	BioMedical Engineering OnLine	Being produced concurrently
Filtering for Removal of Artifacts	2015	Rangayyan	Biomedical Signal Analysis	Being produced concurrently
Motion Artifact Reduction in Photoplethysmographic Signals: A Review	2013	Yadhuraj et al.	INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH & DEVELOPMENT	Being produced concurrently
Motion artifact cancellation from a single channel SCG using adaptive forgetting factor recursive least square filter	2017	Liu et al.	IEEE Access	Being produced concurrently
Wavelet-Based Motion Artifact Removal for Electrodermal Activity	2015	Chen et al.	Conf Proc IEEE Eng Med Biol Soc. 2015 ; 2015: 6223–6226. doi:10.1109/EMBC.2015.7319814.	Being produced concurrently
QRS complexes detection for ECG signal: The Difference Operation Method	Sept 1, 2008	Yeh et al.	Computer Methods and Programs in Biomedicine	Being produced concurrently
QRS COMPLEX DETECTION IN NOISY HOLTER ECG BASED ON WAVELET SINGULARITY ANALYSIS	2010	Tadejko et al.	Zeszyty Naukowe Politechniki Białostockiej. Informatyka, vol. 6, pp. 95-111,	Being produced concurrently
Removal of ocular artifacts from electro-encephalogram by	May 2004	He et al.	Medical and Biological	Being produced concurrently

adaptive filtering			Engineering and Computing	
Removal of Artifacts from EEG Signals: A Review	Feb 2019	Jiang et al.	MDPI	Being produced concurrently
Wavelet based motion artifact removal for ECF signals	2012	Hashim et al.	IEEE-EMBS	Being produced concurrently
Biomedical Engineering (Volume 27, Number 1)	1993	Volkov et al. Viktorov (editor)	Consultants Bureau, New York	Being produced concurrently
Biomedical Engineering (Volume 27, Number 3)	1993	Volkov et al. Viktorov (editor)	Consultants Bureau, New York	Being produced concurrently
Biomedical Engineering (Volume 27, Number 4)	1993	Volkov et al. Viktorov (editor)	Consultants Bureau, New York	Being produced concurrently
Biomedical Engineering (Volume 27, Number 6)	1993	Sterlin et al. Viktorov (editor)	Consultants Bureau, New York	Being produced concurrently
Biomedical Engineering (Volume 28, Number 1)	1994	Gordeev et al. Viktorov (editor)	Consultants Bureau, New York	Being produced concurrently

Defendants further incorporate by reference all "U.S. Patent Documents" and "Other Publications" cited on the face of the Patents-in-Suit. Any citation to one or more of the above prior art references, or other prior art references regarding any method or system, should be construed to constitute not only a citation to the prior art reference itself, but also a reference to the system itself. Discovery has only just begun in this case, and Defendants will supplement if and when more information becomes available from Plaintiffs or third parties.

B. Prior Art Disclosures—Known/Use/Sales/Offers for Sale

Defendants believe that there were prior art disclosures in the form of sales, offers for sale, and/or uses by others of products that qualify as prior art under pre-AIA 35 U.S.C. § 102(a) and/or (b) or under AIA 35 U.S.C. § 102(a)(1) against one or more of the Asserted Claims of the Patents- in-Suit. The below-identified prior art products include products Defendants are currently aware of through an on-going diligent and reasonable investigation at this early stage of discovery and/or based on public available information. Details regarding such offers for sale and public uses may be within the possession of third parties. As discovery progresses, Defendants intend, and reserve the right, to promptly supplement and/or amend the lists below to include additional prior art products that anticipate and/or render the asserted claims obvious. To the extent Plaintiffs contend that any systems presented below do not qualify as prior art to one or more Asserted Patents, Defendants reserve the right to rely on any of such systems as evidence of simultaneous development as an indicia of obviousness.

Table 3: Prior Art Products

System	Sale or Use Date
Biolog 3000 (Micromedical, Inc.)	At least by 1998
Monebo (e.g., Real-time cardiac monitoring and ECG analysis source code)	At least by January, 2002
CardioNet (e.g., MCOT)	At least by January 2003
GE Healthcare (e.g., MUSE)	At least by 2005
Monebo (e.g., Intelligent algorithm ECG Analyzer 1.0)	At least by September, 2005
Lechnologies, Research Inc. (e.g., AfibAlert)	At least by 2006
MyDiagnostick Medical (e.g., MyDiagnostick)	At least by 2010
Zenicor (e.g., EKG Thumb, One, Flex, Direct, View)	At least by 2010
iRhythm Technologies (e.g., Zio patch, Zio Service)	At least by 2011
AliveCor (e.g., Heart Monitor)	At least by 2012
Cardiio (e.g., Cardiio-Heart Rate Monitor, Cardiio Rhythm)	At least by 2012
Mio Global (e.g., Mio Alpha)	At least by 2012
Biotronik (e.g., BioMonitor)	At least by 2012
Cardiac Designs, LLC (e.g., ECG Check)	At least by 2013
Medtronic (e.g., Linq, Seeq MCT)	At least by 2014
Google Android Wear	At least by March 2014
Sensium Healthcare Ltd (Sensium Patch)	At least by 2014
LG (e.g., G Watch R)	At least by October 2014
Happitech	At least by 2015

Philips (e.g., Healthwatch)	At least by 2016
Cardiogram	At least by 2017
Alivecor (e.g., Kardiaband)	At least by 2017
Verily (e.g., Verily Study Watch)	At least by 2017

For the public uses identified herein, Defendants are investigating the identities of the individuals who knew about and/or were involved in the making, first public use, offer for sale and/or sale of these products and systems. Defendants are also investigating the exact date that these products and systems were first made, first publicly used, offered for sale and/or sold. In addition, Defendants are currently investigating the dates of conception and reduction to practice of these products and systems and when these products and systems were first known or used by others.

In the course of their investigation, Defendants may identify additional prior art documents describing these products, systems, and/or disclosures that may also anticipate and/or render obvious as invalidating printed publications. Any citation to one or more of prior art references regarding these products, systems, and/or disclosures should be construed to constitute not only a citation to the prior art reference itself, but also a reference to the associated products, systems, and/or disclosures.

C. Prior art under Pre-AIA 35 U.S.C. § 102(f), Post-AIA § 101, and/or § 116

Discovery has only just recently begun, and inventor discovery is forthcoming. Based on limited discovery received to date, Defendants contend that the Asserted Claims are invalid under pre-AIA 35 U.S.C. § 102(f), post-AIA § 101 and/or for failing to satisfy § 116 on the grounds that the named inventors of the Patents-in-Suit did not invent the subject matter

claimed therein and/or improperly omitted an inventor. A patent is invalid if more or fewer than the true inventors are named. Should Defendants obtain additional evidence, they will provide the name of the person(s) from whom and the circumstances under which the alleged invention or any part of it was derived.

For example, Defendants believe that one or more other people may have invented or contributed to the subject matter claimed in the Patents-in-Suit, whose subject matter qualifies as prior art under pre-AIA 35 U.S.C. § 102(f) or post-AIA § 101 against one or more of the Patent-in- Suits. Defendants may identify additional information describing additional persons, facts, and circumstances that may also demonstrate that the named inventors are not entitled to the Patents-in- Suit under pre-AIA 35 U.S.C. § 102(f) and/or post-AIA § 101 and/or failed to satisfy the requirements under § 116 such that the Asserted Claims of the Patents-in-Suit are invalid.

Additionally, Plaintiff may have in its possession, custody, or control information related to or pertaining to prior art under pre-AIA 35 U.S.C. § 102(f), post-AIA § 101, and/or information concerning the failure to satisfy § 116. Defendants will supplement these Invalidity Contentions if and when Plaintiffs produces such information and Defendants have had the opportunity to obtain and analyze that information. Defendants contend that the Patents-in-Suit are invalid under pre-AIA 35 U.S.C. § 102(f), post-AIA § 101, and/or § 116 in the event Defendants obtain evidence that the named inventor of any of the Patents-in-Suit did not invent (either together or in conjunction with other parties) the subject matter claimed therein and/or omitted a true inventor.

D. Invalidity by Anticipation or Obviousness

Subject to the Defendants' reservation of rights stated in these Invalidity Contentions

and based on Defendants' present understanding of the Asserted Claims and the apparent interpretations that Plaintiffs are asserting based on Plaintiffs' Complaint and their Infringement Contentions, Defendants provide below exemplary references and combinations of references that anticipate and/or render the Asserted Claims of the '326 patent obvious in Table 4, exemplary references and combinations of references that anticipate and/or render the Asserted Claims of the '576 patent obvious in Table 5, exemplary references and combinations of references that anticipate and/or render the Asserted Claims of the '428 patent obvious in Table 6, exemplary references and combinations of references that anticipate and/or render the Asserted Claims of the '921 patent obvious in Table 7, exemplary references and combinations of references that anticipate and/or render the Asserted Claims of the '647 patent obvious in Table 8, exemplary references and combinations of references that anticipate and/or render the Asserted Claims of the '601 patent obvious in Table 9, and exemplary references and combinations of references that anticipate and/or render the Asserted Claims of the '362 patent obvious in Table 10.

Aspects of these Invalidity Contentions are based, in whole or in part, on Defendants' present understanding of Plaintiffs' apparent interpretations of the Asserted Claims based on Plaintiffs' Complaint and its Infringement Contentions. Given Plaintiffs' apparent interpretations of the Asserted Claims, Defendants have attempted to apply those interpretations, but this application of Plaintiffs' interpretations is not an agreement or admission that any of Plaintiffs' interpretations are correct. To be clear, Defendants do not agree with Plaintiffs' Infringement Contentions but are merely offering Invalidity Contentions based on those interpretations. To the extent Plaintiffs' supplement its infringement contentions (if any) under Section 3(a)(i) of the Discovery Order in this case and identify

source code that Defendants contend does not infringe but was otherwise available before the priority date at issue for the respective claims, Defendants reserve the right to prepare supplemental invalidity contentions since it is axiomatic that a product, if alleged to infringe, would anticipate, if earlier.

The references identified in the exhibits attached to these Invalidity Contentions may disclose the elements of the Asserted Claims explicitly and/or inherently, and/or they may be relied upon to show how the state of the art in the relevant time frame invalidates the asserted patent claims. In some instances, multiple prior art publications discuss the same underlying system, software, or other project. For example, some patents and published patent applications reflect commercial products or services offered in the market. It would have been obvious to consider and combine the teachings of a patent or patent application that relate to a certain product or service with the features of that product or service as provided commercially. Similarly, where multiple publications discuss the same underlying product, service, project, or system, it would have been obvious to combine the discussions and disclosures of the publications as they would have been understood to describe features or potential features of the underlying subject matter. Likewise, where one publication discusses another publication, it would have been obvious to consider and combine the teachings of each publication in combination with each other.

Defendants' contentions that the references in this section, in various combinations, render the Asserted Claims of the Patents-in-Suit obvious under 35 U.S.C. § 103 are in no way an admission or suggestion that each reference does not independently anticipate the Asserted Claims under 35 U.S.C. § 102. Any of these references may be combined with other disclosed references, the disclosed products and systems, and/or with the knowledge of one of ordinary

skill in the art during the relevant time period to render obvious, and, therefore, invalidate, the Asserted Claims of the Patents-in-Suit. Although Defendants have identified at least one disclosure of a limitation for each prior art reference, each and every disclosure of the same limitation in the same reference is not necessarily identified. To focus the issues, Defendants cite only exemplary and representative portions of an identified reference, even where a reference may contain additional support for a particular claim limitation. Persons of ordinary skill in the art read an item of prior art as a whole and in the context of other publications and literature. Thus, to understand and interpret any specific statement or disclosure within a prior art reference that Defendants identify as exemplary and representative, such persons of ordinary skill in the art would rely on other information within the reference, along with other publications and their general scientific knowledge. As such, Defendants may rely upon uncited portions of the prior art references and on other publications and expert testimony to provide context, and as aids to understanding and interpreting the exemplary portions that are cited.

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.*, 127 S. Ct. 1727, 1739-40 (2007) (rejecting the Federal Circuit's "rigid" application of the teaching, suggestion, or motivation to combine test, instead espousing an "expansive and flexible" approach). That said, the Supreme Court's rationale, 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," applies equally

here. *Id.* at 1742. Nevertheless, in addition to the information contained in the section(s) above and elsewhere in these contentions, Defendants hereby identify additional motivations and reasons to combine the cited art. Further motivations are provided in the attached charts.

One or more combinations of the prior art references identified herein 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 prompts variations based on predictable design incentives and/or market forces either in the same field or a different one. In addition, the combinations of the prior art references identified above would have been obvious because the combinations represent the known potential options with a reasonable expectation of success.

Motivation to combine any two or more of the identified references, systems, and/or products comes from the fact that one would have been motivated by considerations of efficiency, effectiveness, convenience, cost-savings, power savings, and accessibility, to combine the various teachings. Additional evidence that there would have been a motivation or reason to combine the prior art references identified above includes the interrelated teachings of multiple prior art references; 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; the existence of a known need or problem in the field of endeavor at the time of the invention; and the background knowledge that would have been possessed by a person having

ordinary skill in the art. For example, the prior art references, systems, and/or products are generally directed to the same or similar problems. Some references expressly incorporate others by reference or are authored by the same inventor. Thus, a skilled artisan seeking to solve these problems would have looked to these cited references in combination.

Thus, the motivation or reason to combine the teachings of the prior art references disclosed herein is found in the references themselves and 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 fact that the prior art is generally directed towards the same problem; (5) the predictable results obtained in combining the different elements of the prior art; (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 having a reasonable expectation of success; and/or (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.

