

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

WHOOP, INC.,
Petitioner,
v.

OMNI MEDSCI, INC.,
Patent Owner.

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

Case No. PGR2026-00003

DECLARATION OF IGOR EFIMOV, PH.D.

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I, Igor Efimov, declare as follows:

1. I make this declaration based upon my own personal knowledge and, if called upon to testify, would testify competently to the matters stated herein.

2. I have been retained on behalf of Omni MedSci, Inc., (“Omni” or “Patent Owner”) as an independent expert to provide this declaration concerning the technical subject matter relevant to U.S. Patent No. 12,193,790 (“the ’790 Patent”) (Ex. 1001) in connection with a post grant review (“PGR”) petition filed by Whoop, Inc. (“Petitioner”).

3. I am being compensated at my standard hourly rate of \$700 per hour for the time I spend on this matter. My compensation is not based on the content of my opinions or the resolution of this matter, and I have no financial or other interest in this proceeding.

4. I understand that Patent Owner is asserting the ’790 Patent against Whoop, Inc., in a related matter currently pending in the United States District Court for the District of Delaware (the “Delaware Case”).

5. I understand that Patent Owner is asserting the ’790 Patent against Samsung Electronics Co., Ltd., and others, in a related matter currently pending in the United States District Court for the Eastern District of Texas (“the Texas Case”).

6. I understand that the Defendants in the Texas Case filed an IPR petition challenging the ’790 Patent in IPR2025-01253 (“the Samsung ’790 IPR”) and a PGR

petition challenging the '790 Patent in PGR2025-00064 ("the Samsung '790 PGR").

I understand that the Patent Office Director denied the Samsung '790 PGR and initially instituted the Samsung '790 IPR. I further understand that the Director later vacated institution of the Samsung '790 IPR.

7. In this declaration, I offer opinions relating to the '790 Patent, claim construction, the references in the Petition, definiteness, enablement, and the declaration of Petitioner's expert, Dr. Mercier. The substance and bases of my opinions appear below.

I. BACKGROUND AND QUALIFICATIONS

8. In formulating my opinions, I have relied on my knowledge, training, and experience in the relevant field, which I will summarize briefly herein.

9. I am currently a Professor of Biomedical Engineering and a Professor of Medicine (Division of Cardiology) at Northwestern University, Chicago, Illinois. Prior to my tenure at Northwestern University, from 2015 to 2022, I was the Alisann and Terry Collins Professor of Biomedical Engineering at The George Washington University, Washington, D.C., where I also served as Founding Chair of the Department of Biomedical Engineering from 2015 to 2019. Before that, from 2004 to 2015, I served as the Lucy & Stanley Lopata Distinguished Professor of Biomedical Engineering at Washington University in Saint Louis, Missouri. I was also a Professor of Medicine, Professor of Radiology, and Professor of Cell Biology

& Physiology at the Washington University School of Medicine. I also served on the faculty of the Department of Cardiology of the Cleveland Clinic Foundation (1994-2000) and the Department of Biomedical Engineering of Case Western Reserve University (2000-2004), Cleveland, Ohio.

10. My research focuses on the physiological mechanisms of cardiovascular disease and the development of diagnostic and therapeutic bioelectronics for heart rhythm disorders, heart failure, and vascular dysfunction. My laboratory develops implantable, wearable, and optical sensing and imaging systems for real-time physiological diagnostics and device-based therapy. These systems incorporate semiconductor light sources, photodiodes, and spectroscopic analysis.

11. I received my Master of Science degree in experimental nuclear physics from the Moscow Institute of Physics and Technology, USSR, in 1986. In 1992, I received a Ph.D. in Biophysics from the Moscow Institute of Physics and Technology after completing a doctoral study on the mechanisms of sudden cardiac death due to ventricular arrhythmias. I completed my postdoctoral training in 1992-1994 in the fields of fast fluorescent imaging / optical mapping, cardiac electrophysiology, and arrhythmia at the University of Pittsburgh in Pittsburgh, Pennsylvania. Then, I started my independent cardiac research career in the Department of Cardiology at the Cleveland Clinic Foundation (1994-2000), where I

established an NIH-funded laboratory. Cleveland Clinic has been consistently ranked the #1 Cardiology program nationwide by U.S. News & World Report since 1994.

12. For the past 26 years, I have taught undergraduate and graduate courses in Biomedical Engineering, including courses relating to quantitative physiology, applied bioelectricity, biomedical optics, biosignal acquisition and analysis, light-tissue interaction, physiology of the heart, introduction to biomedical engineering, clinical cardiovascular engineering, and cardiovascular engineering and technology. In these and other courses, I taught sections on engineering and physiological principles of cardiac electrophysiology, arrhythmia, medical devices, and electrocardiography. Many of my trainees are currently working at leading national medical device companies, including Medtronic, Abbott, and Boston Scientific, developing novel cardiac antiarrhythmic therapies, medical diagnostic, and therapeutic devices.

13. I have also mentored over 30 clinical fellows and postdoctoral research fellows, many of whom are currently professors, cardiologists, cardiac and vascular surgeons, and clinical engineers throughout the national and world Universities and hospitals, including Harvard University, MA; University of California, CA; Ohio State University, OH; University of Wisconsin, WI; University of Fukuoka, Japan; University of Bordeaux, France; University of Brno, Czech Republic; Imperial

College London, UK; etc.

14. I have published a book in 2009 on cardiac bioelectric diagnostics and therapy (Efimov I.R., Kroll, M.W., Tchou, P.J., Eds., Cardiac Bioelectric Therapy: Mechanisms and Practical Implications, Springer, 2009. ISBN 978-0-387-79402- 0), and I have published a second updated edition of this book in 2021 (Efimov I.R., Ng F.S., Laughner J.I., Eds., Cardiac Bioelectric Therapy: Mechanisms and Practical Implications, Springer, 2nd Edition. 2021. ISBN 978-3-030-63354-7). These volumes address optical imaging technology and electrophysiological principles of diagnosis and therapy, providing novel approaches to the treatment of cardiac arrhythmias using implantable devices, percutaneous ablation therapies, machine learning, and other approaches.

15. Most of my 300+ peer-reviewed publications focus on cardiac electrophysiology, biomedical optics, device development, the physiological mechanisms of cardiac arrhythmias, and their diagnostics and therapy. In collaboration with Professor John A. Rogers from Northwestern University, we have developed a novel implantable, interventional, and wearable electronics platform for monitoring cardiac electrophysiology, optical image mapping, diagnosis of heart rhythm disorders due to brady- and tachyarrhythmias, and antiarrhythmic therapy. Many high-impact publications have been published on that subject recently in leading scientific journals. For example, our recent paper on novel bioresorbable

electronics platform (Choi YS, Yin RT, Pfenniger A, Koo H, Avila R, Lee KB, Chen SW, Lee G, Li G, Qiao Y, Murillo-Berlitz A, Kiss A, Han S, Lee SM, Li C, Xie Z, Chen YY, Burrell A, Geist B, Jeong H, Kim J, Yoon HJ, Banks A, Kang SK, Zhang ZJ, Haney CR, Sahakian AV, Johnson D, Efimova T, Huang Y, Trachiotis GD, Knight BP, Arora RK, Efimov IR, Rogers JA. Fully implantable and bioresorbable cardiac pacemakers without leads or batteries. *Nature Biotechnology*, June 28, 2021, <https://doi.org/10.1038/s41587-021-00948-x>.) was featured by over 150 international news outlets reaching at least 12 million listeners/viewers from 5 continents, including PBS, Guardian, and NIH Research Matters (NIH Director's office online publication).

16. Another 2025 publication in *Nature* (Zhang Y, Rytkin E, Zeng L, Kim JU, Tang L, Zhang H, Mikhailov A, Zhao K, Wang Y, Ding L, Lu X, Lantsova A, Aprea E, Jiang G, Li SG Seo, Wang T, Wang J, Liu J, Gu J, Liu F, Bailey K, L YFL, Burrell A, Pfenniger A, Ardashev A, Yang T, Liu N, Lyu Z, Purwanto NS, Ying Y, Lu Y, Hoepfner C, Melisova A, Gong J, Jeong J, Choi J, Hou A, Nolander R, Bai W, Jin SH, Ma Z, Torkelson JM, Huang Y, Ouyang W, Arora RK, Efimov IR, Rogers JA. Millimetre-scale, bioresorbable optoelectronic systems for electrotherapy. *Nature*, 2025, 640 (8057), 77-86.) was recognized among the Best Inventions of 2025 by the Time.

17. I have also delivered 400+ invited lectures at prestigious professional

conferences and leading Universities worldwide, most of them on biomedical imaging, semiconductor-based light emission, optical coupling through tissue, wireless control architectures, cardiac arrhythmias, and therapy.

18. In 2021-2025, I served as the Editor-in-Chief of Cardiovascular Engineering and Technology, a journal of the Biomedical Engineering Society, published by Springer Nature. I was responsible for reviewing and decision-making of approximately 250-300 manuscripts submitted for publication, including biomedical imaging, medical devices, cardiac electrophysiology, signal processing, arrhythmia therapy, etc.

19. I have served on the editorial board of the American Journal of Physiology: Heart and Circulatory Physiology and Heart Rhythm Journal, where I manage and make decisions on manuscripts related to biomedical sensing and imaging, cardiac electrophysiology, and electrotherapy. I have served or currently am serving on many editorial boards of other leading cardiac journals, where I review papers on biomedical imaging technique, cardiac electrophysiology and arrhythmia. These journals include Circulation Research, Heart Rhythm, Journal of Cardiac Electrophysiology, Journal of Molecular and Cellular Cardiology, American Journal of Physiology, IEEE Transactions in Biomedical Engineering, Experimental Physiology, etc. I regularly review papers on biomedical imaging, cardiovascular physiology, and arrhythmia for Nature, Science, Proceedings of the

National Academy of Science, Circulation, and other leading journals.

20. I have served on numerous national and international expert panels, which consider grant applications from the leading experts in the field of biomedical optics, diagnostic sensing, cardiac electrophysiology, and defibrillation from many countries, including the USA, the European Union, Canada, the UK, France, Switzerland, Germany, the Netherlands, Russia, Australia, New Zealand, South Africa, Singapore, etc. From 2009 to 2013, I served as a chartered member of the leading US panel at the National Institutes of Health, the Electrical Signaling, Transporters and Arrhythmia (ESTA) Study section, which is the major funding source for leading US bioinstrumentation investigators. I have also served on many international panels that consider policy, research, and funding decisions in the field of biomedical sensing, cardiac electrophysiology and therapy in numerous countries from most continents. For example, I served on the Expert Panel on the Medical and Physiological Impacts of Conducted Energy Weapons, the Council of Canadian Academies.

21. My research on biomedical imaging and electronics has been funded by the National Heart, Lung, and Blood Institute of the National Institutes of Health and other federal and private foundations without interruptions since 1998, with an average of approximately \$1M per year during recent years. I am also funded by the American Heart Association, National Science Foundation, Leducq Foundation, etc.

22. I have been designing and developing medical devices and diagnostic systems for more than twenty-five years. My inventions and patent portfolio include methods for low-voltage cardiac defibrillation, optical and electrical biosensors, cardiac and neural stimulators, and hybrid optoelectronic systems for tissue monitoring and physiological diagnostics. Many of these devices integrate semiconductor light sources, photodetectors, and optical mapping technologies. For example, I am the inventor or co-inventor on several patents and patent applications, including “Systems and Methods for Triple-Parametric Optical Mapping” (U.S. Pat. App. Pub. No. 2023/0085578), “Distributed Neuromorphic Computing for High-Definition Bioelectric Diagnostics and Therapy” (U.S. Patent No. 11,701,002), and “High-Resolution Multi-Function and Conformal Electronics Device for Diagnosis and Treatment of Cardiac Arrhythmias” (PCT/US18/16499). With the support of NIH funding, I have invented a method for low-voltage defibrillation of cardiac arrhythmias by effectively unpinning anatomical reentry (U.S. Patent No. 8,175,702), a method for cardiac pacing using the inferior nodal extension (U.S. Patent No. 8,391,995), and a method and device for low-energy termination of atrial tachyarrhythmias (U.S. Patent No. 8,509,889). I founded Cardialen, Inc. to develop clinical defibrillators based on this method, which received over \$30M in venture and NIH funding. Cardialen was acquired in 2022.

23. I have received many awards in recognition of my research and

innovation in the field of bioengineering and diagnostic device development. For example, I was elected to the United States National Academy of Inventors in 2019; and I have received the 2021 Distinguished Scientist Award and the 2025 Ralph Lazzara Lectureship Award from the leading clinical cardiac electrophysiology professional association – the Heart Rhythm Society. In 2025, I was elected to the American Academy of Sciences and Letters.

24. A more detailed listing of my credentials is set forth in my curriculum vitae (Ex. 2047).

II. MATERIALS CONSIDERED

25. In forming the opinions set forth herein, I have considered and relied upon my education, knowledge of the relevant field, and my experience. I have also reviewed and considered the '790 Patent (Ex. 1001), the '790 Patent's file history (Ex. 1002), and at least the following additional materials:

- Petition for Post Grant Review of the '790 Patent (Paper 1) (“Petition”);
- Declaration of Dr. Patrick Mercier in Support of Petition for *Inter Partes* Review of U.S. Patent No. 12,193,790 (Ex. 1003);
- Final Written Decision in *Apple Inc. v. Omni MedSci, Inc.*, IPR2019-00916, Paper 39 (PTAB Oct. 14, 2020) (Ex. 1008);
- U.S. Patent No. 9,241,676 (“Lisogurski”) (Ex. 1027);

- U.S. Pat. App. Pub. No. 2005/0049468 (“Carlson”) (Ex. 1028);
- “The Biomedical Engineering Handbook,” by Joseph D. Bronzino (1995) (Ex. 1033);
- U.S. Patent App. Pub. No. 2011/0237911 (“Lamego”) (Ex. 1062);
- U.S. Patent No. 6,304,767 (“Soller”) (Ex. 1030);
- “A new generation of sensors for non-invasive blood glucose monitoring,” by Juncen Wu, Yuqing Liu, Hao Yin, Meng Guo (2023) (Ex. 1065);
- Joint Claim Construction and Prehearing Statement, *Omni MedSci, Inc. v. Samsung Electronics Co. Ltd. et al.*, 2:24-cv-01070-JRG-RSP (E.D. Tex.) (Nov. 21, 2025) (Ex. 2049);
- Communication and Energy Delivery Architectures for Personal Medical Devices, Patrick Philip Mercier (June 2012) (Ex. 2050);
- Declaration of Dr. Patrick Mercier, IPR2025-00147 (Dec. 17, 2025) (Ex. 2051);
- Transcript of June 11, 2026 Deposition of Dr. Patrick Mercier (Ex. 2052);

- Reply Brief of Appellant Omni MedSci, Inc., *Omni MedSci, Inc. v. Apple Inc.*, No. 25-1646 (Fed. Cir.) (Dkt. 24) (Dec. 15, 2025) (Ex. 2053).

26. I have also considered any materials cited in this declaration to the extent they are not expressly listed above. My review of these materials was informed by my education, my work experience, and my experience designing medical devices.

27. I reserve the right to supplement my opinions or express additional opinions should additional and/or presently unknown information about this matter become known by me at a later date.

III. LEGAL STANDARDS

28. As a technical expert, I am not offering any legal opinions. Rather, I am offering technical assessments and opinions. In rendering my analysis, I have been informed by counsel regarding various legal standards for determining patentability. I have applied those standards in forming my technical opinions expressed in this declaration.

A. Level of Ordinary Skill in the Art

29. I understand that the claims and specification of a patent are addressed to and intended to be read by others of skill in the art to which the patent pertains, or to which the patent is most nearly connected, at the time of the filing of the patent

application.

30. I understand that a person of ordinary skill in the art (“POSITA”) is a hypothetical person who is presumed to be aware of all of the pertinent art. The person of ordinary skill is not an automaton, and may be able to fit together the teachings of multiple prior art references employing ordinary creativity and the common sense that familiar items may have obvious uses beyond their primary purposes.

31. I understand that multiple factors should be used to decide the skill of the POSITA, including: the types of problems encountered in the art, prior art solutions to those problems, the rapidity with which innovations are made, the sophistication of the technology, and the education level of active workers in the field.

B. Claim Construction

32. The patent claims describe the invention made by the inventor and describe what the patent owner owns and what the owner may prevent others from using. I understand that an independent claim sets forth all the requirements that must be met to be covered by that claim. I further understand that a dependent claim does not itself recite all of the requirements of the claim but refers to another claim and incorporates all of the requirements of the claim to which it refers.

33. I understand that claim construction is the process by which the scope

and meaning of terms used in the claims of a patent is determined. I understand that the goal of this process is to give claim terms the ordinary and customary meaning they would have had to a POSITA at the time of the invention, after reading the patent and its prosecution history.

34. I understand that the patent specification may reveal a special definition given to a claim term by the patentee that differs from the plain and ordinary meaning it would otherwise have to a POSITA. In such cases, I understand that the patentee's definition usually controls.

35. I understand that the prosecution history of a patent can inform the meaning of some claim language and that the prosecution history must be considered when construing the claims.

36. I understand that extrinsic evidence, such as dictionaries, treatises, and expert opinions, may also be considered to understand the technology at issue and the way in which claim terms would be understood by a POSITA in the relevant timeframe.

C. Anticipation

37. I understand that anticipation analysis is a two-step process. The first step is to determine the meaning and scope of the asserted claims. Each claim must be viewed as a whole, and it is improper to ignore any element of the claim. For a claim to be anticipated under U.S. patent law: (1) each and every claim element must

be identically disclosed, either explicitly or inherently, in a single prior art reference; (2) the claim elements disclosed in the single prior art reference must be arranged in the same way as in the claim; and (3) the identical invention must be disclosed in the single prior art reference, in as complete detail as set forth in the claim. Where even one element is not disclosed in a reference, the anticipation contention fails. Moreover, to serve as an anticipatory reference, the reference itself must be enabled, i.e., it must provide enough information so that a person of ordinary skill in the art can practice the subject matter of the reference without undue experimentation.

38. I understand that where a prior art reference fails to explicitly disclose a claim element, the prior art reference inherently discloses the claim element only if the prior art reference must necessarily include the undisclosed claim element. Inherency may not be established by probabilities or possibilities. The fact that an element may result from a given set of circumstances is not sufficient to prove inherency.

D. Obviousness

39. I understand that a patent claim is invalid under 35 U.S.C. § 103 only if the differences between the claimed invention and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person of ordinary skill in that art. An obviousness analysis requires consideration of four factors: (1) scope and content of the prior art relied upon to

challenge patentability; (2) differences between the prior art and the claimed invention; (3) the level of ordinary skill in the art at the time of the invention; and (4) the objective evidence of non-obviousness, such as commercial success, unexpected results, the failure of others to achieve the results of the invention, a long-felt need which the invention fills, copying of the invention by competitors, praise for the invention, skepticism for the invention, or independent development.

40. I understand that a prior art reference is proper to use in an obviousness determination if the prior art reference is analogous art to the claimed invention. I understand that a prior art reference is analogous art if at least one of the following two considerations is met. First, a prior art reference is analogous art if it is from the same field of endeavor as the claimed invention, even if the prior art reference addresses a different problem and/or arrives at a different solution. Second, a prior art reference is analogous art if the prior art reference is reasonably pertinent to the problem faced by the inventor, even if it is not in the same field of endeavor as the claimed invention.

41. Furthermore, I understand that a claim may be obvious in view of a single prior art reference, without the need to combine references, if the elements of the claim that are not found in the reference can be supplied by the knowledge or common sense of one of ordinary skill in the relevant art.

42. I further understand that a reconstructive hindsight approach to this

analysis, i.e., the improper use of post-invention information to help perform the selection and combination, or the improper use of the listing of elements in a claim as a blueprint to identify selected portions of different prior art references in an attempt to show that the claim is obvious, is not permitted. In other words, one should avoid using the challenged patent as a guide through the prior art references, combining the right references in the right way so as to achieve the result of the claims at issue. Instead, one must put oneself in the place of a person of ordinary skill at the time the invention was made and consider only what was known before the invention was made and not consider what was only known after the invention was made.

43. I also understand that when considering the obviousness of a patent claim, one must consider whether a teaching, suggestion, or motivation to combine the references exists so as to avoid impermissibly applying hindsight when considering the prior art. I understand that a teaching, suggestion, or motivation may be found explicitly or implicitly: (1) in the prior art; (2) in the knowledge of those of ordinary skill in the art; or (3) from the nature of the problem to be solved. I also understand that the motivation to combine references may include logic, judgment, and common sense, but that any such motivation to combine references must still avoid the improper application of hindsight or reliance on the patentee's disclosure of his invention as found in the patent specification, drawings, and claims.

44. I understand that it must also be shown that one having ordinary skill in the art at the time of the invention would have had a reasonable expectation that a modification or combination of one or more prior art references would have succeeded.

45. I understand that obviousness should be considered in light of the problems known to the person having ordinary skill in the art and the complexity of the alternatives for solving the problems. That individual elements of the claimed invention are disclosed in the prior art is not alone sufficient to reach a conclusion of obviousness.

46. While certain combinations of the prior art might be “obvious to try,” I understand that any obvious to try analysis will not render a patent invalid unless it is shown that the possible combinations are: (1) sufficiently small in number so as to be reasonable to conclude that the combination would have been selected; and (2) such that the combination would have been believed to be one that would produce predictable and well understood results.

47. I understand that each alleged prior art reference in a proposed obviousness combination must be evaluated in its entirety, i.e., including those portions that would argue against obviousness, and must be considered for everything that it teaches, not simply the described invention or a preferred embodiment. I understand that it is impermissible to pick and choose from any one

reference only so much of it as will support a given position to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one skilled in the art, or to ignore portions of the reference that argue against obviousness. I also understand that all of the supposed prior art to be combined as proposed must also be evaluated as a whole and should be evaluated for what they teach in combination as well as separately.

48. I also understand that if the teachings of a prior art reference would lead one skilled in the art to make a modification that would render that prior art device, system, or method inoperable, then such a modification would generally not be obvious. I also understand that if a proposed modification would render the prior art device, system, or method unsatisfactory for its intended purpose, then there is strong evidence that no suggestion or motivation existed at the time of the subject invention to make the proposed modification.

49. I understand that it is improper to combine references where the references teach away from their combination. I understand that a reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant. It is also my understanding that the degree of teaching away will depend on the particular facts; in general, a reference will teach away if it suggests that the line of development

flowing from the reference's disclosure is unlikely to be productive of the result sought by the applicant. I understand that a reference teaches away, for example, if (1) the combination would produce a seemingly inoperative device, or (2) the references leave the impression that the product would not have the property sought by the applicant or would no longer achieve the intended purpose(s) of the references being modified or combined.

