

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

**SAMSUNG ELECTRONICS CO., LTD.,
SAMSUNG ELECTRONICS AMERICA, INC.,
FOSSIL GROUP, INC.,
FOSSIL STORES I, INC.,
FOSSIL PARTNERS, L.P.,
OURA HEALTH OY, AND
ONEPLUS TECHNOLOGY (SHENZHEN) CO., LTD.**

Petitioners,

v.

OMNI MEDSCI, INC.,

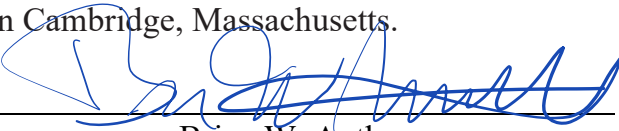
Patent Owner.

Case IPR2025-01254

Patent No. 12,268,475

**DECLARATION OF BRIAN W. ANTHONY IN SUPPORT
OF PETITIONERS' REPLY TO PATENT OWNER'S RESPONSE**

Executed this 30th day of July, 2026, in Cambridge, Massachusetts.



Brian W. Anthony

TABLE OF CONTENTS

	Page
I. INTRODUCTION	1
II. LEVEL OF ORDINARY SKILL IN THE ART	2
III. CLAIM CONSTRUCTION.....	3
IV. CLAIM LIMITATIONS PREVIOUSLY ADDRESSED BY THE BOARD	4
V. GROUNDS OF UNPATENTABILITY.....	6
A. LISOGURSKI DISCLOSES AND RENDERS OBVIOUS “ONE OR MORE BIOSENSORS,” “A LIGHT SOURCE,” AND “A DETECTION SYSTEM” (GROUNDS 1-8; ELEMENTS [1.A], [1.D], [1.F]).....	6
B. LISOGURSKI DISCLOSES AND RENDERS OBVIOUS “WHEREIN THE APPARATUS IS ... CONFIGURED TO DETERMINE, BASED . . . ON THE OUTPUT SIGNAL, THAT THE APPARATUS IS BEING WORN BY THE USER” (GROUNDS 1-8, ELEMENT [1.N])	8
C. LISOGURSKI DISCLOSES AND RENDERS OBVIOUS “A PROCESSOR CONFIGURED TO: ... (IV) DETERMINE, BASED ... ON THE THIRD OUTPUT SIGNAL, THAT THE WEARABLE DEVICE IS BEING WORN BY THE USER” (GROUNDS 1-8, ELEMENT [8.G])	29
D. LISOGURSKI DISCLOSES AND RENDERS OBVIOUS “SIX LIGHT EMITTING DIODES” (GROUNDS 1-8, CLAIM 6).....	42
E. LISOGURSKI DISCLOSES AND RENDERS OBVIOUS A FIRST AND SECOND OUTPUT SIGNAL RESPONSIVE TO LIGHT SOURCE BEING ON AND OFF, AND A THIRD OUTPUT SIGNAL BASED ON THE FIRST AND SECOND OUTPUT SIGNAL HAVING A THIRD SIGNAL-TO-NOISE RATIO THAT IS GREATER THAN THOSE OF THE FIRST AND SECOND OUTPUT SIGNAL (GROUNDS 1-8, ELEMENTS [8.D]-[8.F])	53

Declaration of Brian Anthony in Support of Petitioners’ Reply
to Patent Owner’s Response, U.S. Patent No. 12,268,475 (IPR2025-01254)

F. LISOGURSKI DISCLOSES AND RENDERS OBVIOUS THE
MEMORY LIMITATION (GROUNDS 2, 4, 6, 8; CLAIM 5).....63

G. LISOGURSKI DISCLOSES AND RENDERS OBVIOUS, ALONE
AND IN VIEW OF LEBOEUF, THE ARC LIMITATION
(GROUNDS 1-8; CLAIMS 6-7).....68

VI. SECONDARY CONSIDERATIONS 87

VII. CONCLUSION 101

Declaration of Brian Anthony in Support of Petitioners' Reply
to Patent Owner's Response, U.S. Patent No. 12,268,475 (IPR2025-01254)

TABLE OF EXHIBITS

Exhibit No.	DESCRIPTION
1001	U.S. Patent No. 12,268,475 ("475")
1002	File History of U.S. Application No. 18/927,698 ("475FH")
1003	Declaration of Brian Anthony in Support of Petition for Inter Partes Review of U.S. Patent No. 12,268,475 ("Anthony")
1004	Declaration of Brian Anthony in Support of Petition for Inter Partes Review of U.S. Patent No. 9,651,533 submitted in IPR2019-00916, Ex. 1003 ("533-Anthony")
1005	<i>Apple Inc. v. Omni Medsci, Inc.</i> , No. IPR2019-00916, Paper 1 (PTAB Apr. 10, 2019) ("533-Pet.")
1008	<i>Apple Inc. v. Omni Medsci, Inc.</i> , No. IPR2019-00916, Paper 39 (PTAB Oct. 14, 2020) ("533-FWD")
1009	<i>Omni MedSci, Inc. v. Apple Inc.</i> , No. 21-01229, ECF 69 (Fed. Cir. June 8, 2022)
1010	Declaration of Brian Anthony in Support of Petition for Inter Partes Review of U.S. Patent No. 10,517,484 submitted in IPR2021-00453, Ex. 1003 ("484-Anthony")
1011	<i>Apple Inc. v. Omni Medsci, Inc.</i> , No. IPR2021-00453, Paper 1 (PTAB Jan. 22, 2021) ("484-Pet.")
1013	<i>Apple Inc. v. Omni Medsci, Inc.</i> , No. IPR2021-00453, Paper 7 (PTAB Aug. 6, 2021) ("484-Inst.")
1015	<i>Apple Inc. v. Omni Medsci, Inc.</i> , No. IPR2021-00453, Paper 22 (PTAB Aug. 3, 2022) ("484-FWD")

Declaration of Brian Anthony in Support of Petitioners' Reply
to Patent Owner's Response, U.S. Patent No. 12,268,475 (IPR2025-01254)

Exhibit No.	DESCRIPTION
1016	<i>Apple Inc. v. Omni Medsci, Inc.</i> , No. IPR2021-00453, Paper 26 (PTAB Feb. 14, 2025) (“484-RFWD”)
1018	<i>Omni MedSci, Inc. v. Apple Inc.</i> , 2:18-cv-00134-RWS, Dkt. No. 211 (E.D. Tex. June 24, 2019)
1019	<i>Omni MedSci, Inc. v. Apple Inc.</i> , 2:18-cv-00429-RWS, Dkt. No. 152 (E.D. Tex. Aug. 14, 2019)
1023	Defendants’ Supplemental Invalidity and Subject Matter Eligibility Contentions, July 18, 2025. <i>Omni MedSci, Inc. v. Samsung Electronics Co., Ltd. et al.</i> , No. 2:24-cv-01070-JRG-RSP (E.D. Tex.)
1025	U.S. Patent No. 9,241,676 (“Lisogurski”)
1026	U.S. Patent Pub. No. 2010/0217102 (“LeBoeuf”)
1027	U.S. Patent No. 8,108,036 (“Tran”)
1028	U.S. Patent Pub. No. 2005/0049468A1 (“Carlson”)
1031	U.S. Patent No. 8,050,730 (“Zhang”)
1033	U.S. Patent Pub. No. 2011/0237911 (“Lamego”)
1034	U.S. Patent No. 5,942,749 (“Takeuchi”)
1035	U.S. Patent No. 5,822,473 (“Magel”)
1036	US Patent 5,592,124 (“Mullins”)
1037	E.F. Schubert, <i>Light-Emitting Diodes</i> (Cambridge Univ. Press, 2nd ed. reprinted 2014)
1038	“The Biomedical Engineering Handbook,” by Joseph D. Bronzino (1995)

Declaration of Brian Anthony in Support of Petitioners' Reply
to Patent Owner's Response, U.S. Patent No. 12,268,475 (IPR2025-01254)

Exhibit No.	DESCRIPTION
1039	U.S. Patent No. 8,079,735 ("Vakil")
1044	U.S. Patent No. 5,511,553 ("Segalowitz")
1045	U.S. Patent No. 6,801,799 ("Mendelson")
1048	U.S. Pat. No. 9,239,951 ("Hoffberg")
1049	U.S. Pat. Pub. 2007/0194939 ("Alvarez")
1052	U.S. Patent No. 8,996,088 ("Dasco")
1053	U.S. Patent Pub. No. 2007/0149868 ("Blank")
1054	U.S. Patent No. 8,852,103 ("Rothberg")
1057	U.S. Patent No. 8,922,788 ("Addison")
1058	JP3552090 ("Denso") (Certified English Translation)
1059	JP3552090 ("Denso")
1064	U.S. Patent No. 5,554,273 ("Demmin")
1065	U.S. Patent No. 5,953,713 ("Behbehani")
1081	U.S. Patent No. 9,651,533 ("533")
1082	U.S. Patent No. 10,517,484 ("484")
1083	Declaration of Brian Anthony in Support of Petition for Inter Partes Review of U.S. Patent No. 9,861,286 submitted in IPR2019-00914, Ex. 1003
1122	Claim Construction Order, <i>Omni MedSci, Inc. v. Samsung Electronics Co., Ltd. et al.</i> , No. 2:24-cv-01070-JRG-RSP, Dkt. No. 154 (E.D. Tex. Mar. 24, 2026)

Declaration of Brian Anthony in Support of Petitioners' Reply
to Patent Owner's Response, U.S. Patent No. 12,268,475 (IPR2025-01254)

Exhibit No.	DESCRIPTION
1127	Transcript of Igor Efimov, Ph.D. (July 16, 2026) [CONFIDENTIAL]
1128	Transcript of the Deposition of Mohammed Islam, Sc.D. (July 23, 2026)

TABLE OF ABBREVIATIONS

ABBREVIATION	DESCRIPTION
'475	U.S. Patent No. 12,268,475 (Ex. 1001)
Claims / Challenged Claims	Claims 1, 5-8, 11-13 of the '475
IPR	<i>Inter Partes</i> Review
Petitioners	Petitioners Samsung Electronics Co. Ltd., Samsung Electronics America Inc., Fossil Group, Inc., Fossil Stores I, Inc., Fossil Partners, L.P., Oura Health Oy, and OnePlus Technology (Shenzhen) Co., Ltd.
PO	Patent Owner Omni MedSci, Inc.
POSITA	Person of Ordinary Skill in the Art
Board	Patent Trial and Appeal Board
EDTX	Eastern District of Texas
Pet.	<i>Samsung Electronics Co., Ltd. et al. v. Omni MedSci, Inc.</i> , No. IPR2025-01254, Pap. 1 (PTAB Aug. 5, 2025)
POR	<i>Samsung Electronics Co., Ltd. et al. v. Omni MedSci, Inc.</i> , No. IPR2025-01254, Pap. 29 (PTAB May 7, 2026)
'533	U.S. Patent No. 9,651,533 (Ex. 1081)
'484	U.S. Patent No. 10,517,484 (Ex. 1082)
'533-FWD	<i>Apple Inc. v. Omni Medsci, Inc.</i> , No. IPR2019-00916, Paper 39 (PTAB Oct. 14, 2020) (Ex. 1008)
'484-FWD	<i>Apple Inc. v. Omni Medsci, Inc.</i> , No. IPR2021-00453, Paper 22 (PTAB Aug. 3, 2022) (Ex. 1015)