1. '326 Patent

Table 4: Exemplary Anticipatory and Combinations for the Asserted Claims of the '326 Patent

Chart (Exhibit)	Prior Art References
326Pat_1 (and 326Pat_1_Supplement)	Fitts either alone or in combination with one or more of Challis, Zar, Sheskin, Oh, Moore, Rangayyan, Palreddy, Ho, Dordari, Wessel, Wiesel, Poli, Mainardi, Voss, Dyjach, Masè, Taha, Flick, Lake, Richman, Tuzcu, Linker, Cammarota, Slocum, Kroll, Gilham, Korzinov, Tateno, and/or Foo (and/or any other references listed in the exhibits)
326Pat_2 (and 326Pat_2_Supplement)	Lu either alone or in combination with one or more of Linker, Challis, Sheskin, Cammarota, Slocum, Fitts,

	Kroll, Dyjach, Gilham, Korzinov, Voss, Tateno, Rangayyan, Oh, and/or 2001 Mainardi (and/or any other references listed in the exhibits)
326Pat_3 (and 326Pat_3_Supplement)	Wiesel either alone or in combination with one or more of Challis, Zar, Sheskin, Oh, Moore, Rangayyan, Palreddy, Ho, Dordari, Wessel, Poli, Mainardi, Voss, Dyjach, Masè, Taha, Flick, Lake, Richman, Tuzcu, Linker, Cammarota, Slocum, Kroll, and/or Foo (and/or any other references listed in the exhibits)
326Pat_4 (and 326Pat_4_Supplement)	Poli either alone or in combination with one or more of Challis, Zar, Sheskin, Oh, Moore, Rangayyan, Palreddy, Ho, Dordari, Wessel, Wiesel, Masè, Taha, Flick, Voss, Lake, Richman, Tuzcu, Mainardi, Fitts, Linker, Cammarota, Slocum, Kroll, and/or 2001 Mainardi (and/or any other references listed in the exhibits)
326Pat_5 (and 326Pat_5_Supplement)	Mainardi either alone or in combination with one or more of Challis, Poli, Wessel, Wiesel, Zar, Sheskin, Oh, Moore, Rangayyan, Palreddy, Ho, Dordari, Lake, Richman, Tuzcu, Fitts, Linker, Taha, Cammarota, Slocum, Kroll, Dyjach, Gilham, Korzinov, Voss, Tateno, and/or 2001 Mainardi (and/or any other references listed in the exhibits)
326Pat_6	Rajendra either alone or in combination with one or more of Challis, Poli, Wessel, Wiesel, Zar, Sheskin, Oh, Moore, Rangayyan, Palreddy, Ho, Dordari, Lake, Richman, Tuzcu, Fitts, Linker, Taha, Cammarota, Slocum, Kroll, Dyjach, Gilham, Korzinov, Voss, Tateno, and/or 2001 Mainardi (and/or any other references listed in the exhibits)
326Pat_7	KR100493714B1 either alone or in combination with one or more of Challis, Poli, Wessel, Wiesel, Zar, Sheskin, Oh, Moore, Rangayyan, Palreddy, Ho, Dordari, Lake, Richman, Tuzcu, Fitts, Linker, Taha, Cammarota, Slocum, Kroll, Dyjach, Gilham, Korzinov, Voss, Tateno, and/or 2001 Mainardi (and/or any other references listed in the exhibits)
326Pat_8	US7123953B2 either alone or in combination with one or more of Challis, Poli, Wessel, Wiesel, Zar, Sheskin, Oh, Moore, Rangayyan, Palreddy, Ho, Dordari, Lake, Richman, Tuzcu, Fitts, Linker, Taha, Cammarota, Slocum, Kroll, Dyjach, Gilham, Korzinov, Voss, Tateno, and/or 2001 Mainardi (and/or any other references listed in the exhibits)
326Pat_9	US20070123787A1 either alone or in combination with one or more of Challis, Poli, Wessel, Wiesel, Zar, Sheskin, Oh, Moore,

	Rangayyan, Palreddy, Ho, Dordari, Lake, Richman, Tuzcu, Fitts, Linker, Taha, Cammarota, Slocum, Kroll, Dyjach, Gilham, Korzinov, Voss, Tateno, and/or 2001 Mainardi (and/or any other references listed in the exhibits)
326Pat_10	US20080045815A1 either alone or in combination with one or more of Challis, Poli, Wessel, Wiesel, Zar, Sheskin, Oh, Moore, Rangayyan, Palreddy, Ho, Dordari, Lake, Richman, Tuzcu, Fitts, Linker, Taha, Cammarota, Slocum, Kroll, Dyjach, Gilham, Korzinov, Voss, Tateno, and/or 2001 Mainardi (and/or any other references listed in the exhibits)
326Pat_11	WO2008055078A2 either alone or in combination with one or more of Challis, Poli, Wessel, Wiesel, Zar, Sheskin, Oh, Moore, Rangayyan, Palreddy, Ho, Dordari, Lake, Richman, Tuzcu, Fitts, Linker, Taha, Cammarota, Slocum, Kroll, Dyjach, Gilham, Korzinov, Voss, Tateno, and/or 2001 Mainardi (and/or any other references listed in the exhibits)

The prior art identified above, and in the attached ’326 charts, individually anticipate and/or can properly be combined in multiple ways to demonstrate the obviousness of the Asserted Claims of the ’326 patent. Various combinations of the references would have naturally been considered as part of the exercise of ordinary skill by one skilled in the art. The references disclosed in the attached charts and herein are also directed to the same or similar features as the purported invention claimed in the Asserted Claims of the ’326 patent. To the extent Plaintiffs contend that any of these features solved a problem in the art, the references cited herein show that that problem was known to those of ordinary skill and had already been solved using obvious solutions.

To that end, the Asserted Claims of the ’326 patent simply combine elements already combined and well known in the art and yield no more than what one skilled in the art would have expected from such a combination. For example, with respect to the ’326 patent, when confronted with the alleged problems described in the ’326 patent, one of ordinary skill in the art at the time of the alleged inventions would have been motivated to consider the techniques

taught by the prior art cited in these Invalidity Contentions. Consideration of the teachings of this prior art, both individually and in combination, would necessarily lead to the alleged invention claimed in the ’326 patent. This is demonstrated by the cited prior art, which disclose all of the elements of the Asserted Claims of the ’326 patent, as well as motivations to modify or combine their individual teachings. One of skill in the art would have been motivated to either modify the prior art identified in the claim charts or to combine that prior art in the manner indicated, by, for example, their background knowledge, design incentives, effects of demands known to the design community, or other market forces. Moreover, the cited prior art share commonalities. To the extent it is argued that any cited prior art does not expressly disclose a particular claim or element, it would have been inherent in the disclosure and/or obvious to a person of ordinary skill in the art to include the claimed element to perform the invention as claimed in the ’326 patent.

As described in the attached charts, all the elements of the Asserted Claims of the ’326 patent were commonplace before the alleged date of inventions. For each element, there exists evidence from the cited prior art that it was well known in the art prior to the date of invention. To the extent it is argued any of the cited prior art references, systems, and/or products do not anticipate the Asserted Claims, it would have been obvious to a person of ordinary skill in the art that the Asserted Claims are merely combinations of well-known methods and systems resulting in expected results.

Additionally, Defendants hereby incorporate by reference the motivations to combine references set forth during the prosecution of the Asserted Claims of the ’326 patent, including the statements and reasoning set forth by the examiner, as to why it would have been obvious to modify or combine references to achieve the limitations of the Asserted Claims of the ’326

patent. Defendants also incorporate by reference the admissions during prosecution regarding what was already known in the art.

2. '576 Patent

Table 5: Exemplary Anticipatory and Combinations for the Asserted Claims of the '576 Patent

Chart (Exhibit)	Prior Art References
576Pat_1 (and 576Pat_1_Supplement)	Sarkar either alone or in combination with one or more of Chon-466, Dash, Dash-2, Couceiro, Couceiro-2, Conover, Gertsch, Osowski, Krasteva, Corbucci, Gacek, Tateno, Jones, Lee, Scully, Chon-428, Pelegris, Foo, Kishimoto, Soykan, Mitra, Shaquer, Bajcsy, Almaki, Selvaraj, Greco, Delorme, Wang, Bogunovic, Cammarota, Geva, Climent, Teixeira, Wessel, Wiesel-037, Poli, Challis, Mainardi, McManus, and/or Esperer (and/or any other references listed in the exhibits)
576Pat_2 (and 576Pat_2_Supplement)	Corbucci either alone or in combination with one or more of Chon-466, Dash, Dash-2, Sarkar, Couceiro, Couceiro-2, Conover, Gertsch, Osowski, Krasteva, Gacek, Tateno, Jones, Lee, Scully, Chon-428, Pelegris, Foo, Kishimoto, Soykan, Mitra, Shaquer, Bajcsy, Almaki, Selvaraj, Greco, Delorme, Wang, Bogunovic, Cammarota, Geva, Climent, Teixeira, Wessel, Wiesel-037, Poli, Challis, Mainardi, McManus, and/or Esperer (and/or any other references listed in the exhibits)
576Pat_3 (and 576Pat_3_Supplement)	Ritscher either alone or in combination with one or more of Chon-466, Dash, Dash-2, Sarkar, Couceiro, Couceiro-2, Conover, Gertsch, Osowski, Krasteva, Corbucci, Gacek, Tateno, Jones, Lee, Scully, Chon-428, Pelegris, Foo, Kishimoto, Soykan, Mitra, Shaquer, Bajcsy, Almaki, Selvaraj, Greco, Delorme, Wang, Bogunovic, Cammarota, Geva, Climent, Teixeira, Wessel, Wiesel-037, Poli, Challis, Mainardi, McManus, and/or Esperer (and/or any other references listed in the exhibits)
576Pat_4	McManus either alone or in combination with one or more of Chon-466, Dash, Dash-2, Sarkar, Couceiro, Couceiro-2, Conover, Gertsch, Osowski, Krasteva, Corbucci, Gacek, Tateno, Jones, Lee, Scully, Chon-428, Pelegris, Foo, Kishimoto, Soykan, Mitra, Shaquer, Bajcsy, Almaki, Selvaraj, Greco, Delorme, Wang, Bogunovic, Cammarota, Geva, Climent, Teixeira, Wessel, Wiesel-037, Poli, Challis, Mainardi, McManus, and/or Esperer (and/or any other references listed in

	the exhibits)
576Pat_5	Dash either alone or in combination with one or more of Chon-466, Dash-2, Sarkar, Couceiro, Couceiro-2, Conover, Gertsch, Osowski, Krasteva, Corbucci, Gacek, Tateno, Jones, Lee, Scully, Chon-428, Pelegris, Foo, Kishimoto, Soykan, Mitra, Shaquer, Bajcsy, Almaki, Selvaraj, Greco, Delorme, Wang, Bogunovic, Cammarota, Geva, Climent, Teixeira, Wessel, Wiesel-037, Poli, Challis, Mainardi, McManus, and/or Esperer (and/or any other references listed in the exhibits)
576Pat_6	Park either alone or in combination with one or more of Chon-466, Dash, Dash-2, Sarkar, Couceiro, Couceiro-2, Conover, Gertsch, Osowski, Krasteva, Corbucci, Gacek, Tateno, Jones, Lee, Scully, Chon-428, Pelegris, Foo, Kishimoto, Soykan, Mitra, Shaquer, Bajcsy, Almaki, Selvaraj, Greco, Delorme, Wang, Bogunovic, Cammarota, Geva, Climent, Teixeira, Wessel, Wiesel-037, Poli, Challis, Mainardi, McManus, and/or Esperer (and/or any other references listed in the exhibits)
576Pat_7	Corbucci either alone or in combination with one or more of Chon-466, Dash, Dash-2, Sarkar, Couceiro, Couceiro-2, Conover, Gertsch, Osowski, Krasteva, Corbucci, Gacek, Tateno, Jones, Lee, Scully, Chon-428, Pelegris, Foo, Kishimoto, Soykan, Mitra, Shaquer, Bajcsy, Almaki, Selvaraj, Greco, Delorme, Wang, Bogunovic, Cammarota, Geva, Climent, Teixeira, Wessel, Wiesel-037, Poli, Challis, Mainardi, McManus, and/or Esperer (and/or any other references listed in the exhibits)

The prior art identified above, and in the attached ’576 charts, individually anticipate and/or can properly be combined in multiple ways to demonstrate the obviousness of the Asserted Claims of the ’576 patent. Various combinations of the references would have naturally been considered as part of the exercise of ordinary skill by one skilled in the art. The references disclosed in the attached charts and herein are also directed to the same or similar features as the purported invention claimed in the Asserted Claims of the ’576 patent. To the extent Plaintiffs contend that any of these features solved a problem in the art, the references cited herein show

that that problem was known to those of ordinary skill and had already been solved using obvious solutions.

To that end, the Asserted Claims of the ’576 patent simply combine elements already combined and well known in the art and yield no more than what one skilled in the art would have expected from such a combination. For example, with respect to the ’576 patent, when confronted with the alleged problems described in the ’576 patent, one of ordinary skill in the art at the time of the alleged inventions would have been motivated to consider the techniques taught by the prior art cited in these Invalidity Contentions. Consideration of the teachings of this prior art, both individually and in combination, would necessarily lead to the alleged invention claimed in the ’576 patent. This is demonstrated by the cited prior art, which disclose all of the elements of the Asserted Claims of the ’576 patent, as well as motivations to modify or combine their individual teachings. One of skill in the art would have been motivated to either modify the prior art identified in the claim charts or to combine that prior art in the manner indicated, by, for example, their background knowledge, design incentives, effects of demands known to the design community, or other market forces. Moreover, the cited prior art share commonalities. To the extent it is argued that any cited prior art does not expressly disclose a particular claim or element, it would have been inherent in the disclosure and/or obvious to a person of ordinary skill in the art to include the claimed element to perform the invention as claimed in the ’576 patent.