E. Dependent Claims

50. I understand that a dependent claim incorporates each and every limitation of the claim from which it depends. Thus, my understanding is that if a prior art reference or combination of prior art references fails to render obvious an independent claim, then that prior art reference or combination of prior art references also necessarily fails to render obvious all dependent claims that depend from the independent claim.

F. Definiteness

51. I understand that, under 35 U.S.C. § 112, a patent must include one or more claims that point out and distinctly claim the subject matter that the inventor regards as his or her invention. I understand that a patent may be held indefinite if its claims, read in light of the specification delineating the patent, and the prosecution history, fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention.

52. I understand from counsel that the amount of detail required for a claim to be definite depends on the particular invention, the prior art, and the description of the invention contained in the patent. I understand that a claim, when read along with the rest of the patent, must reasonably inform those skilled in the art what the patent claims cover, and that the simple fact that claim language may not be precise does not automatically mean that the claim is indefinite. I understand that the claim language need only be as precise as the subject matter permits. That is, the claims must be precise enough to afford clear notice of what is claimed while recognizing that some modicum of uncertainty is inherent due to the limitations of language.

G. Enablement

53. I understand that, under 35 U.S.C. § 112, a patent's specification must describe the invention in sufficient detail such that a person of ordinary skill in the art ("POSITA") can make and use the claimed invention. I understand that enablement is assessed from the perspective of a POSITA as of the effective filing date, in view of the patent's disclosure and the state of the art at that time, and that the disclosure must enable the invention across the full scope of the claims.

54. I further understand that the legal question is whether practicing the full scope of the claimed invention would have required undue experimentation by a POSITA. I understand that whether experimentation is 'undue' is a fact-intensive inquiry that considers, among other things, the quantity of experimentation

necessary, the amount of direction or guidance provided in the specification, the presence or absence of working examples, the nature of the invention, the state of the prior art, the relative skill in the art, the predictability or unpredictability of the art, and the breadth of the claims (often referred to as the *Wands* factors). I also understand that the mere fact that implementation may be challenging, or may require routine optimization or refinement, does not by itself establish lack of enablement.

IV. LEVEL OF SKILL IN THE ART

55. I understand that the level of ordinary skill in the relevant art at the time of the invention is relevant to inquiries such as the meaning of claim terms, the meaning of disclosures found in the prior art, and the reasons one of ordinary skill in the art may have for combining references.

56. I have reviewed the definition of the level of ordinary skill in the art proposed in the Petition, which is:

“A person of ordinary skill in the art (“POSITA”) at the time of the alleged invention (December 2012) would have had good working knowledge of optical sensing techniques and their applications, and familiarity with optical system design and signal processing techniques. EX1003 ¶25. The POSITA would have an undergraduate degree in engineering (electrical, mechanical, biomedical, or optical) or a related field of study, along with relevant experience studying or developing physiological monitoring devices (e.g., non-invasive optical biosensors) in industry or academia. *Id.* Lack of professional experience can be remedied by additional education, and vice versa. *Id.*”

Petition at 19.

57. Dr. Mercier's declaration states the following regarding the appropriate level of skill in the art: "a POSITA would have had an undergraduate degree in engineering (electrical, mechanical, biomedical, or optical) or a related field of study, along with either (a) relevant industrial experience studying or developing physiological monitoring devices (e.g., non-invasive optical biosensors) in industry or (b) additional education or experience in academia (e.g., a Ph.D) studying or developing physiological monitoring devices." Ex. 1003 at ¶ 25.

58. The definition provided in the Petition and in Dr. Mercier's declaration does not quantify how much experience an individual with the requisite educational experience would need to qualify as a POSITA. Petition at 19; Ex. 1003 at ¶ 25. I understand that during his deposition, Dr. Mercier clarified that he believes that two years of experience would be sufficient. Ex. 2052 at 155:17-156:15.

59. For purposes of this declaration, I have been asked to apply Petitioner's proposed definition in my analysis.

60. As of December 2012 (the relevant time period for the '790 Patent), I was at least a person of ordinary skill in the art through my education and experience under the definition Petitioner has proposed (including under the clarification that Dr. Mercier provided during his deposition). I am also familiar with individuals

having this level of skill in the relevant timeframe and am capable of addressing the issues from the perspective of such a person, and I have done so in this declaration.

61. I understand that Petitioner contends that the earliest priority date for claim 7 of the '790 Patent is December 17, 2013. My opinions in this declaration would not change regardless of whether the priority date of claim 7 is December 31, 2012 or December 17, 2013.

V. OVERVIEW OF THE '790 PATENT

62. The '790 Patent discloses wearable optical systems, such as a smartwatch or other wrist-worn device, that generate optical light, including near-infrared wavelengths, deliver that light to tissue (such as skin at the wrist), detect returned light with one or more detectors, and process the resulting signals to obtain physiological information and, in certain embodiments, identify an object or material based on its optical response. Ex. 1001 at 87:32-33.

63. The specification describes implementations employing a plurality of semiconductor diodes (e.g., LEDs or laser diodes) capable of emitting at one or more wavelengths, including near- and far-infrared wavelengths in the 700-2500 nm range. Optical lenses are used to deliver source light efficiently into tissue, while a detection system receives reflected or transmitted light and produces an electrical signal for subsequent analysis. Ex. 1001 at 20:56-22:34, FIG. 65B.

64. The '790 Patent discloses synchronization between the light source and the detection system to improve the signal to noise ratio, and various modulation techniques to improve the signal to noise ratio. Ex. 1001 at 9:19-21; 59:64-67. Improving the signal to noise ratio provides greater accuracy by reducing the relative contribution of ambient light and other background noise influences. For example, the specification describes the use of an active illuminator to modulate sunlight and use synchronous or lock-in detection such that sun light changes are factored out, improving the signal to noise ratio. Ex. 1001 at 58:24-45.

65. As another example, the specification teaches that “narrow band filtering around the modulation frequency may be used to reject noise outside the modulation frequency,” thereby also improving the signal to noise ratio. Ex. 1001 at 58:34-36.

66. As another example, the specification teaches that “change detection schemes may be used, where the detection system captures the signal with the light source on and with the light source off. Again, for this system the light source may be modulated. Then, the signal with and without the light source is differenced.” Ex. 1001 at 58:37-41. This technique improves the signal to noise ratio.

67. In addition to physiological monitoring (such as by deriving physiological parameters from the optical signal), the '790 Patent describes identification capabilities by applying algorithmic analysis to spectral of multi-

wavelength data. Examples include comparison against reference libraries, the use of mathematical modeling (such as multivariate techniques), and signal processing technologies to determine specific material identity. Ex. 1001 at 18:10-27; 20:28-32; 21:7-28; 54:32-59. “In addition, change detection may help to identify objects that change in the field of view.” Ex. 1001 at 58:42-45 (emphasis added).

68. The '790 Patent describes correlating spectral data with a spectral library to identify the blood constituents of interest, including, for example, glucose, triacetin, ascorbate, lactate, alanine, and others. Ex. 1001 at 18:10-27. “Although glucose has a distinctive signature in the SWIR wavelength range, one problem of non-invasive monitoring is that many other blood constituents also have hydro-carbon bonds.” Ex. 1001 at 18:3-6. “To *identify* the blood constituents of interest...the spectrum may be correlated with a library of known spectra.” Ex. 1001 at 18:19-24.

69. The '790 Patent describes identifying other blood constituents such as proteins, albumin, urea, creatine, or nitrates through SWIR optical techniques, including pattern matching libraries and algorithms. Ex. 1001 at 20:28-32.

70. The '790 Patent describes that the selection of the blood constituent of interest may be improved by a number of techniques. Ex. 1001 at 21:7-28. These techniques include a higher light level or intensity to improve the signal to noise ratio. Ex. 1001 at 21:11-13. Mathematical modeling and signal processing

methodologies reduce interference and help to accentuate differences between spectra. Ex. 1001 at 21:13-22. “In addition, by using a wider wavelength range and using more sampling wavelengths may improve the ability to discriminate one signal from another.” Ex. 1001 at 21:22-28.

71. The ’790 Patent describes referencing the chemical signature of data from a spectral library in order to identify materials. Ex. 1001 at 54:32-59. Active remote sensing can be used to distinguish different materials, such as gypsum, painted structures, and others, from plant life, soil, and trees. Ex. 1001 at 54:32-59. This is “namely, *identification of objects* based on their chemical signature.” Ex. 1001 at 54:58-59.

72. Independent claim 7 of the ‘790 Patent, which I understand is the challenged independent claim, is reproduced below with the identifiers used in the Petition (Pet., 28-29) for ease of reference:

[7.pre]	An optical system, comprising:
[7.a.]	a wearable device for measuring one or more physiological parameters, the wearable device adapted to be placed on a wrist of a user;
[7.b]	the wearable device including a light source comprising a plurality of semiconductor diodes that are configured to generate an output optical light having one or more optical wavelengths, wherein at least a portion of the one or more optical wavelengths is a near-infrared wavelength between 700 nanometers and 2500 nanometers;
[7.c]	the wearable device comprising one or more lenses configured to receive at least a portion of the output optical light and to deliver a lens output light to tissue comprising skin;

[7.d]	the wearable device further comprising a detection system configured to receive at least a portion of the lens output light reflected from the tissue and to generate an output signal having a signal-to-noise ratio, wherein the detection system is configured to be synchronized to the light source;
[7.e]	wherein the detection system comprises a plurality of detectors that are spatially separated from each other, and wherein at least one analog to digital converter is coupled to at least one of the plurality of detectors;
[7.f]	wherein the output signal is indicative of the one or more of the physiological parameters;
[7.g]	the wearable device configured to increase the signal-to-noise ratio by increasing light intensity of at least one of the plurality of semiconductor diodes from an initial light intensity; and
[7.h]	the detection system further configured to:
[7.i]	generate a first signal responsive to light received while the semiconductor diodes are off
[7.j]	generate a second signal responsive to light received while at least one of the semiconductor diodes is on, and
[7.k]	increase the signal-to-noise ratio by comparing the first signal and the second signal; and
[7.l]	wherein the wearable device is at least in part configured to identify an object.

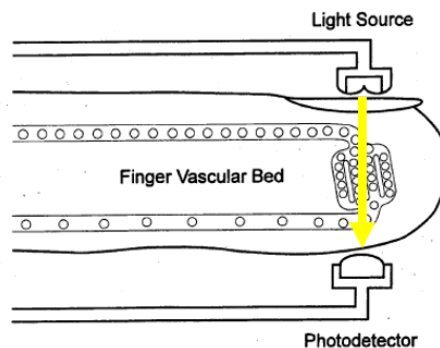
VI. TECHNOLOGY BACKGROUND

73. The technology background section of the Petition discusses photoplethysmography (PPG) as applied to pulse oximetry, where different wavelengths of light can be used to “calculate the composition of the blood and tissue” based on “how much light is absorbed” by tissue. Petition at 20.

74. “Oximetry refers to the colorimetric measurement of the degree of oxygen saturation, that is, the relative amount of oxygen carried by the hemoglobin

in the erythrocytes, by recording the variation in the color of deoxyhemoglobin (Hb) and oxyhemoglobin (HbO₂).” Ex. 1033 at 14; *see also id.* at 58 (“Oximetry is the determination of the oxygen content of blood or tissues, normally by optical means”). Oximetry operates based on known absorbance properties for Hb and HbO₂ at different wavelengths of light.

75. A POSITA would understand that there are two modes that can be used for pulse oximetry, depending on the particular application. Ex. 1033 at 14. One option is transmission mode oximetry, where light is transmitted through one side of a relatively thin tissue sample (e.g., a finger or an earlobe) and detected by a photodetector on the other side. An example is shown below. Ex. 1033 at 61.



76. The other mode is reflectance mode oximetry. In this mode, light is directed onto a sample and a detector measures light that is reflected from the sample.

77. A POSITA would know that transmissive and reflectance mode oximetry have different applications. For example, transmissive mode requires a

relatively thin sample so that light can pass through. Transmissive mode would not be viable for a thicker sample such as a wrist because the light would not pass all the way through the sample to the other side.

VII. CLAIM CONSTRUCTION

78. The Petition asserts that “with the exception of the term discussed below—all other terms should be construed according to their plain and ordinary meaning, as they would have been understood by a POSITA.” Petition at 17-18 (citing Ex. 1003 at ¶¶ 43-44).

79. In the cited paragraphs of Dr. Mercier’s declaration, he begins by reciting legal standards that were apparently provided by counsel. Ex. 1003 at ¶ 43. Dr. Mercier then states that he understands that the phrase “to identify an object” (which I discuss below) was construed in a prior IPR. *Id.* at ¶ 44. Dr. Mercier does not provide any further opinions or discussion of claim construction.

A. Limitation 7[l]: “Identify an Object”

80. Claim 7 of the ‘790 Patent recites: “wherein the wearable device is at least in part configured to identify an object.” Ex. 1001 at 87:32-33.

81. I understand that in a prior IPR concerning related U.S. Patent No. 10,517,484 (“the ‘484 Patent”), the Board construed the phrase “to identify an object” to mean “to recognize or establish an object as being a particular thing.” Ex. 1011 at 8-10.

82. I have reviewed the Board’s discussion of this claim construction in the Decision concerning the ‘484 Patent, which summarized the parties’ claim construction arguments. Ex. 1011 at 8-10. The Patent Owner had argued that there is a difference between (1) identification, which requires recognizing or establishing an object is a particular thing and (2) detection, which merely requires noticing an object’s presence.” *Id.* at 8. The petitioner in that proceeding, Apple, argued that the phrases “identify an object” and “detect an object” should have the same meaning. *Id.* at 9.

83. The Board stated the following in its final written decision:

[W]e decline to adopt Petitioner’s proposal to construe the terms “identify an object” and “detect an object” to have the same meaning. Instead, we construe these terms consistent with the dictionary definitions of “identify” and “detect,” *i.e.*, we construe “to identify an object” to mean “to recognize or establish an object as being a particular thing,” and we construe “to detect an object” to mean “to discover or notice the existence or presence of something.”

Ex. 1011 at 10.

84. I understand that the Board’s claim construction for the phrase “to identify an object” was affirmed on appeal by the Federal Circuit. In affirming the claim construction, the Federal Circuit rejected Apple’s argument that the claims of the ‘484 Patent “only require the claimed wearable device to discover or determine

the existence, presence, or fact of an object—i.e., detecting said object.” Ex. 1012 at

3. The Federal Circuit also observed that “when claims 3 and 8 [of the ‘484 Patent] require the claimed device to ‘identify an object,’ the claims require a determination of the identity of an object, even if the claims never do anything with that identity.” Ex. 1012 at 4.

85. I note that Dr. Mercier’s declaration does not address the difference between “identify” and “detect” that was discussed by the Board and the Federal Circuit. *See* Ex. 1003 at ¶¶ 44, 76, 196.

86. I understand that in the Texas Case involving Patent Owner and defendants other than Petitioner, the parties in that case have both proposed that the phrase “to identify an object” should be construed as “to recognize or establish an object as being a particular thing.” Ex. 2049.

87. For purposes of my analysis in this declaration, I have been asked to adopt the Board’s construction of “to identify an object” to mean “to recognize or establish an object as being a particular thing.” Petition at 18, Ex. 1003 at ¶ 44. I have also expressly considered and applied the Board’s reasoning distinguishing the term “identify” from the term “detect,” along with the Federal Circuit’s reasoning reinforcing that distinction.

B. Other Constructions

88. Claim 7 of the '790 Patent recites: "one or more lenses." Ex. 1001 at 87:4. I am informed and understand that in a previous litigation regarding a related patent (the '533 Patent) in the Eastern District of Texas, the court determined that the term "lenses" should be given its "plain and ordinary meaning without the need for further construction." Ex. 1018 at 10-13 (construing "plurality of lenses" in claims 5 and 13 of the related '533 patent); Ex. 1019 at 12-15 (construing "lens" and "one or more lenses" in related patents).

89. For purposes of this declaration, I have applied the plain and ordinary meaning of "lenses" for my analysis of the grounds in the Petition.

VIII. OVERVIEW OF ASSERTED GROUNDS AND REFERENCES IN THE PETITION

A. The Grounds in the Petition

90. I understand that Petitioner has challenged claim 7 of the '790 Patent based on five (5) separate Grounds, as follows (Petition at 16-17):

Ground	Claim	Basis for Rejection
1	7	Alleged Obviousness Over Lisogurski in view of Carlson under § 103
2	7	Alleged Obviousness Over Lisogurski in view of Carlson and Lamego under § 103
3	7	Alleged Obviousness Over Lisogurski in view of Carlson and Soller under § 103
4	7	Alleged Indefiniteness under § 112
5	7	Alleged Lack of Enablement under § 112

B. Summary of Asserted References

91. Grounds 1-3 assert various combinations of the following references: “Lisogurski” (Ex. 1027), “Carlson” (Ex. 1028), Lamego (Ex. 1062), and “Soller” (Ex. 1030). Petition at 15-17. Herein, I refer to these references individually or in various combinations (depending on context) as the “the asserted reference[s].” Below are brief summaries of the asserted references.

1. Lisogurski (Ex. 1027) (Grounds 1, 2, and 3)

92. U.S. Patent No. 9,241,676 (“Lisogurski”) describes a non-invasive physiological monitoring system using pulse oximetry to measure blood oxygen saturation and related parameters. Ex. 1027 at 3:61-4:5. The system is illustrated in Figures 3 and 1:

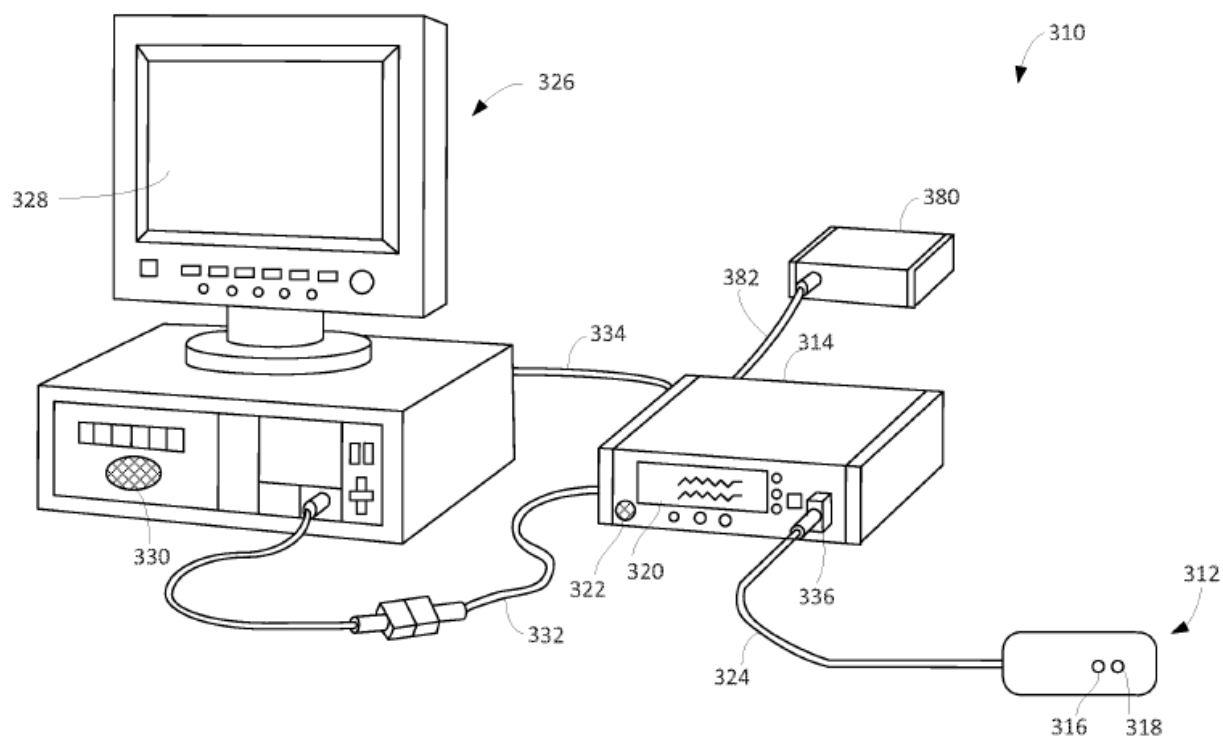


FIG. 3

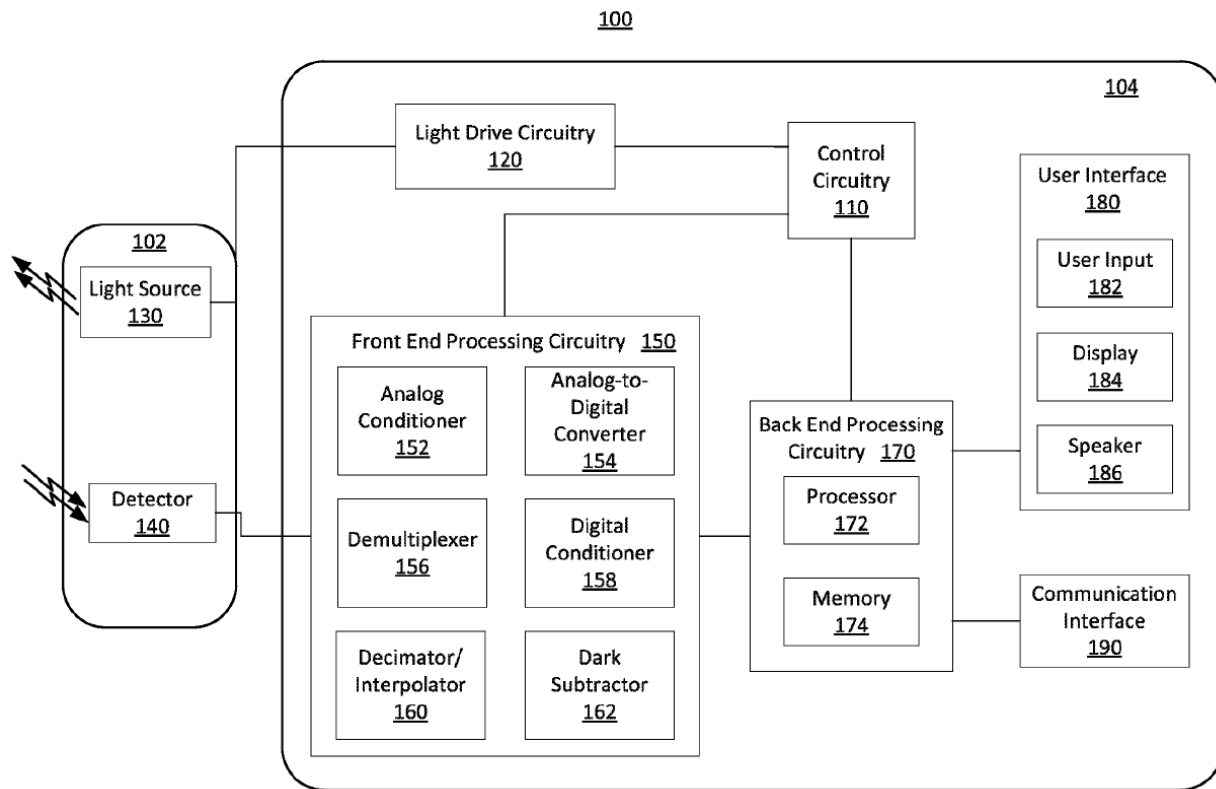


FIG. 1

Ex. 1027 at FIGS. 3, 1

93. Sensor unit 312 is wearable by a user, while the other components calibrate the system, process collected data, and display information. Ex. 1027 at 17:54-18:15, 18:32-67. The system uses semiconductor emitters at different wavelengths to illuminate tissue, and a photodetector receives light and converts it into an electrical signal. Ex. 1027 at 4:42-62; 10:48-64. Front end processing circuitry 150 processes the electronic signal. Ex. 1027 at 12:42-49. Then, “[p]rocessor 172 may receive and process physiological signals received from front end processing circuitry 150. For example, processor 172 may determine one or

more physiological parameters based on the received physiological signals.” Ex. 1027 at 14:60-64. Based on known differences in the absorption spectra of oxyhemoglobin or deoxyhemoglobin, the system compares the intensities at the different wavelengths to estimate blood oxygen saturation. Ex. 1027 at 24:58-25:5.