Declaration of Brian Anthony in Support of Petitioners' Reply
to Patent Owner's Response, U.S. Patent No. 12,268,475 (IPR2025-01254)

ABBREVIATION	DESCRIPTION
'484-RFWD	<i>Apple Inc. v. Omni Medsci, Inc.</i> , No. IPR2021-00453, Paper 26 (PTAB Feb. 14, 2025) (Ex. 1016)
Prior FWDs	'533-FWD, '484-FWD, and '484-RFWD (Exs. 1008, 1015-1016)
Prior IPRs	<i>Apple Inc. v. Omni Medsci, Inc.</i> , No. IPR2019-00916 (PTAB) and <i>Apple Inc. v. Omni Medsci, Inc.</i> , No. IPR2021-00453 (PTAB)
Texas Case	<i>Omni MedSci, Inc. v. Samsung Electronics Co., Ltd. et al.</i> , No. 2:24-cv-01070-JRG-RSP (E.D. Tex.)
Related EDTX Cases	<i>Omni MedSci, Inc. v. Apple Inc.</i> , 2:18-cv-00134-RWS (E.D. Tex.) <i>Omni MedSci, Inc. v. Apple Inc.</i> , 2:18-cv-00429-RWS (E.D. Tex.)
Lisogurski	U.S. Patent No. 9,241,676 (Ex. 1025)
LeBoeuf	U.S. Patent Pub. No. 2010/0217102 (Ex. 1026)
Tran	U.S. Patent No. US 8,108,036 (Ex. 1027)
Carlson	U.S. Patent Pub. No. 2005/0049468 (Ex. 1028)
Lamego	U.S. Patent Pub. No. 2011/0237911 (Ex. 1033)
Mendelson	U.S. Patent No. 6,801,799 (Ex. 1045)
Addison	U.S. Patent No. 8,922,788 (Ex. 1057)
Denso	JP3552090 (Certified English Translation) (Ex. 1058)

I. INTRODUCTION

1. I am the same Brian W. Anthony who provided a declaration for this matter executed on August 5, 2025 ("Declaration") (Ex. 1003 ("Anthony")).

2. As part of my work in this proceeding, I have been asked by Petitioners to respond to certain assertions offered by Omni Medsci, Inc. ("Omni" or "Patent Owner") in IPR2025-01254 regarding U.S. Patent No. 12,268,475 ("the '475 patent").

3. My experience, qualifications, and compensation are provided in my August 5, 2025 Declaration and **Appendix A** thereto. Anthony, ¶¶6, 14, 16-24, Appendix A. In this Reply Declaration, I have been asked to respond to certain assertions raised by Omni in its Patent Owner's Response ("POR") (Paper 29) and by Igor Efimov, Ph.D., in his supporting declaration (Ex. 2043 ("Efimov")).

4. I understand that, in this proceeding, the Board has instituted *Inter Partes* Review proceedings of claims 1, 5-8, 11-13 of the '475 patent ("Challenged Claims") as anticipated and/or rendered obvious based on all grounds (Grounds 1-8) set forth in my prior Declaration. Anthony, ¶¶12, 68-73.

5. In reaching the conclusions described in this Reply Declaration, I have relied on the documents and materials cited herein as well as those cited within and identified in my prior Declaration (*see* Anthony, ¶¶8, Appendix B). A complete listing of all materials upon which I have relied or considered upon in formulating

my opinion are included in **Appendix A** attached hereto. The materials that I have relied upon in this Reply Declaration and in my prior Declaration are the types of materials upon which experts in the relevant field of art would reasonably rely upon in forming an opinion on the subject.

6. In formulating the opinions set forth in this Reply Declaration, I have also relied upon the legal understandings set forth in my prior Declaration. *See* Anthony, ¶¶25-39, 55. My opinions are also based upon my education, training, research, knowledge, and personal and professional experience.

II. LEVEL OF ORDINARY SKILL IN THE ART

7. In my August 5, 2025 Declaration, I opined that on or before December 31, 2012, a person of ordinary skill in the art (“POSITA”) relating to the technology of the ’475 patent “would have had a good working knowledge of optical sensing techniques and their applications, and some familiarity with optical system design and signal processing techniques. That knowledge would have been gained via an undergraduate education in engineering (electrical, mechanical, biomedical or optical) or a related field of study, along with relevant experience in studying or developing physiological monitoring devices (e.g., non-invasive optical biosensors) in industry or academia. This description is approximate; varying combinations of education and practical experience also would be sufficient.” Anthony ¶52. Patent

Owner and Dr. Efimov applied the same definition (POR, 4-5; Efimov, ¶¶51-52), and I continue to apply that definition here.

III. CLAIM CONSTRUCTION

8. I was instructed to apply certain constructions in providing my opinions in the Declaration. Anthony, ¶¶55-65. I understand that, after I submitted my August 5, 2025 Declaration, the court in *Omni MedSci, Inc. v. Samsung Electronics Co., Ltd. et al.*, No. 2:24-cv-01070-JRG-RSP (E.D. Tex.) (“Texas Case”) rendered its opinions regarding certain claim terms. Ex. 1122. I have reviewed each of these constructions, and applying those constructions has no impact on my opinions set forth in my Declaration or in this Reply Declaration, except as otherwise set forth in this Reply Declaration.

9. For example, in the parallel Texas Case, the court construed the modulation limitations in Claim 13 (“modulate”) as “[vary/varying/the varying of] the amplitude, frequency, or phase of the light produced.” Ex.1122, 14-18. I also understand that, in the parallel Texas Case, the Petitioners had proposed the Board’s prior construction (“varying the amplitude, frequency, or phase of the light produced by at least one of the LEDs *to include information*”), which is narrower than the construction adopted by the court because it includes the additional requirement that the light is varied “to include information.” Anthony, ¶56; Ex.1122, 10-14. As I explained in my Declaration, the modulation limitations are met by Lisogurski under

the narrower prior Board construction. Anthony, ¶¶265-269. Lisogurski therefore also meets the modulation limitations under the broader construction adopted by the court in the parallel Texas Case, which only requires that the semiconductor sources vary the amplitude, frequency, or phase of the light produced. Accordingly, either construction may be used and the limitation would still be met by Lisogurski. Neither Patent Owner nor Dr. Efimov disagrees that the limitation is met. POR, 11, 50; Efimov, ¶¶72-73, 75, 209-211.

10. The court also construed “modulation frequency” limitation in claim 13 as “pulse repetition rate.” Ex. 1122, 14-18. As I explained in my Declaration, Lisogurski discloses modulating light source “aligned with pulses of the heart,” which repeats at a certain rate (i.e., “pulse repetition rate”), and thus meets this limitation under the court’s construction. Anthony, ¶268; Lisogurski 5:25-47. Neither Patent Owner nor Dr. Efimov disagrees that the limitation is met. POR, 11, 50; Efimov, ¶¶74-75, 209-211.

IV. CLAIM LIMITATIONS PREVIOUSLY ADDRESSED BY THE BOARD

11. For claim limitations that are identical or substantially identical to the limitations addressed in the prior ’533 and ’484 IPRs, my Declaration explains why my prior opinions remain applicable in this proceeding, why I agree with the Board’s

analyses, and why any differences in claim language do not alter my conclusions.

See e.g., Anthony, ¶¶109-112, 114-118, 120-122, 133-137, 139-144, 146-159.

12. Patent Owner mischaracterizes both that analysis and my testimony. POR, 17. I did not simply quote the Board's prior decisions or "incorporate by reference" prior testimony in lieu of analysis. Instead, I understand my declarations from the previous '533 and '484 IPRs have been resubmitted in this IPR as Exhibits 1004 and 1010. Further, my opinions here go well beyond "quoting the prior IPR decisions" and "incorporating by reference" my prior testimony. For example, with respect to element [1.pre], I (i) discuss the prior analysis of the Board regarding relevant claim limitations in the prior '484 IPR (Anthony, ¶110); (ii) compare the claim limitation at issue to the relevant claim limitation in the prior '484 IPR (Anthony, ¶¶109, 111); (iii) confirm that my opinion from my declarations from the prior '484 IPR apply equally here (Anthony, ¶111); and (iv) set forth further support for the limitation (Anthony, ¶112). I performed similar analyses for the other limitations cited by Patent Owner. *See e.g.*, Anthony, ¶¶115-118, 121-122, 135-137, 141-144, 149-152, 156-159. Consistent with this approach, my deposition testimony explained that I was not relying on the Board's opinions themselves, but rather that the Board's findings were consistent with my previously expressed opinions regarding the same prior-art disclosures. Ex. 2045, 125:9-126:10. Further, for limitations where there is no prior Board decision (for example, "biosensor"

limitation in [1.a]), I provided detailed opinions regarding why those limitations are met. *See* Anthony, ¶¶116-118.

V. GROUNDS OF UNPATENTABILITY

13. I note that Patent Owner's and Dr. Efimov's challenges to the asserted prior-art Grounds are limited to the issues addressed in the following sections. With respect to the remaining claims and Grounds, Patent Owner and Dr. Efimov rely on the same, but no additional, arguments. *See* POR, 32, 37, 50, 53-54, 67-69; Efimov, ¶¶131, 155-157, 209-211, 214-215, 230-232, 235, 289-312. Accordingly, those arguments fail as to the remaining claims and Grounds for the same reasons discussed below.

A. LISOGURSKI DISCLOSES AND RENDERS OBVIOUS "ONE OR MORE BIOSENSORS," "A LIGHT SOURCE," AND "A DETECTION SYSTEM" (GROUNDS 1-8; ELEMENTS [1.A], [1.D], [1.F])

14. As I explained in my Declaration, Lisogurski discloses a sensor, a light source, a detector, and front-end processing circuitry. Anthony, ¶¶113-118, 132-137, 145-152.

15. Patent Owner argues that Petitioners improperly rely on the same prior-art components to satisfy the claimed "one or more biosensors," "a light source," and "a detection system." POR, 18-19. Dr. Efimov does not offer any opinion on this issue in his Declaration. I disagree with Patent Owner's argument.