As described in the attached charts, all the elements of the Asserted Claims of the ’576 patent were commonplace before the alleged date of inventions. For each element, there exists evidence from the cited prior art that it was well known in the art prior to the date of invention. To the extent it is argued any of the cited prior art references, systems, and/or products do not

anticipate the Asserted Claims, it would have been obvious to a person of ordinary skill in the art that the Asserted Claims are merely combinations of well-known methods and systems resulting in expected results.

Additionally, Defendants hereby incorporate by reference the motivations to combine references set forth during the prosecution of the Asserted Claims of the ’576 patent, including the statements and reasoning set forth by the examiner, as to why it would have been obvious to modify or combine references to achieve the limitations of the Asserted Claims of the ’576 patent. Defendants also incorporate by reference the admissions during prosecution regarding what was already known in the art.

3. ’428 Patent

Table 6: Exemplary Anticipatory and Combinations for the Asserted Claims of the ’428 Patent

Chart (Exhibit)	Prior Art References
428Pat_1 (and 428Pat_1_Supplement)	Asada either alone or in combination with one or more of Hyde, Porges, Selvaraj, Greco, Delorme, Chon, Dash, Lee, Cox, Pelegris, Chon2009, Petersen, Scharf, Lake, Richman, Zhang, Tuczu, Krishnan (multiple references), Zhao, Kaestle, Diab, Volkov I, Volkov II, Volkov III, Gordeev, Sterlin, Heneghan, and/or Veen (and/or any other references listed in the exhibits)
428Pat_2 (and 428Pat_2_Supplement)	Bifulco either alone or in combination with one or more of Hyde, Porges, Selvaraj, Greco, Delorme, Chon, Dash, Lee, Cox, Pelegris, Chon2009, Petersen, Scharf, Lake, Richman, Zhang, Tuczu, Krishnan (multiple references), Zhao, Kaestle, Diab, Volkov I, Volkov II, Volkov III, Gordeev, Sterlin, Heneghan, and/or Veen (and/or any other references listed in the exhibits)
428Pat_3 (and 428Pat_3_Supplement)	Tran either alone or in combination with one or more of Hyde, Porges, Selvaraj, Greco, Delorme, Chon, Dash, Lee, Cox, Pelegris, Chon2009, Petersen, Scharf, Lake, Richman, Zhang, Tuczu, Krishnan (multiple references), Zhao, Kaestle, Diab, Volkov I, Volkov II, Volkov III, Gordeev, Sterlin,

	Heneghan, and/or Veen (and/or any other references listed in the exhibits)
428Pat_4	Chon either alone or in combination with one or more of Hyde, Porges, Selvaraj, Greco, Delorme, Chon, Dash, Lee, Cox, Pelegris, Chon2009, Petersen, Scharf, Lake, Richman, Zhang, Tuczu, Krishnan (multiple references), Zhao, Kaestle, Diab, Volkov I, Volkov II, Volkov III, Gordeev, Sterlin, Heneghan, and/or Veen (and/or any other references listed in the exhibits)
428Pat_5	Dash either alone or in combination with one or more of Hyde, Porges, Selvaraj, Greco, Delorme, Chon, Dash, Lee, Cox, Pelegris, Chon2009, Petersen, Scharf, Lake, Richman, Zhang, Tuczu, Krishnan (multiple references), Zhao, Kaestle, Diab, Volkov I, Volkov II, Volkov III, Gordeev, Sterlin, Heneghan, and/or Veen (and/or any other references listed in the exhibits)
428Pat_6	Krishnan either alone or in combination with one or more of Hyde, Porges, Selvaraj, Greco, Delorme, Chon, Dash, Lee, Cox, Pelegris, Chon2009, Petersen, Scharf, Lake, Richman, Zhang, Tuczu, Krishnan (multiple references), Zhao, Kaestle, Diab, Volkov I, Volkov II, Volkov III, Gordeev, Sterlin, Heneghan, and/or Veen (and/or any other references listed in the exhibits)
428Pat_7	Moussavi either alone or in combination with one or more of Hyde, Porges, Selvaraj, Greco, Delorme, Chon, Dash, Lee, Cox, Pelegris, Chon2009, Petersen, Scharf, Lake, Richman, Zhang, Tuczu, Krishnan (multiple references), Zhao, Kaestle, Diab, Volkov I, Volkov II, Volkov III, Gordeev, Sterlin, Heneghan, and/or Veen (and/or any other references listed in the exhibits)
428Pat_8	Li either alone or in combination with one or more of Hyde, Porges, Selvaraj, Greco, Delorme, Chon, Dash, Lee, Cox, Pelegris, Chon2009, Petersen, Scharf, Lake, Richman, Zhang, Tuczu, Krishnan (multiple references), Zhao, Kaestle, Diab, Volkov I, Volkov II, Volkov III, Gordeev, Sterlin, Heneghan, and/or Veen (and/or any other references listed in the exhibits)
428Pat_9	Chon-570 either alone or in combination with one or more of Hyde, Porges, Selvaraj, Greco, Delorme, Chon, Dash, Lee, Cox, Pelegris, Chon2009, Petersen, Scharf, Lake, Richman, Zhang, Tuczu, Krishnan (multiple references), Zhao, Kaestle,

	Diab, Volkov I, Volkov II, Volkov III, Gordeev, Sterlin, Heneghan, and/or Veen (and/or any other references listed in the exhibits)

The prior art identified above, and in the attached ’428 charts, individually anticipate and/or can properly be combined in multiple ways to demonstrate the obviousness of the Asserted Claims of the ’428 patent. Various combinations of the references would have naturally been considered as part of the exercise of ordinary skill by one skilled in the art. The references disclosed in the attached charts and herein are also directed to the same or similar features as the purported invention claimed in the Asserted Claims of the ’428 patent. To the extent Plaintiffs contend that any of these features solved a problem in the art, the references cited herein show that that problem was known to those of ordinary skill and had already been solved using obvious solutions.

To that end, the Asserted Claims of the ’428 patent simply combine elements already combined and well known in the art and yield no more than what one skilled in the art would have expected from such a combination. For example, with respect to the ’428 patent, when confronted with the alleged problems described in the ’428 patent, one of ordinary skill in the art at the time of the alleged inventions would have been motivated to consider the techniques taught by the prior art cited in these Invalidity Contentions. Consideration of the teachings of this prior art, both individually and in combination, would necessarily lead to the alleged invention claimed in the ’428 patent. This is demonstrated by the cited prior art, which disclose all of the elements of the Asserted Claims of the ’428 patent, as well as motivations to modify or combine their individual teachings. One of skill in the art would have been motivated to either modify the prior art identified in the claim charts or to combine that prior art in the manner indicated, by, for example, their background knowledge, design incentives, effects of demands known to the design

community, or other market forces. Moreover, the cited prior art share commonalities. To the extent it is argued that any cited prior art does not expressly disclose a particular claim or element, it would have been inherent in the disclosure and/or obvious to a person of ordinary skill in the art to include the claimed element to perform the invention as claimed in the ’428 patent.

As described in the attached charts, all the elements of the Asserted Claims of the ’428 patent were commonplace before the alleged date of inventions. For each element, there exists evidence from the cited prior art that it was well known in the art prior to the date of invention. To the extent it is argued any of the cited prior art references, systems, and/or products do not anticipate the Asserted Claims, it would have been obvious to a person of ordinary skill in the art that the Asserted Claims are merely combinations of well-known methods and systems resulting in expected results.

Additionally, Defendants hereby incorporate by reference the motivations to combine references set forth during the prosecution of the Asserted Claims of the ’428 patent, including the statements and reasoning set forth by the examiner, as to why it would have been obvious to modify or combine references to achieve the limitations of the Asserted Claims of the ’428 patent. Defendants also incorporate by reference the admissions during prosecution regarding what was already known in the art.

4. ’921 Patent

Table 7: Exemplary Anticipatory and Combinations for the Asserted Claims of the ’921 Patent

Chart (Exhibit)	Prior Art References
921Pat_1 (and 921Pat_1_Supplement)	Chon either alone or in combination with Sarkar, Dash, Esperer, Ritscher, Conover, Gertsch, Jones, Osowski, Kraesteva, Couceiro, Cammarota, Corbucci, Shaquer, Allen, Korhonen, Sukor, Wagner, Douglas, Richman, Tuzcu, Duong-Van, Wessel,

	Wiesel, Poli, Challis, Mainardi, Lian, Xu, Hernandez-Silveira, Chong, Anderson, Sweeney, Sholder, Chen, Lynn, Polania-Cabrera, Matsunaga, Olde, Visinescu, Harrington, Cho, Desok. Corbucci, Derchak, Brockway, Moorman, Hickey, Ferranti, McManus, and/or Othman (and/or any other references listed in the exhibits)
921Pat_2 (and 921Pat_2_Supplement)	Dash either alone or in combination with Sarkar, Dash, Chon, Esperer, Ritscher, Conover, Gertsch, Jones, Osowski, Kraesteva, Couceiro, Cammarota, Corbucci, Shaquer, Allen, Korhonen, Sukor, Wagner, Douglas, Richman, Tuzcu, Duong-Van, Wessel, Wiesel, Poli, Challis, Mainardi, Lian, Xu, Hernandez-Silveira, Chong, Anderson, Sweeney, Sholder, Chen, Lynn, Polania-Cabrera, Matsunaga, Olde, Visinescu, Harrington, Cho, Desok. Corbucci, Derchak, Brockway, Moorman, Hickey, Ferranti, McManus, and/or Othman (and/or any other references listed in the exhibits)
921Pat_3	Xu either alone or in combination with Sarkar, Dash, Esperer, Ritscher, Conover, Gertsch, Jones, Osowski, Krasteva, Couceiro, Couceiro-2, Cammarota, Corbucci, Shaquer, Allen, Korhonen, Sukor, Wagner, Lake, Richman, Tuzcu, Duong-Van, Lian, Wessel, Poli, Challis, and/or Mainardi (and/or any other references listed in the exhibits)
921Pat_4	Hernandez-Silveira either alone or in combination with Sarkar, Dash, Esperer, Ritscher, Conover, Gertsch, Jones, Osowski, Krasteva, Couceiro, Couceiro-2, Cammarota, Corbucci, Shaquer, Allen, Korhonen, Sukor, Wagner, Lake, Richman, Tuzcu, Duong-Van, Lian, Wessel, Poli, Challis, and/or Mainardi (and/or any other references listed in the exhibits)
921Pat_5	Chong either alone or in combination with Sarkar, Dash, Esperer, Ritscher, Conover, Gertsch, Jones, Osowski, Krasteva, Couceiro, Couceiro-2, Cammarota, Corbucci, Shaquer, Allen, Korhonen, Sukor, Wagner, Lake, Richman, Tuzcu, Duong-Van, Lian, Wessel, Poli, Challis, and/or Mainardi (and/or any other references listed in the exhibits)
921Pat_6	Anderson either alone or in combination with Sarkar, Dash, Esperer, Ritscher, Conover, Gertsch, Jones, Osowski, Krasteva, Couceiro, Couceiro-2, Cammarota, Corbucci, Shaquer, Allen, Korhonen, Sukor, Wagner, Lake, Richman, Tuzcu, Duong-Van, Lian, Wessel, Poli, Challis, and/or Mainardi (and/or any other references listed in the exhibits)

921Pat_7	Dash 2010 either alone or in combination with Sarkar, Dash, Esperer, Ritscher, Conover, Gertsch, Jones, Osowski, Krasteva, Couceiro, Couceiro-2, Cammarota, Corbucci, Shaquer, Allen, Korhonen, Sukor, Wagner, Lake, Lake-2010, Richman, Tuzcu, Duong-Van, Lian, Wessel, Poli, Challis, and/or Mainardi (and/or any other references listed in the exhibits)
921Pat_8	Larkin either alone or in combination with Sarkar, Dash, Esperer, Ritscher, Conover, Gertsch, Jones, Osowski, Krasteva, Couceiro, Couceiro-2, Cammarota, Corbucci, Shaquer, Allen, Korhonen, Sukor, Wagner, Lake, Lake-2010, Richman, Tuzcu, Duong-Van, Lian, Wessel, Poli, Challis, and/or Mainardi (and/or any other references listed in the exhibits)
921Pat_9	McManus either alone or in combination with Sarkar, Dash, Esperer, Ritscher, Conover, Gertsch, Jones, Osowski, Krasteva, Couceiro, Couceiro-2, Cammarota, Corbucci, Shaquer, Allen, Korhonen, Sukor, Wagner, Lake, Lake-2010, Richman, Tuzcu, Duong-Van, Lian, Wessel, Poli, Challis, and/or Mainardi (and/or any other references listed in the exhibits)

The prior art identified above, and in the attached ’921 charts, individually anticipate and/or can properly be combined in multiple ways to demonstrate the obviousness of the Asserted Claims of the ’921 patent. Various combinations of the references would have naturally been considered as part of the exercise of ordinary skill by one skilled in the art. The references disclosed in the attached charts and herein are also directed to the same or similar features as the purported invention claimed in the Asserted Claims of the ’921 patent. To the extent Plaintiffs contend that any of these features solved a problem in the art, the references cited herein show that that problem was known to those of ordinary skill and had already been solved using obvious solutions.