2. Carlson (Ex. 1028) (Grounds 1, 2, and 3)

94. U.S. Pat. App. Pub. No. 2005/0049468A1 (“Carlson”) describes an optical pulse oximeter for non-invasive measurement of pulsation and blood oxygen saturation. Ex. 1028 at ¶ [0002]. Carlson describes an ear-clip form factor. Ex. 1028 at ¶¶ [0048]-[0049]. That form factor is illustrated in Figures 1 and 2:

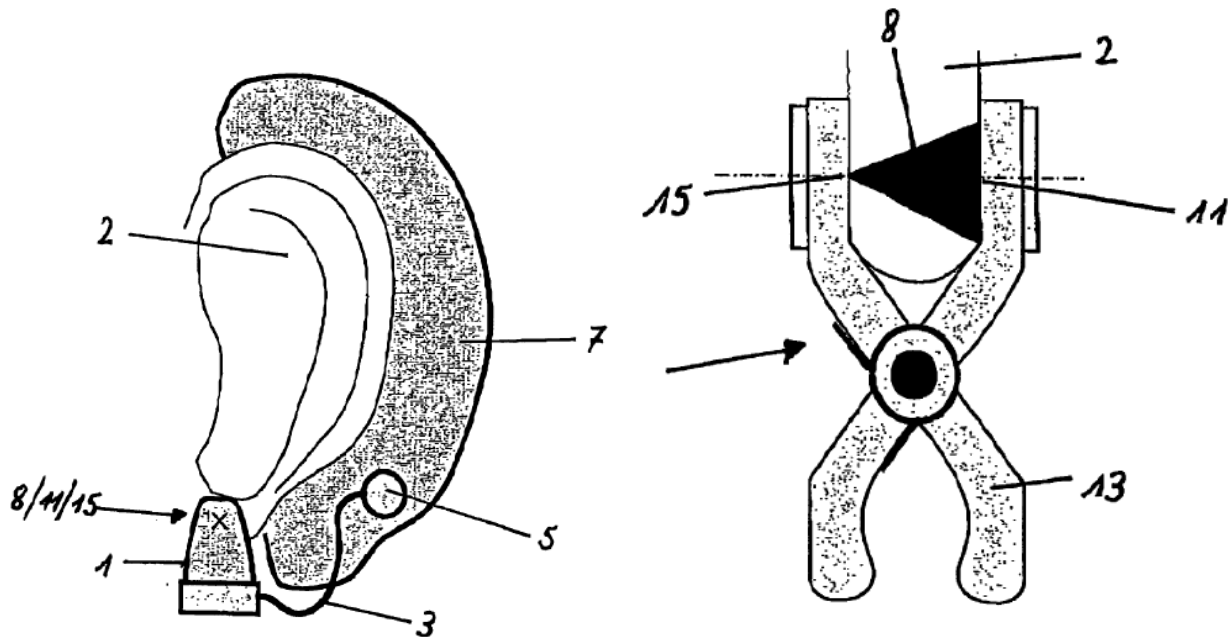


Figure 1

Figure 2

Ex. 1028 at FIGS. 1-2

95. Carlson describes optical and/or electronic means to improve signal-to-

noise and signal-to-background performance by using beam shaping optical elements, such as diffractive or refractive lenses, to direct light into tissue and a photo detecting element. Ex. 1028 at ¶¶ [0010], [0013]-[0014], [0062]. Carlson also discloses the use of “optical wavelength filters” for filtering light to a particular range of wavelengths before it reaches a photo detecting element. Ex. 1028 at ¶¶ [0026], [0062]. Finally, Carlson describes module packaging arrangements integrating these optical elements. Ex. 1028 at ¶¶ [0041], [0062], FIG. 6c.

3. Lamego (Ex. 1062) (Ground 2)

96. U.S. Patent App. Pub. No. 2011/0237911 (“Lamego”) describes a multi-wavelength physiological monitor that uses multiple light sources (e.g., LEDs), each emitting at a different wavelength and a detector to measure attenuated light from tissue in order to determine physiological parameters, including oxygen saturation and related blood constituent information. Ex. 1062 at Abstract, ¶¶ [0003].

97. Lamego describes using additional wavelengths that can identify and compensate for additional hemoglobin species or blood constituents, including methemoglobin (MetHb) and carboxyhemoglobin (COHb) that may affect oxygen saturation measurements. Ex. 1062 at [0033]-[0041].

4. Soller (Ex. 1030) (Ground 3)

98. U.S. Patent No. 6,304,767 (“Soller”) describes non-invasive optical measurement of hematocrit using a portable device with one or more LEDs and one

or more photodiodes (detectors), including measuring tissue reflectance at multiple wavelengths. EX. 1030 at 1:17-44, 1:47-4:28.

99. Soller describes determining hematocrit using statistical/mathematical analysis, including regression based techniques, to correlate spectral changes to hematocrit, and discusses applying signal processing techniques such as smoothing algorithms to improve signal-to-noise ratio (“SNR”). Ex. 1030, 5:33-11:42.

IX. DIFFERENCES BETWEEN THE ‘790 PATENT AND THE ‘533 AND ‘484 PATENTS

100. As part of my assignment, I have been asked to analyze and explain the differences between claim 7 of the ‘790 Patent and the claims of the ‘533 and ‘484 Patents that were considered in prior IPRs. As discussed below, there are material differences between these claims.

101. The Petition asserts that claim 7 of the ‘790 Patent “is materially identical to the claims found unpatentable by the Board in the prior ‘533 and ‘484 IPRs” and provides a “comparison of the limitations of Claim 7 against an exemplary previously invalidated claim limitation from those related IPRs.” Petition at 26-27. I have reviewed the comparison table in the Petition. Below is a simplified version of Petitioner’s table showing which patent claim was cited for each limitation in the table in the Petition.

Claim 7	Cited Claim(s)
7[pre]	‘533 Patent, Claim 5

7[a]	‘533 Patent, Claim 13; ‘484 Patent, Claim 1
7[b]	‘533 Patent, Claim 13
7[c]	‘484 Patent, Claim 1
7[d]	‘484 Patent, Claim 1
7[e]	‘484 Patent, Claim 1
7[f]	‘484 Patent, Claim 1
7[g]	‘484 Patent, Claim 1
7[h]	‘484 Patent, Claim 1
7[i]	‘484 Patent, Claim 1
7[j]	‘484 Patent, Claim 1
7[k]	‘484 Patent, Claim 1
7[l]	‘484 Patent, Claim 3

102. As shown above, the table in the Petition only cites the ‘533 Patent for elements 7[pre], 7[a], and 7[b] and does not cite any claim of the ‘533 Patent for elements 7[c] – 7[l]. I note that for the ‘533 Patent, the table cites claim 5 of the ‘533 Patent for 7[pre] and claim 13 of the ‘533 Patent for elements 7[a]. The table in the Petition does not cite the ‘484 Patent for elements 7[pre] or 7[b].

103. Dr. Mercier states that “a POSITA would have understood the invention described in the Challenged Claims of the ‘790 Patent significantly overlaps with and is not meaningfully distinct from the challenged claims of” the ‘533 and ‘484 Patents. Ex. 1003 at ¶ 77. Dr. Mercier testified during his deposition that he did not perform “a claim by claim analysis” comparing claim 7 of the ‘790 Patent and the previously challenged claims of the ‘533 and ‘484 Patents. Ex. 2052 at 110:18-111:3.

A. Differences Between Claim 7 of the ‘790 Patent and Claims 5, 7-10, 13, and 15-17 of the ‘533 Patent

104. I understand that on April 10, 2019, Apple filed a petition challenging claims 5, 7-10, 13, and 15-17 of the ‘533 Patent. Ex. 1015 at 3. I understand that the Board issued a final written decision on October 14, 2020 finding 5, 7-10, 13, and 15-17 of the ‘533 Patent unpatentable. Ex. 1008 at 51.

105. There are multiple differences between claim 7 of the ‘790 Patent and the previously challenged claims of the ‘533 Patent.

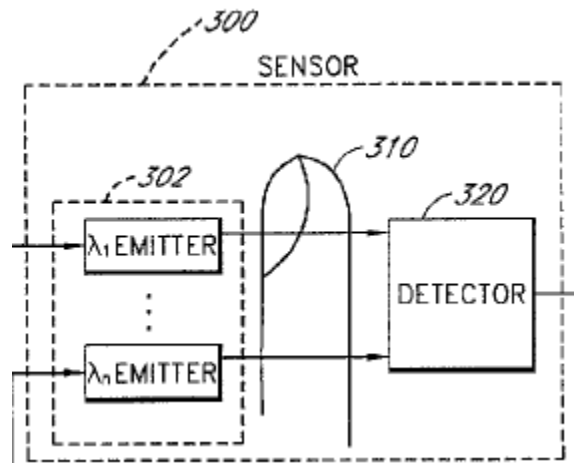
106. First, claim 7 of the ‘790 Patent requires that “the wearable device is at least in part configured to identify an object.” Ex. 1001 at 87:32-33. None of claims 5, 7-10, 13, and 15-17 of the ‘533 Patent recite the phrase “identify an object.” *See* Ex. 1004. Indeed, the comparison table in the Petition only cites claim 3 of the ‘484 Patent for this claim limitation. Petition at 26-27. As discussed below in connection with Ground 1, Lisogurski does not disclose a wearable device configured to identify an object. In Grounds 2 and 3, Petitioner and Dr. Mercier argue that Lamego and Soller, respectively, disclose “identify an object.” I understand that Lamego and Soller were not considered during the prior IPR for the ‘533 Patent.

107. Second, claim 7 of the ‘790 Patent recites the wearable device is “adapted to be placed on a wrist of a user.” Ex. 1001 at 86:62-63. Independent claim 5 of the ‘533 Patent does not specify that the claimed components are part of a

wearable device, let alone a wearable device adapted to be placed on a wrist of a user. Ex. 1004 at 29:43-30:10. Independent claim 13 of the ‘533 Patent recites a “wearable device,” but does not specify which portion of the body of the user that the wearable device is adapted to be placed. Ex. 1004 at 30:46-31:20.

108. Third, claim 7 of the ‘790 Patent recites “a detection system configured to receive at least a portion of the lens output light reflected from the tissue.” Ex. 1001 at 87:8-10. This differs from independent claims 5 and 13 of the ‘533 Patent. Claim 5 of the ‘533 Patent recites: “a receiver configured to receive and process at least a portion of the analysis output beam reflected *or transmitted* from the sample.” Ex. 1004 at 29:59-61. Claim 13 of the ‘533 Patent similarly recites: “a receiver configured to receive and process at least a portion of the analysis output beam reflected *or transmitted* from the sample.” *Id.* at 30:64-67.

109. A person of skill in the art would understand that there are generally two types of pulse oximetry: transmission mode pulse oximetry and reflectance mode pulse oximetry. Transmission mode pulse oximetry involves positioning a light source on one side of a sample (e.g., a finger) and a detector on the opposite side of the sample that measures the light that passes through the tissue. An example of transmission pulse oximetry is shown in FIG. 3 of Lamego:



Ex. 1062 at FIG. 3 (excerpted)

Reflectance mode pulse oximetry involves positioning the light source and the detector(s) on the same side of the sample (as opposed to opposite sides) so that the detector(s) can measure the light that is reflected from the sample.

110. Claim 7 of the '790 Patent is directed to reflectance mode pulse oximetry. By contrast, claims 5 and 13 of the '533 Patent are directed to reflectance mode pulse oximetry or transmission mode pulse oximetry. This difference is material. A person of skill in the art would understand that transmission and reflectance modes have different use cases. For example, transmission mode pulse oximetry is only viable for relative thin tissue samples (e.g., an earlobe) and would not be viable for thicker tissue samples (e.g., a wrist).

111. Fourth, claim 7 of the '790 Patent recites that the detection system is configured to: (1) "generate a first signal responsive to light received while the semiconductor diodes are off," (2) "generate a second signal responsive to light

received while at least one of the semiconductor diodes is on” and (3) “increase the signal-to-noise ratio by comparing the first signal and the second signal.” Ex. 1001 at 87:24-33. None of the previously challenged claims of the ‘533 Patent recite these limitations. Ex. 1004 at 29:43-32:23.

112. Fifth, claim 7 of the ‘790 Patent recites “a plurality of detectors spatially separated from each other.” Ex. 1001 at 87:14-15. Claims 5 and 13 of the ‘533 Patent do not require a plurality of spatially separated detectors. Ex. 1004 at 29:43-30:10 (claim 5), 30:46-31:20 (claim 13). While claims 8 and 16 of the ‘533 Patent recite a spatial relationship between the receiver and LEDs, these claims concern a receiver at different distances from LEDs, not multiple detectors spatially separated from each other. *Id.* at 30:24-30 (claim 8), 32:10-14 (claim 16).

113. Sixth, claim 7 of the ‘790 Patent recites “wherein at least one analog to digital converter is coupled to at least one of the plurality of detectors.” Ex. 1001 at 87:16-17. None of the previously challenged claims of the ‘533 Patent recite an analog to digital converter.

114. Additionally, claims 5 and 13 of the ‘533 Patent recite a “sample,” whereas claim 7 of the ‘790 Patent recites “tissue comprising skin.” The term “sample” is broader than “tissue comprising skin.” This is yet another difference between the claims of the ‘533 Patent and claim 7 of the ‘790 Patent.

B. Differences Between Claim 7 of the ‘790 Patent and Claims 1-23 of the ‘484 Patent

115. I understand that on January 22, 2021, Apple filed a petition challenging claims 1-23 of the ‘484 Patent. Ex. 1021 at 7. I understand that the Board issued a first final written decision on August 3, 2022 finding some claims patentable and others unpatentable based on the grounds in the table below:

Claims	35 U.S.C. §	Basis	Claims Shown Unpatentable	Claims Not shown Unpatentable
1, 7, 15, 17	103	Lisogurski, Carlson	1, 7, 15, 17	
1-4, 7-17, 15-22	103	Lisogurski, Carlson, Tran	1, 2, 7, 15-22	3, 4, 8-12
5, 13	103	Lisogurski, Carlson, Tran, Isaacson		5, 13
6, 14, 23	103	Lisogurski, Carlson, Tran, Isaacson, Valencell-093	23	6, 14
Overall Outcome			1, 2, 7, 15-23	3-6, 8-14

Ex. 1011 at 61.

116. The Petition cites claims 1 and 3 of the ‘484 Patent as allegedly overlapping with claim 7 of the ‘790 Patent. Petition at 26-29. I note that the Board found independent claim 1 of the ‘484 Patent unpatentable on two independent bases: (1) obviousness over Lisogurski and Carlson and (2) obviousness over Lisogurski, Carlson, and Tran. Ex. 1011 at 61.

117. I understand that following an appeal, the IPR involving the ‘484 Patent

was remanded to the Board for further consideration. I understand that in a second final written decision dated February 14, 2025, the Board reversed course and found the remaining claims unpatentable. Ex. 1013 at 12. The Board found claims 3 and 8 of the ‘484 Patent unpatentable as obvious over Lisogurski, Carlson, and Tran. *Id.* I understand that Patent Owner is appealing the remand decision and its appeal remains pending as of the date of this declaration.

118. There are multiple differences between claim 7 of the ‘790 Patent and the previously challenged claims of the ‘484 Patent.

119. First, claim 7 of the ‘790 Patent recites that the wearable device is “adapted to be placed on a wrist of a user.” Ex. 1001 at 86:62-63. By contrast, claim 1 of the ‘484 Patent recites “a wearable device adapted to be placed on a wrist or an ear of a user.” Ex. 1005 at 36:49-50. The other independent claims of the ‘484 Patent contain similar limitations. Thus, the ‘484 Patent is broad enough to cover a wearable device adapted to be placed on an ear of a user, whereas the ‘790 Patent is limited to being “placed on a wrist of a user.”

120. Second, claim 7 of the ‘790 Patent recites “a light source comprising a plurality of semiconductor diodes that are configured to generate an output optical light having one or more optical wavelengths, wherein at least a portion of the one or more optical wavelengths is a near-infrared wavelength between 700 nanometers and 2500 nanometers.” Ex. 1001 at 86:64-87:3. Subsequent limitations refer back to

the term “output optical light.” None of the claims in the ‘484 Patent recites a specific wavelength like claim 7 of the ‘790 Patent.

121. Claim 1 of the ‘484 Patent includes several limitations that are not present in claim 7 of the ‘790 Patent. For example, claim 1 of the ‘484 Patent recites (1) an amplifier having a gain configured to improve detection sensitivity; (2) a smartphone or tablet with a wireless receiver, wireless transmitter, display, speaker, voice input module, buttons or knobs, microprocessor, and touch screen; and (3) a cloud configured to receive an output status over a wireless transmission link, process it to generate processed data, and store processed data. Claim 7 of the ‘790 Patent does not include these features. Claim 1 of the ‘484 Patent recites increasing SNR “by increasing a pulse rate” from an initial pulse rate. Claim 7 of the ‘790 Patent does not require increasing pulse rate.

X. OPINIONS ON GROUNDS IN THE PETITION

122. The Petition and Dr. Mercier’s declaration include 5 grounds challenging the validity of the ‘790 Patent. My opinions on each ground follow.

A. Ground 1: Obviousness Based on Lisogurski in view of Carlson (Claim 7)

123. In Ground 1, Petitioner and Dr. Mercier assert that claim 7 of the ‘790 Patent is obvious over Lisogurski in view of Carlson. Petition at 32; Ex. 1003 at ¶¶ 90-92. For the reasons discussed below, I disagree.

1. Limitation 7[l]: Lisogurski Does Not Disclose a Wearable Device at Least in Part Configured to Identify an Object

124. Limitation [7.l] recites: “wherein the wearable device is at least in part configured to identify an object.” Ex. 1001 at 87:32-33.

125. As discussed above, the Board previously construed the phrase “to identify an object” to mean “to recognize or establish an object as a particular thing,” and Petitioner and Dr. Mercier apply this claim construction. Petition at 18; Ex. 1003 at ¶¶ 196, 219.

126. Petitioner and Dr. Mercier fail to show that Lisogurski discloses limitation [7.l] for at least two reasons. First, Lisogurski does not disclose recognizing or establishing an object as a particular thing. Second, even if Lisogurski identifies an object under the Board’s claim construction (which I disagree with), Petitioner and Dr. Mercier fail to show that Lisogurski discloses or renders obvious a wearable device that is configured to recognize or establish an object as a particular thing, i.e., identify an object.

a) Lisogurski Does Not Recognize or Establish an Object as Being a Particular Thing

127. Based on the claim construction, and in the context of the ‘790 Patent, a POSITA would recognize that identifying an object is different from merely detecting something or measuring a parameter of a presumed object. Ex. 1011 at 10. To identify an object, the system must determine what the object is, recognizing the

object as a particular thing. This is distinct from assuming an object and simply quantifying one of its attributes. The '790 Patent's specification is consistent with this approach, describing identification in terms of classifying materials or constituents, such as via spectral analysis and library matching, as opposed to signal measurement. Ex. 1001 at 18:20-27; 78:51-79:12.

128. Distinguishing an object is distinct from measurement, and the specification explains this in further detail with examples. One example in the specification makes this clear, describing how building materials such as gypsum, painted structures, plywood, and others may be distinguished from plant life:

“[B]uilding materials such as gypsum, painted structures, plywood, and concrete of various sorts, may be distinguished from plant life, soil and trees. Thus, beyond three dimensional imaging, this can add a fourth dimension-namely, *identification of objects* based on their chemical signature.”

Ex. 1001 at 54:54-59 (emphasis added)

129. The specification describes spectral techniques that support identification. For example, the specification explains that other blood constituents besides glucose have spectral features in the same wavelength range. Ex. 1001 at 18:3-27. To distinguish glucose from these other blood constituents, the '790 Patent describes collecting information in multiple wavelengths. Ex. 1001 at 18:3-27.

130. The specification also describes using pattern-matching techniques to support identification. For example, the specification discloses that “it may be

advantageous to use pattern-matching algorithms and other software and mathematical methods to identify the blood constituents of interest.” Ex. 1001 at 18:17-20.

131. The specification describes using software and mathematical modeling to support identification: “software and mathematical methods to identify the blood constituents of interest.” Ex. 1001 at 18:19-20. “This is just one way to perform the signal processing, and many other techniques, algorithms, and software may be used and would fall within the scope of this disclosure.” Ex. 1001 at 18:24-27.

132. The specification describes signal processing techniques that support object identification. “Different signal processing techniques can be used to enhance the spectral differences between different constituents.” Ex. 1001 at 19:29-47. These signal processing techniques include the process of taking first or second derivatives of the spectra in order to “remove any flat offset or background,” thereby improving the analysis of the spectral data to improve the identification of objects. Ex. 1001 at 19:29-47. Ketone or glucose are identified, not simply measured, using this technique to distinguish the derivative spectra from protein, urea, and creatine. Ex. 1001 at 19:29-47.