16. As I explained in my Declaration, Lisogurski discloses distinct components, including light source 130, detector 140, and front-end processing circuitry 150. Anthony, ¶¶117-118. I further explained that “light source 130/316, detector 140/318, and front end processing circuitry 150 within detector 140/318 as modified” are adapted to be placed on the user and that “together a light source, detector, and front end processing circuitry, all of which are contained with[in] Lisogurski's sensor as modified, would comprise a ‘biosensor.’” Anthony, ¶117. Thus, the same components are not relied upon to satisfy all three claim elements. Rather, light source 130 corresponds to the claimed “light source,” detector 140 and front-end processing circuitry 150 correspond to the claimed “detection system,” and those components together form part of the claimed “biosensor,” as is common in practice. Anthony, ¶117; '484-FWD, 24-27; '533-FWD, 22-25.

17. To the extent Patent Owner contends that claim 1 requires the claimed “biosensor,” “light source,” and “detection system” to be physically separate structures, I see nothing in the claim language or specification that imposes such a requirement. Claim 1 simply recites those elements as components of the claimed apparatus and does not require the light source or detection system to be separately housed or otherwise physically separated from the “biosensor.”

18. Moreover, Patent Owner's position that the claimed biosensor cannot encompass the claimed light source and detection system is inconsistent with both

its own infringement position and Dr. Efimov's deposition testimony. I have reviewed Patent Owner's infringement contentions served in the parallel Texas Case, which Patent Owner marked as Exhibit 2116, and Dr. Efimov's deposition testimony marked as Exhibit 1127. In Exhibit 2116, Patent Owner identified Samsung's BioActive Sensor as the claimed "biosensor," while separately identifying components within that same BioActive Sensor as the claimed "light source" and "detection system." Ex. 2116, 4-8, 18-21, 28-42. And, during his deposition, Dr. Efimov likewise agreed with Patent Owner's infringement mapping, contradicting Patent Owner's position in this proceeding. Ex. 1127, 176:12-17, 184:20-185:19, 188:3-9, 188:22-189:6.

**B. LISOGURSKI DISCLOSES AND RENDERS OBVIOUS
"WHEREIN THE APPARATUS IS ... CONFIGURED TO
DETERMINE, BASED ... ON THE OUTPUT SIGNAL,
THAT THE APPARATUS IS BEING WORN BY THE
USER" (GROUNDS 1-8, ELEMENT [1.N])**

19. As I explained in my Declaration, Lisogurski discloses, and at minimum renders obvious the limitation requiring that "the apparatus is ... configured to determine, based at least in part on the output signal, that the apparatus is being worn by the user." Anthony, ¶¶99, 147, 196-198.

20. Patent Owner and Dr. Efimov argue otherwise, asserting that: (1) Lisogurski's disclosure of "probe-off" system error does not disclose or render obvious determining that the apparatus is being worn by the user; (2) Lisogurski

does not disclose or render obvious that its sensor (i.e. the claimed “apparatus”) performs such a determination; (3) Lisogurski does not disclose or render obvious that the error detection (i.e. the claimed “determination” of wear) is made based on the processed signals (i.e. the claimed “output signal”); and (4) Lisogurski's error detection cannot both be performed by the sensor and be based on the processed signals, because those processed signals are transmitted to back-end processing circuitry 170. Efimov, ¶¶94-129; POR, 20-32. For the reasons explained below, I disagree with each such opinion.

21. **First**, Patent Owner and Dr. Efimov incorrectly contend that Lisogurski's disclosure of detecting a “probe-off signal” does not disclose or render obvious determining that the apparatus is being worn by the user. Efimov, ¶¶94-102; POR, 21-24. As an initial matter, Patent Owner and Dr. Efimov focuses primarily on Lisogurski's disclosure of a “probe-off signal” while giving little attention to Lisogurski's separate disclosure of detecting a “physiologically impossible value” as though it raised no distinct question, and never separately analyzing what such a value would indicate. Lisogurski, 36:66-37:2. As explained in my Declaration, however, a person of ordinary skill in the art would have understood, and at least found obvious, that both the “probe-off signal” and the “physiologically impossible value” would independently allow determining that the sensor is being worn and therefore support the claimed wear determination.

Anthony, ¶198.

22. Specifically, Lisogurski discloses a physiological sensing system in which light source 130 emits red and infrared light into a subject's tissue, detectors 140 detect light that has passed through or been reflected by the tissue, convert the received light into electrical signals, and provide those signals for processing to determine physiological parameters. Lisogurski, 10:49-52, 11:9-23, 11:16-20, 17:40-45; Anthony, ¶77. Accordingly, Lisogurski's system is designed to detect light that has interacted with a subject's tissue and to use that interaction to determine physiological parameters. Lisogurski, 10:49-52, 11:9-23, 11:16-20, 17:40-45; Anthony, ¶¶77, 198. In particular, Lisogurski's sensor is configured such that its detectors detect emitted light reflected from the subject's tissue—conversely, such light is not detected when the sensor is not worn because there is no subject tissue from which the emitted light can be reflected. Lisogurski, 10:49-52, 11:9-23, 11:16-20, 17:40-45; Anthony, ¶¶77, 198. A person of ordinary skill in the art would thus have understood and, at minimum found obvious, to configure Lisogurski's probe signal in this manner, as such functionality was a known implementation detail in physiological sensing systems at the time. *See e.g.*, Ex. 1058 (“Denso”), ¶¶29-33 (“The attachment detecting circuit 3 is a circuit that determines whether or not the attachment means 1 has been fitted over a finger 11.... [W]hen the attachment means 1 is fitted over a finger 11 and the light-emitting diode 22 emits light, the photodiode

23 receives light reflected from the skin surface (indicated by the dotted lines) and light reflected from the body (indicated by the solid lines) after hitting the capillaries 12, etc.... The signals outputted by the photodiode 23 when the light-emitting diode 22 emits light is compared with the signals outputted by the photodiode 23 when the light-emitting diode 22 does not emit light. When the signals are at the same level ... it is determined that the attachment means 1 is not fitted over a finger 11, and when there is a difference in the signals ... it is determined that attachment means 1 is fitted over a finger 11.”). Therefore, when the sensor is not worn, a person of ordinary skill in the art would have understood, and at least found obvious, that the system would generate a probe-off error signal. Anthony, ¶198; Lisogurski, 36:66-37:2. Conversely, absence of such probe-off error signal would allow the sensor to determine that the sensor is worn by a user. Anthony, ¶198.

23. Similarly, a “physiologically impossible value,” which neither the Patent Owner nor Dr. Efimov separately analyzes, would be generated when the system attempts to derive a physiological parameter from signals that do not reflect the intended interaction between the emitted light and the user's tissue. Anthony, ¶198. For example, if the sensor is not worn, a pulse-rate value generated by the system (Lisogurski, 4:3-7) indicates a physiologically impossible value (e.g., a pulse rate of 0 beats per minute or a pulse rate far outside human physiological limits), because the emitted light would not be interacting with the user's tissue as intended.

Anthony, ¶198. More specifically, in such a scenario, the detected signal would be dominated by non-physiological contributions, such as detector dark signal or ambient light. Any physiological parameter value calculated from such a signal would therefore fall outside the range of physiologically attainable values, which is the type of “physiologically impossible value” described by Lisogurski. Lisogurski, 36:66-37:2; ¶198. Accordingly, the absence of those error conditions and, when those error conditions are not detected, the system determines that the sensor is being worn. Anthony, ¶198.

24. For the reasons explained above, I disagree with Patent Owner's and Dr. Efimov's assertion that Lisogurski's “probe-off” error detection is fundamentally different from the claimed “determine ... that the apparatus is being worn by the user.” Efimov, ¶¶95, 98, 101; POR, 22. To the contrary, “probe-off” error, and also “physiologically impossible value” error, is directly related to wear detection; when the probe off signal is not active, the probe is on—i.e., the device is being worn. When the “physiologically impossible value” error is not active, there is a physiologically possible value because the device is being worn. Lisogurski's sensor “determine ... that the apparatus is being worn by the user” based on the absence of such signals. Anthony, ¶198. I recognize that Dr. Efimov also asserts that the absence of a probe-off signal or physiologically impossible value does not necessarily indicate that the device is being worn. Efimov, ¶100. That assertion

does not change my opinion, for the same reason discussed below with respect to his converse argument: claim 1 requires only that the apparatus be “configured to determine ... that the apparatus is being worn by the user,” not that the determination be correct in every circumstance. ’475, claim 1.

25. Patent Owner and Dr. Efimov further note that Lisogurski's discussion of detecting a “physiologically impossible value” or a “probe-off signal” appears in a single sentence and does not expressly identify which component performs the detection or how it is implemented. POR, 22; Efimov, ¶¶96. But they ignore Lisogurski's teaching that such error detection occurs during a “physiological measurement” and is performed by “the system.” Lisogurski, 36:48-37:5. “The system” refers to Lisogurski's disclosed physiological monitoring system, System 100, which is the only disclosed architecture identifying the components that perform physiological monitoring functions. *See* Lisogurski, 2:11-13, 3:8-10, 10:42-46, 12:42-51, 19:3-6, Figure. 1. As further discussed below, within that system, a person of ordinary skill in the art would have understood, and at least found obvious, that Lisogurski's modified sensor would detect “physiologically impossible value” or a “probe-off signal” (or their absence) using its processed signals because such error conditions result from the sensor's own measurements, and it was conventional to perform such monitoring at the sensor level. Lisogurski, 36:66-37:2, Pet., 35-36, 42-44; Anthony, ¶¶99, 196-198.

26. Patent Owner and Dr. Efimov also note that Lisogurski does not expressly define the term “probe-off” and, on that basis, point to Lisogurski’s discussion of “on” and “off” states for emitters and other system components. Efimov, ¶97 (citing Lisogurski, 8:27-44); POR, 22. I do not agree that this changes the understanding of a “probe-off signal.” Lisogurski’s discussion of “on” and “off” states relates to the operation of emitters and other system variables, such as brightness, current, duty cycle, and power states. Lisogurski, 8:27-44. By contrast, the “probe-off signal” is disclosed separately as a type of “system error” detected during a physiological measurement. Lisogurski, 36:66-37:2. Nothing in Lisogurski suggests that the “probe-off signal” refers to an emitter being turned off or otherwise derives its meaning from the discussion of “on” and “off” operating states. If anything, Lisogurski’s disclosure that “off” may correspond to a low, rather than completely absent, level of emission is consistent with my opinion that a probe-off condition occurs when the detector is not receiving, or is receiving an insufficient amount of, the expected probe light signal. Anthony, ¶¶77, 198.

27. I also disagree with Patent Owner’s and Dr. Efimov’s characterization that the claims require some separate “affirmative determination” distinct from determining an error condition. Efimov, ¶¶99, 101-102; POR, 22. Claim 1 requires only to “determine ... that the apparatus is being worn by the user,” without prescribing any particular determination methodology, sensing modality, algorithm,

decision logic, or “affirmative” wear-detection technique. ’475, claim 1. As I explained above, a person of ordinary skill in the art would have understood, and at least found obvious, that the absence of a probe-off signal or physiologically impossible value effectively determines that the apparatus is being worn by the user. Anthony, ¶198.