To that end, the Asserted Claims of the ’921 patent simply combine elements already combined and well known in the art and yield no more than what one skilled in the art would have expected from such a combination. For example, with respect to the ’921 patent, when confronted with the alleged problems described in the ’921 patent, one of ordinary skill in the

art at the time of the alleged inventions would have been motivated to consider the techniques taught by the prior art cited in these Invalidity Contentions. Consideration of the teachings of this prior art, both individually and in combination, would necessarily lead to the alleged invention claimed in the ’921 patent. This is demonstrated by the cited prior art, which disclose all of the elements of the Asserted Claims of the ’921 patent, as well as motivations to modify or combine their individual teachings. One of skill in the art would have been motivated to either modify the prior art identified in the claim charts or to combine that prior art in the manner indicated, by, for example, their background knowledge, design incentives, effects of demands known to the design community, or other market forces. Moreover, the cited prior art share commonalities. To the extent it is argued that any cited prior art does not expressly disclose a particular claim or element, it would have been inherent in the disclosure and/or obvious to a person of ordinary skill in the art to include the claimed element to perform the invention as claimed in the ’921 patent.

As described in the attached charts, all the elements of the Asserted Claims of the ’921 patent were commonplace before the alleged date of inventions. For each element, there exists evidence from the cited prior art that it was well known in the art prior to the date of invention. To the extent it is argued any of the cited prior art references, systems, and/or products do not anticipate the Asserted Claims, it would have been obvious to a person of ordinary skill in the art that the Asserted Claims are merely combinations of well-known methods and systems resulting in expected results.

Additionally, Defendants hereby incorporate by reference the motivations to combine references set forth during the prosecution of the Asserted Claims of the ’921 patent, including the statements and reasoning set forth by the examiner, as to why it would have been obvious

to modify or combine references to achieve the limitations of the Asserted Claims of the ’921 patent. Defendants also incorporate by reference the admissions during prosecution regarding what was already known in the art.

5. ’647 Patent

Table 8: Exemplary Anticipatory and Combinations for the Asserted Claims of the ’647 Patent

Chart (Exhibit)	Prior Art References
647Pat_1 (and 647Pat_1_Supplement)	Lai either alone or in combination with one or more of Fukushima, Morland, Pandhe, Shapiro, Zhang, Pamula, Canlas, Waydo, Mollerus, Najarian, Muehlsteff, Krishnan, Lin, Chon ’947, Li-182, Silva, Keenan, Baba, Maani, Yousefi, Kang, Aoshima, Aoshima 2012, Fahey, Ser, Hesh, Kim, Devries, Lee, de Haan, Shao, Lin, Moyer, Baca, Salehizadeh, Yorkey, Chon 198, Addison, Derkx, Watson, Todros, Norris, Muzet, Choi, Billi, Diab, Rudzinski, Gill, Akselrod, and/or Carney (and/or any other references listed in the exhibits)
647Pat_2 (and 647Pat_2_Supplement)	Venkatraman either alone or in combination with one or more of Lai, Fukushima, Morland, Shapiro, Zhang, Najarian, Krishnan, Mollerus, Canlas, Waydo, Chon ’947, Lin, Muehlsteff, Li-182, Silva, Keenan, Baba, Maani, Yousefi, Kang, Aoshima, Aoshima 2012, Fahey, Ser, Hesh, Kim, Devries, Lee, de Haan, Shao, Lin, Moyer, Baca, Salehizadeh, Yorkey, Chon 198, Addison, Derkx, Watson, Todros, Norris, Muzet, Choi, Billi, Diab, Rudzinski, Gill, Akselrod, and/or Carney (and/or any other references listed in the exhibits)
647Pat_3 (and 647Pat_3_Supplement)	Waydo either alone or in combination with one or more of Lai, Fukushima, Morland, Shapiro, Zhang, Krishnan, Pandhe, Pamula, Canlas, Lin, Najarian, Muehlsteff, Mollerus, Chon ’947, Li-182, Silva, Keenan, Baba, Maani, Yousefi, Kang, Aoshima, Aoshima 2012, Fahey, Ser, Hesh, Kim, Devries, Lee, de Haan, Shao, Lin, Moyer, Baca, Salehizadeh, Yorkey, Chon 198, Addison, Derkx, Watson, Todros, Norris, Muzet, Choi, Billi, Diab, Rudzinski, Gill, Akselrod, and/or Carney (and/or any other references listed in the exhibits)
647Pat_4 (and 647Pat_4_Supplement)	Shao either alone or in combination with one or more of Lai, Fukushima, Morland, Shapiro, Zhang, Pamula, Lin, Canlas, Pandhe, Waydo, Mollerus, Najarian, Krishnan, Muehlsteff, and/or Chon ’947, Li-182, Silva, Keenan, Baba, Maani,

	Yousefi, Kang, Aoshima, Aoshima 2012, Fahey, Ser, Hesh, Kim, Devries, Lee, de Haan, Shao, Lin, Moyer, Baca, Salehizadeh, Yorkey, Chon 198, Addison, Derkx, Watson, Todros, Norris, Muzet, Choi, Billi, Diab, Rudzinski, Gill, Akselrod, and/or Carney (and/or any other references listed in the exhibits)
647Pat_5	Shapiro either alone or in combination with one or more of Pandhe, Fukushima, Muehlsteff, Krishnan, Canlas, Waydo, Mollerus, Najarian, Chon, Morland, Zhang, Li, Silva, Keenan, Baba, Maani, Yousefi, Kang, Aoshima 2014, Aoshima 2012, Fahey, Ser, Hesh, Kim, Devries, Lee, de Haan, Shao, Lin, Moyer, Baca, Salehizadeh, Yorkey, Chon 198, Addison, Derkx, Watson, Todros, Norris, Muzet, Choi, Billi, Diab, Rudzinski, Gill, Akselrod, and/or Carney (and/or any other references listed in the exhibits)
647Pat_6	Li (U.S. Patent No. 10,722,182) either alone or in combination with one or more of Pandhe, Fukushima, Muehlsteff, Krishnan, Canlas, Waydo, Mollerus, Najarian, Chon, Morland, Zhang, Li, Silva, Keenan, Baba, Maani, Yousefi, Kang, Aoshima 2014, Aoshima 2012, Fahey, Ser, Hesh, Kim, Devries, Lee, de Haan, Shao, Lin, Moyer, Baca, Salehizadeh, Yorkey, Chon 198, Addison, Derkx, Watson, Todros, Norris, Muzet, Choi, Billi, Diab, Rudzinski, Gill, Akselrod, and/or Carney (and/or any other references listed in the exhibits)
647Pat_7	Silva either alone or in combination with one or more of Pandhe, Fukushima, Muehlsteff, Krishnan, Canlas, Waydo, Mollerus, Najarian, Chon, Morland, Zhang, Li, Silva, Keenan, Baba, Maani, Yousefi, Kang, Aoshima 2014, Aoshima 2012, Fahey, Ser, Hesh, Kim, Devries, Lee, de Haan, Shao, Lin, Moyer, Baca, Salehizadeh, Yorkey, Chon 198, Addison, Derkx, Watson, Todros, Norris, Muzet, Choi, Billi, Diab, Rudzinski, Gill, Akselrod, and/or Carney (and/or any other references listed in the exhibits)
647Pat_8	Keenan either alone or in combination with one or more of Pandhe, Fukushima, Muehlsteff, Krishnan, Canlas, Waydo, Mollerus, Najarian, Chon, Morland, Zhang, Li, Silva, Keenan, Baba, Maani, Yousefi, Kang, Aoshima 2014, Aoshima 2012, Fahey, Ser, Hesh, Kim, Devries, Lee, de Haan, Shao, Lin, Moyer, Baca, Salehizadeh, Yorkey, Chon 198, Addison, Derkx, Watson, Todros, Norris, Muzet, Choi, Billi, Diab, Rudzinski, Gill, Akselrod, and/or Carney (and/or any other references listed in the exhibits)

647Pat_9	Baba either alone or in combination with one or more of Pandhe, Fukushima, Muehlsteff, Krishnan, Canlas, Waydo, Mollerus, Najarian, Chon, Morland, Zhang, Li, Silva, Keenan, Baba, Maani, Yousefi, Kang, Aoshima 2014, Aoshima 2012, Fahey, Ser, Hesh, Kim, Devries, Lee, de Haan, Shao, Lin, Moyer, Baca, Salehizadeh, Yorkey, Chon 198, Addison, Derkx, Watson, Todros, Norris, Muzet, Choi, Billi, Diab, Rudzinski, Gill, Akselrod, and/or Carney (and/or any other references listed in the exhibits)
647Pat_10	Maani either alone or in combination with one or more of Pandhe, Fukushima, Muehlsteff, Krishnan, Canlas, Waydo, Mollerus, Najarian, Chon, Morland, Zhang, Li, Silva, Keenan, Baba, Maani, Yousefi, Kang, Aoshima 2014, Aoshima 2012, Fahey, Ser, Hesh, Kim, Devries, Lee, de Haan, Shao, Lin, Moyer, Baca, Salehizadeh, Yorkey, Chon 198, Addison, Derkx, Watson, Todros, Norris, Muzet, Choi, Billi, Diab, Rudzinski, Gill, Akselrod, and/or Carney (and/or any other references listed in the exhibits)
647Pat_11	Salehizadeh (article) either alone or in combination with one or more of Pandhe, Fukushima, Muehlsteff, Krishnan, Canlas, Waydo, Mollerus, Najarian, Chon, Morland, Zhang, Li, Silva, Keenan, Baba, Maani, Yousefi, Kang, Aoshima 2014, Aoshima 2012, Fahey, Ser, Hesh, Kim, Devries, Lee, de Haan, Shao, Lin, Moyer, Baca, Salehizadeh, Yorkey, Chon 198, Addison, Derkx, Watson, Todros, Norris, Muzet, Choi, Billi, Diab, Rudzinski, Gill, Akselrod, and/or Carney (and/or any other references listed in the exhibits)
647Pat_12	Chong either alone or in combination with one or more of Pandhe, Fukushima, Muehlsteff, Krishnan, Canlas, Waydo, Mollerus, Najarian, Chon, Morland, Zhang, Li, Silva, Keenan, Baba, Maani, Yousefi, Kang, Aoshima 2014, Aoshima 2012, Fahey, Ser, Hesh, Kim, Devries, Lee, de Haan, Shao, Lin, Moyer, Baca, Salehizadeh, Yorkey, Chon 198, Addison, Derkx, Watson, Todros, Norris, Muzet, Choi, Billi, Diab, Rudzinski, Gill, Akselrod, and/or Carney (and/or any other references listed in the exhibits)
647Pat_13	Krishnan either alone or in combination with one or more of Pandhe, Fukushima, Muehlsteff, Krishnan, Canlas, Waydo, Mollerus, Najarian, Chon, Morland, Zhang, Li, Silva, Keenan, Baba, Maani, Yousefi, Kang, Aoshima 2014, Aoshima 2012, Fahey, Ser, Hesh, Kim, Devries, Lee, de Haan, Shao, Lin, Moyer, Baca, Salehizadeh, Yorkey, Chon 198, Addison, Derkx, Watson, Todros, Norris, Muzet, Choi, Billi, Diab, Rudzinski, Gill, Akselrod, and/or Carney (and/or any other references listed in the exhibits)

The prior art identified above, and in the attached ’647 charts, individually anticipate and/or can properly be combined in multiple ways to demonstrate the obviousness of the Asserted Claims of the ’647 patent. Various combinations of the references would have naturally been considered as part of the exercise of ordinary skill by one skilled in the art. The references disclosed in the attached charts and herein are also directed to the same or similar features as the purported invention claimed in the Asserted Claims of the ’647 patent. To the extent Plaintiffs contend that any of these features solved a problem in the art, the references cited herein show that that problem was known to those of ordinary skill and had already been solved using obvious solutions.

To that end, the Asserted Claims of the ’647 patent simply combine elements already combined and well known in the art and yield no more than what one skilled in the art would have expected from such a combination. For example, with respect to the ’647 patent, when confronted with the alleged problems described in the ’647 patent, one of ordinary skill in the art at the time of the alleged inventions would have been motivated to consider the techniques taught by the prior art cited in these Invalidity Contentions. Consideration of the teachings of this prior art, both individually and in combination, would necessarily lead to the alleged invention claimed in the ’647 patent. This is demonstrated by the cited prior art, which disclose all of the elements of the Asserted Claims of the ’647 patent, as well as motivations to modify or combine their individual teachings. One of skill in the art would have been motivated to either modify the prior art identified in the claim charts or to combine that prior art in the manner indicated, by, for example, their background knowledge, design incentives, effects of demands known to the design community, or other market forces. Moreover, the cited prior art share commonalities. To the

extent it is argued that any cited prior art does not expressly disclose a particular claim or element, it would have been inherent in the disclosure and/or obvious to a person of ordinary skill in the art to include the claimed element to perform the invention as claimed in the ’647 patent.

As described in the attached charts, all the elements of the Asserted Claims of the ’647 patent were commonplace before the alleged date of inventions. For each element, there exists evidence from the cited prior art that it was well known in the art prior to the date of invention. To the extent it is argued any of the cited prior art references, systems, and/or products do not anticipate the Asserted Claims, it would have been obvious to a person of ordinary skill in the art that the Asserted Claims are merely combinations of well-known methods and systems resulting in expected results.

Additionally, Defendants hereby incorporate by reference the motivations to combine references set forth during the prosecution of the Asserted Claims of the ’647 patent, including the statements and reasoning set forth by the examiner, as to why it would have been obvious to modify or combine references to achieve the limitations of the Asserted Claims of the ’647 patent. Defendants also incorporate by reference the admissions during prosecution regarding what was already known in the art.