133. Spectral fingerprinting is a method known in chemistry to identify different chemical species in a complex mix. It requires acquiring a high-resolution spectrum as shown in several figures of ‘790 Patent. It allows identification of a

particular molecule in a mixture including, in a living organism. Measurements of one or several wavelengths, as in Lisogurski, are not sufficient to implement such identification. Like fingerprinting, this method is uniquely equipped to identify an object, not just to establish its presence.

134. The Petition argues that Lisogurski meets the claim construction because “measuring blood oxygen saturation requires selecting oxygenated and deoxygenated hemoglobin from among other blood constituents, and then identifying and quantifying both components.” Petition at 70. The Petition also argues that “in order to calculate blood oxygen saturation, a pulse oximeter, like the one taught by Lisogurski, necessarily must distinguish between the different forms of hemoglobin—oxygenated and deoxygenated.” *Id.* Dr. Mercier offers similar assertions. Ex. 1003 at ¶¶ 198 (“To measure blood oxygen saturation, Lisogurski’s system must select, identify, and quantify oxygenated and deoxygenated hemoglobin (from among other blood constituents).”), 200 (asserting “a pulse oximeter like the one taught in Lisogurski must distinguish between the two forms [of hemoglobin] in order to measure blood oxygen saturation” and “Lisogurski necessarily must ‘recognize or establish an object as being a particular thing,’ specifically, a particular form of hemoglobin.”). I disagree.

135. Petitioner and Dr. Mercier do not cite any explicit disclosure in Lisogurski in which the wearable device is configured to recognize or establish what

object is being sensed as a particular thing.

136. Pulse oximetry measures the oxygen saturation of blood. There is no need to identify a particular blood constituent as either oxygenated or deoxygenated hemoglobin to measure oxygen saturation. There is also no need to identify a blood constituent as hemoglobin as opposed to different blood constituents to measure blood oxygen. Pulse oximetry is based on known absorption properties of hemoglobin at two specific wavelengths of light.

137. Consistent with a POSITA's understanding, Lisogurski explains that pulse oximetry uses the known absorption properties of hemoglobin at different wavelengths to estimate the blood oxygen saturation using standard calculations. Ex. 1027 at 4:36-62, 9:38-42, 24:41-57, 37:2-12. For example, Lisogurski explains that "it has been observed that highly oxygenated blood will absorb relatively less red light and more IR light than blood with a lower oxygen saturation" and "[b]y comparing the intensities of two wavelengths at different points in the pulse cycle, it is possible to estimate the blood oxygen saturation of hemoglobin in arterial blood." Ex. 1027 at 4:45-51.

138. In Lisogurski "the system may determine blood oxygen saturation using two wavelengths of light and a ratio-of-ratios calculation." Ex. 1027 at 4:54-56. "Ratio-of-ratio calculations are common calculations in pulse oximeters" and "use IR and red . . . to determine oxygen saturation." *Id.* at 45:6-8. Lisogurski

provides an exemplary equation for this calculation “where terms relate to the maximum, minimum, and mean amplitudes of the associated signals.” *Id.* at 45:9-22.

$$\frac{\left(\frac{Red_{max} - Red_{min}}{Red_{mean}} \right)}{\left(\frac{IR_{max} - IR_{min}}{IR_{mean}} \right)}$$

139. Solving the equation above does not require establishing or recognizing an object as a particular thing. It does not require differentiating or distinguishing oxygenated hemoglobin and deoxygenated hemoglobin. Signals received by the detector are plugged into an equation to yield blood oxygen saturation. There is no intermediate step where the amounts of oxygenated and deoxygenated hemoglobin are separately quantified. There is also no need to discriminate hemoglobin from other blood constituents. In other words, Lisogurski is designed to monitor a known constituent (hemoglobin) and to compute a known metric (oxygen saturation) from the optical signals. Ex. 1027 at 3:61-4:3.

140. The Biomedical Engineering Handbook (Ex. 1033) submitted with the Petition also describes how oxygen saturation is calculated:

Oximetry

Oximetry refers to the colorimetric measurement of the degree of oxygen saturation, that is, the relative amount of oxygen carried by the hemoglobin in the erythrocytes, by recording the variation in the color of deoxyhemoglobin (Hb) and oxyhemoglobin (HbO₂). A quantitative method for measuring blood oxygenation is of great importance in assessing the circulatory and respiratory status of a patient.

Various optical methods for measuring the oxygen saturation of arterial (SaO₂) and mixed venous (SvO₂) blood have been developed, all based on light transmission through, or reflecting from, tissue and blood. The measurement is performed at two specific wavelengths: λ_1 , where there is a large difference in light absorbance between Hb and HbO₂ (e.g., 660 nm red light), and λ_2 , which can be an isobestic wavelength (e.g., 805 nm infrared light), where the absorbance of light is independent of blood oxygenation, or a different wavelength in the infrared region > 805 nm, where the absorbance of Hb is slightly smaller than that of HbO₂.

Assuming for simplicity that a hemolyzed blood sample consists of a two-component homogeneous mixture of Hb and HbO₂, and that light absorbance by the mixture of these two components is additive, a simple quantitative relationship can be derived for computing the oxygen saturation of blood:

$$\text{Oxygen saturation} = A - B \left[\frac{OD(\lambda_1)}{OD(\lambda_2)} \right]$$

where A and B are coefficients which are functions of the specific absorptivities of Hb and HbO₂, and OD is the corresponding absorbance (optical density) of the blood.

Ex. 1033 at 14-15. As shown in the equation above, all that is required to calculate oxygen saturation are two known coefficients (shown as A and B in the equation), the absorbance (OD) at a first wavelength, and the absorbance (OD) at a second wavelength, i.e., at an isobestic wavelength. The calculation does not require recognizing or establishing a blood constituent as oxygenated or deoxygenated hemoglobin or determining the amounts of oxygenated and deoxygenated hemoglobin in blood. Nor does the calculation require distinguishing oxygenated and deoxygenated hemoglobin from other blood constituents.

141. A POSITA would recognize that Lisogurski's pulse oximeter is merely measuring something, not identifying an object. Ex. 1027 at 3:61-4:3. Lisogurski

operates on the presupposition that the object of interest, hemoglobin, is present. Ex. 1027 at 4:35-41. It uses known characteristics of that constituent to estimate oxygen saturation. Ex. 1027 at 4:35-41. Lisogurski does not include any step where the system attempts to determine what the substance or object is. Ex. 1027 at 4:35-41. Instead, Lisogurski assumes the object. Ex. 1027 at 4:35-41. A POSITA would understand that this approach does not amount to identifying an object as required under the claim construction.

142. To identify an object as required by limitation [7.1] under the claim construction, a POSITA would understand that discernment of the object's identity is required. The '790 Patent describes how a wearable device may use spectral data and algorithms to classify unknown samples, identifying them through techniques including spectral analysis and library matching, as opposed to simply signal measurement. Ex. 1001 at 18:20-27; 78:51-79:12. "Different signal processing techniques can be used to enhance the spectral differences between different constituents," identifying glucose among a mixture of other blood constituents. Ex. 1001 at 19:29-47. This is an example of object identification.

143. Dr. Mercier points to Lisogurski's calculation of oxygen saturation by using two wavelengths and modeling light absorption by oxygenated and deoxygenated hemoglobin. Ex. 1003 at ¶¶ 196-200. But as explained above, Lisogurski's pulse oximeter operates on the presupposition that hemoglobin is

present and is the relevant constituent; then it estimates oxygen saturation from the relative absorption at selected wavelengths. *See, e.g.*, Ex. 1027 at 3:61-4:62; FIG. 4.

144. Petitioner and Dr. Mercier also assert that “Lisogurski teaches that other wavelengths may be used that can identify other blood constituents using the spectral signature of those constituents. Petition at 71; Ex. 1003 at ¶ 202. I disagree. Lisogurski does not mention identifying and distinguishing a given blood constituent from others. Instead, it describes a system which will “estimate the blood oxygen saturation of hemoglobin”—which is a specific and known constituent—and determine “physiological parameters.” Ex. 1027 at 4:36-62. Lisogurski’s description of determining “physiological parameter such as blood oxygen saturation, hemoglobin, blood pressure, pulse rate, other suitable parameters, or any combination thereof” (Ex. 1027 at 1:22-25) and “an amount of a blood constituent (e.g., oxyhemoglobin) being measured” (*Id.* at 4:36-41) does not refer to recognizing or establishing an object as a particular thing.

145. There is a clear difference between merely measuring something and identifying something. For instance, a scale can measure how much an object weighs, but it does not identify the object. The scale does not need to know the object’s identity: it simply measures its mass. A thermometer is another example: it can measure the temperature of whatever object it touches but does not identify the object.

146. Per the claim construction, there is also a clear difference between detecting an object and identifying an object. For example, a simple motion sensor can notice the existence of something moving in its field of view but does not recognize or establish the moving object as a particular thing. Measuring or detecting an object's properties or presence is distinct from recognizing or establishing the object as a particular thing.

147. The Board stated the following regarding the difference between the terms “identify” and “detect” that appeared in certain claims of the related ‘484 Patent:

[W]e decline to adopt Petitioner's proposal to construe the terms “identify an object” and “detect an object” to have the same meaning. Instead, we construe these terms consistent with the dictionary definitions of “identify” and “detect,” *i.e.*, we construe “to identify an object” to mean “to recognize or establish an object as being a particular thing,” and we construe “to detect an object” to mean “to discover or notice the existence or presence of something.”

Ex. 1011 at 10.

148. The Federal Circuit's decision confirmed this difference by rejecting Apple's argument that the claims of the ‘484 Patent “only require the claimed wearable device to discover or determine the existence, presence, or fact of an object—*i.e.*, detecting said object.” Ex. 1012 at 3. The Federal Circuit also observed

that “when claims 3 and 8 [of the ‘484 Patent] require the claimed device to ‘identify an object,’ the claims require a determination of the identity of an object, even if the claims never do anything with that identity.” Ex. 1012 at 4.

149. I note Dr. Mercier’s declaration does not acknowledge, let alone address, the difference between identifying an object and detecting an object under the claim construction. Ex. 1003 at ¶¶ 43-44 (claim construction), 196-203 (Ground 1), 206-216 (Ground 2), 219-230 (Ground 3). When asked during his deposition “[w]hat’s the difference between the phrase ‘identify an object’ and ‘detect an object’ under the Board’s claim construction,” Dr. Mercier testified “I didn’t do that analysis” and did not discuss the difference between identify an object and detecting an object in his declaration Ex. 2052 at 25:21-26:14.

150. Petitioner and Dr. Mercier’s analysis is flawed because they conflate identifying an object (which is what claim 7 of the ‘790 Patent requires) with detecting an object. For example, when discussing alleged indefiniteness in Ground 4, Dr. Mercier states that “[t]he specification [of the ‘790 Patent] describes identifying objects as establishing the presence of the target.” Ex. 1003 at ¶ 232. Discovering or noticing the presence of something qualifies as detecting an object. Ex. 1011 at 10. The fact that Dr. Mercier describes “identifying objects” using the same terminology that the Board used in construing the phrase “detect an object” demonstrates that he has conflated detecting and identifying, which is contrary to

the Board's prior claim construction findings.

151. As another example, Dr. Mercier quotes portions of Lisogurski in his discussion of the “identify an object” limitation that refer to *detecting* something. For example, he quotes the following from Lisogurski:

- For example, if a cardiac cycle modulation technique only *detects* the peaks and valleys of a pulse cycle, a first type of blood oxygen saturation algorithm may be used (e.g., discrete oximetry based only on the peak and valley information). If the cardiac cycle modulation technique *detects* the entire pulse, a different blood oxygen saturation *detection* algorithm may be used (e.g., a regression based algorithm). Ex. 1003 at ¶ 197 (quoting Ex. 1027 at 9:38-45).
- The system may *detect* the physiological condition using information obtained through measurements in step 1902, from an external sensor or controller, by any other suitable technique, or any combination thereof. In some embodiments, the system may *detect* a condition where a second mode is required that is not related to a physiological condition. For example, the system may *detect* a change in background noise, a change in ambient light, a change in the available power, other suitable changes, or any combination thereof. Ex. 1003 at ¶ 197 (quoting Ex. 1027 at 37:2-12).

152. For at least these reasons, I disagree with Petitioner and Dr. Mercier's

assertions that Lisogurski discloses recognizing or establishing an object as a particular thing.

b) Lisogurski Does Not Meet The “Wearable Device” Requirement in Limitation 7[l]

153. Limitation 7.[l] recites: “wherein the wearable device is at least in part configured to identify an object.” Ex. 1001 at 87:32-33 (emphasis added).

154. As I discussed in the preceding section, Lisogurski does not disclose identifying an object under the Board’s claim construction. However, even if Petitioner and Dr. Mercier’s contentions regarding Lisogurski and identifying an object were correct, they have not shown that Lisogurski discloses a **wearable device** that is configured to identify an object. Rather, to the extent an identification of an object occurs in Lisogurski (which in my opinion, it does not), that identification would occur in Lisogurski’s monitor – not the wearable device.

155. As I discuss more fully below in the section regarding limitation 7[d], Petitioner and Dr. Mercier rely on the sensor 102 in FIG. 1 of Lisogurski as the claimed wearable device and the front end processing circuitry 150 in monitor 104 as the claimed detection system, and they propose relocating front end processing circuitry 150 to sensor 102 so that it is in the same device as the detector 140.

156. Lisogurski discloses that “front end processing circuitry 150 may receive a detection signal from detector 140 and provide one or more processed

signals to back end processing circuitry 170.” Ex. 1027 at 12:42-45. In the next sentence, Lisogurski defines the term “detection signals” as referring “to any of the signals generated within front end processing circuitry 150 as it processes the output signal of detector 140.” *Id.* at 12:45-48. For example, the “[f]ront end processing circuitry 150 may perform various analog and digital processing of the detector signal.” *Id.* at 12:48-49.

157. Unlike the front end processing circuitry 150, the back end processing circuitry 170 includes processor 172 and memory 174. Ex. 1027 at 14:56-57; FIG. 1. Lisogurski discloses that the processor 172 “may receive and process physiological signals received from front end processing circuitry 150” and “may determine one or more physiological parameters based on the received physiological signals,” i.e., the signals from the front end processing circuitry 150. *Id.* at 14:60-64.

158. In Lisogurski, the term “physiological parameters” refers to “blood oxygen saturation, hemoglobin, blood pressure, pulse rate, other suitable parameters, or any combination thereof.” *Id.* at 1:22-25; *see also id.* at 4:3-5 (referring to “a patient’s pulse rate and blood pressure” as physiological parameters), 4:36-41 (referring to calculating “any of a number of physiological parameters, including an amount of a blood constituent (e.g., oxyhemoglobin) being measured as well as a pulse rate and when each individual pulse occurs”), 17:62-67 (“monitor 314 may be configured to determine pulse rate, blood pressure, blood oxygen saturation (e.g.,

arterial, venous, or both), hemoglobin concentration (e.g., oxygenated, deoxygenated, and/or total), any other suitable physiological parameters, or any combination thereof”).

159. The Petition argues that Lisogurski “teaches techniques for measuring blood oxygen saturation and other blood constituents” and that “measuring blood oxygen saturation requires selecting oxygenated and deoxygenated hemoglobin from among other blood constituents, and then identifying and quantifying both components.” Petition at 69-70. In other words, the Petition argues that when Lisogurski determines blood oxygen saturation, Lisogurski identifies an object under the Board’s claim construction. While I disagree that this constitutes identifying an object for the reasons discussed above, even if this were found to meet the claim construction, Lisogurski is clear that blood oxygen saturation is a physiological parameter that is determined by the back end processing circuitry 170 in the monitor 104, which is **not** part of the wearable device (i.e., the sensor 102).

160. The Petition cites the Board’s remand decision concerning the ’484 Patent finding that Lisogurski’s sensor allegedly “calculate[es] an amount of a blood constituent, e.g., oxyhemoglobin” and that this allegedly “in-volves distinguishing and identifying oxyhemoglobin in blood.” Petition at 69 (citing Ex. 1013 at 7). The Petition also quotes the following from the Board’s remand decision: “[as] Lisogurski discloses a method of measuring oxygen saturation that uses different

wavelengths to distinguish hemoglobin from oxygen carrying hemoglobin, *i.e.*, oxyhemoglobin, Lisogurski teaches identifying an object, *i.e.*, the blood constituent oxyhemoglobin.” *Id.* As discussed above, the calculations or measurements that the Board pointed to as including identifying an object would be performed by the back end processing circuitry 170 in the monitor 104 – they are not performed in the sensor 102, even if the sensor 102 were modified to include the front end processing circuitry 150.

161. Petitioner and Dr. Mercier have proposed modifying Lisogurski to relocate the front end processing circuitry 150 into the sensor 102. *See* Petition at 49-51; Ex. 1003 at ¶¶ 149-152. Lisogurski’s front end processing circuitry 150 does not determine physiological parameters like blood oxygen saturation – that determination is made by the back end processing circuitry 170. Ex. 1027 at 14:60-64. Thus, even if Lisogurski were modified such that the entirety of the front end circuitry 150 were located in the same device as the light source 130 and detector 140 (which I disagree with), the wearable device would not identify an object even under Petitioner’s interpretation because physiological parameters would still be determined by the back end processing circuitry 170 in the monitor 104.

162. Petitioner and Dr. Mercier have not proposed modifying Lisogurski’s sensor 102 to include the back processing circuitry 170 from the monitor 104 – they have only proposed modifying the sensor 102 to include the front end processing

circuitry 150 and potentially the control circuitry 110 and light drive circuitry 120. *See* Petition at 49-51 (discussing relocating front end processing circuitry 150 to the sensor 102), 54-55 (discussing relocating control circuitry 110 and light drive 120 to be part of light source 130 in sensor 102); Ex. 1003 at ¶¶ 149-152 (discussing relocating front end processing circuitry 150 to the sensor 102), ¶ 181 (discussing relocating control circuitry 110 and light drive 120 to be part of light source 130 in sensor 102); Ex. 2052 at 74:12-75:6.

163. Neither the Petition nor Dr. Mercier’s declaration expressly address the requirement that the wearable device is configured to identify an object. Petition at 68-72; Ex. 1003 at ¶¶ 196-203. Dr. Mercier does not mention the term “wearable device” at all in his discussion of limitation 7[I]. *See* Ex. 1003 at ¶¶ 196-203. The Petition similarly only mentions the term “wearable device” in a footnote when characterizing Patent Owner’s infringement allegations. Petition at 68 n.10.

164. I note that the Board did not expressly address *where* the alleged identification of an object occurs in Lisogurski in its remand decision for the ‘484 Patent. Ex. 1013 at 4-7. I further note that in finding claims 3 and 8 of the ‘484 Patent unpatentable, the Board relied on a combination of Lisogurski, Carlson, and Tran. Ex. 1013 at 12. Tran is not part of Ground 1 in the Petition for the ‘790 Patent.

**2. Limitation 7[d]: A POSITA Would Not Relocate
Components from Lisogurski's Monitor Into the Sensor**

165. Limitation 7[d] recites: “the wearable device further comprising a detection system configured to receive at least a portion of the lens output light reflected from the tissue and to generate an output signal having a signal-to-noise ratio, wherein the detection system is configured to be synchronized to the light source.” Ex. 1001 at 87:8-13.

166. Claim 7 specifies that this detection system is configured to perform certain functions, including: (1) “generate a first signal responsive to light received while the semiconductor diodes are off”; (2) “generate a second signal responsive to light received while at least one of the semiconductors is on”; and (3) “increase the signal-to-noise ratio by comparing the first signal and the second signal.” Ex. 1001 at 87:24-33.

167. Dr. Mercier asserts that a “POSITA would have understood the detector and the front end processing circuitry in Lisogurski to comprise the ‘detection system’ that is configured to perform the functions” recited in claim 7. Ex. 1003 at ¶ 149. Dr. Mercier acknowledges that “the front end processing circuitry in Lisogurski is depicted as a separate device,” i.e., the monitor 104 that includes the front end process circuitry “is depicted as a separate device from the detector in the wearable sensor.” *Id.* Dr. Mercier goes on to assert that “if Lisogurski does not

expressly teach a detection ‘system’ comprising detector(s) and processing circuitry, this limitation would have been an obvious modification to Lisogurski” and that it was allegedly “obvious to integrate the front end processing circuitry (150) and detector (140) in the same device.” *Id.*

168. I note that Dr. Mercier does not affirmatively opine that Lisogurski expressly teaches a detection system comprising detectors and processing circuitry. Ex. 1003 at ¶ 149. By contrast, the Petition argues “Lisogurski teaches the front end processing circuitry in the detection system may be integrated directly with the sensor, rather than in a separate monitor.” Petition at 49 (citing Ex. 1003 at ¶ 149). I disagree. Lisogurski does not teach that the front end processing circuitry in the monitor can be integrated in the same device as the sensor containing the detector. The Petition does not identify any such teaching in Lisogurski. Petition at 49.

169. In the next sentence, the Petition asserts that “Lisogurski suggests integrating the front end processing circuitry with the detection system in the manner depicted below.” Petition at 49 (citing Ex. 1027 at 11:20-25, 17:55-59, 18:23-25, 17:23-35); *see also* Ex. 1003 at ¶ 149 (citing same portions of Lisogurski). I disagree. Below, I address each portion of Lisogurski cited in the Petition and explain why it does not suggest integrating the front end processing circuitry with the detection system.

170. At column 11, lines 20 through 25, Lisogurski states: “After converting

the received light to an electrical signal, detector 140 may send the detection signal to monitor 104, where the detection signal may be processed and physiological parameters may be determined (e.g., based on the absorption of the Red and IR wavelengths in the subject's tissue)." Ex. 1027 at 11:20-25. This sentence does not disclose or suggest that the front end processing circuitry can be integrated in the same device as the detector 104. It merely states that the detector 140 sends a signal to the monitor 104 (which is a separate device from the sensor 102) where it may be processed.

171. At column 17, lines 55 through 59, Lisogurski states: "Sensor unit 312 may be powered by an internal power source, e.g., a battery (not shown). Sensor unit 312 may draw power from monitor 314. In another embodiment, the sensor may be wirelessly connected to monitor 314 (not shown)." Ex. 1027 at 17:55-59. These two sentences do not disclose or suggest that the front end processing circuitry can be integrated in the same device as the detector. They merely state that the sensor unit 312 shown in FIG. 3 may be powered internally (e.g., via a battery) as opposed to receiving power from the monitor 314 and that the sensor may be wirelessly connected to monitor 314. Ex. 1027 at 17:56-57 ("Sensor unit 312 may draw power from monitor 314"), 18:25-27 ("Monitor 314 may include a sensor integrate configured to . . . provide signals and power to sensor unit 312"), 18:65-67 ("Monitor 314 may be powered by a battery (not shown) or by a conventional power source

such as a wall outlet”).