28. Patent Owner and Dr. Efimov additionally rely on several hypothetical examples in which a probe-off signal allegedly might not be generated, including where the device is attached to another object, where detection is delayed, or where a malfunction suppresses the error signal. Efimov, ¶99; POR, 23. But these examples concern potential inaccuracies or error conditions, not whether the apparatus is configured to make the determination—I see no requirement in the claims to achieve any particular level of accuracy or to eliminate all errors. ’475, Claim 1. Moreover, Dr. Efimov provides no testing, technical analysis, or disclosure from Lisogurski showing that these hypothetical scenarios would actually occur. Regardless, the same hypothetical scenarios could affect any wear-detection methodology, including the “affirmative determination” approach advocated by Dr. Efimov. For example, a system making an affirmative wear determination could likewise suffer from the same exact issues that Dr. Efimov raises—it could generate a false positive if attached to a non-user object, could experience delays in detection, or could malfunction. Efimov, ¶99.

29. Patent Owner and Dr. Efimov also assert that my deposition testimony supports his opinion because I acknowledged that system errors may arise from causes other than a device not being worn. Efimov, ¶100; POR, 23. I disagree. My testimony simply recognized that, like any measurement system, physiological-monitoring systems may experience error conditions. Ex. 2045, 48:16-49:21. That observation does not undermine my opinion that the absence of a probe-off signal or physiologically impossible value indicates user wear, or that the probe-off signal or physiologically impossible value is a separate system error identified in Lisogurski. Anthony, ¶198. Dr. Efimov's criticism incorrectly assumes that, any error in wear determination means that the device is not configured to determine that it is worn by the user. But claim 1 requires determining only “*that* the apparatus is being worn by the user.” ’475, claim 1. In other words, the claim does not require distinguishing every instance in which the apparatus is *not* worn. The mere possibility that a probe-off signal or physiologically impossible value may arise in circumstances other than when the apparatus is not worn does not change my opinion that the absence of those error conditions determines *that* the apparatus is being worn.

30. **Second**, Patent Owner and Dr. Efimov argue that Lisogurski does not disclose or render obvious that the sensor performs the determination. Efimov, ¶¶103-117; POR, 24-28. I disagree. As explained in my Declaration, Lisogurski expressly teaches that “the functionality of some of the components may be

combined in a single component.” Lisogurski, 15:66-16:4; Anthony, ¶¶99, 198. I further explained that integrating functionalities into the sensor would have provided recognized advantages including improved signal integrity, reduced latency, simplified system architecture, enhanced reliability, and improved robustness. Anthony, ¶¶98-107. A person of ordinary skill in the art would have understood, and at minimum found obvious, that wear-detection functionality is the type of functionality that would be incorporated into the modified sensor consistent with these teachings. Anthony, ¶198. This understanding is further confirmed by contemporaneous art, which likewise reflects the known practice of integrating sensing and associated wear detection functionality within wearable physiological-monitoring systems. Ex. 1058 claim 1, [0025], [0030], [0034], Figures 1-2 (disclosing a “pulse wave monitoring system,” that includes “attachment means,” which is “attached to a part of a human body,” along with a “sensor 2” and an “attachment detecting circuit 3” that work together to “determine[] whether the attachment means 1 is fitted over a finger 11.”)

31. Patent Owner and Dr. Efimov repeatedly argue that (1) Lisogurski's probe-off signal or physiologically impossible value detection appears only once, (2) Lisogurski identifies only “the system” as performing the detection, and (3) Lisogurski does not expressly identify which component performs that function or how it is implemented—based on those, Dr. Efimov concludes that Lisogurski does

not disclose or render obvious that the detection is performed by the sensor. Efimov, ¶¶104-109; POR, 24. I disagree.

32. As explained above, Lisogurski discloses that its error detection occurs during a “physiological measurement” and is performed by “the system,” which refers to Lisogurski’s physiological monitoring system, System 100—the only disclosed architecture identifying the components that perform physiological monitoring functions. Lisogurski, 2:11-13, 3:8-10, 10:42-46, 12:42-51, 19:3-6, 36:48-37:5, Fig. 1. Further, as I explained above and in my Declaration, Lisogurski expressly teaches that “the functionality of some of the components may be combined in a single component,” thereby providing flexibility regarding where functionality is implemented within the system. Lisogurski, 15:66-16:4; Anthony, ¶¶99, 198. In other words, the very purpose of Lisogurski’s integration disclosure is to permit functionality to be allocated among components in different ways. *Contra* Efimov, ¶¶107-109 (arguing against integration simply because the component performing the error detection is not explicitly recited in Lisogurski). Thus, even if Lisogurski does not expressly identify the component performing the error detection, a person of ordinary skill in the art would have understood, and at minimum found it obvious, to implement that functionality within the modified sensor in view of Lisogurski’s integration teachings, the modified architecture approved by the Board, and known trends toward increasing functionality within

wearable sensors. Anthony, ¶¶99, 147, 198; *see also* Ex. 1058 claim 1, [0025], [0030], [0034], Figure 2 (disclosing a “pulse wave monitoring system,” that includes “attachment means,” which is “attached to a part of a human body,” along with a “sensor 2” and an “attachment detecting circuit 3” that work together to “determine[] whether the attachment means 1 is fitted over a finger 11”).

33. As discussed above, my opinion is further confirmed by the knowledge of a person of ordinary skill in the art. For example, Ex. 1058 explains that its physiological sensor itself also performs wear-detection functionality and that doing so eliminates the need for a separate dedicated attachment-detection sensor and allows the device to be made smaller (Ex. 1058, [0045]), further reinforcing that incorporating wear-detection functionality into the physiological sensing device itself was a known and desirable design approach.

34. Patent Owner and Dr. Efimov dismiss Ex. 1058 as “unrelated” or as having “no connection” to Lisogurski and for not being part of the Ground, but otherwise provides no basis to ignore it. Efimov, ¶¶110, 123; POR, 25-26, 29-30. I disagree. While Ex. 1058 is not part of the Ground, as discussed above, Ex. 1058 confirms what was known in the art regarding wear-detection functionality and what a person of ordinary skill in the art would have understood and at minimum found obvious regarding the desirability and feasibility of implementing such functionality within physiological-monitoring devices. Anthony, ¶198.

35. Patent Owner incorrectly characterizes my testimony as evasive and contradictory with respect to where Lisogurski's error-detection functionality would be performed. POR, 26. I was not evading counsel's questions; rather, I understood the questioning to be directed to the unmodified version of Lisogurski shown in Figure 1 (as indicated by the questions from counsel), and I explained that my opinions are based on the Board's modified Lisogurski configuration. Ex. 2046, 295:18-300:12. Nor is there any contradiction between my testimony. I testified that the detection functionality is part of Lisogurski's sensor as modified (Ex. 2046, 293:11-25) and then explained that Lisogurski further permits functionalities to "be grouped in different ways" and "be incorporated as part of the biosensor" (Ex. 2046, 299:19-300:12). Thus, my testimony consistently reflected my opinion that, in view of Lisogurski's teachings and the Board's modification, functionalities such as the disclosed probe-off and error-detection functionality would be incorporated within the sensor and performed by front-end processing circuitry 150. Anthony, ¶198.

36. Patent Owner and Dr. Efimov also contend that a person of ordinary skill in the art would have understood Lisogurski's front-end processing circuitry to perform only the specific signal-conditioning functions expressly assigned to its subcomponents, that none of those subcomponents performs error detection, that decision-making and detection functions instead would be performed by back-end processing circuitry 170 and processor 172—based on those, Patent Owner and Dr.

Efimov conclude that wear detection would not be performed by the front-end circuitry or the modified sensor. Efimov, ¶¶111-114; POR, 26-27. I do not agree.

37. The fact that Lisogurski identifies particular signal-processing functions performed by front-end processing circuitry 150 does not imply that additional functions would not also be implemented there. *Contra* POR, 26-27; Efimov, ¶¶111-112. Indeed, Lisogurski expressly discloses front-end processing circuitry 150 performing signal-processing operations, including analog-to-digital conversion, generation of Red/IR and dark signals from detected waveforms, and subtraction of dark values to produce adjusted Red/IR signals. Lisogurski, 13:7-14:14. Lisogurski further emphasizes that the depicted front-end processing circuitry components are “merely illustrative” and that the functionality of front-end processing circuitry 150 and back-end processing circuitry 170 “may be combined in a single processor system,” thereby providing flexibility in the allocation and integration of functionality throughout the system. Lisogurski, 14:11-14; 15:66-16:6. Consistent with these disclosures, I confirmed that front-end processing circuitry 150 includes processing and memory capable of performing such operations and that Lisogurski contemplates distributing functionality across system components. Exs. 2046-, 54:19-55:1, 362:16-363:3. Nothing in Lisogurski states that monitoring, control, error-detection, or decision-making functions are restricted exclusively to back-end processing circuitry 170 simply because certain signal-

conditioning functions are performed by front-end processing circuitry 150. Nor do I agree with Dr. Efimov's assertion that processor 172 and step 1904 demonstrate that wear detection must occur only in the back-end processing circuitry. Efimov, ¶¶113-114. At most, those disclosures show that back-end processing circuitry 170 may perform physiological-processing functions. They do not state that all detection, monitoring, or error-related functions must be performed there, nor do they exclude implementation of wear-detection functionality elsewhere in the system. Indeed, following the modification discussed in my Declaration, which the Board agreed with, a person of ordinary skill in the art would have understood, and at minimum found it obvious, to implement wear-detection functionality within the modified sensor in view of Lisogurski's integration teachings, the technical benefits of sensor-level processing, and known industry trends toward increasing functionality within wearable sensors. Anthony, ¶¶99, 147, 198.

38. **Third**, Patent Owner and Dr. Efimov argue that Lisogurski does not disclose or render obvious that the wear determination is based on the processed signals, i.e. the claimed output signal, because Lisogurski does not expressly link its error-detection disclosure to the processed signals, because my analysis incorporates by reference my earlier discussion of those signals that does not expressly discuss error detection, and because the error-detection disclosure allegedly is disconnected from System 100. Efimov, ¶¶115-124; POR, 28-30. I disagree.

39. As I explained in my Declaration, the processed signals generated by the modified sensor would be used to determine whether a physiologically impossible value or probe-off condition exists and therefore whether the apparatus is being worn. Anthony, ¶198. A person of ordinary skill in the art would have understood, and at least found obvious, that wear determinations are performed using processed physiological measurements because those signals have already undergone conditioning and processing designed to improve reliability and measurement quality. Anthony, ¶¶98-107, 198. Indeed, Lisogurski discloses detecting error conditions during physiological measurements performed by the system (Lisogurski, 36:48-37:5), and a person of ordinary skill in the art would have understood those determinations to be based on the physiological signals generated and processed by the system. At a minimum, it would have been obvious to use processed physiological signals for wear detection, consistent with industry practice at the time, to increase the accuracy and reliability of the wear determination—a determination made on a conditioned signal is less susceptible to the ambient and background contributions that Lisogurski identifies as degrading the detection signal. Lisogurski, 14:46-55; Anthony, ¶¶98-107, 191, 198.