6. ’601 Patent

Table 9: Exemplary Anticipatory and Combinations for the Asserted Claims of the ’601 Patent

Chart (Exhibit)	Prior Art References
601Pat_1 (and 601Pat_1_Supplement)	Chon either alone or in combination with Sarkar, Dash, Esperer, Ritscher, Conover, Gertsch, Jones, Osowski, Kraesteva, Couceiro, Cammarota, Corbucci, Shaquer, Allen, Korhonen, Sukor, Wagner, Douglas, Richman, Tuzcu, Duong-Van, Wessel, Wiesel, Poli, Challis, Mainardi, Lian, Xu, Hernandez-Silveira, Chong, Anderson, Sweeney, Sholder, Chen, Lynn, Polania-

	Cabrera, Matsunaga, Olde, Visinescu, Dash, Harrington, Cho, Desok, Corbucci, Derchak, Brockway, Ritscher, Moorman, Hickey, Ferranti, McManus, and/or Othman (and/or any other references listed in the exhibits)
601Pat_2 (and 601Pat_2_Supplement)	Dash either alone or in combination with Sarkar, Chon, Esperer, Ritscher, Conover, Gertsch, Jones, Osowski, Kraesteva, Couceiro, Cammarota, Corbucci, Shaquer, Allen, Korhonen, Sukor, Wagner, Douglas, Richman, Tuzcu, Duong-Van, Wessel, Wiesel, Poli, Challis, Mainardi, Lian, Xu, Hernandez-Silveira, Chong, Anderson, Sweeney, Sholder, Chen, Lynn, Polania-Cabrera, Matsunaga, Olde, Visinescu, Dash, Harrington, Cho, Desok, Corbucci, Derchak, Brockway, Ritscher, Moorman, Hickey, Ferranti, McManus, and/or Othman (and/or any other references listed in the exhibits)
601Pat_3	Xu either alone or in combination with Sarkar, Dash, Esperer, Ritscher, Conover, Gertsch, Jones, Osowski, Krasteva, Couceiro, Couceiro-2, Cammarota, Corbucci, Shaquer, Allen, Korhonen, Sukor, Wagner, Lake, Lake-2010, Richman, Tuzcu, Duong-Van, Lian, Wessel, Poli, Challis, and/or Mainardi (and/or any other references listed in the exhibits)
601Pat_4	Hernandez-Silveira either alone or in combination with Sarkar, Dash, Esperer, Ritscher, Conover, Gertsch, Jones, Osowski, Krasteva, Couceiro, Couceiro-2, Cammarota, Corbucci, Shaquer, Allen, Korhonen, Sukor, Wagner, Lake, Lake-2010, Richman, Tuzcu, Duong-Van, Lian, Wessel, Poli, Challis, and/or Mainardi (and/or any other references listed in the exhibits)
601Pat_5	Chong either alone or in combination with Sarkar, Dash, Esperer, Ritscher, Conover, Gertsch, Jones, Osowski, Krasteva, Couceiro, Couceiro-2, Cammarota, Corbucci, Shaquer, Allen, Korhonen, Sukor, Wagner, Lake, Lake-2010, Richman, Tuzcu, Duong-Van, Lian, Wessel, Poli, Challis, and/or Mainardi (and/or any other references listed in the exhibits)
601Pat_6	Anderson either alone or in combination with Sarkar, Dash, Esperer, Ritscher, Conover, Gertsch, Jones, Osowski, Krasteva, Couceiro, Couceiro-2, Cammarota, Corbucci, Shaquer, Allen, Korhonen, Sukor, Wagner, Lake, Lake-2010, Richman, Tuzcu, Duong-Van, Lian, Wessel, Poli, Challis, and/or Mainardi (and/or any other references listed in the exhibits)

601Pat_7	Dash 2010 either alone or in combination with Sarkar, Dash, Esperer, Ritscher, Conover, Gertsch, Jones, Osowski, Krasteva, Couceiro, Couceiro-2, Cammarota, Corbucci, Shaquer, Allen, Korhonen, Sukor, Wagner, Lake, Lake-2010, Richman, Tuzcu, Duong-Van, Lian, Wessel, Poli, Challis, and/or Mainardi (and/or any other references listed in the exhibits)
601Pat_8	Larkin either alone or in combination with Sarkar, Dash, Esperer, Ritscher, Conover, Gertsch, Jones, Osowski, Krasteva, Couceiro, Couceiro-2, Cammarota, Corbucci, Shaquer, Allen, Korhonen, Sukor, Wagner, Lake, Lake-2010, Richman, Tuzcu, Duong-Van, Lian, Wessel, Poli, Challis, and/or Mainardi (and/or any other references listed in the exhibits)
601Pat_9	McManus either alone or in combination with Sarkar, Dash, Esperer, Ritscher, Conover, Gertsch, Jones, Osowski, Krasteva, Couceiro, Couceiro-2, Cammarota, Corbucci, Shaquer, Allen, Korhonen, Sukor, Wagner, Lake, Lake-2010, Richman, Tuzcu, Duong-Van, Lian, Wessel, Poli, Challis, and/or Mainardi (and/or any other references listed in the exhibits)

The prior art identified above, and in the attached ’601 charts, individually anticipate and/or can properly be combined in multiple ways to demonstrate the obviousness of the Asserted Claims of the ’601 patent. Various combinations of the references would have naturally been considered as part of the exercise of ordinary skill by one skilled in the art. The references disclosed in the attached charts and herein are also directed to the same or similar features as the purported invention claimed in the Asserted Claims of the ’601 patent. To the extent Plaintiffs contend that any of these features solved a problem in the art, the references cited herein show that that problem was known to those of ordinary skill and had already been solved using obvious solutions.

To that end, the Asserted Claims of the ’601 patent simply combine elements already combined and well known in the art and yield no more than what one skilled in the art would have expected from such a combination. For example, with respect to the ’601 patent, when confronted with the alleged problems described in the ’601 patent, one of ordinary skill in the

art at the time of the alleged inventions would have been motivated to consider the techniques taught by the prior art cited in these Invalidity Contentions. Consideration of the teachings of this prior art, both individually and in combination, would necessarily lead to the alleged invention claimed in the ’601 patent. This is demonstrated by the cited prior art, which disclose all of the elements of the Asserted Claims of the ’601 patent, as well as motivations to modify or combine their individual teachings. One of skill in the art would have been motivated to either modify the prior art identified in the claim charts or to combine that prior art in the manner indicated, by, for example, their background knowledge, design incentives, effects of demands known to the design community, or other market forces. Moreover, the cited prior art share commonalities. To the extent it is argued that any cited prior art does not expressly disclose a particular claim or element, it would have been inherent in the disclosure and/or obvious to a person of ordinary skill in the art to include the claimed element to perform the invention as claimed in the ’601 patent.

As described in the attached charts, all the elements of the Asserted Claims of the ’601 patent were commonplace before the alleged date of inventions. For each element, there exists evidence from the cited prior art that it was well known in the art prior to the date of invention. To the extent it is argued any of the cited prior art references, systems, and/or products do not anticipate the Asserted Claims, it would have been obvious to a person of ordinary skill in the art that the Asserted Claims are merely combinations of well-known methods and systems resulting in expected results.

Additionally, Defendants hereby incorporate by reference the motivations to combine references set forth during the prosecution of the Asserted Claims of the ’601 patent, including the statements and reasoning set forth by the examiner, as to why it would have been obvious

to modify or combine references to achieve the limitations of the Asserted Claims of the ’601 patent. Defendants also incorporate by reference the admissions during prosecution regarding what was already known in the art.

7. ’362 Patent

Table 10: Exemplary Anticipatory and Combinations for the Asserted Claims of the ’362 Patent

Chart (Exhibit)	Prior Art References
362Pat_1 (and 362Pat_1_Supplement)	Mollerus either alone or in combination with one or more of Bollmann, Yu, Wang, Edgar, Chon 2009, Fukushima, Lu, Kamath, Hsu, Osowski, Shapiro, Diab, Chon ’947, Chon 2013, Chon 2014, Wang, De Haan,Devries, Chon ‘219, Shao, Clifford, Changguo, Visvanathan, Rodriguez-Llorente, McGonigle, Brockway, Silva, Scharf, LeBoeuf, Laughner, Temko, Polimeni, Chong, Tamura, Krishnan, Verma, Barbé, Rodriguez-Llorente, Rodriguez-Llorente '865, Rodriguez-Llorente '935, Wegerich, Rodriguez-Llorente, Engelbrecht, Rodriguez-Llorente ‘937, Rodriguez-Llorente ‘957, Dunbar, Yan, Gardadori, Sukor, Kulkami, Hassan, Elgendi, Ardalan, Islam, Peng, Ram, and/or Clarke (and/or any other references listed in the exhibits)
362Pat_2 (and 362Pat_2_Supplement)	Chon ’947 either alone or in combination with one or more of Bollmann, Yu, Wang, Edgar, Chon 2009, Fukushima, Lu, Hsu, Kamath, Osowski, Shapiro, Diab, Chon ’947, Mollerus, Chon 2013, Chon 2014, Wang, De Haan,Devries, Chon ‘219, Shao, Clifford, Changguo, Visvanathan, Rodriguez-Llorente, McGonigle, Brockway, Silva, Scharf, LeBoeuf, Laughner, Temko, Polimeni, Chong, Tamura, Krishnan, Verma, Barbé, Rodriguez-Llorente, Rodriguez-Llorente '865, Rodriguez-Llorente '935, Wegerich, Rodriguez-Llorente, Engelbrecht, Rodriguez-Llorente ‘937, Rodriguez-Llorente ‘957, Dunbar, Yan, Gardadori, Sukor, Kulkami, Hassan, Elgendi, Ardalan, Islam, Peng, Ram, and/or Clarke (and/or any other references listed in the exhibits)
362Pat_3 (and 362Pat_3_Supplement)	Chon 2014 either alone or in combination with one or more of Edgar and/or Chon ’947, De Haan,Devries, Chon ‘219, Shao, Clifford, Changguo, Visvanathan, Rodriguez-Llorente, McGonigle, Brockway, Silva, Scharf, LeBoeuf, Laughner, Temko, Polimeni, Chong, Tamura, Krishnan, Verma, Barbé, Rodriguez-Llorente, Rodriguez-Llorente '865, Rodriguez-

	Llorente '935, Wegerich, Rodriguez-Llorente, Engelbrecht, Rodriguez-Llorente '937, Rodriguez-Llorente '957, Dunbar, Yan, Gardadori, Sukor, Kulkami, Hassan, Elgendi, Ardalan, Islam, Peng, Ram, and/or Clarke (and/or any other references listed in the exhibits)
362Pat_4	Chon '947 either alone or in combination with one or more of Bollmann, Chon 2009, Chon 2013, Chon 2014, Fukushima, Hsu, Kamath, Lu, Osowski, Edgar, Diab, Mollerus, Wegerich, Shapiro, Yu, and/or Wang (and/or any other references listed in the exhibits)
362Pat_5	De Haan either alone or in combination with one or more of Bollmann, Chon 2009, Chon 2013, Chon 2014, Fukushima, Hsu, Kamath, Lu, Osowski, Edgar, Diab, Mollerus, Wegerich, Shapiro, Yu, and/or Wang (and/or any other references listed in the exhibits)
362Pat_6	DeVries either alone or in combination with one or more of Bollmann, Chon 2009, Chon 2013, Chon 2014, Fukushima, Hsu, Kamath, Lu, Osowski, Edgar, Diab, Mollerus, Wegerich, Shapiro, Yu, and/or Wang (and/or any other references listed in the exhibits)
362Pat_7	Edgar either alone or in combination with one or more of Bollmann, Chon 2009, Chon 2013, Chon 2014, Fukushima, Hsu, Kamath, Lu, Osowski, Edgar, Diab, Mollerus, Wegerich, Shapiro, Yu, and/or Wang (and/or any other references listed in the exhibits)
362Pat_8	Chon '219 either alone or in combination with one or more of Bollmann, Chon 2009, Chon 2013, Chon 2014, Fukushima, Hsu, Kamath, Lu, Osowski, Edgar, Diab, Mollerus, Wegerich, Shapiro, Yu, and/or Wang (and/or any other references listed in the exhibits)
362Pat_9	Shao either alone or in combination with one or more of Bollmann, Chon 2009, Chon 2013, Chon 2014, Fukushima, Hsu, Kamath, Lu, Osowski, Edgar, Diab, Mollerus, Wegerich, Shapiro, Yu, and/or Wang (and/or any other references listed in the exhibits)
362Pat_10	Clifford either alone or in combination with one or more of Bollmann, Chon 2009, Chon 2013, Chon 2014, Fukushima, Hsu, Kamath, Lu, Osowski, Edgar, Diab, Mollerus, Wegerich, Shapiro, Yu, and/or Wang (and/or any other references listed in the exhibits)
362Pat_11	Temko either alone or in combination with one or more of Bollmann, Chon 2009, Chon 2013, Chon 2014, Fukushima, Hsu, Kamath, Lu, Osowski, Edgar, Diab, Mollerus, Wegerich,

	Shapiro, Yu, and/or Wang (and/or any other references listed in the exhibits)
362Pat_12	Polimeni either alone or in combination with one or more of Bollmann, Chon 2009, Chon 2013, Chon 2014, Fukushima, Hsu, Kamath, Lu, Osowski, Edgar, Diab, Mollerus, Wegerich, Shapiro, Yu, and/or Wang (and/or any other references listed in the exhibits)
362Pat_13	Chong either alone or in combination with one or more of Bollmann, Chon 2009, Chon 2013, Chon 2014, Fukushima, Hsu, Kamath, Lu, Osowski, Edgar, Diab, Mollerus, Wegerich, Shapiro, Yu, and/or Wang (and/or any other references listed in the exhibits)
362Pat_14	Krishnan either alone or in combination with one or more of Bollmann, Chon 2009, Chon 2013, Chon 2014, Fukushima, Hsu, Kamath, Lu, Osowski, Edgar, Diab, Mollerus, Wegerich, Shapiro, Yu, and/or Wang (and/or any other references listed in the exhibits)

The prior art identified above, and in the attached ’362 charts, individually anticipate and/or can properly be combined in multiple ways to demonstrate the obviousness of the Asserted Claims of the ’362 patent. Various combinations of the references would have naturally been considered as part of the exercise of ordinary skill by one skilled in the art. The references disclosed in the attached charts and herein are also directed to the same or similar features as the purported invention claimed in the Asserted Claims of the ’362 patent. To the extent Plaintiffs contend that any of these features solved a problem in the art, the references cited herein show that that problem was known to those of ordinary skill and had already been solved using obvious solutions

To that end, the Asserted Claims of the ’362 patent simply combine elements already combined and well known in the art and yield no more than what one skilled in the art would have expected from such a combination. For example, with respect to the ’362 patent, when confronted with the alleged problems described in the ’362 patent, one of ordinary skill in the art

at the time of the alleged inventions would have been motivated to consider the techniques taught by the prior art cited in these Invalidity Contentions. Consideration of the teachings of this prior art, both individually and in combination, would necessarily lead to the alleged invention claimed in the ’362 patent. This is demonstrated by the cited prior art, which disclose all of the elements of the Asserted Claims of the ’362 patent, as well as motivations to modify or combine their individual teachings. One of skill in the art would have been motivated to either modify the prior art identified in the claim charts or to combine that prior art in the manner indicated, by, for example, their background knowledge, design incentives, effects of demands known to the design community, or other market forces. Moreover, the cited prior art share commonalities. To the extent it is argued that any cited prior art does not expressly disclose a particular claim or element, it would have been inherent in the disclosure and/or obvious to a person of ordinary skill in the art to include the claimed element to perform the invention as claimed in the ’362 patent.