172. At column 18, lines 23 through 35, Lisogurski states: “In some embodiments, a wireless transmission device (not shown) or the like may be used instead of or in addition to cable 324.” Ex. 1027 at 18:23-25. This sentence does not disclose or suggest that the front end processing circuitry can be integrated in the same device as the detector. It merely states that an unspecified wireless transmission device can be used in addition to or instead of the cable 324 that connects the sensor unit 312 to the monitor 314 in FIG. 3.

173. Contrary to Petitioner and Dr. Mercier’s assertions, Lisogurski’s discussion of wireless communication undermines the alleged motivation to put the front end process circuitry in the same device as the detector. Lisogurski states that the purpose of the wireless communication is to send data from the detector 140 in the sensor 102 to the front end processing unit 150 in the monitor 104. Ex. 1027 at 11:20-25, 17:55-59, 18:23-25. If the front end processing circuitry were moved to the same physical device as the detector, there would be no reason to have wireless communication between the detector and the front end processing circuitry. Thus, Lisogurski’s discussion of wireless communication suggests to a POSITA that the detector and front end processing circuitry remain in different physical devices.

174. At column 18, lines 23 through 25, Lisogurski states: “In some embodiments, one or more components of physiological monitoring system 310 may

include one or more components of physiological monitoring system 100 of FIG. 1.” Ex. 1027 at 17:32-35. This sentence merely states that the system 310 in FIG. 3 can include one or more of the components shown in the block diagram in FIG. 1 and does not disclose or suggest that the front end processing circuitry can be integrated in the same device as the detector.

175. Petitioner and Dr. Mercier also cite Lisogurski’s statement that “[i]n some embodiments the functionality of some of the components may be combined in a single component . . . [or] the functionality of some of the components of monitor 104 . . . may be divided over multiple components.” Ex. 1027 at 16:2-9; Ex. 1003 at ¶ 151; Petition at 51. This does not expressly disclose that the front end processing can be integrated into the sensor unit. Lisogurski gives an example where the front end processing circuitry and back end processing circuitry 170 “may be combined in a single processor system.” Ex. 1027 at 16:4-6. Lisogurski gives another example, where “the functionality of control circuitry 110 may be performed in front end processing circuitry 150, in back end processing circuitry 170, or both.” *Id.* at 16:9-12. None of the examples suggest relocating components from the monitor 104 to the sensor 102. As discussed below, there is good reason why components from the monitor 104 are not integrated in the sensor 102 in FIG. 1 of Lisogurski.

176. The portions of Lisogurski discussed above describe two different

embodiments: the embodiment shown in FIG. 1 and the embodiment shown in FIG. 3. *See, e.g.*, Ex. 1027 at 17:32-35, 17:55-59, 18:23-25 (discussing FIG. 3) and 11:20-25 (discussing FIG. 1). Dr. Mercier agreed that FIGS. 1 and 3 illustrate different embodiments in Lisogurski. Ex. 2052 at 39:21-23. Petitioner and Dr. Mercier do not explain why a POSITA would allegedly combine Lisogurski's FIG. 1 embodiment and Lisogurski's FIG. 3 embodiment.

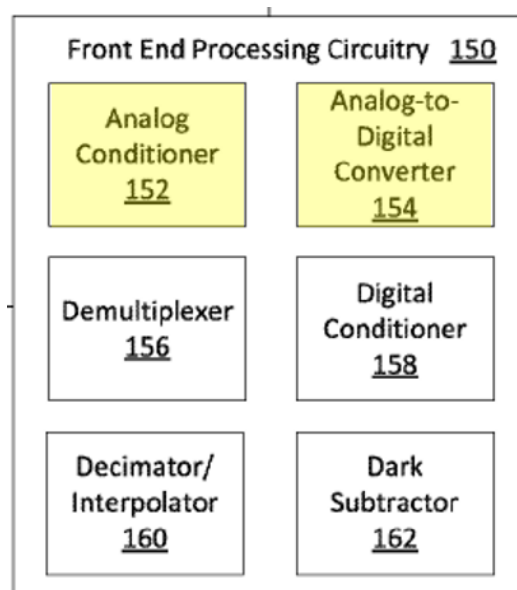
177. Petitioner and Dr. Mercier's proposed modification to Lisogurski is based on Lisogurski's description of a wireless embodiment where the detector in the sensor communicates wirelessly with the monitor. Petition at 49-51; Ex. 1003 at ¶¶ 150-151 ("in order to satisfy Lisogurski's disclosed embodiment of wirelessly connecting the monitor to the detector"). At the outset, I note that Lisogurski does not provide any details about how wireless transmission between the detector and the monitor would work. For example, while Lisogurski provides examples for how wireless communication would work for the communication interface 190 in monitor 104 (Ex. 1027 at 15:55-57), Lisogurski does not identify a wireless communication protocol for wireless communication between the detector and the monitor. Ex. 1027 at 17:57-59 ("the sensor may be wirelessly connected to monitor 314 (not shown)"), 18:23-25 ("a wireless transmission device (not shown) or the like may be used instead of or in addition to cable 324").

178. Regarding the wireless embodiment, Dr. Mercier first asserts that "the

signal received by the detector would *preferably* need to be converted from analog to digital form in order to be wirelessly transmitted to the monitor.” Ex. 1003 at ¶ 150 (emphasis added). During his deposition, Dr. Mercier confirmed that an analog to digital converter is “not strictly necessary” to wirelessly transmit an analog signal. Ex. 2052 at 76:25-77:10, 78:16-18. I agree with this statement. A POSITA would know that an analog signal like the one from the detector 140 in Lisogurski could be transmitted wirelessly (e.g., using radio frequency (RF) communication) without adding an analog to digital converter to the sensor 102.

179. In the next paragraph of his declaration, Dr. Mercier asserts that “in order to satisfy Lisogurski’s disclosed embodiment of wirelessly connecting the monitor to the detector, a POSITA would have understood that the analog-to-digital conversion processing circuitry would need to be integrated into the sensor where the signal is initially captured/received by the detection system.” *Id.* at ¶ 151. He then states that “adding this additional necessary circuitry in the sensor would not affect the device’s operation.” *Id.* However, as discussed above and as Dr. Mercier agreed during his deposition, it is *not* “necessary” to integrate an analog to digital converter in the sensor 102 for wireless communication. Dr. Mercier’s suggestion in paragraph 151 that an analog to digital converter is necessary for wireless communication is inconsistent with his concession in the prior paragraph 150 that an analog to digital converter is not necessary for wireless communication.

180. Even assuming the analog signals from the detector need to be converted to digital signals prior to being wirelessly transmitted from the sensor unit to the monitor (which they do not), that would, at most, only motivate a POSITA to add an analog-to-digital converter to the sensor unit in Lisogurski. As shown in the block diagram of FIG. 1, front end processing circuitry 150 includes several individual components, including an analog conditioner 152 and an analog-to-digital converter 154.



Ex. 1027 at FIG. 1 (excerpted and annotated)

181. Lisogurski explains that the analog conditioner 152 “may perform any suitable analog conditioning of the detector signal.” Ex. 1027 at 13:12-20. Lisogurski then explains that “[t]he conditioned analog signal may be processed by analog-to-digital converter 154, which may convert the conditioned analog signal

into a digital signal.” *Id.* at 13:21-23. Lisogurski further explains that the dark subtractor 162 “may operate on the digital signal.” *Id.* 13:60. Lisogurski teaches, and a POSITA would understand, that the analog signal from the detector in the sensor unit is first conditioned by the analog conditioner 152, then converted to a digital signal by the analog-to-digital converter 154, and then the digital signal is used by the dark subtractor 162. Lisogurski does not disclose or suggest that the dark subtractor 162 operates on the analog signal from the detector in the sensor unit. Thus, the only components from the front end process circuitry that would be necessary for analog-to-digital conversion are, at most, the analog conditioner 152 and the analog-to-digital converter 154.

182. Petitioner and Dr. Mercier do not explain why a POSITA would allegedly be motivated to modify the sensor unit in Lisogurski to include the entirety of the front end processing circuitry 150 as opposed to only the analog conditioner 152 and the analog-to-digital converter 152. Petition at 49-50; Ex. 1003 at ¶¶ 149-152. In particular, they do not explain why a POSITA would allegedly be motivated to modify the sensor unit to include the dark subtractor 162. *Id.*

183. Dr. Mercier further asserts that a “POSITA would have been motivated to make this routine adjustment to Lisogurski’s optical sensor based on the market trends towards miniaturized, power-efficient electronics used for health and fitness applications.” Ex. 1003 at ¶ 151. I disagree.

184. Dr. Mercier does not explain why modifying Lisogurski's sensor to incorporate the front end processing circuitry from the monitor would allegedly result in "miniaturized . . . electronics." Ex. 1003 at ¶ 151. A POSITA would recognize that if Lisogurski's sensor were modified to include the front end processing circuitry 150 from the monitor 104, this would lead to an increased component count within the sensor and would increase its physical size or footprint. To the extent a POSITA wanted to miniaturize Lisogurski's sensor 102, they would not add the front end processing circuitry 150 to the sensor 102 – they would keep it in the monitor 104.

185. Dr. Mercier and Petitioner's proposed modification to Lisogurski fails to account for the fact that the wearable device must be adapted to be worn on a wrist of the user. A POSITA would recognize that the form factor of the device is important for a wrist-worn device, i.e., it must be sized and shaped so that it may be worn on a wrist. While Dr. Mercier and Petitioner do not address this issue, a POSITA would recognize that there are at least two potential ways to construct a wearable device adapted to be worn on a wrist. For example, the detection system could be implemented in a housing like a watch face. A typical watch face with a circular shape has a circumference that can range between approximately 1-2 inches. This means that the internal components (including the detection system, battery, and wireless communication components) would need to fit within a relatively small

housing. As another example, the detection system could be implemented within a curved band. This would require curved components or components that are small enough to fit within the curved band. Petitioner and Dr. Mercier do not explain how a POSITA would implement additional components in the sensor (in particular, the front end processing circuitry 150) within the physical constraints of a wearable device that must be adapted to be worn on a wrist.

186. Dr. Mercier further does not explain why modifying Lisogurski's sensor to incorporate the front end processing circuitry from the monitor would allegedly result in "power-efficient electronics." Ex. 1003 at ¶ 151. A POSITA would recognize that if Lisogurski's sensor were modified to include the front end processing circuitry from the monitor, the sensor would require *more* power to operate and reduce the battery life of the sensor. The power requirements of the sensor 102 would be substantial if it were modified to include the front end processing circuitry 150 while actively monitoring health conditions and actively communicating wirelessly with the monitor 104. A POSITA would not have been motivated to modify Lisogurski's sensor in a way that increases power consumption and reduces the battery life.

187. Dr. Mercier agreed that constantly monitoring health conditions and active wireless communication would require substantial amounts of peak and average power draws. Ex. 2052 at 90:7-92:6; Ex. 2051 at ¶ 139. He also agreed

battery life is an important consideration in the context of a wearable device and that the pace of battery miniaturization was slow in the 2013 timeframe. Ex. 2052 at 84:2-85:3; Ex. 2050 at 28. But Dr. Mercier's proposed modification would lead to reduced battery life and/or require a larger battery increasing the device size.

188. I further note that in Dr. Mercier's 2012 thesis, he stated that "[f]rom a system perspective, it makes sense to push complexity away from locations where weight and volume (and as a result, energy) are constrained, and move this complexity to locations where energy is more abundant." Ex. 2050 at 29; Ex. 2052 at 86:13-23. Applying this to Lisogurski, the weight, volume, and energy are constrained in the wearable sensor 102, but are less constrained in the monitor 104, which does not need to be designed to have a wearable form factor. The monitor 104 can be much larger and does not necessarily need to be powered by a battery. This is why Lisogurski places the front end processing circuitry 150 (among other components) in the monitor 104 rather than the sensor 102.

189. A POSITA would understand that adding additional components to the sensor 102, such as the front end processing circuitry 150, would introduce an additional source of noise. All powered electronic components generate noise. In FIG. 1 of Lisogurski, the components in the monitor 104 are physically isolated from the sensor 102 and do not introduce noise. If the front end processing circuitry 150 were added to the sensor 102, this would introduce more heat and noise and reduce

the signal to noise ratio and/or signal to background ratio.

3. Limitation 7[c]: Lisogurski, Alone or with Carlson, Does Not Disclose or Render Obvious the Claimed Lens

190. Limitation 7[c] recites: “the wearable device comprising one or more lenses configured to receive at least a portion of the output optical light and to deliver a lens output light to tissue comprising skin.” Ex. 1001 at 87:4-7.

191. The Petition analyzes this limitation in two parts. First, the Petition addresses “Lisogurski Alone.” Petition at 43. Then, the Petition addresses “Lisogurski + Carlson.” *Id.* at 45. Dr. Mercier’s declaration presents the same theories. *See* Ex. 1003 at ¶¶ 137-145. I address these theories in turn below.

a) Lisogurski Alone

192. The Petition argues that “Lisogurski teaches a wearable device . . . comprising one or more lens configured to receive at least a portion of the output optical light and to deliver a lens output light to tissue comprising skin” and that “Lisogurski teaches that its measurement device . . . is configured to receive a portion of the output optical light via, e.g., an encapsulant or a lens system that captures and focuses the emitted light.” Petition at 43-44. I disagree.

193. The Petition does not identify any express disclosure of a lens in Lisogurski. Petition at 43-45. Indeed, Lisogurski does not expressly disclose a lens. The words “lens” and “lenses” do not appear in Lisogurski and no lens is illustrated

in any of the figures. *See* Ex. 1027.

194. Dr. Mercier conceded during his deposition that Lisogurski does not expressly disclose a lens. Ex. 2052 at 60:5-10. In his declaration, Dr. Mercier asserts that “a POSITA would have understood Lisogurski teaches an LED with an encapsulant that may or may not function as a lens, rather than an LED with no encapsulant at all, as such an approach would not likely operate reliably under real-world use.” Ex. 1003 at ¶ 139. Dr. Mercier appears to be contending that it is possible that the LEDs in Lisogurski include an encapsulant that functions as a lens while acknowledging that it is also possible that the LEDs in Lisogurski do not include an encapsulant at all or include an encapsulant that does not function as a lens.

195. Dr. Mercier does not contend that the LEDs in Lisogurski must have an encapsulant that functions as a lens or necessarily has an encapsulant that functions as a lens. Moreover, Dr. Mercier does not contend that all optically active encapsulants would function as a lens. Ex. 2052 at 57:14-20 (“Certainly some optically active encapsulants would function as a lens. I’m not sure about all: I’d have to consider that more carefully”).

196. The Petition does not identify any express disclosure in Lisogurski that any LEDs include a lens or an encapsulant, let alone an encapsulant that functions as a lens. Petition at 43-45. Indeed, Lisogurski does not expressly disclose that an LED includes an encapsulant or that an encapsulant can function as a lens. The word

“encapsulant” does not appear in Lisogurski and no encapsulant is illustrated in any of the figures. *See* Ex. 1027. Like the Petition, Dr. Mercier does not identify any express disclosure of an encapsulant in Lisogurski. Ex. 1003 at ¶¶ 137-141. During his deposition, Dr. Mercier testified that he was “not sure” whether Lisogurski expressly discloses that its LEDs include an encapsulant and agreed that he did not cite any explicit disclosure of an encapsulant in his declaration. Ex. 2052 at 58:14-24.

197. The Petition and Dr. Mercier assert that there are three types of LEDs: (1) LEDs with no encapsulant; (2) LEDs with an optically inert encapsulant; and (3) LEDs with an optically active encapsulant that function as, e.g., a lens. Petition at 44; Ex. 1003 at ¶ 139. Petitioner and Dr. Mercier do not assert that the first option (LEDs with no encapsulant or the second option (LEDs with an optically inert encapsulant) meet the requirement of “one or more lenses” in limitation 7[c]. *Id.* None of these three options are expressly disclosed in Lisogurski or Carlson (the only references in Ground 1).

198. I agree with Petitioner and Dr. Mercier that the LEDs in Lisogurski do not necessarily include an encapsulant, let alone an encapsulant that functions as a lens. It is possible that the LEDs described in Lisogurski could be implemented with no encapsulant or an encapsulant that does not function as a lens and does not meet the requirements of limitation 7[c] in claim 7 of the ‘790 Patent.

b) Lisogurski + Carlson

199. Petitioner and Dr. Mercier contend that Carlson teaches or renders obvious the use of a lens as claimed. Petition at 35-37, 42-47; Ex. 1003 at ¶¶ 142-145. I disagree.

200. As an initial matter, like Lisogurski, Carlson does not expressly disclose that any of its LEDs include an encapsulant, let alone an encapsulant that functions as a lens. *See* Ex. 1028.

201. The Petition discusses an alleged motivation to combine Lisogurski and Carlson in a separate subsection prior to analyzing each limitation of claim 7. Petition at 35-37. Dr. Mercier similarly discusses an alleged motivation to combine in a separate subsection of his declaration. Ex. 1003 at ¶ 107-111.

202. Petitioner and Dr. Mercier both assert that both Lisogurski and Carlson “concern miniaturized, wireless pulse oximetry devices directed to the same applications (in particular, remote monitoring of a person’s pulse, oxygen saturation, and other characteristics).” Ex. 1003 at ¶ 107; Petition at 35. As discussed below, Petitioner and Dr. Mercier do not address the fact that Carlson is directed to a transmission oximetry embodiment.

203. Petitioner and Dr. Mercier provide the following annotated version of FIG. 4 of Carlson.

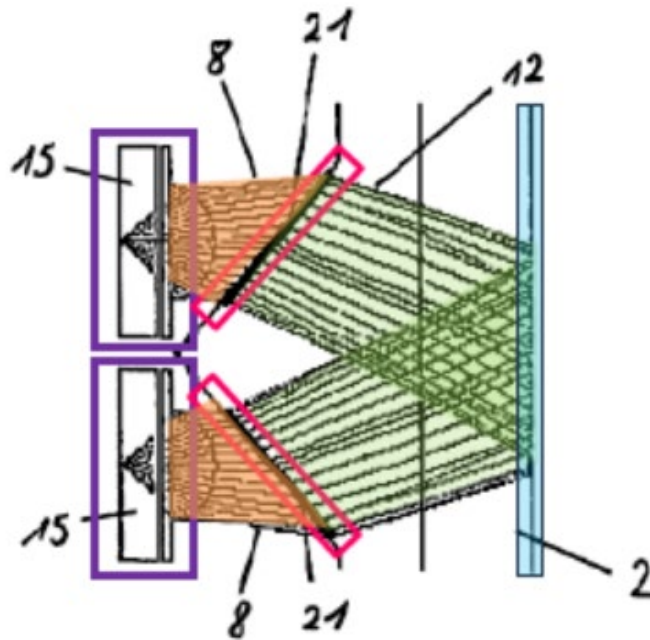


Figure 4

204. Carlson describes FIG. 4 as follows: “it is proposed, as shown in FIG. 4, to use beam shaping optics 20 to direct the emitted optical radiation 8 emitted from the two LEDs 15 to the middle of the earlobe. As it is shown clearly in FIG. 4, using the beam shaping optics 21, the two initial light beams 8 are guided in form of bundled beams 12 to a relatively small area within the middle ear 2.” Ex. 1028 at ¶ [0054]. Carlson also teaches that the purpose of the beam shaping elements is “to direct the emitted optical radiation of, e.g., the LED light source into the human or animal tissue and the photo detecting element in order to increase the optical signal power, detected by the pulsoximeter sensor, and thus increasing the Signal/Noise—and signal/Background ratio.” *Id.* at ¶ [0014].

205. Carlson describes an undesirable situation where “the beam path could

divert substantially from the optical axis of the LED and the photo detector” and that explains “it is preferred to further provide means for stabilizing the signal guiding and detecting and to provide means for the beam path to be co-linear with the optical axis of the LED and the photo detector.” Ex. 1028 at ¶ [0073]. Carlson also describes a clamping mechanism “which guarantees that the beam path has always been co-linear with the optical axis 67 of the LED and the photo detector.” *Id.*

206. As discussed above, claim 7 of the ‘790 Patent recites that the detection system is “configured to receive at least a portion of the lens output light reflected from the tissue.” Ex. 1001 at 87:8-10. Carlson, by contrast, is directed to transmission oximetry where a photodetector is measuring light that is transmitted through the tissue (e.g., an earlobe) rather than light that is reflected from the tissue. A POSITA would recognize, and Carlson teaches, that the beam-shaping elements are intended to focus light emitted from LEDs to direct a beam of light through the tissue and directly onto the detector on the opposite side. This ensures that the beam of light passing through the tissue is co-linear with the detector, i.e., pointed directly at the detector.

207. Petitioner and Dr. Mercier fail to address why or how Carlson’s teachings pertaining to transmission oximetry apply to reflectance oximetry. In the case of reflectance oximetry, there is no need to ensure that a beam of light from the LEDs is directly aligned with a detector. In reflectance oximetry, it is not

geometrically possible to align the LED(s) directly across from the detector(s) since they are positioned on the same side of the sample being measured.

208. Lisogurski and Carlson also differ in terms of their form factor, which is at least in part dictated by whether they use transmission or reflectance oximetry. Petitioner and Dr. Mercier contend that Lisogurski discloses a wearable device adapted to be worn on a wrist. *See* Petition at 38-39; Ex. 1003 at ¶¶ 127-128. Carlson does not disclose a wearable device adapted to be worn on a wrist. Instead, Carlson only suggests using its sensor on the following locations of the user's body: ear, finger, or toe. Ex. 1028 at ¶¶ [0048], [0052], [0075]. A POSITA would know that the transmission oximetry technique used in Carlson for these locations would not be viable for a wrist-worn wearable device, i.e., one could not realistically place LED(s) on one side of the wrist and have a detector on the opposite side of the wrist measure the light that passes through. Dr. Mercier agreed during his deposition that transmission oximetry would not be viable for a wrist-worn embodiment. Ex. 2052 at 122:18-21, 117:15-17, 116:21-117:8.