40. For example, Ex. 1058 determines whether a physiological sensing device is attached to a user based on dark-subtracted signals (i.e. processed physiological measurement signals) and, consistent with my opinion, explains that

doing so prevents transmission of noise, ensures that valid physiological signals are reliably transmitted, and prevents erroneous downstream determinations. Ex. 1058, [0030], [0033] (“The signals outputted by the photodiode 23 when the light-emitting diode 22 emits light is compared with the signals outputted by the photodiode 23 when the light-emitting diode 22 does not emit light. When the signals are at the same level ... it is determined that the attachment means 1 is not fitted over a finger 11, and when there is a difference in the signals ... it is determined that attachment means 1 is fitted over a finger 11.”), [0044] (“The pulse wave detecting device A is configured so that when the attachment detecting circuit 3 detects that the attachment means 1 has been fitted over a finger 11, the operating control circuit 4 supplies operating power to the transmission circuit 6 to transmit pulse waves to the pulse wave monitoring device B. As a result, the problem of the sensor 2 picking up external noise and the transmission circuit 6 transmitting noise to the pulse wave monitoring device B does not occur, and the pulse waves detected by the sensor 2 when the attachment means 1 is fitted over a finger 11 are reliably transmitted to the pulse wave monitoring device B. This makes it possible to prevent erroneous determinations by the pulse wave monitoring device B. There is also no need to operate an operating switch to operate the pulse wave detecting device A when pulse waves are detected, thereby making the device easy to use.”), Fig. 3. A person of ordinary skill in the art therefore would have understood and at least found it obvious

to base wear determination on physiological measurement signals (i.e., Lisogurski's processed signal) to improve the reliability of subsequent physiological processing and analysis. Thus, I disagree with Patent Owner's and Dr. Efimov's assertion that a person of ordinary skill in the art would not have understood, or at least found obvious, to base the wear determination on Lisogurski's processed signals.

41. Patent Owner and Dr. Efimov again attempt to isolate Lisogurski's discussion of error detection from the physiological monitoring system disclosed in Figure 1. Efimov, ¶¶118-119; POR, 29. I disagree again. As explained above, Lisogurski's disclosure that "the system" detects a "probe-off signal" or "physiologically impossible value" refers to System 100 because Figure 1 is the only disclosed block diagram identifying the internal components of Lisogurski's physiological monitoring system. Lisogurski, 2:11-13, 10:42-46, Fig. 1, 36:48-37:5. Accordingly, the error-detection disclosure describes functionality performed within the disclosed physiological monitoring system, not some separate or undisclosed system. And, as discussed above, because System 100 (and more specifically, sensor 102 as discussed above) generates and processes the physiological signals used to determine physiological measurements and parameters, a person of ordinary skill in the art would have understood, and at minimum found obvious, that the disclosed "probe-off signal" and "physiologically impossible value" are determined based on those same processed physiological signals. Anthony, ¶¶98-107, 198; Ex. 1058,

¶¶[0029]-[0033] (teaching a wear determination made by comparing the signals detected when the light-emitting element is on against those detected when it is off), [0045] (teaching that the physiological sensor itself performs that function, so that “a dedicated sensor for detecting attachment of the attachment means is not required”).

42. Patent Owner and Dr. Efimov also incorrectly assert that the discussion of limitation [1.n] in the Petition and my Declaration did not mention or relate to the processed signals. POR, 29; Efimov, ¶¶120-122. To the contrary, I explained, “[a] person of ordinary skill in the art would thus have understood (or at least found obvious) that *the processed signals (see my discussion in Section IX.A.3.g.[1.f])* are used by Lisogurski’s sensor to determine—not only whether the sensor is not being worn—but also when it is being worn by the user.” Anthony, ¶198. Patent Owner and Dr. Efimov also assert that the cross-referenced [1.f] analysis does not address error detection. POR, 29; Efimov, ¶¶120-122. That criticism overlooks the relationship between the processed signals and the disclosed error conditions. As I detailed in my Declaration, the processed signals are generated by Lisogurski’s system (and more specifically the sensor 102), and are used to produce physiological measurements and identify physiological parameters. Anthony, ¶¶145-152. As explained above, a person of ordinary skill in the art would have understood, and at minimum found obvious, that the disclosed probe-off signal and physiologically

impossible value arise from those same physiological measurements and physiological parameters generated by the sensor. Thus, my discussion identifies the processed signals that provide the basis for the wear determination discussed in ¶198, and my reliance on those paragraphs directly connects the wear determination to the processed signals.

43. Patent Owner and Dr. Efimov again attempt to dismiss Ex. 1058 as unrelated, having no connection to Lisogurski, and for not being part of the Ground. Efimov, ¶ 123; POR, 29-30. As discussed above, I cited Exhibit 1058 as evidence of what was known in the art regarding wear-detection functionality and the use of physiological measurement signals to determine whether a physiological sensing device is attached to a user. Anthony, ¶198. Thus, the relevance of Exhibit 1058 is not that it changes the meaning of Lisogurski's disclosures or provides an additional teaching to be incorporated into Lisogurski, but that it confirms how a person of ordinary skill in the art would have understood Lisogurski's disclosure, and at minimum found it obvious to use Lisogurski's physiological measurement signals, i.e., processed signals, to determine whether a sensor is being worn.

44. **Fourth**, Patent Owner and Dr. Efimov argue that Lisogurski cannot both (1) perform the wear determination at the sensor and (2) base that determination on the processed signals identified as the claimed output signal because those processed signals are transmitted from front-end processing circuitry 150 to back-

end processing circuitry 170. Efimov, ¶¶115-116, 125-129; POR, 27-28, 30-32. According to Patent Owner and Dr. Efimov, if the determination is based on the processed signals, then it must be performed by the back-end circuitry that receives those signals rather than by the sensor. Efimov, ¶¶125-129; POR, 30-32. That conclusion does not follow from Lisogurski.

45. Nothing in Lisogurski restricts use of the processed signals exclusively to the back-end processing circuitry or prohibits additional use of those same signals elsewhere in the system. Rather, Dr. Efimov's incompatibility theory assumes that the circuitry that transmits a processed signal cannot also use that signal itself. I have reviewed and found no such restriction in Lisogurski. To the contrary, consistent with the opinions set forth in my Declaration regarding integration of front-end processing and detection functionality within the sensor, a person of ordinary skill in the art would have understood, and at minimum found obvious, that the same processed signals would be used for additional functions, including wear detection and error monitoring, before, during, or after transmission to other circuitry. Anthony, ¶¶98-107, 147, 198. In particular, wear-detection functionality would benefit from using those same processed signals because they reflect whether meaningful physiological information is being obtained from the user. A person of ordinary skill in the art therefore would have understood, and at minimum found obvious, that the same processed signals would be used for multiple purposes within

the system, including both physiological monitoring and related functions such as wear detection and error monitoring at the sensor. Anthony, ¶¶99, 147, 198.

46. In sum, my opinion remains the same that Lisogurski discloses, and at minimum renders obvious, the limitation requiring that “the apparatus is ... configured to determine, based . . . on the output signal, that the apparatus is being worn by the user.”

**C. LISOGURSKI DISCLOSES AND RENDERS OBVIOUS
“A PROCESSOR CONFIGURED TO: ... (IV)
DETERMINE, BASED ... ON THE THIRD OUTPUT
SIGNAL, THAT THE WEARABLE DEVICE IS BEING
WORN BY THE USER” (GROUNDS 1-8, ELEMENT
[8.G])**

47. As I explained in my Declaration, Lisogurski discloses, and at minimum renders obvious, the limitation requiring that “a processor configured to: ... (iv) determine, based ... on the third output signal, that the wearable device is being worn by the user.” Anthony, ¶¶248-254.

48. Patent Owner and Dr. Efimov contend that [8.g] presents many of the same issues as limitation [1.n] and that Petitioners and I rely on the same Lisogurski disclosure—detecting a “physiologically impossible value” or “probe-off signal”—to satisfy the claimed determination that the wearable device is being worn by the user. POR, 38; Efimov, ¶¶158-161, 165, 174. Thus, Patent Owner and Dr. Efimov assert that the same alleged deficiencies he identifies with respect to limitation [1.n]

likewise apply to limitation [8.g]. POR, 38, Efimov, ¶161. To the extent Patent Owner and Dr. Efimov rely on the same arguments and alleged deficiencies discussed above with respect to limitation [1.n], my responses above apply equally here and are incorporated by reference. *See* Section V.B.

49. Patent Owner and Dr. Efimov further contend that limitation [8.g], together with limitation [8.d], imposes two additional requirements beyond those implicated by limitation [1.n]. POR, 38, Efimov, ¶¶159, 166-169. First, because limitation [8.d] recites “a processor configured to” perform the wear determination, Patent Owner and Dr. Efimov assert that the claimed determination must be performed by the claimed processor, which he understands Petitioners and I to identify as Lisogurski's front-end processing circuitry 150. Efimov, ¶¶159, 162, 167; POR, 38-39. Second, because limitation [8.g] requires that the determination be made “based at least in part on the third output signal,” Patent Owner and Dr. Efimov assert that the claimed determination must be based on what he understands Petitioners and I to identify as Lisogurski's ““dark subtract[ed]’ signal.” Efimov, ¶¶159, 163, 168; POR, 38-39. According to Patent Owner and Dr. Efimov, Petitioners and I therefore must show not only that Lisogurski's error detection constitutes the claimed wear determination, but also that the determination is performed by front-end processing circuitry 150 and is based on the alleged ““dark subtract[ed]’ signal.” Efimov, ¶¶164, 169; POR, 38-39. Patent Owner and Dr.

Efimov finally contend that Lisogurski does not disclose or render obvious these additional requirements (Efimov, ¶169; POR, 39), with which I disagree for the reasons explained below.

50. **First**, Patent Owner and Dr. Efimov argue that Lisogurski does not disclose or render obvious that the claimed wear determination is performed by its processor. Efimov, ¶¶171-181; POR, 39-41. In support of that position, Patent Owner and Dr. Efimov largely repeat the same arguments he previously raised regarding limitation [1.n], namely, that Lisogurski's disclosure of detecting a "probe-off signal" or "physiologically impossible value" appears only once, identifies only "the system" as performing the detection, does not expressly identify which component performs that function, and therefore does not disclose or render obvious that the wear determination is performed by front-end processing circuitry 150. Efimov, ¶¶172-180; POR, 39-41. Patent Owner and Dr. Efimov further contend that Petitioners and I do not explain how Lisogurski's alleged wear determination is connected to front-end processing circuitry 150 and instead identified only the modified sensor as performing the determination. Efimov, ¶¶173-174; POR, 39-40. According to Patent Owner and Dr. Efimov, a person of ordinary skill in the art would have understood that front-end processing circuitry 150 performs only the signal-conditioning functions expressly assigned to its subcomponents, while decision-making and detection functions would be performed by back-end

processing circuitry 170 and processor 172, including the error-detection functionality disclosed in step 1904. Efimov, ¶¶175-180; POR, 40-41. Patent Owner and Dr. Efimov therefore conclude that Lisogurski does not disclose or render obvious that front-end processing circuitry 150 performs the claimed wear determination. Efimov, ¶181; POR, 39. Again, I disagree with each such argument.