As described in the attached charts, all the elements of the Asserted Claims of the ’362 patent were commonplace before the alleged date of inventions. For each element, there exists evidence from the cited prior art that it was well known in the art prior to the date of invention. To the extent it is argued any of the cited prior art references, systems, and/or products do not anticipate the Asserted Claims, it would have been obvious to a person of ordinary skill in the art that the Asserted Claims are merely combinations of well-known methods and systems resulting in expected results.

Additionally, Defendants hereby incorporate by reference the motivations to combine references set forth during the prosecution of the Asserted Claims of the ’362 patent, including the statements and reasoning set forth by the examiner, as to why it would have been obvious to modify or combine references to achieve the limitations of the Asserted Claims of the ’362 patent.

Defendants also incorporate by reference the admissions during prosecution regarding what was already known in the art.

III. Invalidity Under 35 U.S.C. § 112

Defendants contend that one or more of the Asserted Claims are invalid under 35 U.S.C.

§ 112. As explained below, these claims lack priority, are indefinite, and/or fail to satisfy the written description and/or enablement requirements.[2]

A. '326 Patent

Defendants contend that none of the '326 patent asserted claims are entitled to their claimed priority date. As explained below, the '326 patent purports to claim priority to one or more prior applications whose disclosures do not support the '326 patent asserted claims. Accordingly, the Asserted Claims are not entitled to the benefit of the earlier filing dates of these applications. *See, e.g.*, *In re Katz Interactive Call Processing Litig.*, 639 F.3d 1303, 1322 (Fed. Cir. 2011); *PowerOasis, Inc. v. T-Mobile USA, Inc.*, 522 F.3d 1299, 1306 (Fed. Cir. 2008).

The Asserted Claims of the '326 patent are not entitled to the claimed priority date. Plaintiffs allege that the asserted claims of the '326 patent are entitled to and claim priority to "U.S. Provisional Patent Application No. 60/953,508, filed on August 2, 2007, and U.S.

[2] For each of the asserted patents, there exists a wealth of prior art that leads to conclusions of prior art invalidity under Sections 102 and 103. In terms of the teachings provided by this prior art and the motivations to combine different individual prior art references within this wealth of art, these Invalidity Contentions provide numerous examples. Should Plaintiffs try to later dispute the teachings provided by this prior art and/or dispute any of the motivations to combine individual references within this wealth of prior art, Plaintiffs' later arguments in dispute of what would have been known to person of ordinary skill may well raise additional Section 112 bases for the invalidity of the Asserted Claims, including additional examples of written description deficiencies as well as a lack of an enabling disclosure. Since Plaintiffs have not yet shared those positions, should it later choose to do so, Defendants reserve their rights to amend these contentions based on this later provided information.

Provisional Patent Application No. 61/084,389, filed on July 29, 2008." Plaintiffs' PR 3-1 and 3-2 Disclosures. The '326 patent purports to claim priority to the following U.S. provisional applications:

- U.S. Provisional No. 60/953,508 (filed August 2, 2007); and
- U.S. Provisional No. 61/084,389 (filed July 29, 2008).

See '326 patent, at (60).

However, the priority application(s) do not sufficiently support the Asserted Claims of the '326 patent, as explained below with reference to exemplary claim elements that lack such support. Because the applications to which the '326 patent claims priority do not support the claim elements identified below, the claims containing those claim elements—and any claim(s) depending directly or indirectly therefrom—are not entitled to the benefit of an earlier filing date.

One or more of the Asserted Claims of the '326 patent are invalid under 35 U.S.C. § 112, ¶ 1, or 35 U.S.C. § 112(a).

The '326 patent and/or its priority application(s) do not provide sufficient written description support to establish that the alleged inventors possessed the alleged inventions recited in the Asserted Claims of the '326 patent. *See Ariad Pharm.*, 598 F.3d at 1351.

For example, the '326 patent and/or its priority application(s) do not provide sufficient support—by itself or through any disclosure incorporated by reference—for at least the following claim terms in combination with the other recited limitations of the claim:

- "analyzing a number (N) of heart beat intervals from the output" (claim 1);
- "the RMSSD threshold is a percentage of a mean heart beat interval of a beat segment of the N intervals" (claim 3);

- "calculating autocorrelation coefficients" (claim 6);
- "analyzing a number (N) of heart beat intervals from the output" (claim 15); and
- the additional limitations recited in dependent claims 6, 7.

Because the '326 patent and/or its priority application(s) do not support these claim elements, the foregoing claims—and any claim(s) depending directly or indirectly therefrom—are either invalid under 35 U.S.C. § 112, ¶ 1, or 35 U.S.C. § 112(a) or lack priority.

B. '576 Patent

One or more of the Asserted Claims of the '576 patent are invalid under 35 U.S.C. § 112, ¶ 1, or 35 U.S.C. § 112(a).

The '576 patent does not provide sufficient written description support to establish that the alleged inventors possessed the alleged inventions recited in the Asserted Claims of the '576 patent. *See Ariad Pharm.*, 598 F.3d at 1351.

For example, the '576 patent does not provide sufficient support—by itself or through any disclosure incorporated by reference—for at least the following claim terms in combination with the other recited limitations of the claim:

- "demarcat[ing] boundaries in a Poincare plot space, the boundaries being obtained

  from data from a test set of test subjects" (claims 1, 8, 16);
- "obtain[ing] updated data by subtracting the data in the patterns

  corresponding to combinations of at least one of bigeminy, trigemini,

  quadragemini indicating one of PAC or PVC from the time interval data

  from the subject under test" (claims 1, 8, 16);
- "determin[ing], if each of the root mean square of successive differences, the

Shannon entropy, and the turning point ratio is less than a corresponding predetermined threshold, that the subject under test has normal sinus rhythm (NSR) with PVC or PAC" (claims 1, 8, 16);

- "peak amplitude data" (claims 2, 9, 17);
- "determin[ing] that the subject under test has NSR with PAC if the first Kullback- Leibler divergence is greater than the second Kullback-Leibler divergence; and determin[ing] that the subject under test has NSR with PVC if the first Kullback- Leibler divergence is at most equal to the second Kullback-Leibler divergence" (claims 2, 9, 17);
- "compar[ing] a difference between the number of turning points and the expected number of turning points to a fourth predetermined threshold; and determin[ing], if the difference is greater than the fourth predetermined threshold, that the PAC or PVC pattern is a quadrigeminy pattern" (claims 3, 10, 18);
- "compar[ing] a difference between the number of turning points and the expected number of turning points to a fourth predetermined threshold; and determin[ing], if the difference is greater than the fourth predetermined threshold, that the PAC or PVC pattern is a trigeminy pattern" (claims 4, 11, 19).

Because the '576 patent does not support these claim elements, the foregoing claims—and any claim(s) depending directly or indirectly therefrom—are invalid under 35 U.S.C. § 112, ¶ 1, or 35 U.S.C. § 112(a).

As explained below, one or more of the Asserted Claims of the '576 patent are also

invalid as indefinite under 35 U.S.C. § 112, ¶ 2, or 35 U.S.C. § 112(b). These claims fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention. *Nautilus*, 572 U.S. at 901. Accordingly, these claims are invalid as indefinite. For example, an artisan of ordinary skill could not discern, with reasonable certainty, the scope of the following claim terms of the ’576 patent:

- “obtain[ing] updated data by subtracting the data in the patterns corresponding to combinations of at least one of bigeminy, trigemini, quadragemini indicating one of PAC or PVC from the time interval data from the subject under test” (claims 1, 8, 16);
- “determin[ing], if each of the root mean square of successive differences, the Shannon entropy, and the turning point ratio is less than a corresponding predetermined threshold, that the subject under test has normal sinus rhythm (NSR) with PVC or PAC” (claims 1, 8, 16);
- “peak amplitude data” (claims 2, 9, 17);

Accordingly, these claims—and any claim(s) depending directly or indirectly therefrom—are invalid under 35 U.S.C. § 112, ¶ 2, or 35 U.S.C. § 112(b) as indefinite.

C. ’428 Patent

Defendants contend that none of the ’428 Patent asserted claims are entitled to their claimed priority date. As explained below, the ’428 Patent purports to claim priority to one or more prior applications whose disclosures do not support the ’428 Patent asserted claims. Accordingly, the ’428 Patent asserted claims are not entitled to the benefit of the earlier filing dates of these applications. *See, e.g.*, *In re Katz Interactive Call Processing Litig.*, 639 F.3d 1303, 1322 (Fed. Cir. 2011); *PowerOasis, Inc. v. T-Mobile USA, Inc.*, 522 F.3d 1299,

1306 (Fed. Cir. 2008).

The Asserted Claims of the ’428 patent are not entitled to the claimed priority date. Plaintiffs allege that the asserted claims of the ’428 patent are entitled to and claim priority to “U.S. Provisional Patent Application No. 61/434,862, filed on January 21, 2011, U.S. Provisional Patent Application No. 61/512,199, filed on July 27, 2011, U.S. Provisional Patent Application No. 61/434,856, filed on January 21, 2011, and U.S. Provisional Patent Application No. 61/566,329, filed on December 2, 2011.” Plaintiffs’ PR 3-1 and 3-2 Disclosures. The ’428 patent purports to claim priority to the following U.S. provisional applications:

- U.S. Provisional No. 61/434,862 (filed January 21, 2011);
- U.S. Provisional No. 61/512,199 (filed July 27, 2011);
- U.S. Provisional No. 61/434,856 (filed January 21, 2011); and
- U.S. Provisional No. 61/566,329 (filed December 2, 2011).

See ’428 patent, at (60).

However, the priority application(s) do not sufficiently support the Asserted Claims of the ’428 patent, as explained below with reference to exemplary claim elements that lack such support. Because the applications to which the ’428 patent claims priority do not support the claim elements identified below, the claims containing those claim elements—and any claim(s) depending directly

or indirectly therefrom—are not entitled to the benefit of an earlier filing date.

One or more of the Asserted Claims of the ’428 patent are invalid under 35 U.S.C. § 112, ¶ 1, or 35 U.S.C. § 112(a).

The ’428 patent and/or its priority application(s) do not provide sufficient written description support to establish that the alleged inventors possessed the alleged inventions recited in the Asserted Claims of the ’428 patent. *See Ariad Pharm.*, 598 F.3d at 1351.