209. Dr. Mercier asserts that “both references teach techniques for improving the signal-to-noise ratio (SNR) of pulse oximeter systems” and “Lisogurski and Carlson are directed to analogous systems that aim to solve the same problems” and “thus would have been considered together by a POSITA.” Ex. 1003 at ¶ 107; Petition at 35-36 (asserting same). Dr. Mercier lists several “techniques”

described in Lisogurski and asserts that “[t]hese teachings in Lisogurski would have motivated a POSITA to look for other techniques accomplishing the same objectives (minimizing power consumption and increasing SNR).” Ex. 1003 at ¶ 108; Petition at 36. Dr. Mercier does not explain why a POSITA reviewing Lisogurski would “look for other techniques” to achieve the same objectives. Indeed, he characterizes Lisogurski and Carlson as describing “techniques for accomplishing the same objectives.” *Id.* Dr. Mercier does not assert that a POSITA would recognize any shortcomings or limitations regarding the techniques described in Lisogurski that would motivate them to look to another reference like Carlson.

210. Petitioner and Dr. Mercier allege that a POSITA would have looked to Carlson’s beam shaping elements to improve the signal to noise and/or signal to background ratio. Ex. 1003 at ¶ 107; Petition at 35-36. But this overlooks that Carlson describes multiple ways to potentially increase the signal to noise or signal to background ratio relative to conventional pulse oximetry.

211. For example, Carlson discloses that “[a]s an alternative” to using beam shaping optics, “it is also possible to influence the sensor architecture of the pulsoximetric sensor.” Ex. 1028 at ¶ [0055]. For example, “it is possible to use a light receiving or light sensitive element 11 with reduced light sensitivity outside the spectral range of the band limited light source as LEDs.” *Id.* In other words, Carlson discloses that the signal to noise ratio and/or signal to background ratio can be

increased by using a detector that is more sensitive to the wavelengths of light emitted from the LEDs and less sensitive to other wavelengths of light.

212. Carlson also describes using filters. For example, a double pass filter 33 can be used to ensure that light with a wavelength between 660 nm and 580-910 nm passes through the filter to the detector. Ex. 1028 at ¶¶ [0056], [0062].

213. Carlson states that when using a beam-shaping element, “[t]he increase of the S/B ratio is estimated e.g. to a factor 5.” Ex. 1028 at ¶ [0014]. Carlson states that when “using geometric baffles or light traps, respectively, and/or optical wavelength filters,” “[t]he increase of the S/B ratio is e.g. estimated to a factor 10-100.” *Id.* at ¶ [0017]. Carlson further states that “[b]y using sensor architecture as shown in FIG. 6c, the Signal-to-Background ratio may be increased in a range of a factor 50 to 1000.” *Id.* at ¶ [0063]. I note that these increases in Carlson are for transmission oximetry and there is no indication that they would apply to reflectance oximetry. I further note that the increases appear to be relative to an embodiment of transmission oximetry that does not contain any of the features described in Carlson besides the emitter and detector. There is no indication in Carlson, or from Petitioner or Dr. Mercier, that the reported improvements described in Carlson would apply to Lisogurski, which as discussed herein, describes a different technique than Carlson for increasing the signal to noise ratio.

214. Even assuming that a POSITA was motivated to increase the signal to

noise and/or signal to background ratio in Lisogurski as Petitioner and Dr. Mercier suggest, according to Carlson, using a beam-shaping element alone would be the least effective way of doing so since using baffles, light traps, and/or filters would be between 2 and 20 times more effective and using the embodiment in FIG. 6c of Carlson would be between 10 and 200 times more effective than adding the beam shaping element. Petitioner and Dr. Mercier have not proposed modifying Lisogurski to include baffles, light traps, and/or filters or to match the embodiment in FIG. 6c. The fact that Petitioner and Dr. Mercier do not propose adding these additional features—which Carlson claims would increase the signal to noise and/or signal to background ratio—undermines their proposed motivation to modify Lisogurski with Carlson to increase the signal to noise and/or signal to background ratio.

215. Furthermore, Carlson explains that its objective is to allow “for robust application of pulsoximetry in telemedicine- and near patient testing applications in rough (optical) environmental conditions, e.g. at changing light influences, such as sunlight, shadow, artificial light, etc.” Ex. 1028 at ¶ [0010]. In reference to FIG. 3, Carlson explains that “Walking around through various rooms, one time halogen light is influencing the light beam 8, the other time conventional light is influencing the measurement, and again at another time, for the person using a car, the sunlight is influencing the measurement, e.g. if sunlight and shadow alternate within a period

of time.” *Id.* at ¶ [0053]. Carlson then explains that the embodiment shown in FIG. 4, which includes the beam shaping elements that Petitioner and Dr. Mercier rely on, solve this problem because “[b]y using the beam shaping optics 21, of course the influence of environmental light or noise, respectively, can be reduced substantially by increasing the S/B ratio.” *Id.* at ¶ [0054]. In other words, Carlson teaches that the purpose of using the beam shaping optics (lenses) is to reduce the influence of environmental light on the signal.

216. Petitioner and Dr. Mercier’s reliance on Carlson overlooks that Lisogurski already teaches a technique for eliminating environmental/ambient light from the signal. Lisogurski’s dark subtraction technique removes ambient light and noise by measuring light when LEDs are off and subtracting that from the measurement when LEDs are on. Ex. 1027 at 16:44-17:10. As shown in FIG. 2A, there is a red light “on” period 202 and IR light “on” period 204, with “off” periods in between. Ex. 1027 at 11:62-12:41, FIG. 2A.

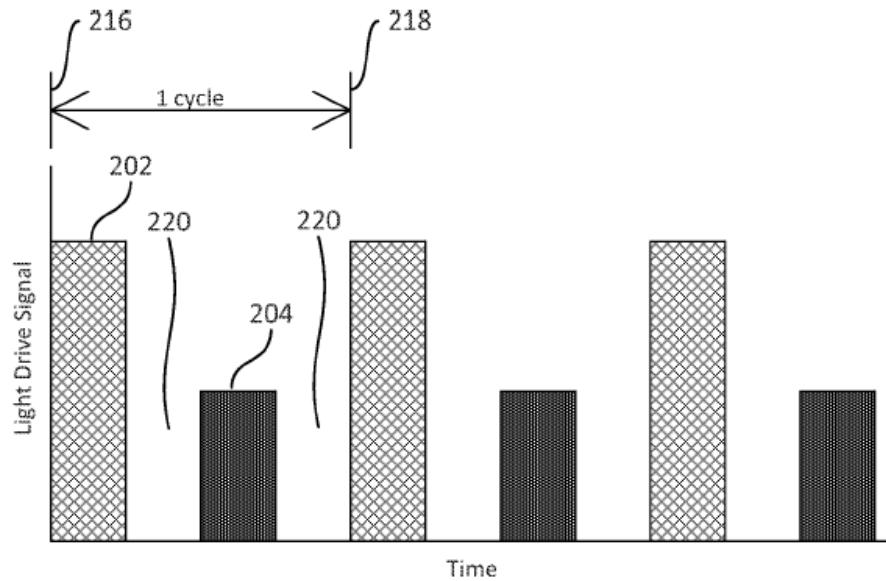


FIG. 2A

Ex. 1027 at FIG. 2A

217. FIG. 2B shows peaks of the detector waveform 214 when the light is on and dark current 222 which is when the light is off. Ex. 1027 at 12:52-13:6.

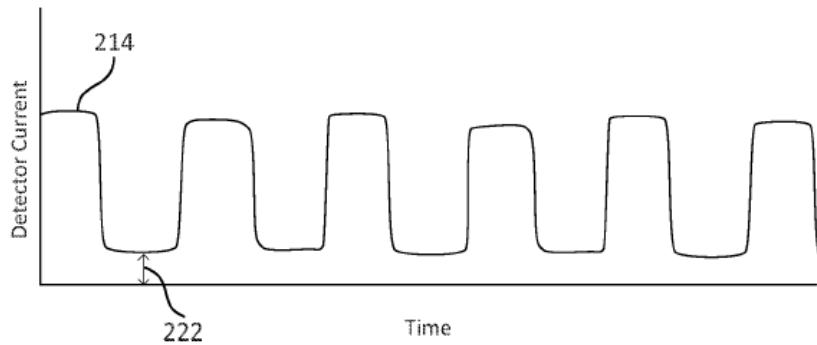


FIG. 2B

Ex. 1027 at FIG. 2B

218. Lisogurski eliminates the effects of ambient light on the detector signal

by subtracting the dark current 222 from the detector current waveform 214. Ex. 1027 at 13:60-14:10. Thus, the concern in Carlson that underpins why it uses beam shaping optics (eliminating the effect of ambient light) has already been addressed by Lisogurski through its substrative technique. A POSITA starting with Lisogurski would have no reason to add Carlson's beam shaping optics for reducing the influence of ambient light when Lisogurski already uses a technique that obviates that concern.

B. Ground 2: Obviousness Based on Lisogurski and Carlson in view of Lamego (Claim 7)

219. In Ground 2, Petitioner and Dr. Mercier assert that claim 7 of the '790 Patent is obvious over Lisogurski and Carlson in view of Lamego. Petition at 72; Ex. 1003 at ¶¶ 99-104, 112-15, 206-16. For the reasons discussed below, I disagree.

220. Petitioner and Dr. Mercier do not rely on Lamego for limitations 7[c] or 7[d]. Petition at 77; Ex. 1003 at ¶ 205. Thus, my analysis above regarding those limitations applies equally to Ground 2.

1. Lamego Does Not Disclose a Wearable Device at Least in Part Configured to Identify an Object

221. As discussed above, Lisogurski fails to disclose limitation 7[l] for at least two reasons: (1) the wearable device is not configured to identify an object even under Petitioner and Dr. Mercier's contentions and (2) Lisogurski does not identify an object under the Board's prior claim construction.

222. Petitioner and Dr. Mercier's reliance on Lamego in Ground 2 does not cure either deficiency because (1) Lamego does not disclose recognizing or establishing an object as a particular thing and (2) even if it did, the Lisogurski-Carlson-Lamego combination does not include a wearable device configured to identify an object.

223. Lamego's multi-wavelength pulse oximeter 299 is shown in Figure 3.

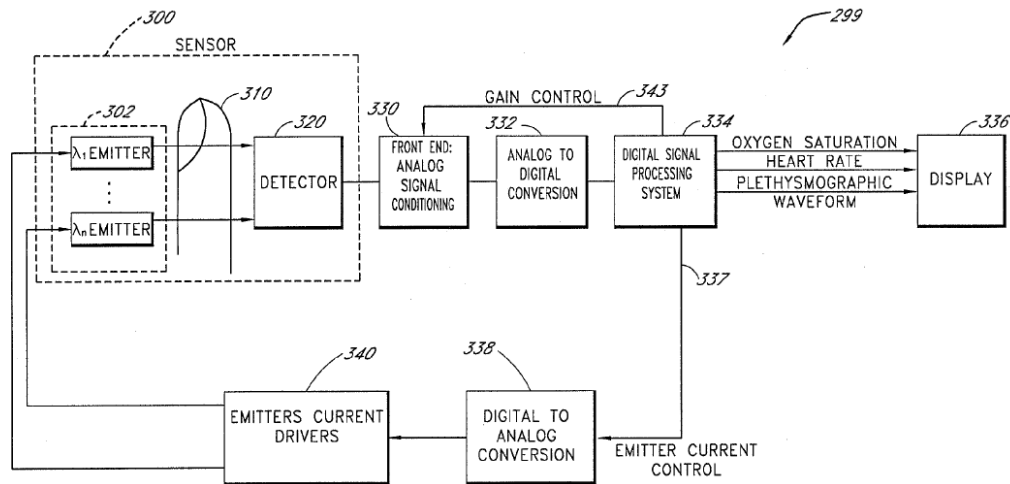


FIG. 3

Ex. 1062 at FIG. 3

224. The system includes a sensor 300 including at least three LEDs (shown as emitters 302) and a photodetector 320. Ex. 1062 at ¶ [0041]. The embodiment shown in FIG. 3 is a transmission mode embodiment, i.e., light is passed through a finger 310 and measured by a detector on the opposite site. *Id.* The photodetector 320 is connected to front end analog signal conditioning circuitry 330, which in turn

has outputs connected to an analog to digital conversion circuit 332, which in turn has outputs connected to digital signal processing system 334. *Id.* at ¶¶ [0041]-[0042]. The digital signal processing system 334 determines parameters such as oxygen saturation, heart rate, and/or a PPG waveform. *Id.* at ¶ [0043].

225. Dr. Mercier cites Lamego's multi-wavelength teachings, contending that Lamego discloses that "its system is capable of determining the levels and/or concentrations of constituents (including constituents not inherently present in the body), such as 'methemoglobin (MetHb), carboxyhemoglobin (COHb), low hemoglobin levels, high hemoglobin levels, bilirubin, methylene blue, deoxyhemoglobin, and lipids.'" Ex. 1003 at ¶ 208 (quoting Ex. 1062 at ¶¶ [0035]-[0036]). Dr. Mercier then provides a bullet-point list of quotes from Lamego. None of these disclose recognizing or establishing an object as a particular thing. I address each quote below.

226. In the first bullet point in paragraph 208, Dr. Mercier quotes paragraph 35 of Lamego. Ex. 1003 at ¶ 208 (quoting Ex. 1062 at ¶ [0035]). In this paragraph, Lamego explains that using more than two wavelengths "can help the system compensate for the additional significant absorbers and enable more accurate calculation of the concentration of each absorber and the blood oxygen saturation." Ex. 1062 at ¶ [0035]. This does not disclose recognizing or establishing an object as a particular thing. It merely describes using the same techniques as Lisogurski, but

with more than two wavelengths. For example, in addition to using red and IR wavelengths, an additional wavelength corresponding to another constituent could be used. Adding an additional wavelength to traditional oximetry does not mean that it identifies an object.

227. In the second bullet point in paragraph 208, Dr. Mercier quotes paragraph 36 of Lamego. Ex. 1003 at ¶ 208 (quoting Ex. 1062 at ¶ [0036]). Here, Lamego states that its system can “determine several blood constituent concentrations based upon signals measured from just the non-red light sources” and says that it “can determine levels and/or concentrations of” certain constituents.” Ex. 1062 at ¶ [0036]. This does not disclose recognizing or establishing an object as a particular thing. It merely describes measuring the quantities of certain constituents. Nothing in Lamego suggests that the system must recognize or establish an object as a particular thing to measure a known constituent. This is not unlike traditional oximetry, where measuring oxygen saturation does not require identifying an object.

228. In the third bullet point in paragraph 208, Dr. Mercier quotes paragraph 37 of Lamego. Ex. 1003 at ¶ 208 (quoting Ex. 1062 at ¶ [0037]). In this paragraph, Lamego discusses how MetHb could cause inaccurate blood oxygen readings and that a “two-wavelength physiological monitor would provide reduced readings of blood oxygen concentration, but would not be able to identify the cause for the decreased reading, or to compensate for such readings.” Ex. 1062 at ¶ [0037]. He

also quotes Lamego's statement that "the multi-wavelength physiological monitors . . . could not only identify the cause of decrease S_pO_2 readings, but also (or alternatively) compensate for such cause." *Id.* Earlier in paragraph 208, Dr. Mercier emphasizes the word "identify" from these sentences, but they do not disclose recognizing or establishing an object as a particular thing. Identifying the cause for something is not the same as recognizing or establishing an object as a particular thing.

229. Based on these paragraphs in Lamego, Dr. Mercier asserts that "by 'identify[ing]' the presence and determining the concentrations and/or levels of other constituents in a user's blood, Lamego's multi-wavelength monitor can 'compensate' for these blood constituents to provide a more accurate S_pO_2 reading." Ex. 1003 at ¶ 209. This conflates detecting with identifying. As discussed above, determining the presence of something is not the same thing as identifying an object. Determining the concentration and/or levels of something, i.e., measuring something, is not the same as identifying an object as a particular thing.

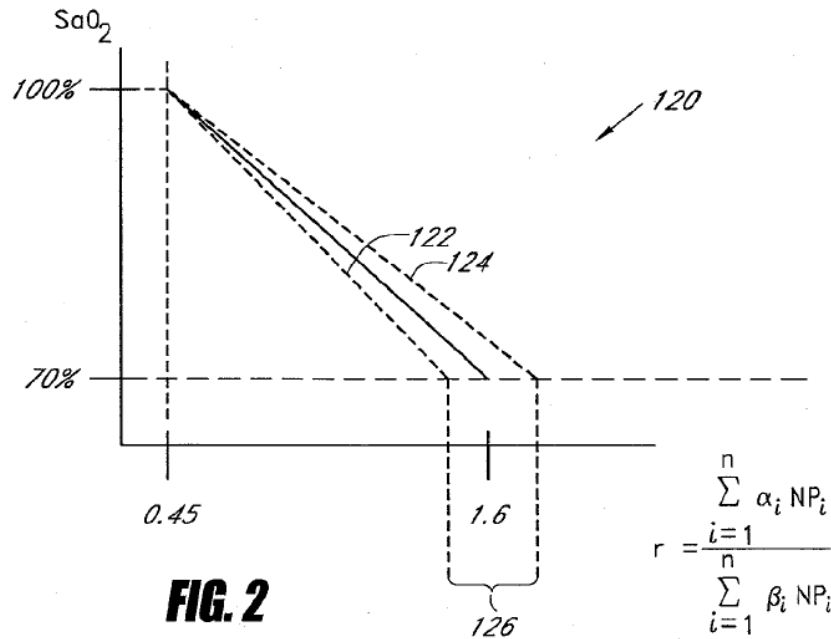
230. Dr. Mercier goes on to assert that "in the MetHb example excerpted above, Lamego discloses a technique for identifying MetHb as an object causing decreased S_pO_2 readings." Ex. 1003 at ¶ 209 (citing Ex. 1062 at ¶ [0037]). This is incorrect. As I discussed above, Lamego does not disclose "identifying MetHb as an object." Instead, Lamego is simply using the same principles as traditional two-

wavelength oximetry—which does not involve identifying an object—and adds another wavelength. As a blood constituent, MetHb is a pre-defined known variable. It is not an unknown object to be identified. A POSITA would understand that Lamego’s system knows from the outset what it is looking for (specific blood constituents) and uses additional wavelengths to measure those known constituents more accurately.

231. Dr. Mercier also asserts that “Lamego’s multi-wavelength monitor can recognize, establish, and separate carboxyhemoglobin and oxyhemoglobin as different constituents and that Lamego increases accuracy “by identifying the presence of a blood constituent that may cause an aberrant SpO2 reading” and “measuring the concentration of that blood constituent.” Ex. 1003 at ¶ 210. I disagree. Lamego does not disclose that improving the accuracy requires “identifying the presence of a blood constituent” and “measuring the concentration of that blood constituent.” Like traditional oximetry, Lamego simply uses known properties of constituents and estimates blood oxygen saturation using an equation or calculation where the inputs are measured signals. This does not require recognizing or establishing an object as a particular thing.

232. Petitioner and Dr. Mercier fail to address Lamego’s description of how blood oxygen saturation is calculated. FIG. 2 of Lamego shows an arterial blood oxygen curve where arterial blood oxygen saturation is represented on the y-axis and

the x-axis represents ratios of composite signals, each comprising signals based upon the light transmission of the various light wavelengths. Ex. 1062 at ¶ [0033].



Ex. 1062 at FIG. 2

233. Lamego provides the following equation for expressing each ratio r , where n is the number of wavelengths used by the monitor, and alpha and beta are coefficients. Ex. 1062 at ¶ [0033].

$$r = \frac{\sum_{i=1}^n \alpha_i NP_{RMS,i}}{\sum_{i=1}^n \beta_i NP_{RMS,i}}$$

This makes clear that calculating blood oxygen saturation does not require recognizing or establishing an object as a particular thing.

234. Dr. Mercier next asserts that “Lamego also teaches mathematical modeling and statistical techniques for processing the data . . . to determine which wavelength corresponds to which constituent.” Ex. 1003 at ¶ 212. It is unclear whether Dr. Mercier is contending that this qualifies as identifying an object. In any event, Lamego is not determining which wavelength corresponds to which constituent – that is a known property. The wavelengths of light that are emitted from the light source(s) are selected based on these known properties.

235. Dr. Mercier also refers to “techniques for the separation, processing, and analysis of the data” and a statistics modules. Ex. 1003 at ¶¶ 213-214. It is unclear if he is intending to suggest that these features qualify as identifying an object, and to the extent that is his intent, he does not explain how they meet the applicable claim construction.

236. Even if Lamego were found to disclose identifying an object, i.e., recognizing or establishing an object as being a particular thing (which it does not, as I discuss below), Petitioner and Dr. Mercier have not shown that (1) Lamego discloses a wearable device adapted to worn on a wrist that is at least in part configured to recognize or establish an object as being a particular thing or (2) that modifying Lisogurski (and Carlson) with Lamego would result in a wearable device

that is configured to recognize or establish an object as being a particular thing.

237. Lamego does not explicitly disclose that any portion of its system is adapted to be worn on a wrist of a user. To this point, Dr. Mercier states that “Lamego’s sensor may be applied in various parts of the body, including the finger and earlobe.” Ex. 1003 at ¶ 99 (citing Ex. 1062 at ¶¶ [0024], [0027]-[0029]). None of the cited paragraphs disclose a device that is worn on a wrist of user. Paragraph 24 states that a monitor “determines blood oxygen saturation by propagating multi-wavelength energy through a medium, such as a portion of a patient’s body where blood flows close to the body surface. For example, energy is propagated through an ear lobe, a digit (such as a finger or toe), a forehead, or a scalp (such as a fetus’s scalp).” Ex. 1062 at ¶ [0024]. This merely describes passing light *through* a portion of the body (but not a wrist). Paragraph 27 similarly only mentions LEDs “positioned on one side of a portion of the body where blood flows close to the body’s surface, such as a finger, and a photodetector is positioned on the opposite side of the surface.” *Id.* at ¶ [0027]. Stating that the LEDs and detectors are “positioned on” opposite sides of the body does not necessarily mean that they are worn. Paragraph 28 describes the makeup of the finger. *Id.* at ¶ [0028]. Paragraph 29 similarly only mentions a finger. *Id.* at ¶ [0029].

238. Lamego does not disclose a wearable device that is at least in part configured to identify an object. Lamego does not specify which, if any, components

shown in Figure 3 are part of a wearable device. As noted above, the closest Lamego comes to describing something worn by a user is when describing LEDs and a detector on opposite sides of a finger. A POSITA would understand that, at most, the sensor 300 shown in FIG. 3 would be part of a wearable device, but the other components shown in FIG. 3 would not be. Ex. 1062 at FIG. 3. This understanding is consistent with Figure 1 of Lisogurski, where only the sensor 102 including light source 130 and detector 140 is worn by a user. Ex. 1027 at FIG. 1.