51. As an initial matter, there is little new in Patent Owner's and Dr. Efimov's analysis as compared to their arguments regarding limitation [1.n]. The principal difference identified by Patent Owner and Dr. Efimov is that, unlike limitation [1.n], limitation [8.g], in conjunction with limitation [8.d], recites the determination by a "processor." Efimov, ¶¶166-169; POR, 38-40. But, as explained in my Declaration, Lisogurski's front-end processing circuitry is incorporated into the modified sensor, i.e. the claimed processor. Anthony, ¶¶236-238. Accordingly, for the same reasons discussed above regarding limitation [1.n], a person of ordinary skill in the art would have understood, and at minimum found obvious, that front-end processing circuitry 150 performs the claimed wear determination. Anthony, ¶¶98-107, 147, 198, 248-253. Nevertheless, for completeness, I address Patent Owner's and Dr. Efimov's remaining arguments below.

52. Patent Owner and Dr. Efimov repeatedly argue that Lisogurski's disclosure of detecting a probe-off signal or physiologically impossible value appears only once, identifies only "the system" as performing the detection, does not

expressly identify which component performs that function or how it is implemented, and therefore does not disclose or render obvious that the determination is performed by front-end processing circuitry 150. Efimov, ¶¶172-174; POR, 39. Those arguments are substantially identical to the arguments discussed above regarding limitation [1.n], and fail for similar reasons.

53. Specifically, as explained above, a person of ordinary skill in the art would have understood that Lisogurski's disclosure that "the system" detects a "probe-off signal" or "physiologically impossible value" refers to System 100, the only disclosed architecture identifying the components of Lisogurski's physiological monitoring system. Lisogurski, 2:11-13, 3:8-10, 10:42-46, 12:42-51, 19:3-6, 36:48-37:5, Fig. 1. Moreover, Lisogurski expressly teaches that "the functionality of some of the components may be combined in a single component." Lisogurski, 15:66-16:4. As explained in my Declaration, a person of ordinary skill in the art would have understood that integrating functions within the sensor would provide recognized advantages including improved signal integrity, reduced latency, simplified system architecture, enhanced reliability, and improved robustness. Anthony, ¶¶98-107. Accordingly, because front-end processing circuitry 150 is the processing circuitry associated with the Board-approved modified-sensor and the generation of physiological measurements, a person of ordinary skill in the art would have understood, and at minimum found it obvious, to implement wear-detection

and related error-detection functionality in that front-end processing circuitry rather than in a separate component. This understanding is further confirmed by contemporaneous art, which reflects the known practice of integrating sensing and associated wear-detection functionality within wearable physiological-monitoring systems. *See* Ex. 1058, claim 1, ¶¶[0025], [0030], [0034], Figs. 1-2. Accordingly, the fact that Lisogurski does not expressly identify the component performing the error detection does not undermine my opinion that a person of ordinary skill in the art would have understood, and at minimum found it obvious, to implement that functionality within front-end processing circuitry 150 incorporated into the modified sensor. Anthony, ¶¶98-107, 147, 198, 253.

54. Patent Owner and Dr. Efimov further contend that Petitioners and I do not explain why front-end processing circuitry 150 performs the determination. Efimov, ¶¶173-180; POR, 39-40. In particular, Patent Owner and Dr. Efimov contend that front-end processing circuitry 150 performs only the specific signal-conditioning functions assigned to its disclosed subcomponents, while decision-making and detection functions would instead be performed by back-end processing circuitry 170 and processor 172, including the error-detection functionality disclosed in step 1904. POR, 40; Efimov, ¶¶175-180. This argument likewise mirrors the arguments addressed above regarding limitation [1.n] and ignores that front-end processing circuitry 150 is incorporated into the modified sensor and performs the

processor functionality relied upon for limitations [8.d] and [8.g], as explained in my Declaration and the Petition. Anthony, ¶¶236-238; Pet., 50-51. The fact that Lisogurski identifies particular signal-processing functions performed by front-end processing circuitry 150 does not imply that additional functions would not also be implemented there. Nothing in Lisogurski states that monitoring, detection, control, or decision-making functions are restricted exclusively to back-end processing circuitry 170. To the contrary, Lisogurski expressly teaches flexibility in the allocation and integration of functionality throughout the system, explaining that “the functionality of some of the components may be combined in a single component.” Lisogurski, 15:66-16:4; Anthony, ¶¶98-107. As discussed above, a person of ordinary skill in the art would have understood that integrating functions within the sensor provided recognized benefits and therefore would have found it obvious to implement wear-detection and related error-detection functionality within front-end processing circuitry 150. Anthony, ¶¶98-107, 198; Ex. 1058, claim 1, ¶¶[0025], [0030], [0034], Figs. 1-2. Accordingly, I do not agree with Patent Owner's or Dr. Efimov's assertion that a person of ordinary skill in the art would have understood Lisogurski's error detection to be performed by back-end processing circuitry 170 rather than front-end processing circuitry 150. POR, 40; Efimov, ¶175.

55. Nor does processor 172 or step 1904 demonstrate that all error-

detection functionality must be performed by back-end processing circuitry 170. Efimov, ¶¶178-179. As I explain above, those disclosures at most show that back-end processing circuitry 170 may perform physiological-processing functions, including determining physiological parameters from received signals. They do not exclude implementation of wear-detection functionality within front-end processing circuitry 150, particularly following the modification discussed in my Declaration and supported by Lisogurski's integration teachings as the Board agreed. Anthony, ¶¶98-107, 147, 198, 253.

56. Likewise, I do not agree with Patent Owner's and Dr. Efimov's assertion that, because the dark-subtracted signal is transmitted from front-end processing circuitry 150 to back-end processing circuitry 170, any determination based on that signal necessarily must be performed by the back-end processing circuitry. POR, 41, 43-45; Efimov, ¶¶180, 190-194. As discussed above, nothing in Lisogurski restricts use of a processed signal exclusively to the circuitry that receives it or prevents the circuitry that generates the signal from also using that same signal for additional functions, including wear detection and error monitoring.

57. To the extent Patent Owner and Dr. Efimov argue that my analysis identifies the modified sensor, rather than front-end processing circuitry 150 specifically, as performing the determination (POR, 40; Efimov, ¶174), that criticism ignores that front-end processing circuitry 150 is part of the Board-

modified sensor and provides the processor functionality relied upon in my analysis. Anthony, ¶¶10-11 117, 147. Thus, my discussion of the modified sensor performing the wear determination encompasses front-end processing circuitry 150, and does identify front-end processing circuitry 150 as performing that determination within the modified architecture.

58. **Second**, Patent Owner and Dr. Efimov argue that Lisogurski does not disclose or render obvious that the claimed wear determination is based on the claimed “third output signal,” which Patent Owner and Dr. Efimov do not dispute as satisfied by Lisogurski’s “dark subtract[ed]’ signal.” Efimov, ¶¶182-189; POR, 41-43. For the reasons explained below, I disagree.

59. Patent Owner and Dr. Efimov contend that Lisogurski’s disclosure of detecting a “probe-off signal” or “physiologically impossible value” contains no express connection to dark subtraction or to the alleged dark-subtracted signal. POR, 42; Efimov, ¶¶183-185. That argument largely mirrors their previously addressed contention that Lisogurski’s error-detection disclosure is disconnected from the remainder of System 100. As explained above, Lisogurski’s disclosure that “the system” detects a “probe-off signal” or “physiologically impossible value” refers to System 100 because Figure 1 is the only disclosed physiological monitoring system and the only disclosed architecture identifying the components that perform physiological monitoring functions. Lisogurski, 2:11-13, 10:42-46, 36:48-37:5, Fig.

1. Thus, the disclosed error detection is performed using the signals processed within System 100, including the output signals generated by front-end processing circuitry 150, which includes dark subtractor 162. Lisogurski, 13:7-12. As discussed above, a person of ordinary skill in the art would have further understood that front-end processing circuitry 150 is the processing circuitry associated with the sensor and the generation of physiological measurements and that implementing wear-detection and related error-detection functionality within that circuitry would have provided recognized advantages including improved signal integrity, reduced latency, simplified system architecture, and enhanced reliability of wireless communications. Anthony, ¶¶98-107. Based on those recognized benefits, and as further discussed below, a POSITA would further have understood, and at least found obvious, to use the dark-subtracted signal for the probe-off signal and physiologically impossible value determination, as doing so would further improve accuracy with the noise from the ambient light removed. Anthony, ¶¶98-107, 198, 252-254.

60. Patent Owner and Dr. Efimov also contend that my analysis improperly relies on my discussion of limitation [1.n] because that discussion does not expressly address the dark-subtracted signal and further argues that my analysis of limitation [8.g] itself does not discuss the dark-subtracted signal. POR, 42; Efimov, ¶¶185-186. Those criticisms overlook my express discussion of limitations [8.d]-[8.f]. In

particular, I stated in my analysis of element [8.g] that “as I discussed above regarding claim elements [8.d] to [8.f] (Sections IX.A.3.v-x.[8.d]-[8.f] in my Declaration), Lisogurski also discloses generating a third output signal based on a dark subtraction technique.” Anthony, ¶251. Thus, contrary to Patent Owner's and Dr. Efimov's characterization, my analysis of limitation [8.g] not only incorporates my discussion of limitation [1.n], which addresses the wear determination, but it also incorporates my discussion of limitations [8.d]-[8.f], which addresses the dark-subtracted signal corresponding to the claimed third output signal.

61. Patent Owner and Dr. Efimov further incorrectly contend that there is no basis for my opinion that a person of ordinary skill in the art would have understood, or at minimum found obvious, using the dark-subtracted signal to detect a probe-off signal or physiologically impossible value. POR, 42-43; Efimov, ¶¶184, 187. As explained in my Declaration, a person of ordinary skill in the art would have understood that the determination of a “probe-off signal” or “physiologically impossible value” would be based at least in part on the dark-subtracted signal because that signal removes ambient noise and thereby minimizes any detrimental effect that noise in the processed signal may have on accurate detection of those conditions. Anthony, ¶253.