For example, the ’428 patent and/or its priority application(s) does not provide sufficient support—by itself or through any disclosure incorporated by reference—for at least the following claim terms in combination with the other recited limitations of the claim:

- “providing a physiological indicator signal to a handheld mobile communication device; the physiological indicator signal being obtained from one of an image acquisition component, a photoplethysmographic (PPG) sensor and an electrocardiogram sensor” (claim 1);
- “detecting, using the handheld mobile communication device and using only the measurements of one or more physiological parameters, effects of motion artifacts in the measurements of the one or more physiological parameters and deciding whether to retain the measurements based on detected effects of motion artifacts” (claim 1);
- “wherein providing a physiological indicator signal comprises: placing a portion of a subject's body over an objective lens of a camera in a handheld mobile communication device; and obtaining video images of the portion of the subject's body” (claim 4);
- “wherein providing a physiological indicator signal comprises: placing a portion of a subject's body over an objective lens of a camera in a mobile communication device;

  and obtaining video images of the portion of the subject's body” (claim 12);

- "wherein obtaining the measure of oxygen saturation comprises: obtaining an average intensity of a red component and a blue component of the video images of the portion of the subject's body; the average intensity of the red component and the average intensity of the blue component constituting DCRED and DCBLUE respectively; obtaining a standard deviation of the red component and the blue component; the standard deviation of the red component and the blue component constituting ACRED and ACBLUE respectively; and obtaining the measure of oxygen saturation (SpO2) by $$SpO2 = A - B\frac{\frac{AC_{RED}}{DC_{RED}}}{\frac{AC_{BLUE}}{DC_{BLUE}}}.$$ " (claim 12);

- "providing a physiological indicator signal to a handheld mobile communication device; the physiological indicator signal being obtained from one of an image acquisition component, a photoplethysmographic (PPG) sensor and an electrocardiogram sensor" (claim 16);
- "wherein analysis does not include Independent Component Analysis" (claim 16);
- "detecting, using the handheld mobile communication device and using only the measurements of one or more physiological parameters, effects of motion artifacts in the measurements of the one or more physiological parameters and deciding whether to retain the measurements based on effects of motion artifacts in the measurements" (claim 16);
- "obtaining a time-varying coherence function by multiplying two time-

varying transfer functions (TVFTs), the two time-varying transfer functions obtained using

two adjacent data segments, from the physiological indicator signal, one of the two adjacent data segment as an input signal and another of the two adjacent data segment as an output signal to produce a first TVTF; a second TVTF is produced by reversing the input and the output signals, using said another of the two adjacent data segment as the input signal and said one of the two adjacent data segment as the output signal; and determining whether the time-varying coherence function is less than a predetermined quantity" (claim 16);

- "wherein the one or more indicators of atrial fibrillation comprise a variance of the time-varying coherence function" (claim 18);
- "a physiological indicator signal sensing component; the physiological indicator signal sensing component being one of an image acquisition component, a photoplethysmographic (PPG) sensor and an electrocardiogram sensor" (claim 21);
- "wherein the physiological indicator signal sensing component comprises an image acquisition component, said acquisition component capable of acquiring a number of frames, each frame acquired at a predetermined time" (claim 24);
- "wherein the handheld mobile communications device comprises said image acquisition component" (claim 25);
- "wherein the physiological indicator signal sensing component

comprises an image acquisition component, said acquisition component capable of acquiring a number of frames, each frame acquired at a predetermined time; wherein said image acquisition component acquires a color image having red, green and blue components; wherein one or more physiological measurements comprise a measure of oxygen saturation; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to: obtain an average intensity of a red component and a blue component of the images of a portion of a subject's body; the average intensity of the red component and the average intensity of the blue component constituting DCRED and DCBLUE respectively; obtain a standard deviation of the red component and the blue component; the standard deviation of the red component and the blue component constituting ACRED and ACBLUE respectively; and obtain

$$SpO2 = A - B\frac{\frac{AC_{RED}}{DC_{RED}}}{\frac{AC_{BLUE}}{DC_{BLUE}}}.$$

the measure of oxygen saturation by " (claim 28);

- "the physiological indicator signal being obtained from one of an image acquisition component, a photoplethysmographic (PPG) sensor and an electrocardiogram sensor" (claim 32);
- "wherein analysis does not include Independent Component Analysis" (claim 32);
- "detect effects of motion artifacts, using only the measurements of one or

more physiological parameters, in the measurements of the one or more physiological parameters; wherein the one or more physiological measurements comprise a measure of atrial fibrillation" (claim 32);

- "obtain a time-varying coherence function by multiplying two time-varying transfer functions (TVFTs), the two time-varying transfer functions obtained using two adjacent data segments from the physiological indicator signal, one of the two adjacent data segment as an input signal and another of the two adjacent data segment as an output signal to produce a first TVTF; a second TVTF is produced by reversing the input and the output signals, using said another of the two adjacent data segment as the input signal and said one of the two adjacent data segment as the output signal; and determine whether the time-varying coherence function is less than a predetermined quantity" (claim 32);
- "wherein the one or more indicators of atrial fibrillation comprise a variance of the time-varying coherence function" (claim 34);
- "the physiological indicator signal being obtained from one of an image acquisition component, a photoplethysmographic (PPG) sensor and an electrocardiogram sensor" (claim 37);
- "detect, using only the measurements of one or more physiological parameters, effects of motion artifacts in the measurements of the one or more physiological parameters" (claim 37);
- "wherein the physiological indicator signal comprises a video color image having red, green and blue components, the video color image

being an image obtained from of a portion of a subject's body; wherein the measurements of one or more physiological parameters comprise a measure of oxygen saturation; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to: obtain an average intensity of the red component and a blue component of the video color image of a portion of a subject's body; the average intensity of the red component and the average intensity of the blue component constituting DCRED and DCBLUE respectively; obtain a standard deviation of the red component and the blue component; the standard deviation of the red component and the blue component constituting ACRED and ACBLUE respectively; and obtain the measure of oxygen

$$SpO2 = A - B\frac{\frac{AC_{RED}}{DC_{RED}}}{\frac{AC_{BLUE}}{DC_{BLUE}}}.$$

saturation by ” (claim 38);

- “the physiological indicator signal being obtained from one of an image acquisition component, a photoplethysmographic (PPG) sensor and an electrocardiogram sensor” (claim 42);
- “wherein analysis does not include Independent Component Analysis” (claim 42);
- “detect, using only the measurements of one or more physiological parameters, effects of motion artifacts in the measurements of the one or more physiological parameters” (claim 42);

- "obtain a time-varying coherence function by multiplying two time-varying transfer functions (TVFTs), the two time-varying transfer functions obtained using two adjacent data segments, from the physiological indicator signal, one of the two adjacent data segment as an input signal and another of the two adjacent data segment as an output signal to produce a first TVTF; a second TVTF is produced by reversing the input and the output signals, using said another of the two adjacent data segment as the input signal and said one of the two adjacent data segment as the output signal; and determine whether the time-varying coherence function is less than a predetermined quantity" (claim 42); and
- "wherein the one or more indicators of atrial fibrillation comprise a variance of the time-varying coherence function" (claim 44).

Because the '428 patent and/or its priority application(s) do not support these claim elements, the foregoing claims—and any claim(s) depending directly or indirectly therefrom—are either invalid under 35 U.S.C. § 112, ¶ 1, or 35 U.S.C. § 112(a) or lack priority.

As explained below, one or more of the Asserted Claims of the '428 patent are also invalid as indefinite under 35 U.S.C. § 112, ¶ 2, or 35 U.S.C. § 112(b). These claims fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention. *Nautilus*, 572 U.S. at 901. Accordingly, these claims are invalid as indefinite. For example, an artisan of ordinary skill could not discern, with reasonable certainty, the scope of the following claim terms of the '428 patent:

- "detecting, using the handheld mobile communication device and using only the measurements of one or more physiological parameters, effects of motion

artifacts in the measurements of the one or more physiological parameters and deciding whether to retain the measurements based on detected effects of motion artifacts" (claim 1);

- "The method of claim 1 wherein obtaining measurements of heart rate and heart rate variability comprise: determining beats for the physiological indicator signal; determining beat to beat intervals; and applying a cubic spline algorithm to obtain a substantially continuous beat to beat interval signal indicative of heart rate." (claim 8); and
- "detecting, using the handheld mobile communication device and using only the measurements of one or more physiological parameters, effects of motion artifacts in the measurements of the one or more physiological parameters and deciding whether to retain the measurements based on effects of motion artifacts in the measurements" (claim 16).

Accordingly, this claim—and any claim(s) depending directly or indirectly therefrom—is invalid under 35 U.S.C. § 112, ¶ 2, or 35 U.S.C. § 112(b) as indefinite.

D. '921 Patent

One or more of the Asserted Claims of the '921 patent are invalid under 35 U.S.C. § 112, ¶ 1, or 35 U.S.C. § 112(a).

The '921 patent does not provide sufficient written description support to establish that the alleged inventors possessed the alleged inventions recited in the Asserted Claims of the '921 patent. *See Ariad Pharm.*, 598 F.3d at 1351.

For example, the '921 patent does not provide sufficient support—by itself or through

any disclosure incorporated by reference—for at least the following claim terms in combination with the other recited limitations of the claim:

- "compar[ing] the turning point ratio to a third predetermined threshold" (claims 1-9)
- "compar[ing] the turning point ratio for the updated data to a third predetermined threshold" (claims 2-3, 4-5, 8-9)
- "construct[ing] a Poincare plot of time interval data from the PPI data; the time interval being a time interval between consecutive pulses obtained by sensing variability in heart rate signal from the subject under test;" (claims 2-3, 5-6, 8-9)
- "determin[ing], when each of the root mean square of successive differences, the Shannon entropy, and the turning point ratio is less than a corresponding predetermined threshold, a subject under test has normal sinus rhythm without PAC or PVC." (claims 1, 4, 7)
- "determin[ing], when not each of the root mean square of successive differences, the Shannon entropy, and the turning point ratio for the updated data is less than a corresponding predetermined threshold, that the subject under test has AF." (claims 2, 5, 8)
- "determin[ing] from comparison of the difference between pulse rise times of consecutive pulses to the fourth predetermined threshold and comparison of the difference between pulse fall times of consecutive pulses to the fifth predetermined threshold, whether the subject under test has one of normal sinus rhythm (NSR) with PAC or NSR with PVC." (claims 3, 6, 9)

Because the '921 patent does not support these claim elements, the foregoing claims—

and any claim(s) depending directly or indirectly therefrom—are invalid under 35 U.S.C. § 112, ¶ 1, or 35 U.S.C. § 112(a).

E. '647 Patent

Defendants contend that none of the '647 Patent asserted claims are entitled to their claimed priority date. As explained below, the '647 Patent purports to claim priority to one or more prior applications whose disclosures do not support the asserted claims. Accordingly, the '647 Patent asserted claims are not entitled to the benefit of the earlier filing dates of these applications. *See, e.g.*, *In re Katz Interactive Call Processing Litig.*, 639 F.3d 1303, 1322 (Fed. Cir. 2011); *PowerOasis, Inc. v. T-Mobile USA, Inc.*, 522 F.3d 1299, 1306 (Fed. Cir. 2008).

The Asserted Claims of the '647 patent are not entitled to the claimed priority date. Plaintiffs allege that the asserted claims of the '647 patent are entitled to and claim priority to "U.S. Provisional Patent Application No. 62/299,944, filed on February 25, 2016, and U.S. Provisional Patent Application No. 62/172,862, filed on June 9, 2015." Plaintiffs' PR 3-1 and 3-2 Disclosures. The '647 patent purports to claim priority to the following U.S. provisional applications:

- U.S. Provisional No. 62/299,944 (filed February 25, 2016); and
- U.S. Provisional No. 62/172,862 (filed June 9, 2015).

See '647 patent, at (60).

However, the priority application(s) do not sufficiently support the Asserted Claims of the '647 patent, as explained below with reference to exemplary claim elements that lack such support. Because the applications to which the '647 patent claims priority do not support the claim elements identified below, the claims containing those claim elements—and any

claim(s) depending directly or indirectly therefrom—are not entitled to the benefit of an earlier filing date.

One or more of the Asserted Claims of the ’647 patent are invalid under 35 U.S.C. § 112, ¶ 1, or 35 U.S.C. § 112(a).

The ’647 patent and/or its priority application(s) do not provide sufficient written description support to establish that the alleged inventors possessed the alleged inventions recited in the Asserted Claims of the ’647 patent. *See Ariad Pharm.*, 598 F.3d at 1351.

For example, the ’647 patent and/or its priority application(s) do not provide sufficient support—by itself or through any disclosure incorporated by reference—for at least the following claim terms in combination with the other recited limitations of the claim:

- “a classification of the movement” (claims 1, 35, 69, 70, 71, 72, 73, 74, 75);
- “pre-processing the heart-related signal to produce a pre-processed heart-related signal, pre-processing the motion signal to produce a pre-processed motion signal” (claims 1, 35, 69);
- “computing a first time-frequency spectrum (TFS) of the heart-related signal using the pre-processed heart-related signal and a second TFS of the motion signal using the pre-processed motion signal” (claims 1, 35, 69);
- “in an event the classification indicates that the movement does not rise to a level causing the motion artifacts, the reconstructed representation is based on an average value of peak-to-peak intervals in the pre-processed heart-related signal” (claims 3, 37)
- “wherein the pre-processing includes filtering the heart-related signal to produce a filtered heart-related signal, the filtered heart-related signal being

the pre-processed heart-related signal" / "pre-processing includes filtering the heart-related signal and the motion signal to produce a filtered heart-related signal and a filtered motion signal, respectively, the filtered heart-related signal being the pre-processed heart- related signal and the filtered motion signal being the pre-processed motion signal" (claims 4, 17, 38, 51)

- "wherein the pre-processing further includes down-sampling the filtered heart- related signal, the down-sampling being at a sampling rate less than an original sampling rate" / "wherein the pre-processing further includes down-sampling, at a sampling rate less than an original sampling rate, both the filtered heart-related signal and the filtered motion signal" (claims 5, 18, 39, 52)
- "based on the classification indicating that the movement does rise to a level causing the motion artifacts and is a pseudo-periodic movement or a periodic movement" / "based on: the classification of the movement indicating that the movement is a pseudo-periodic movement or a periodic movement" (claims 8, 42, 50, 70, 73)
- "wherein, based on a determination that the at least one spectral peak is not present, the current reconstructed representation is based on a prior reconstructed representation, the prior reconstructed representation associated with a previous point in time in the first TFS computed" (claims 8, 42, 70, 73)
- "second discarding, wherein the second discarding discards remaining candidate spectral peaks, of the at least one remaining candidate spectral peak retained, based

on whether a corresponding frequency of the at least one remaining candidate spectral peak retained is distanced by at least a frequency difference threshold from a prior reconstructed representation's frequency" (claims 13, 47)

- "based on each of the at least one remaining candidate spectral peak retained having

  been discarded by the second discarding, reconstructing the current representation is based on the prior reconstructed representation" (claims 14, 48)

- "wherein the retaining and the discarding are based on: the classification indicating that the movement is a pseudo-periodic movement or a periodic movement" (claims 16, 50)