239. Additionally, Petitioner and Dr. Mercier do not allege that it would have been obvious in view of Lamego to modify Lisogurski (as modified by Carlson) such that the wearable device is at least in part configured to identify an object. Petition at 74-83; Ex. 1003 at ¶¶ 112-115, 204-216. Rather, they merely assert that a POSITA would have “implemente[ed] Lamego’s multi-wavelength sensor teachings in a system based on Lisogurski” and more specifically modify “Lisogurski’s light source to include additional LEDs with additional wavelengths.” Ex. 1003 at ¶ 115; *see also id.* at ¶ 215; Petition at 74-77. In the resulting combination of Lisogurski, Carlson, and Lamego, it would still be Lisogurski’s back end processing circuitry 170 (which is not part of the wearable device) that determines physiological parameters and would perform the alleged identification according to Petitioner and Dr. Mercier.

2. A POSITA Would Not Combine Lisogurski, Carlson, and Lamego

240. In a section titled “Motivation to Combine,” the Petition argues that “Lisogurski, Carlson, and Lamego are also analogous references” and that a “POSITA would have considered the references together when implementing a system based on Lisogurski’s teachings.” Petition at 74; *see also* Ex. 1003 at ¶ 112 (“A POSITA would have considered the optical measurement systems taught by Lisogurski and Carlson together with Lamego because (as described above for Lisogurski and Carlson, *supra* § VIII.B.1) all three references are analogous”). I am informed and understand that while prior art references must be “analogous art” for purposes of obviousness, the mere fact that certain references are “analogous art,” standing alone, does not mean that a POSITA would have been motivated to combine them to arrive at the claimed invention.

241. The Petition next summarizes Lisogurski and Lamego. With respect to Lisogurski, the Petition argues “Lisogurski recognizes that variation in the constituents found in the human body, such as variation in skin pigmentation, may affect the quality of measurement of physiological parameters.” Petition at 75. The Petition also argues that “Lisogurski and Carlson also both seek to mitigate the effects of patient motion on signal-to-noise ratio and measurement accuracy.” Petition at 75. With respect to Lamego, the Petition argues “Lamego describes an

optical measurement system that uses multiple wavelengths of light in the sensor to increase the accuracy of measurements of physiological parameters” and “Lamego expressly recognizes that its multi-wavelength technique can be used to improve the accuracy and signal-to-noise ratio of blood oxygen saturation measurements.”
Petition at 76.

242. The Petition then argues “a POSITA would have looked to Lamego to implement and obtain more accurate readings and increase signal-to-noise ratio from Lisogurski’s physiological monitor because a POSITA would have looked for ways to improve the operation of a device by looking to complementary designs and techniques.” Petition at 76. Petitioner and Dr. Mercier do not explain how modifying Lisogurski (and Carlson) with Lamego would result in “more accurate readings and increase[d] signal-to-noise ratio.” Petition at 76. As Petitioner and Dr. Mercier acknowledge, Lisogurski and Carlson already teach techniques for improving the quality and accuracy of physiological measurements and signal-to-noise ratio. Petition at 75. Petitioner and Dr. Mercier provide no evidence or analysis that Lamego offers any improvement relative to the techniques taught in Lisogurski and Carlson that would allegedly motivate a POSITA to modify Lisogurski and Carlson with Lamego.

243. I note that the “Motivation to Combine” section of the Petition does not specifically address why it allegedly would have been obvious to combine

Lisogurski, Carlson, and Lamego to satisfy limitation 7[1]. Petition at 74-77. Dr. Mercier similarly does not specifically address limitation 7[1] in his “Lisogurski and Carlson in view of Lamego” motivation to combine section of his declaration. Ex. 1003 at ¶¶ 112-15.

244. In discussing limitation 7[1], the Petition merely alleges that “a POSITA would have been motivated to combine the teachings of Lisogurski (in view of Carlson) with Lamego to improve the optical measurement of, e.g., blood oxygen concentration, consistent with Lisogurski’s stated goals of reducing noise and improving accuracy.” Petition at 82 (citing Ex. 1003 at ¶ 215). The cited paragraph from Dr. Mercier’s declaration says something different. Dr. Mercier asserts that “a POSITA would have been motivated to combine the teachings of Lamego into the optical measurement system of Lisogurski (as modified by Carlson) with the goal of improving the accuracy and signal-to-noise ratio of the system’s blood oxygen saturation measurements.” Ex. 1003 at ¶ 215. Here, Dr. Mercier does not expressly say that adding Lamego would improve the accuracy and SNR; he merely says that that would be a POSITA’s end goal. *Id.*

245. Additionally, Dr. Mercier alleges that a POSITA would have implemented “Lamego’s multi-wavelength sensor into a system based on Lisogurski because Lamego’s sensor is comprised of conventional LEDs.” Ex. 1003 at ¶ 215. As an initial matter, it is unclear what components comprise Lamego’s sensor in Dr.

Mercier's proposal. I note that the term "multi-wavelength sensor" does not appear in Lamego. *See* Ex. 1062. It is also unclear how Dr. Mercier is proposing that "Lamego's sensor" would be implemented in Lisogurski, including, for example, where it would be implemented in Lisogurski, how it would interact and work with other existing components in Lisogurski, and whether Dr. Mercier is proposing to substitute existing components in Lisogurski with Lamego's sensor.

246. A POSITA would not have been motivated to modify Lisogurski's pulse oximetry system with Lamego's multi-wavelength compensation framework. Lamego's system is directed to improving S_pO_2 accuracy by accounting for interfering conditions such as MetHb and COHb using additional wavelengths and modeling. Ex. 1062 at ¶¶ [0035]-[0039]. However, a POSITA would recognize that there is no technical reason to implement Lamego's eight-wavelength approach in an oximetry device, and doing so would be counterproductive for a wearable device.

247. Oximetry only requires two wavelengths to measure the ratio of oxygenated to deoxygenated hemoglobin. That is, two states of a single constituent with well-known characteristics at red and infrared wavelengths. There is no technical or physiological benefit to adding additional wavelengths for this measurement. As Lisogurski itself demonstrates, two wavelengths are sufficient to achieve oximetry. Ex. 1027 at 4:42-62.

248. A POSITA would not increase the number of wavelengths from two to

eight because doing so provides no utility for oximetry while imposing substantial design burdens. For example, adding six additional light sources (e.g., LEDs) with different wavelengths would substantially increase the component count of the device, as well as size, weight, cost and complexity. As another example, additional light sources increase power consumption, which is a critical constraint for wearable devices that must operate on limited power. Adding additional sources for additional wavelengths increase the physical size of the device. Processing signals from eight wavelengths (rather than two) substantially increases computational requirements and associated power consumption.

249. Lamego's eight-wavelength approach requires multi-dimensional calibration curves. For example, "an eight wavelength physiological monitor utilizes an eight-dimensional calibration curve, which provides eight degrees of freedom." Ex. 1062 at [0035]-[0036]. Developing and validating an eight-dimensional calibration curve with eight degrees of freedom would require empirical data collection and analysis. This represents a significant added engineering and validation burden that provides no benefit for standard oximetry measurements.

250. In sum, a POSITA would have recognized that incorporating Lamego's multi-wavelength framework into Lisogurski would substantially increase device complexity, component count, power consumption, computational requirements, and development/validation costs, which would have dissuaded a POSITA from

making the combination proposed in the Petition.

251. Dr. Mercier characterizes Lamego as complementing Lisogurski for “improving the accuracy and signal-to-noise ratio of the system’s blood oxygen saturation measurements,” not to add object identification. Ex. 1003 at ¶ 215. Notably, Dr. Mercier’s framing underscores the technical reality—the proposed combination allegedly yields an allegedly more accurate oximeter, but not a system configured to identify objects under the claim construction for “identify an object.”

252. For at least these reasons, I disagree with Petitioner’s and Dr. Mercier’s conclusions for Ground 2.

C. Ground 3: Obviousness Based on Lisogurski in view of Carlson and Soller (Claim 7)

253. In Ground 3, Petitioner and Dr. Mercier assert that claim 7 of the ’790 Patent is obvious over Lisogurski in view of Carlson and Soller. Petition at 83; Ex. 1003 at ¶¶ 105-06, 116-18, 217-30. For the reasons discussed below, I disagree.

254. Petitioner and Dr. Mercier do not rely on Soller for limitations 7[c] or 7[d]. Petition at 85; Ex. 1003 at ¶ 217. Thus, my analysis above regarding those limitations applies equally to Ground 2.

1. Soller Does Not Disclose a Wearable Device at Least in Part Configured to Identify an Object

255. Soller is entitled “Non-Invasive Optical *Measurement* of Blood Hematocrit.” Ex. 1030 (emphasis added). As background, a POSITA would

understand what hematocrit is and how it has historically been measured. Hematocrit is the fractional percentage of blood volume that is composed of red blood cells. Historically, since the 1800s, hematocrit was measured by drawing blood from a patient, anticoagulating the sample to prevent clotting, placing it in a glass tube, and centrifuging it. During centrifugation, blood separates into layers. The hematocrit is determined by measuring the volume occupied by the layer of red blood cells relative to the total blood volume.

256. In the background section, Soller explains that hematocrit can be measured non-invasively and describes two approaches, one of which is an optical approach. Ex. 1030 at 1:30-44. Soller states that “[a]ll of the reported optical techniques are variations on oximetric methods where hematocrit is measured using only the concentrations of oxygenated and deoxygenated hemoglobin.” *Id.* It also states that “[t]he concentrations of oxygenated and deoxygenated hemoglobin are directly measured by absorption or reflection using 2 to 4 wavelengths of light in the near-infrared region of the hemoglobin spectrum.” *Id.*

257. In the detailed description, Soller explains that hemoglobin constitutes approximately 90% of the red blood cell, and is mostly present in oxygenated and deoxygenated forms but also exists in other forms. Ex. 1030 at 5:33-35. Soller states “[t]o accurately measure hematocrit, not only must these additional forms of hemoglobin be accounted for, but so must the remaining 10% of the cellular

components, such as the nucleus and cell membranes, which do not contain hemoglobin.” *Id.* at 5:38-42.

258. Dr. Mercier asserts that “Soller teaches a device that can quantify ‘all of the components of red blood cells’ ‘by using a larger set of wavelengths in the measurement and by using a multivariate calibration technique.” Ex. 1003 at ¶ 221 (citing Ex. 1030 at 5:41-58); *id.* at ¶ 227. Based on this, he asserts that “Soller therefore teaches or renders obvious a portable, optical device that can ‘establish or recognize’ various blood constituents through optical measurement followed by statistical and spectral analysis” and “[a] POSITA would have understood Soller to teach ‘identifying an object,’ specifically, hematocrit and its various constituents.” Ex. 1003 at ¶ 227. I disagree.

259. First, I disagree with Dr. Mercier’s suggestion that hematocrit is an object. Ex. 1003 at ¶ 227. Hematocrit is not an object – it is a biological parameter – the fractional percentage of blood volume that is composed of red blood cells. Hematocrit is like blood oxygen saturation in the sense that it is a fraction or ratio of blood constituents. Dr. Mercier does not suggest that blood oxygen saturation is an object (because it is not), and for the same reason, hematocrit is not an object. A device that outputs a percentage of hematocrit has not recognized or established an object as a particular thing.

260. Second, even if the “the various hemoglobin molecules” that Dr. Mercier refers to are objects, Soller does not teach recognizing or establishing any one of these constituents as a particular thing. Soller’s device uses a pre-trained calibration model based on Partial Least Squares (PLS) regression. Ex. 1030 at 5:42-67; 6:27-59; 22:26-42. The device takes optical spectra as input and outputs a single numerical value: hematocrit, expressed as a percentage of red blood cells in blood volume. Ex. 1030 at 1:17-44. Dr. Mercier appears to be suggesting that as part of this process, Soller must necessarily identify individual constituents as particular blood constituents. That is incorrect. Like traditional two-wavelength oximetry, there is no need to do this – Soller simply uses known properties of each constituents and factors that into an equation or model where the inputs are detected signals. This process does not entail identifying individual blood constituents.

261. Dr. Mercier does not point to any teaching in Soller that requires recognizing or establishing an object as a particular thing. Instead, Dr. Mercier incorrectly equates multivariate calibration/regression—mapping optical features to a numeric output—with object identification. Ex. 1003 at ¶¶ 219-30. A regression-based output of hematocrit does not identify discrete constituents as objects; it estimates a parameter correlated with optical features within a predefined calibration framework. Ex. 1030 at Abstract, 5:42-67; 6:27-59; 22:26-42.

262. Soller does not disclose a wearable device that is at least in part

configured to identify an object. Petitioner and Dr. Mercier do not allege that it would have been obvious in view of Soller to modify Lisogurski (as modified by Carlson) such that the wearable device is at least in part configured to identify an object. Petition at 83-90; Ex. 1003 at ¶¶ 116-118, 217-230. Rather, they merely assert that a POSITA would have been motivated to combine the teachings of Soller in Lisogurski's system. Petition at 89; Ex. 1003 at ¶ 229.

263. In the resulting combination of Lisogurski, Carlson, and Soller, it would still be Lisogurski's back end processing circuitry 170 (which is not part of the wearable device) that determines physiological parameters and would perform the alleged identification according to Petitioner and Dr. Mercier.

2. A POSITA Would Not Have Combined Lisogurski, Carlson, and Soller

264. In a section titled "Motivation to Combine," the Petition argues that "[a] POSITA would have considered Lisogurski, Carlson, and Soller together; they are analogous optical measurement systems with common applications and utility." Petition at 84; *see also* Ex. 1003 at ¶ 116 ("A POSITA would have considered the optical measurement systems taught by Lisogurski and Carlson together with Soller because...all three references are directed to analogous systems with common applications and utility."). I am informed and understand that while prior art references must be "analogous art" for purposes of obviousness, the mere fact that

certain references are “analogous art,” standing alone, does not mean that a POSITA would have been motivated to combine them to arrive at the claimed invention.

265. The Petition next summarizes Lisogurski and Soller. With respect to Lisogurski, the Petition argues that “Lisogurski specifically teaches increasing SNR while minimizing power consumption.” Petition at 84. With respect to Soller, the Petition argues that Soller “describes configuring an optical sensor to maximize the accuracy of a physiological measurement by using multiple wavelengths of light to measure the various components of blood, and increasing signal-to-noise ratio by applying various mathematical techniques well known in the art.” Petition at 84-85. Dr. Mercier similarly states that Soller “teaches configuring an optical sensor in a manner that maximizes the accuracy of the measured physiological signal by using “a larger set of wavelengths in the measurement and by using a multivariate calibration technique.”” Ex. 1003 at ¶ 117.

266. The Petition then argues that “[t]hese teachings would have motivated a POSITA to look to techniques used by other systems achieving the same objectives—part of the POSITA’s natural design process.” Petition at 84. Dr. Mercier similarly asserts that “a POSITA would have been motivated to combine the optical and mathematical techniques from Soller, including the increased number of light sources and wavelengths, into Lisogurski’s system as part of the natural design process. Ex. 1003 at ¶ 118. Petitioner and Dr. Mercier do not explain how

modifying Lisogurski (and Carlson) with Soller would result in a system that “identifies an object” under the Board-adopted construction. As Petitioner and Dr. Mercier acknowledge, Soller is directed to improving the accuracy of hematocrit measurement, not to identifying object. Petition at 84-85; Ex. 1003 at ¶¶ 117-18. Petitioner and Dr. Mercier provide no evidence or analysis that Soller offers object identification functionality that would allegedly motivate a POSITA to modify Lisogurski and Carlson with Soller to satisfy limitation 7[1].

267. I note that the “Motivation to Combine” section of the Petition does not specifically address why it allegedly would have been obvious to combine Lisogurski, Carlson, and Soller to satisfy limitation 7[1]. Petition at 83-85. Dr. Mercier similarly does not specifically address limitation 7[1] in his “Lisogurski and Carlson in view of Soller” motivation to combine section of his declaration. Ex. 1003 at ¶¶ 116-18.

268. In discussing limitation 7[1], the Petition merely alleges that “Soller teaches 7[1] under Omni’s understanding of “identify an object.”” Petition at 86. The Petition does not provide a specific motivation to combine Lisogurski, Carlson, and Soller to satisfy limitation 7[1]. Dr. Mercier similarly asserts that a POSITA would have been motivated to combine references “as part of the natural design process” to obtain “accurate measurements,” but does not explain why a POSITA seeking to add object identification functionality would look to Soller (a reference solely

directed to parameter measurement). Ex. 1003 at ¶ 118.

269. Dr. Mercier alleges that “[a] POSITA would have understood that Lisogurski’s system, which is not limited to the measurement of oxygenated and deoxygenated hemoglobin, could have been modified to measure other constituents, including the hematocrit components identified by Soller.” Ex. 1003 at ¶ 118. Dr. Mercier’s statement confirms that the alleged combination would yield a system for measuring additional parameters, not a system for identifying objects. Dr. Mercier does not explain how adding hematocrit measurement capability to Lisogurski would result in a system that recognizes or establishes an object as being a particular thing.

270. Moreover, a POSITA would recognize that the measurement techniques disclosed in Lisogurski are incompatible with measuring hematocrit and could not be modified to do so. Lisogurski discloses a straightforward oximetry technique: the system measures light absorption at two wavelengths (red and infrared), calculates the ratio between them, and derives oxygen saturation. Ex. 1027 at 4:42-62. By taking the ratio of these two measurements, the system determines the proportion of oxygenated versus deoxygenated hemoglobin.

271. A POSITA would understand that this ratio-based technique is specific to oximetry and would not provide useful results for hematocrit measurement. Hematocrit requires a completely different methodology. Unlike oximetry, which

measures the relative states of a single constituent (hemoglobin), hematocrit measures the aggregate volume of red blood cells relative to total blood volume. A POSITA would therefore understand that Lisogurski's disclosed techniques (taking two data points at red and infrared wavelengths and calculating their ratio) simply cannot measure hematocrit.

272. Dr. Mercier's suggestion that "Lisogurski's system...could have been modified to measure other constituents, including the hematocrit components identified by Soller" ignores this fundamental technical incompatibility. Ex. 1003 at ¶ 118. A POSITA would not look to modify Lisogurski to perform a function (hematocrit measurement) that Lisogurski's disclosed techniques cannot accomplish.

273. A POSITA would also recognize that there is no practical reason to measure hematocrit in a wearable device like that disclosed in Lisogurski. Oximetry and hematocrit serve fundamentally different clinical purposes with different temporal requirements.

274. Oximetry monitors a rapid physiological process. If a patient experiences ischemia or another condition causing loss of oxygen, the decline can occur within minutes. Continuous, real-time monitoring via a wearable device provides significant clinical value because it can alert dangerous changes as they happen. This is why pulse oximeters are commonly in wearable form factors.

275. Hematocrit, by contrast, reflects a slow, gradual process. Changes in red blood cell volume occur over days or weeks. There is no clinical need for continuous, real-time monitoring. Hematocrit is traditionally measured in clinical or hospital settings, where a blood sample can be drawn and analyzed with laboratory precision. A POSITA would have no reason to implement hematocrit measurement in a wearable device and no established clinical need for wearable hematocrit monitoring existed at the time of the invention.

276. Soller reinforces that measuring hematocrit has very limited use cases for a wearable device. Soller states that one advantage of its alleged invention is that it “allows facile measurement of blood hematocrit without the need to extract blood from a patient,” which is advantageous because “it is safe and avoids the risk of infection either to the patient or health care worker.” Ex. 1030 at 3:62-4:4-4. Soller gives examples of use cases, including “on trauma patients and during surgical procedures to give the physician immediate feedback on the patient’s condition” and for use by “health care worker[s] assisting in the evaluation of blood loss to trauma victims in remote, outdoor locations.” Ex. 1030 at 4:4-10. In other words, the use cases for Soller’s device are for trauma patients or patients undergoing surgery. Soller further states that its device “can be either hand-held or used with an endoscopic device.” Ex. 1030 at 4:11-14. Soller does not disclose or suggest a wearable device for measuring hematocrit, which makes sense because there is no

clinical need to continuously monitor hematocrit using a wearable device.

277. A POSITA would not have been motivated to modify Lisogurski's pulse oximetry system with Soller's multivariate calibration framework. Soller's system is directed to a fundamentally different purpose: estimating hematocrit (the volume percentage of red blood cells in blood) using a pre-trained PLS regression model. Ex. 1030 at Abstract, 5:42-67, 6:27-59, 22:26-42. A POSITA would not have had reason to incorporate Soller because Lisogurski is not concerned with hematocrit measurement.

278. Even assuming a POSITA had reason to attempt hematocrit measurement in a wearable device (as explained above, a POSITA would not), modifying Lisogurski to use Soller's approach would impose significant hardware and calibration burdens that are incompatible with the wearable form factor of Lisogurski.

279. First, Soller requires an array of at least seven light sources at different wavelengths spanning 500-1100 nm, whereas Lisogurski uses only two wavelengths for pulse oximetry. Ex. 1030 at 5:50-58; Ex. 1027 at 4:45-51. Adding five or more additional LEDs with different wavelengths would substantially increase the component count, cost, power consumption, and physical size of the device. Second, Soller requires a calibration sample set with blood samples of varying, known hematocrit values to train the PLS model. Ex. 1030 at 6:42-59, Fig. 1.

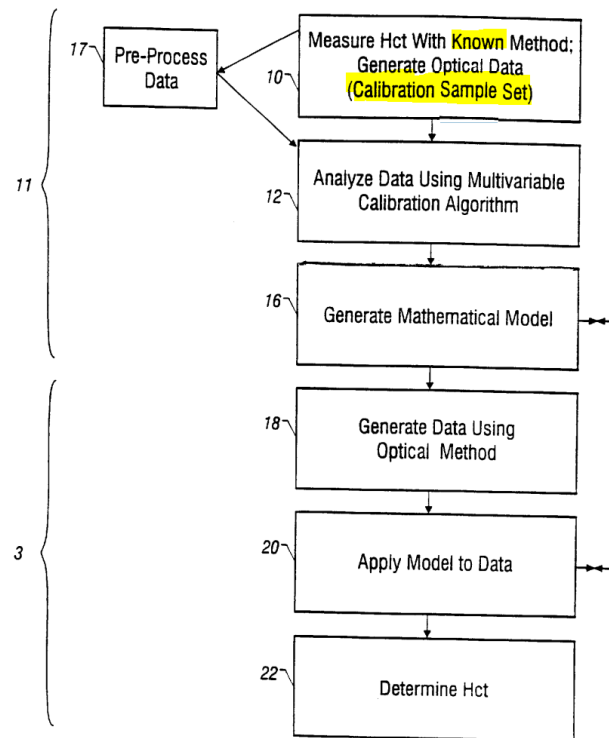


Figure 1

This calibration must be “made as robust as possible” by “taking a large number of spectra at different hematocrit values and under different experimental conditions.”