62. At a minimum, such use would have been obvious in view of well-known practices at the time. Anthony, ¶¶253-254. For example, Exhibit 1057

discloses comparing a detected ambient-light signal and a detected physiological light signal using operations including “subtraction” and then using that analysis to determine whether “the physiological sensor is not properly positioned.” Ex. 1057, 18:45-51 (“Comparisons may include subtraction...”), 20:4-6 (“the system may determine that the physiological sensor is not properly positioned ... based on the analysis”). Similarly, Exhibit 1058 determines whether a sensor is attached to a user by comparing signals obtained when the light-emitting diode emits light with signals obtained when the light-emitting diode does not emit light, and determining that the sensor is attached when those signals differ. Ex. 1058, ¶¶[0032]-[0033]. Indeed, Exhibit 1058 explains that attachment is detected by comparing these two signals, allowing “attachment [to] be accurately detected using a simple circuit configuration.” Ex. 1058, ¶[0046]. Exhibit 1058 further explains that this approach prevents “the sensor 2 picking up external noise” and “makes it possible to prevent erroneous determinations.” Ex. 1058, ¶[0044]. Thus, Exhibits 1057 and 1058 provide additional motivation for a person of ordinary skill in the art (as well as a reasonable expectation of success) to base a wear determination on a dark-subtracted signal in order to improve detection accuracy and reliability while maintaining a simple implementation.

63. Patent Owner and Dr. Efimov contend that Exhibit 1057 does not affect a person of ordinary skill in the art's understanding of Lisogurski because there is

allegedly no connection between the two references. Efimov, ¶188; POR, 43. That criticism misconstrues the purpose for which I cited Exhibit 1057. As explained in my Declaration, I cited Exhibit 1057 as evidence of what was known in the art regarding the use of dark-subtracted signals for wear determination. Anthony, ¶254. In particular, Exhibit 1057 expressly discloses analyzing physiological signals using subtraction and then determining whether a physiological sensor is properly positioned based on that analysis. Ex. 1057, 18:45-51, 20:4-6. Thus, the relevance of Exhibit 1057 is not that it alters the meaning of Lisogurski's disclosures, but that it confirms that a person of ordinary skill in the art would have understood, and at minimum found obvious, using a dark-subtracted signal to determine whether a physiological sensor is being worn. Anthony, ¶254.

64. I also disagree that there is no connection between Lisogurski and Ex. 1057. Lisogurski and Ex. 1057 are both U.S. patents assigned to Covidien LP and disclose substantially the same physiological-monitoring system. In particular, both references share the same Figure 3 and closely corresponding Figure 1 architectures with substantially identical accompanying disclosures. Anthony, ¶¶10-11. *Compare* Lisogurski, cover page, Figs. 1, 3, 11:61-66, 12:22-26, 12:52-57, 13:5-21, *with* Ex. 1057, cover page, Figs. 1, 3, 8:17-22, 8:48-51, 9:14-20, 17:30-45.

65. In sum, my opinion remains the same that Lisogurski discloses, and at minimum renders obvious, the limitation requiring that "a processor configured to:

... (iv) determine, based ... on the third output signal, that the wearable device is being worn by the user.”

**D. LISOGURSKI DISCLOSES AND RENDERS OBVIOUS
“SIX LIGHT EMITTING DIODES” (GROUNDS 1-8,
CLAIM 6)**

66. As I explained in my Declaration, Lisogurski discloses, and at minimum renders obvious, Claim 6's limitation requiring that “six light emitting diodes.” Anthony, ¶¶199-208. Lisogurski teaches that its light source includes “one or more,” or “multiple” LEDs, and that light source 130 “may include any number of light sources with any suitable characteristics,” each of which thus disclosing and at least rendering obvious the claimed “six light emitting diodes.” Lisogurski, 10:52-11:6, 17:43-45, 19:22-31, 27:36-43; Anthony, ¶203. Utilizing multiple LEDs, including multiple wavelengths and multiple LEDs per wavelength, was well known at the time of the alleged invention and a person of ordinary skill in the art would have understood that using multiple LEDs would allow for improved measurement robustness, accuracy, and redundancy, and address various physiological monitoring objectives. *See* Anthony, ¶¶204-206. Using multiple LEDs, including six or more, in a physiological measurement device was in fact well known in the art, and a person of ordinary skill in the art would have understood—and at least found obvious—that Lisogurski's disclosure of “one or more,” “multiple,” or “any number” of LEDs includes six LEDs. Anthony, ¶¶207-208. Patent Owner and Dr.

Efimov argue otherwise. POR, 34-37; Efimov, ¶¶144-154.

67. Patent Owner and Dr. Efimov argue that “[t]he ’475 patent specification specifically depicts an embodiment with six light-emitting diodes in FIG. 18B,” and that “[f]rom the disclosure of the ’475 Patent specification, a person of ordinary skill in the art would understand that the use of six LEDs provides the technical advantage of increasing the probability that emitted light will illuminate blood vessels within the tissue—a requirement for accurate physiological measurement.” Efimov, ¶¶146-147; POR, 35. I disagree to the extent Patent Owner and Dr. Efimov contend that the ’475 patent specification sets forth a particular technical advantage to using six LEDs.

68. Fig. 18B depicts a mouth guard having light source input ports 1852, 1853 and detector output ports 1854, 1855. However, a person of ordinary skill would have understood that the specification of the ’475 patent does not provide a *particular* technical advantage to using six LEDs. In fact, the specification states that “the mouth guard may have one or more light source input ports 1852, 1853 and one or more detector output ports 1854, 1855,” and that “[a]lthough six input and output ports are illustrated, any number of ports may be used.” ’475 patent, 27:42-45. Based on this, a person of ordinary skill in the art would have understood that the specification of the ’475 patent provides that there is no *specific* technical advantage to using six LEDs. Notably, Dr. Efimov does not cite this portion of the

'475 patent specification when discussing Fig. 18B and therefore does not attempt to reconcile this disclosure with his opinions. Further, when asked if this passage is limited to six LEDs during his deposition, Dr. Efimov acknowledged that "it does say more." Ex. 1127, 192:21-193:17.

69. Patent Owner and Dr. Efimov further argue that "using six LEDs provides sufficient redundancy for each wavelength used without reducing LED efficiency," "when a system uses three distinct wavelengths—six LEDs provide exactly two LEDs per wavelength," and "[t]his two-per-wavelength pairing is not an arbitrary selection; it provides meaningful redundancy for each wavelength channel while maintaining system efficiency." Efimov, ¶146; POR, 35. I disagree. It is true that using three wavelengths and two LEDs per wavelength results in six total LEDs. However, as I described above, a person of ordinary skill in the art would have understood that there is no *specific* technical advantage to using six LEDs, or two LEDs for each of three wavelengths. The '455 specification uses neither the phrase "two LEDs" nor "per wavelength," identifies no redundancy benefit, and says only that "any number of ports may be used." '455 patent, 28:26-27..

70. Patent Owner and Dr. Efimov further contend that "disclosures of 'one or more,' 'multiple,' and 'any number' do not expressly disclose six," and that the "only specific embodiment described in Lisogurski uses two LEDs—one red and one infrared." POR, 34-35; Efimov, ¶148 (citing Lisogurski, at 10:52-60, 17:43-45,

19:22-31). I disagree. First, Lisogurski discloses using more than just one red and one IR LEDs. *See* Lisogurski, 7:56-59 (“[T]he first light source may be a high efficiency infrared (IR) LED **while the one or more additional light sources may be lower efficiency red LEDs or laser diodes.**”). Further, as I previously opined, “a person of ordinary skill in the art would have understood that Lisogurski’s disclosure of ‘one or more,’ ‘multiple,’ or ‘any number’ ... of LEDs would include six LEDs.” Anthony, ¶208. Dr. Efimov does not disagree with that opinion.

71. Patent Owner and Dr. Efimov further mischaracterize “Lisogurski’s stated objectives” as being directed to reducing power consumption and minimizing heating effects to the exclusion of its other objectives, and assert on that basis that those objectives “counsel against using six LEDs.” POR, 35-36; Efimov, ¶149 (citing Lisogurski, at Title, 1:10-25, 3:50-60). I disagree. Power optimization is not Lisogurski’s sole objective. Another, and at least equally important, objective in Lisogurski is measurement accuracy and achieving high signal to noise ratios. *See e.g.*, Lisogurski, 6:3-6, 9:4-7, 9:46-60, 14:40-55, 16:33-17:10, 25:66-26:14. Thus, a person of ordinary skill reading Lisogurski would have understood that Lisogurski’s objective of conserving power needs to be at least balanced against its objective of accurate measurement. Indeed, Lisogurski specifically notes making a tradeoff for power consumption versus accuracy: “the system may operate in a high power mode without cardiac cycle modulation for a certain time period following, for example,

high noise levels, a loss of signal, or an irregular cardiac rhythm.” Lisogurski, 9:4-

7. In fact, Lisogurski does not teach compromising its accuracy for battery power, indeed it discloses: “it may be desirable to reduce the power consumption of the light source, *while still enabling high quality physiological parameters to be determined.*” Lisogurski, 3:50-53.

72. Dr. Efimov continues that “[t]ripling the number of LEDs from the two disclosed in Lisogurski to the claimed six would cut against Lisogurski’s stated objectives,” and would “increase heat generation,” “increase signal-processing complexity,” and “increase sensor size.” Efimov, ¶150; *see also* POR, 36. I disagree with each such assertion. In fact, such assertion ignores Lisogurski’s explicit teaching for “one or more,” “multiple,” and “any number” of LEDs—an *unbounded* number. *See* Lisogurski, 10:52-11:6, 17:43-45, 19:22-31, 27:36-43.

73. Regarding heat generation, the cited passages of Lisogurski discuss reducing power consumption and heating effects through operational techniques such as varying light intensity, firing rate, and duty cycle. Lisogurski, 1:10-25, 3:50-60. I do not agree that those disclosures would have led a person of ordinary skill in the art to conclude that a six-LED configuration was inconsistent with Lisogurski’s objectives, particularly given Lisogurski’s repeated disclosure that the system may employ multiple light sources. Lisogurski, 10:52-11:6, 17:43-45, 19:22-31, 27:36-43. Further, by the time of the alleged invention, a person of ordinary skill in the art

would have understood how to implement LED-based physiological monitoring systems, including systems employing six LEDs, while managing heat generation. For example, the contemporaneous art explains that LEDs were available in packages that provided a thermal path from the LED chip through the package to an external heat sink for heat dissipation and discusses significant improvements in thermal resistance and heat-sink performance prior to the alleged invention. Ex. 1037, 00026-00028.

74. Regarding signal processing complexity, a person of ordinary skill in the art would have understood how to program Lisogurski's system to accommodate signal processing for additional wavelengths without unduly increasing signal processing complexity. Indeed, Lisogurski specifically discloses that "[w]hen light source 130 is configured to emit two or more wavelengths of light, the light drive signal may be configured to control the operation of each wavelength of light," and that the light drive signal "may comprise a single signal or may comprise multiple signals (e.g., one signal for each wavelength of light)." Lisogurski, 11:54-60. A person of ordinary skill in the art therefore would have understood that Lisogurski already contemplates controlling and processing multiple wavelengths and corresponding signals. A person of ordinary skill in the art would also have understood that adding emitters does not change Lisogurski's signal-processing architecture. Lisogurski already drives its emitters in separate time slots and

separates the resulting detector signal with demultiplexer 156. Lisogurski, 12:4-35; 13:11-12. Additional emitters therefore add drive slots within a cycle rather than additional processing blocks.