- "classifying the classification of the movement by comparing an amount of amplitude modulation in the second TFS computed to an amplitude modulation threshold, wherein the classification indicates whether the movement rises to a level of causing the motion artifacts based on a result of the comparing" / "further including a classification unit, the classification unit configured to: classify the classification of the movement by comparing an amount of amplitude modulation in the second TFS computed to an amplitude modulation threshold, wherein the classification indicates whether the movement rises to a level causing the motion artifacts based on a result of the comparing" / "a classification unit configured to classify the classification of the movement by comparing an amount of amplitude modulation in the second TFS computed to an amplitude modulation threshold, wherein the

classification indicates whether the movement rises to a level causing the motion artifacts based on a result of the comparing" (claims 19, 53, 72, 75)

- "wherein the amplitude modulation threshold is dependent on a type of the motion detector sensor" (claims 20, 54)
- "wherein, in an event the result indicates that the movement does rise to the level causing the motion artifacts, classifying the classification of the movement further includes determining whether the movement is either a pseudo-periodic movement or a periodic movement, versus a random movement" / "wherein, in an event the result indicates that the movement does rise to the level causing the motion artifacts, the classification unit is further configured to classify the classification of the movement by determining whether the movement is either a pseudo-periodic movement or a periodic movement, versus a random movement" (claim 21, 55)
- "wherein, in determining whether the movement is either the pseudo-periodic movement or the periodic movement, versus the random movement includes" (claims 22, 56)
- "wherein the classification further indicates that the movement is either the pseudo- periodic movement or the periodic movement, versus the random movement, based on the first comparison result and the second comparison result" (claims 22, 56)
- "computing a first ratio of the second frequency identified to the first frequency identified and determining a first comparison result by comparing the first ratio computed to a first ratio value" (claims 22, 56)

- "computing a second ratio of the third frequency identified to the first frequency identified and determining a second comparison result by comparing the second ratio computed to a second ratio value, wherein the classification further indicates that the movement is either the pseudo-periodic movement or the periodic movement, versus the random movement, based on the first comparison result and the second comparison result" (claims 22, 56)
- "wherein the first ratio value is 2 and the second ratio value is 3" (claims 23, 57)
- "wherein, in an event the classification of the movement indicates random movement, the reconstructing includes" (claims 24, 58)
- "computing a bandpass filter cutoff frequency based on the average value computed" (claims 24, 58)
- "filtering the pre-processed heart-related signal by applying the band pass filter computed to produce a filtered, pre-processed heart-related signal" (claims 24, 58)
- "further comprising employing the reconstructed representation to determine an arterial oxygen saturation (Sp02) estimate" / "further comprising an arterial oxygen saturation (SpO2) unit configured to employ the reconstructed representation to determine a SpO2 estimate" (claims 31, 65)
- "further comprising employing the reconstructed representation to detect or predict a heart-related ailment, the heart-related ailment including at least one of a heart rate variability (HRV) condition, atrial fibrillation condition, congestive heart failure condition, and tachycardia condition" / "further

comprising an ailment unit configured to employ the reconstructed representation to detect or predict a heart- related ailment, the heart-related ailment including at least one of a heart rate variability (HRV) condition, an atrial fibrillation condition, a congestive heart failure condition, and a tachycardia condition" (claims 32, 66)

Because the '647 patent and/or its priority application(s) do not support these claim elements, the foregoing claims—and any claim(s) depending directly or indirectly therefrom—are either invalid under 35 U.S.C. § 112, ¶ 1, or 35 U.S.C. § 112(a) or lack priority.

As explained below, one or more of the Asserted Claims of the '647 patent are also invalid as indefinite under 35 U.S.C. § 112, ¶ 2, or 35 U.S.C. § 112(b). These claims fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention. *Nautilus*, 572 U.S. at 901. Accordingly, these claims are invalid as indefinite. For example, an artisan of ordinary skill could not discern, with reasonable certainty, the scope of the following claim terms of the '647 patent:

- "based on each of the at least one remaining candidate spectral peak retained having been discarded by the second discarding, reconstructing the current representation is based on the prior reconstructed representation; and, based on at least one last candidate spectral peak remaining, the at least one last candidate spectral peak remaining not discarded by the second discarding, reconstructing the current representation is based on a selected candidate spectral peak selected from amongst the at least one last candidate spectral peak remaining having a closest corresponding frequency to the prior reconstructed representation's frequency relative to respective frequencies of each of the at least one last

candidate spectral peak remaining" (claims 14, 48)

- "classifying the classification of the movement by comparing an amount of amplitude modulation in the second TFS computed to an amplitude modulation threshold, wherein the classification indicates whether the movement rises to a level of causing the motion artifacts based on a result of the comparing" / "classify the classification of the movement by comparing an amount of amplitude modulation in the second TFS computed to an amplitude modulation threshold, wherein the classification indicates whether the movement rises to a level causing the motion artifacts based on a result of the comparing" (claims 19, 53, 72, 75)
- "wherein the amplitude modulation threshold is dependent on a type of the motion detector sensor" (claims 20, 54)
- "filtering the pre-processed heart-related signal by applying the band pass filter computed to produce a filtered, pre-processed heart-related signal" (claim 24)
- "wherein the biomedical sensor is at least one of: a photoplethysmogram (PPG) sensor, piezoelectric sensor, Light Emitting Diode (LED) based sensor, camera sensor, and pulse oximeter sensor, and wherein the motion sensor is an accelerometer" (claims 28, 62)
- "employing the reconstructed representation to detect or predict a heart-related ailment, the heart-related ailment including at least one of a heart rate variability (HRV) condition, atrial fibrillation condition, congestive heart failure condition, and tachycardia condition" (claims 32, 66)

Accordingly, these claims—and any claim(s) depending directly or indirectly therefrom—are invalid under 35 U.S.C. § 112, ¶ 2, or 35 U.S.C. § 112(b) as indefinite.

F. ’601 Patent

One or more of the Asserted Claims of the ’601 patent are invalid under 35 U.S.C. § 112, ¶ 1, or 35 U.S.C. § 112(a).

The ’601 patent does not provide sufficient written description support to establish that the alleged inventors possessed the alleged inventions recited in the Asserted Claims of the ’601 patent. *See Ariad Pharm.*, 598 F.3d at 1351.

For example, the ’601 patent does not provide sufficient support—by itself or through any disclosure incorporated by reference—for at least the following claim terms in combination with the other recited limitations of the claim:

- “compar[ing] the turning point ratio to a third predetermined threshold” (claims 1-3)
- “compar[ing] the turning point ratio for the updated data to a third predetermined threshold” (claims 2-3)
- “construct[ing] a Poincare plot of time interval data from the PPI data; the time interval being a time interval between consecutive pulses obtained by sensing variability in heart rate signal from the subject under test;” (claims 2-3)
- "determin[ing], when each of the root mean square of successive differences, the Shannon entropy, and the turning point ratio is less than a corresponding predetermined threshold, a subject under test has normal sinus rhythm without PAC or PVC.” (claim 1)
- “determin[ing], when not each of the root mean square of successive

differences, the Shannon entropy, and the turning point ratio for the updated data is less than a corresponding predetermined threshold, that the subject under test has AF." (claim 2)

- "determin[ing] from comparison of the difference between pulse rise times of consecutive pulses to the fourth predetermined threshold and comparison of the difference between pulse fall times of consecutive pulses to the fifth predetermined threshold, whether the subject under test has one of normal sinus rhythm (NSR) with PAC or NSR with PVC." (claim 3)

Because the '601 patent does not support these claim elements, the foregoing claims—and any claim(s) depending directly or indirectly therefrom—are invalid under 35 U.S.C. § 112, ¶ 1, or 35 U.S.C. § 112(a).

G. '362 Patent

One or more of the Asserted Claims of the '362 patent are invalid under 35 U.S.C. § 112, ¶ 1, or 35 U.S.C. § 112(a).

The '362 patent does not provide sufficient written description support to establish that the alleged inventors possessed the alleged inventions recited in the Asserted Claims of the '362 patent. *See Ariad Pharm.*, 598 F.3d at 1351.

For example, the '362 patent does not provide sufficient support—by itself or through any disclosure incorporated by reference—for at least the following claim terms in combination with the other recited limitations of the claim:

- "determining a first trace of amplitudes in the narrow band spectrum of the time frequency spectrum centered at the dominant frequency" (claim 1);

- "determining a second trace of amplitudes in a narrow band spectrum of the time frequency spectrum centered at twice the dominant frequency" (claim 1);
- "determining a third trace of amplitudes in a narrow band spectrum of the time frequency spectrum centered at three times the dominant frequency" (claim 1);
- "subtracting the first, second and third traces of amplitudes from the time frequency spectrum" (claim 1);
- "the noise quality index being a weighted sum of factors including the residual noise power and the projected difference; weights being selected such that each weighted factor represents less than a predetermined percentage of power in an uncorrupted segment" (claim 1);
- the additional limitations recited in claims 8, 10, 17, and 19 similar to the recitations in claim 1.

Because the '362 patent does not support these claim elements, the foregoing claims—and any claim(s) depending directly or indirectly therefrom—are invalid under 35 U.S.C. § 112, ¶ 1, or 35 U.S.C. § 112(a).

As explained below, one or more of the Asserted Claims of the '362 patent are also invalid as indefinite under 35 U.S.C. § 112, ¶ 2, or 35 U.S.C. § 112(b). These claims fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention. *Nautilus*, 572 U.S. at 901. Accordingly, these claims are invalid as indefinite. For example, an artisan of ordinary skill could not discern, with reasonable certainty, the scope of the following

claim term of the ’362 patent:

- “the noise quality index being used to determine whether the segment is corrupted

  by motion and noise artifacts” (claim 1);
- “normalizing the time frequency spectrum to a total power in a

  narrow band centered at the dominant frequency” (claim 1);
- “determining a difference in frequency between the first trace and the second

  and third traces, the difference in frequency referred to as a projected

  difference” (claim 1);
- “determining a difference between the dominant frequency and a heart rate

  obtained from peak to peak intervals from the signal used as the PPG signal in

  a time domain, the difference between the dominant frequency and the heart

  rate obtained from peak to peak intervals referred to as a heart rate frequency

  difference; wherein the noise quality index also comprises the heart rate

  frequency difference; the noise quality index being a weighted sum of factors

  including the residual noise power, the projected difference and the heart rate

  frequency difference” (claim 3);
- “the noise quality index also comprising the heart rate frequency

  difference” (claim 8);
- “normalize the time frequency spectrum to the total power in a

  narrow band centered at the dominant frequency” (claim 10);
- the additional limitations recited in claims 8, 10, 12, 17, and 19 similar

  to the recitations above.

Accordingly, these claims—and any claim(s) depending directly or indirectly therefrom—are invalid under 35 U.S.C. § 112, ¶ 2, or 35 U.S.C. § 112(b) as indefinite.

IV. P.R. 3-4: Document Production Accompanying Invalidity Contentions

Defendants are contemporaneously producing and/or making documents available pursuant to P.R. 3-4(a) and P.R. 3-4(b). Prior art materials are produced as PA_0000001 to PA_0009090. Further, Plaintiffs are already in possession of SAM-SNY_00000001 through SAM- SNY_00001366; SAM-SNY_00002219 through SAM-SNY_00002615; and SAM-SNY_00015714 through SAM-SNY_00058278, which Defendants incorporate by reference herein. Plaintiffs also have had access to third-party Monebo Technologies, Inc.'s prior art materials, which are also incorporated by reference herein.

V. Defendants' Subject Matter Eligibility Contentions Under 35 U.S.C. § 101

The Asserted Claims of the '326, '576, '428, '921, '647, '601, and '362 Patents are invalid under 35 U.S.C. § 101 for failing to recite patent-eligible subject matter. Defendants incorporate by reference herein their Subject Matter Eligibility Contentions concurrently served with these Invalidity Contentions.

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Respectfully submitted,

/s/ Siddhesh V. Pandit
Siddhesh V. Pandit (admitted to practice in the EDTX)
svp@maierandmaier.com
Timothy J. Maier (*pro hac vice to be submitted*)
tjm@maierandmaier.com
Michael R. Casey (*pro hac vice to be submitted*)
mrc@maierandmaier.com
MAIER & MAIER PLLC
345 South Patrick Street
Alexandria, Virginia 22314
Telephone: (703) 740-8322
Facsimile: (703) 991-7071

ATTORNEYS FOR DEFENDANTS XIAOMI CORPORATION, XIAOMI H.K. LTD., XIAOMI COMMUNICATIONS CO., LTD., AND XIAOMI INC.

/s/ Jack Shaw
Jack Shaw (admitted in this District)
Jack.Shaw@procopio.com
PROCOPIO, CORY, HARGREAVES & SAVITCH LLP
3000 El Camino Real, Suite 5-400
Palo Alto, CA 94306
Tel: (650) 645-9019
Fax: (650) 687-8326

ATTORNEY FOR DEFENDANT ZEPP HEALTH CORPORATION

CERTIFICATE OF SERVICE

I hereby certify that a copy of the foregoing document and accompanying exhibits and documents were served on counsel for Plaintiffs by email at the following emails addresses on December 12, 2024:

Michael A. Siem
msiem@devlinlawfirm.com

Timothy Devlin
tdevlin@devlinlawfirm.com

Christopher Reed
cclayton@devlinlawfirm.com

Cedric Tan
ctan@devlinlawfirm.com

Chiara Michele Carni
ccarni@devlinlawfirm.com

Claire Abernathy
claire@millerfairhenry.com

Andrea Leigh Fair
andrea@millerfairhenry.com

/s/ Jack Shaw
Jack Shaw