Ex. 1030 at 9:28-31.

280. Lisogurski’s oximetry system does not require such calibration sample set because oximetry relies on well-established characteristics of oxygenated and deoxygenated hemoglobin. Third, Soller acknowledges that different models may be needed for patients having different “temperatures, skin color, fat content, etc.” Ex. 1030 at 10:3-5. This patient-specific requirement, potentially requiring blood draws to create patient-specific calibration samples, further confirms that Soller’s approach

is for clinical settings, not portable wearable devices. A POSITA would have recognized that incorporating these requirements into a wearable pulse oximeter like Lisogurski would substantially increase device complexity, cost, and power consumption—all to achieve hematocrit estimation. Fourth, Soller’s multi-wavelength approach and multivariate calibration processing would substantially increase computational requirements compared to Lisogurski’s ratio calculation. This increased computational burden results in increased power consumption and increased processing hardware, which is contrary to the goals of a wearable device.

281. A POSITA would have recognized that incorporating Soller’s requirements into Lisogurski would be counterproductive, all to achieve hematocrit estimation functionality that has no practical application in a wearable form factor and that still would not satisfy limitation 7[l]’s requirement to identify an object.

282. For at least these reasons, I disagree with Petitioner’s and Dr. Mercier’s conclusions for Ground 3.

D. Ground 4: Alleged Indefiniteness

283. In Ground 4, Petitioner and Dr. Mercier assert that Patent Owner’s position as to the scope of “identify an object” in its appeal of the ’484 IPR, if accepted, would render claim 7 indefinite. Petition at 90; Ex. 1003 at ¶¶ 221-30. For the reasons set forth below, I disagree. Petitioner’s indefiniteness argument rests on a mischaracterization of Patent Owner’s appellate arguments and ignores the

specification's teachings.

284. At the outset, I note that the phrase “identify an object” has already been construed and applied by the Board and the Federal Circuit and, to my understanding, was not found indefinite in either forum. Ex. 1011 at 8-10; Ex. 1012 at 2-4.

285. In the prior IPR for the related ‘484 Patent, Apple and its expert were able to understand the scope of this term and apply the prior art to it to argue unpatentability. Ex. 1012 at 3-4. Similarly, Samsung did not argue that this phrase is indefinite in its PGR petition challenging the ‘790 Patent. Ex. 1053 at 25. While I am informed and understand that indefiniteness cannot be raised as a ground in an IPR, I note that Samsung was able to apply the prior art to this phrase in arguing for unpatentability. *Id.*

286. Petitioner and Dr. Mercier apparently understood the scope of the phrase “identify an object” sufficiently such that they could apply the prior art to that phrase in Grounds 1-3. Petition at 32-89.

287. Petitioner and Dr. Mercier both frame their indefiniteness argument as being based on their understanding of Patent Owner's arguments in its opening appeal brief. Petition at 90-93. Ex. 1003 at ¶¶ 231, 235-238. Dr. Mercier confirmed during his deposition that his opinions on indefiniteness are based on his understanding of Patent Owner's arguments its appeal brief. Ex. 2052 at 138:25-

139:6, 131:20-132:16. He further testified that he is not opining that claim 7 is indefinite based solely on the specification and prosecution history. *Id.* at 124:4-125:1.

288. Based on my review of the materials cited by Petitioner and Dr. Mercier, their indefiniteness assertions are mischaracterizing Patent Owner's position. Petitioner and Dr. Mercier do not quote or cite any statements from Patent Owner's appeal brief stating that Lisogurski does not identify an object because oxygenated and deoxygenated blood cannot qualify as separate "objects." Petition at 92; Ex. 1003 at ¶¶ 235-236 (citing Ex. 1061 at 37-42). Based on my review of the cited pages of Patent Owner's brief, Patent Owner does not argue that oxygenated hemoglobin and deoxygenated hemoglobin do not qualify as separate objects. Ex. 1061 at 37-42. When asked during his deposition, Dr. Mercier was unable to identify where Patent Owner supposedly argued this in its appeal brief. Ex. 2052 at 133:3-136:25.

289. I have reviewed Patent Owner's opening appeal brief in which it explains why Lisogurski does not disclose identifying an object and agree with the analysis therein. Ex. 1061.

290. In the '484 IPR appeal, Patent Owner explained that a pulse oximeter is "configured to know from the outset precisely what it [is] measuring," namely, blood oxygen saturation, and therefore does not identify an object in the sense of

recognizing or establishing an unknown constituent as a particular thing. Ex. 1061 at 27. Patent Owner contrasted this with devices that “consider[] a sample with an array of unidentified constituents” and determine what is present using “spectral techniques that “identify and distinguish between spectrally similar materials” with “only subtle signature differences.” Ex. 1061 at 27-28 (quoting Ex. 1005 at 7:21-24). This is a distinction in the function the device performs (measuring known parameters versus identifying unknown constituents), not a distinction in what can or cannot qualify as an object. A pulse oximeter measures the ratio of known forms of hemoglobin to calculate a percentage. It does not identify what is present among unknown constituents.

291. I am informed and understand that there has been subsequent briefing in the appeal concerning the ‘484 Patent. I understand that Apple filed a response brief on or around October 27, 2025. I understand that Patent Owner filed a reply brief on or around December 15, 2025. Ex. 2053. Based on my review, Patent Owner did not argue in its reply brief that Lisogurski does not “identify an object” because oxygenated hemoglobin and deoxygenated hemoglobin are not separate objects. Ex. 2053. In its reply brief, Patent Owner argued that measuring oxygen saturation does not involve distinguishing deoxygenated hemoglobin from oxygenated hemoglobin. Ex. 2053 at 11-13. Patent Owner also argued that distinguishing between two objects is not the same as identifying an object. *Id.* at 13. I agree with these arguments.

292. The '790 Patent provides multiple examples of how identification of an object as performed. *See, e.g.*, Ex. 1001 at Fig. 65B, 54:33-59. Dr. Mercier does not identify any specific ambiguity that would prevent a POSITA from applying the Board-adopted construction.

293. The specification provides concrete examples of objects that can be identified: building materials such as gypsum, painted structures, plywood, and concrete (Ex. 1001 at 54:54-56); plant life, soil, and trees (Ex. 1001 at 54:56-57); blood constituents such as glucose, triacetin, ascorbate, lactate, alanine, and urea (Ex. 1001 at 18:3-27); and tissue constituents with specific spectral signatures (Ex. 1001 at 76:37-49). The specification also provides functional context, explaining that identification involves using spectral techniques and pattern matching to recognize materials based on their chemical signatures. Ex. 1001 at 54:57-59; 18:20-27. A POSITA would understand that an “object” in the context of the claims refers to any material, constituent, or thing that can be recognized or established as a particular thing based on its optical or spectral properties. The specification provides sufficient examples and functional context to inform the skilled artisan of the term’s meaning with reasonable certainty

294. Read in light of the specification, a POSITA would readily be able to determine what qualifies as an object with reasonable certainty. A POSITA would understand that the references in the Petition, at best, are directed to *measurement of*

an object, not *identification* of an object. That distinction does not render “identify an object” indefinite. To illustrate, a scale measures mass—it does not identify the object on the scale. Similarly, a pulse oximeter measures the ratio of oxygenated to deoxygenated hemoglobin to calculate oxygen saturation. It does not “identify” hemoglobin as a particular thing because the device is not determining what is present; it is determining how much of a known constituent is present. A POSITA would understand this distinction.

295. Petitioner argues that Patent Owner’s observation—that a pulse oximeter “knows from the outset” what it is measuring—creates an unsupported distinction. Petition at 91; Ex. 1003 at ¶ 235. Dr. Mercier contends that the distinction between devices that know from the outset what they are measuring versus devices that examine an array of unidentified constituents would not be readily apparent to a POSITA. Ex. 1003 at ¶ 235.

296. I disagree. The ’790 Patent specification clearly distinguishes between systems designed to measure known parameters and systems designed to identify objects. For example, the specification describes using active remote sensing to “distinguish different concrete structures, including roadways, buildings, and reinforced structures such as bridges” and to distinguish “building materials such as gypsum, painted structures, plywood, and concrete of various sorts” from “plant life, soil, and trees.” Ex. 1001 at 54:33-54. The specification explains that this capability

adds “a fourth dimension—namely, identification of objects based on their chemical signature.” Ex. 1001 at 54:57-59. These disclosures make clear that identification involves recognizing or establishing a particular thing—not something known from the outset—in accordance with the operative claim construction. A POSITA would readily understand the distinction between identification (to recognize or establish an object as being a particular thing) and measurement (determining how much of something is present).

297. A POSITA reading the specification and the figures would understand the scope of “object” as used in the claims. The specification provides concrete examples of objects that can be identified: building materials such as gypsum, painted structures, plywood, and concrete (Ex. 1001 at 54:54-56); plant life, soil, and trees (Ex. 1001 at 54:56-57); blood constituents such as glucose, triacetin, ascorbate, lactate, alanine, and urea (Ex. 1001 at 18:3-27); and tissue constituents with specific spectral signatures (Ex. 1001 at 76:37-49). The specification also provides functional context, explaining that identification involves using spectral techniques and pattern matching to recognize materials based on their chemical signatures. Ex. 1001 at 54:57-59, 18:20-27. A POSITA would understand that an “object” in the context of the claims refers to any material, constituent, or thing that can be recognized or established as a particular thing based on its optical or spectral properties. The specification provides sufficient examples and functional context to inform the

skilled artisan of the term's meaning with reasonable certainty.

E. Ground 5: Enablement

298. In Ground 5, the Petition argues that claim 7 is “unpatentable for non-enablement, particularly in view of Omni’s understanding of the scope of ‘identify an object,’ as evidenced by its positions in the appeal of the ‘484 IPR.” Petition at 93. Specifically, Petitioner argues that “if ... ‘identify an object’ refers to a non-invasive, wearable device that can distinguish any spectral signature of a blood constituent, including glucose signatures, from that of other blood constituents, then the Challenged Claim is not enabled.” Petition at 93-94; Ex. 1003 at ¶¶ 240-42.

299. Dr. Mercier opines that if “identify an object” is read broadly to encompass a variety of blood constituents, including glucose, a POSITA would not have been informed with certainty and without undue experimentation. Ex. 1003 at ¶¶ 240-42. I disagree.

300. As an initial matter, I am informed by counsel that whether experimentation is “undue” is a fact-intensive inquiry that consider several factors, including: the quantity of experimentation necessary, the amount of direction or guidance provided in the specification, the presence or absence of working examples, the nature of the invention, the state of the prior art, the relative skill in the art, the predictability or unpredictability of the art, and the breadth of the claims. Dr. Mercier did not analyze these factors specifically in his declaration. Ex. 1003 at

¶¶ 240-42. I reserve the right to respond should Petitioner and/or Dr. Mercier attempt to address these factors.

301. Dr. Mercier opinions regarding enablement are heavily qualified. For example, he asserts that “non-invasive optical monitoring of glucose, to a degree of certainty that would be useful in health or disease monitoring and that would distinguish glucose reliably in practical application . . . has not been accomplished to the present day.” Ex. 1003 at ¶ 242. This statement is qualified in the sense that Dr. Mercier is not saying that non-invasive optical monitoring of glucose is not possible or that a POSITA could not do so without undue experimentation. He is instead saying that what would allegedly require undue experimentation is doing so reliable in a way that would be useful for health or disease monitoring.

302. To the extent that Dr. Mercier is suggesting that it is not possible, even to the present day, to non-invasively measure glucose using optical techniques, this is incorrect. There is ample literature describing non-invasive optical techniques for detecting glucose. For example, Exhibit 1065, which states on its face that it was published in June 2023, describes non-invasive blood glucose monitoring techniques:

Nowadays, most non-invasive blood glucose monitoring techniques rely on the quantification of glucose molecules that exhibit distinct characteristics in different light frequencies, such as ultrasonic waves, near-infrared (NIR), and visible light. While these methods enable real-time quantitative monitoring, they do not offer the same level of accuracy as traditional electrochemical blood glucose meters in clinical settings [4]. As a result, improving the accuracy and precision of non-invasive monitoring devices remains a critical technical challenge in the field of diabetes treatment.

Ex. 1065 at 2. This refutes Dr. Mercier's suggestion that this practice is impossible to achieve.

303. Dr. Mercier quotes a statement in this paper that "accurate detection of blood glucose concentration is not feasible without stable measurement conditions."

Ex. 1065 at 10. This does not say that detecting blood glucose concentrations non-invasively is not feasible at all. It says that "accurate" detection is not feasible "without stable measurement conditions." The clear implication of this statement is that accurate detection of blood glucose monitoring techniques is feasible with stable measurement conditions. Again, this refutes Dr. Mercier's suggestion that this is impossible and has never been achieved even to the present day.

304. As another example, an article from 2020 indicates that "NIR/MIR spectroscope non-invasive glucose sensors have been successfully used commercially."

range that is as highly specifically absorbed by glucose as possible. Although there are examples of NIR/MIR spectroscopic non-invasive glucose sensors that have been successfully used commercially, the sensitivity and selectivity of the sensors, the correlation between measurement results and actual values, and the subsequent algorithms used need to be further improved and modified.

Ex. 2054 at 7. As the article states, it may be true that these techniques can be further improved for more accurate results, and it may be true that these techniques may not be a suitable replacement for traditional methods in certain medical applications where precision is critical, but the notion that a POSITA could not build a system that identifies glucose under the applicable claim construction without undue experimentation is incorrect.

305. Claim 7 of the '790 Patent does not require monitoring glucose levels. The relevant claim limitation requires identifying an object – while glucose is an exemplary object, the claim does not require identifying a glucose *level*. Moreover, the claim does not specify any quantitative requirements in terms of accuracy or reliability. I note that claim 7 is a system claim. The claim does not specify that the system must be “useful in health or disease monitoring.”

306. The 790 Patent's specification provides substantial guidance and working embodiments within the scope of claim 7's language that “the wearable device is at least in part configured to identify an object.” These embodiments include at least non-invasive glucose and blood-constituent monitoring using near-infrared spectroscopy (Ex. 1001 at 2:60-3:30); identification of the glucose spectrum

(Ex. 1001 at 16:48-18:27); monitoring ketone bodies (Ex. 1001 at 18:28-19:47); and hemoglobin A1c monitoring (Ex. 1001 at 19:48-21:28). This same framework is used for remote sensing embodiments where the specification describes identifying building materials, vegetation, concrete structures, and other materials based on their spectral signatures (Ex. 1001 at 54:32-59).

307. The specification teaches that “[t]he glucose molecule has the chemical formula $C_6H_{12}O_6$ ” and illustrates “the infrared transmittance of glucose 100” in FIG. 1. Ex. 1001 at 16:49-17:4.

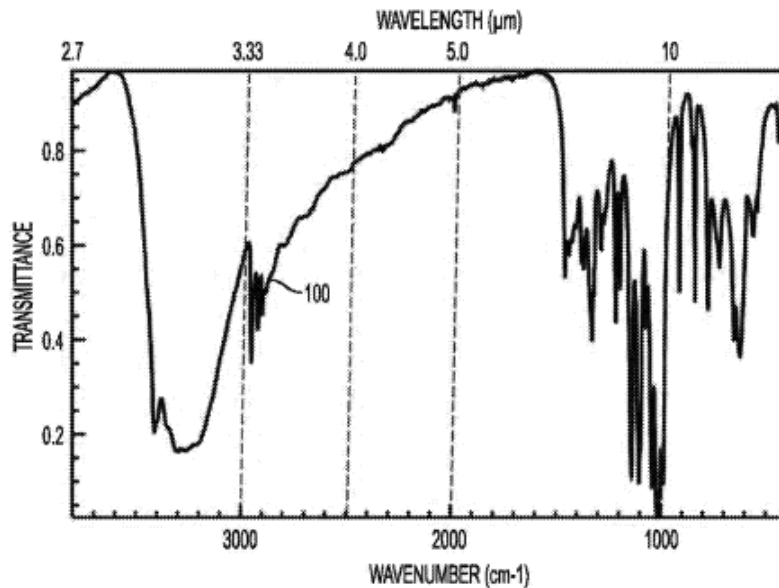
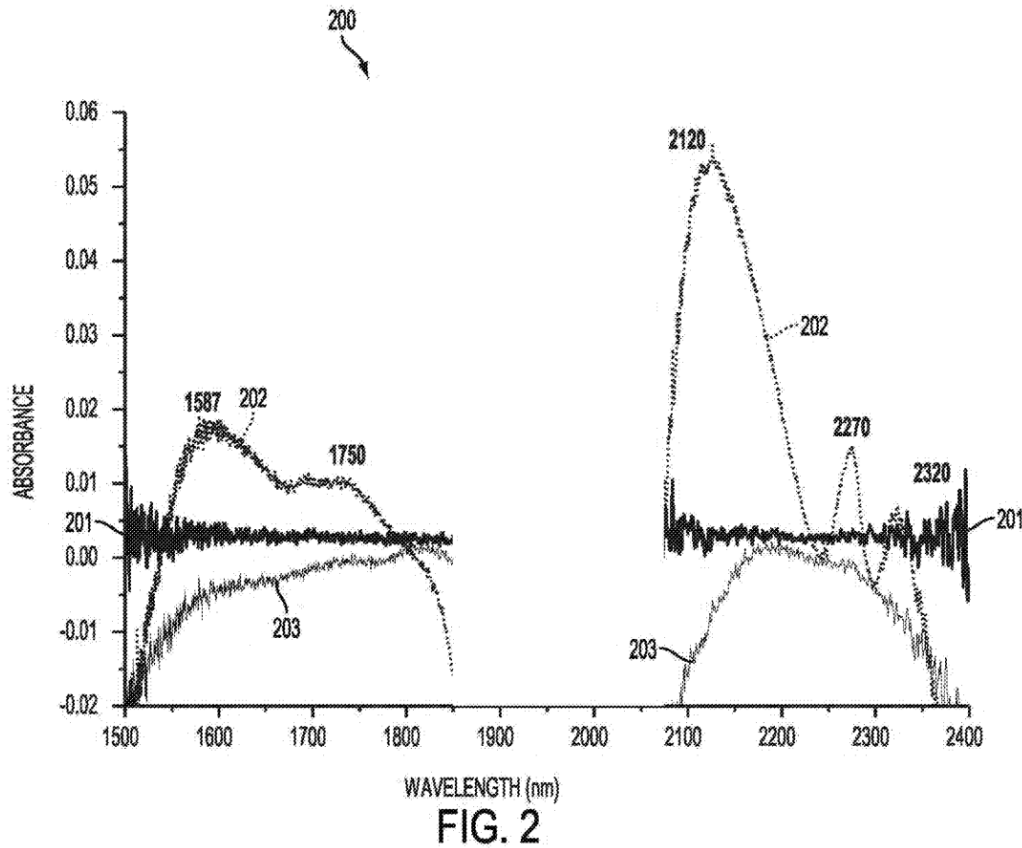


FIG. 1

Ex. 1001 at FIG. 1

308. Figure 2 illustrates measurement test data proving full enablement of the absorbance of different blood constituents, such as glucose, hemoglobin, and

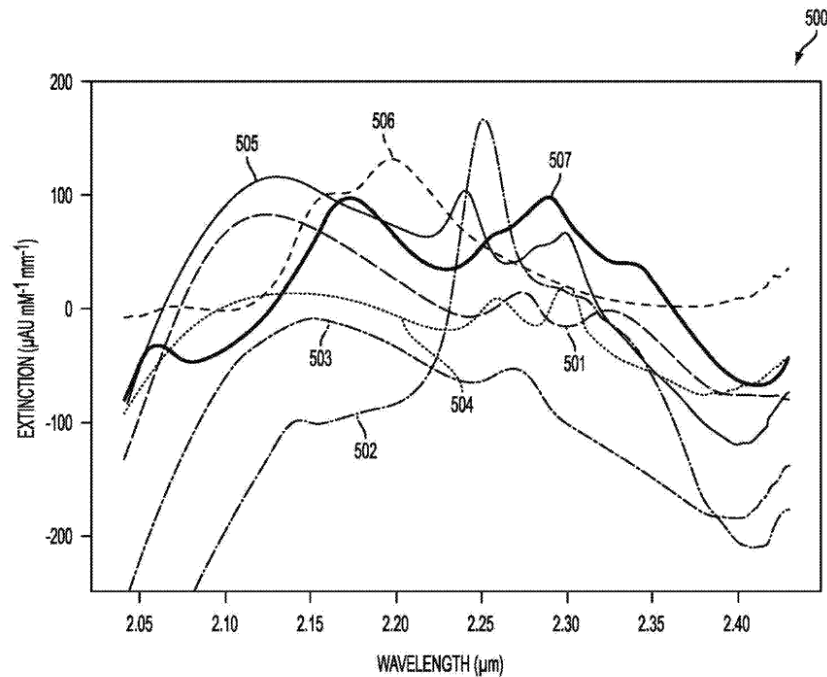
hemoglobin Alc.



Ex. 1001 at FIG. 2

309. The specification teaches that “in the SWIR wavelength range hemoglobin is nearly flat in spectrum 201” and “the glucose absorbance 202 has at least five distinct peaks near 1587 nm, 1750 nm, 2120 nm, 2270 nm and 2320 nm.” Ex. 1001 at 17:8-13; *see also id.* at 17:14-30, FIG. 3A.

310. FIG. 5 “illustrates the spectrum 500 for different blood constituents” and that “[t]he glucose absorption spectrum 501 can be unique with its three peaks in this wavelength range.” Ex. 1001 at 18:8-11.



Ex. 1001 at FIG. 5

311. The specification explains that “[t]o distinguish the glucose 501 from . . . overlapping spectra, it may be advantageous to have information at multiple wavelengths” and “to use pattern matching algorithms and other software and mathematical methods *to identify the blood constituents of interest.*” Ex. 1001 at 18:14-19; *see also id.* at 21:3-6 (“Various signal processing methods may be used to identify and quantify the concentration of cholesterol 876 and/or glucose 877, or some of the other blood constituents”), 46:55-58 (“The SWIR wavelength range may be particularly valuable for identifying materials based on their chemical composition”).

XI. CONCLUSION

312. I reserve the right to modify or supplement my opinions, if necessary, based on further review and analysis of the evidence in this case, including review and analysis of information that may be provided to me subsequent to the date of this Declaration.

I declare that all statements made herein of my own knowledge are true and all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Date: June 29, 2026



Igor Efimov, Ph.D.