75. Regarding sensor size, by the time of the alleged invention, standard LEDs were small enough such that utilizing six LEDs would not negatively impact the size of the sensor. Ex. 1038, at 765 (“In certain applications, for example in portable instrumentation, LEDs have significant advantages over other light sources because they are small and inexpensive, consume low power, produce selective wavelengths, and are easy to work with.”). Further, Dr. Efimov opines that “[c]onsistent with these objectives, Lisogurski teaches techniques intended to minimize the number and brightness of LEDs operating at any given time.” Efimov, ¶151 (citing Lisogurski, 7:38-8:3). However, that portion of Lisogurski is not limited to a system with two light sources. It describes operating a first light source at full brightness together with “one or more additional light sources”:: “operat[ing] a first light source at full or regular brightness, while operating *one or more additional light sources* in a switched or otherwise modulated mode.” Lisogurski, at 7:38-43. The remainder of the cited portion provides further examples of a system with more than two LEDs, for example: “the *first light source* may be a high efficiency infrared (IR) LED while the *one or more additional light sources* may be lower efficiency red LEDs or laser diodes.” See Lisogurski, at 7:38-43.

76. Patent Owner and Dr. Efimov further assert that “LeBoeuf’s Figure 8B shows only four LEDs.” Efimov, ¶152; POR, 36-37. Such assertion is contradicted by Dr. Efimov’s own admission that LeBoeuf discloses that “[v]arious configurations and arrangements of optical emitters and detectors ... may be utilized in accordance with embodiments of the present invention.” Efimov, ¶152; LeBoeuf, [0123]. A person of ordinary skill would have understood the disclosure of “[v]arious configurations and arrangements” does not limit the number of optical emitters to the four depicted, and a person of ordinary skill in the art would have understood six to be among the arrangements contemplated, as was well-known in the art.

77. For example, Lamego (Ex. 1033) explicitly discloses a sensor with six LEDs and teaches using multiple LEDs to improve accuracy. Lamego, [0041] (“In one embodiment, the n LEDs 302 include four, six, eight or sixteen LEDs of different wavelengths.”). Patent Owner and Dr. Efimov do not dispute that Lamego (Ex. 1033) explicitly discloses a sensor with six LEDs. POR, 37; Efimov, ¶153. However, Dr. Efimov argues that “Lamego’s system is designed for multi-constituent spectral analysis—a different measurement task than Lisogurski’s single-parameter pulse oximetry,” and that I do not explain “why a POSITA would have a motivation to combine Lisogurski with LeBoeuf and/or Lamego.” Efimov, ¶¶153-154; *see also* POR, 37 (arguing that Lamego is not part of any ground).

Rather than combining Lisogurski and Lamego, however, I noted Lamego for its demonstration of the knowledge of a person of ordinary skill in the art, specifically confirming that using six LEDs was well known in the art and, at the very least, providing a motivation and reasonable expectation of success in using such a configuration. *See* Anthony, ¶¶206-208. I note as well that the six LEDs Lamego describes are six LEDs of six different wavelengths. Lamego, [0041]. Lamego therefore confirms that a six-emitter sensor was a known configuration independent of Dr. Efimov's premise that six can arise only from pairing two light emitting diodes with each of three wavelengths. Further, I disagree that Lamego's system is designed for a different measurement task than Lisogurski's system. Both Lisogurski and Lamego disclose pulse oximetry and multiparameter physiological monitoring systems. *See e.g.*, Lisogurski, 4:6-7 ("An **oximeter** may include a light sensor that is placed at a site on a patient....), 18:53-56 ("For example, **multi-parameter physiological monitor** 326 may be configured to display an estimate of a subject's blood oxygen saturation and hemoglobin concentration"); Lamego, [0036] ("For example, such a **multi-wavelength physiological monitor** can determine levels and/or concentrations of: methemoglobin (MetHb), carboxyhemoglobin (COHb), low hemoglobin levels, high hemoglobin levels, bilirubin, methylene blue, deoxyhemoglobin, and lipids.") [0041] ("A schematic of one embodiment of a **multi-wavelength physiological monitor** for pulse oximetry is shown in FIGS. 3-

5.”). Lisogurski likewise contemplates the use of “one or more wavelengths” and is not limited to single-parameter pulse oximetry or measuring only two absorbers. Lisogurski, 4:37-45 (“The light intensity or the amount of light absorbed may then be used to calculate *any of a number of physiological parameters*, including an amount of a blood constituent (e.g., oxyhemoglobin”), 17:17-39 (“Sensor unit 312 may include *one or more light source 316 for emitting light at one or more wavelengths* into a subject’s tissue.”), 17:62-66 (“For example. monitor 314 may be configured to determine pulse rate, blood pressure, *blood oxygen saturation (e.g.. arterial, venous, or both), hemoglobin concentration (e.g.. oxygenated, deoxygenated, and/or total), any other suitable physiological parameters, or any combination thereof.*”).

78. Regardless, a person of ordinary skill in the art would have recognized that multi-wavelength monitoring also would increase accuracy of Lisogurski’s pulse oximetry measurements by distinguishing constituents that may interfere with measurements obtained using only two wavelengths. *See e.g.*, Lamego, [0037] (“For example, many drugs cause the level of MetHb within a patient's blood to increase. MetHb also absorbs light at the two wavelengths used in a typical two-wavelength physiological monitor, which may cause inaccurate SPO2 readings. Increased levels of MetHb generally cause blood oxygen concentration level (e.g., SPO2) readings to decrease. 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. On the other hand, a multi-wavelength physiological monitor, such as any of the multi-wavelength physiological monitors described below, could not only identify the cause of decreased SPO2 readings, but also (or alternatively) compensate for such cause when calculating the patient's SPO2 level and/or signal. For example, to compensate for MetHb, one or more wavelengths sensitive to MetHb can be used.”). Thus, a person of ordinary skill in the art’s knowledge of using three or more wavelengths (e.g., six) to address the known issue of limited differentiation capability in dual-wavelength systems, as demonstrated by Lamego, would be relevant to Lisogurski’s pulse oximetry system. Anthony, ¶¶205-208.

79. Patent Owner and Dr. Efimov also allege that Petitioners and I failed to explain “why a POSITA would have chosen six LEDs over other numbers, nor does it identify any technical reason or advantage for using specifically six LEDs in a pulse oximetry system.” Efimov, ¶154; POR, 37. Contrary to their mischaracterization, and as discussed above, I provided a detailed explanation based on the disclosures of Lisogurski and what was known in the art as to why a person of ordinary skill would have understood or at least found obvious to use multiple LEDs, including six or more, to improve accuracy in Lisogurski’s pulse oximetry system. Anthony, ¶¶204-208.

80. In sum, my opinion remains the same that Lisogurski discloses, and at minimum renders obvious, Claim 6's limitation requiring "six light emitting diodes."

E. LISOGURSKI DISCLOSES AND RENDERS OBVIOUS A FIRST AND SECOND OUTPUT SIGNAL RESPONSIVE TO LIGHT SOURCE BEING ON AND OFF, AND A THIRD OUTPUT SIGNAL BASED ON THE FIRST AND SECOND OUTPUT SIGNAL HAVING A THIRD SIGNAL-TO-NOISE RATIO THAT IS GREATER THAN THOSE OF THE FIRST AND SECOND OUTPUT SIGNAL (GROUNDS 1-8, ELEMENTS [8.D]-[8.F])

81. As I explained in my Declaration, Lisogurski discloses, and at minimum renders obvious, a first and second output signal responsive to light source being on and off, and a third output signal based on the first and second output signal having a third signal-to-noise ratio that is greater than those of the first and second output signal. Anthony, ¶¶236-247.

82. Before addressing Patent Owner's and Dr. Efimov's specific arguments, I note that the Board already found that Lisogurski's modified front-end processing circuitry performs the functionality recited in limitations [8.d]-[8.f], including generating processed output signals ('484-FWD, 23-24, 26-27; Pet. 35-36, 50-54; Anthony, ¶¶145-152), one of which (i.e., first output signal) is responsive to the LEDs being on and another of which (i.e., second output signal) is responsive to the LEDs being off ('484-FWD, 43-44; Pet., 40-42, 50-52; Anthony, ¶¶182-189, 236-243), and generating a third output signal by subtracting the second signal from

the first signal to improve signal-to-noise ratio by removing noise captured in the second signal. ('484-FWD, 44; Pet. 53-54, Anthony, ¶¶244-247). These findings are consistent with my opinions in this proceeding and with my opinions in my prior declaration submitted in the '484 IPR. Anthony, ¶¶146, 241, 247; '484-Anthony, ¶117.

83. Patent Owner and Dr. Efimov nevertheless raise two principal arguments. First, they argue that I do not show that Lisogurski's third output signal has a signal-to-noise ratio greater than second output signal, while not disputing that third output signal has a greater signal-to-noise ratio greater than first output signal. POR, 45-47; Efimov, ¶¶195-200. Second, they argue that Petitioners and I do not identify signals in Lisogurski that are both "output signal[s]" and "responsive to the light source being on" or "off," as required by limitations [8.d]-[8.f]. POR 47-50; Efimov, ¶¶201-208. For the reasons explained below, I disagree.

84. **First**, Patent Owner and Dr. Efimov argue that Petitioner and I do not show that Lisogurski's third output signal has a signal-to-noise ratio greater than both the first and second output signals, and in particular contend that I did not establish that Lisogurski's dark signal has a signal-to-noise ratio to begin with. Efimov, ¶¶197-200; POR, 46-47. I disagree. As explained in my Declaration, Lisogurski discloses a dark-subtraction technique that "subtract[s] dark values from the Red and IR components to generate adjusted Red and IR signals," thereby

removing “ambient and background signals.” Anthony, ¶246; Lisogurski, 6:7-19, 13:60-14:10. I further explained that Lisogurski teaches that ambient light has “a detrimental effect on the signal-to-noise ratio of the detection signal” and that signal-modification techniques are employed “to reduce the effect of ambient light on the detection signal” and “thereby reduce the contribution of the noise component.” Anthony, ¶247; Lisogurski, 14:46-55. Thus, a person of ordinary skill in the art would have understood, and at minimum found obvious, that the adjusted signal resulting from dark subtraction has an improved signal-to-noise ratio relative to the signal before subtraction. Anthony, ¶247.

85. Patent Owner's and Dr. Efimov's argument appears to rest primarily on a misunderstanding that Lisogurski's dark signal lacks “a relevant signal-to-noise ratio.” POR, 46; Efimov, ¶¶198-200. But that position is inconsistent with Lisogurski's disclosures, my prior analysis, the '475 Patent specification itself, and Patent Owner's own infringement contentions. As I explained in my prior '484 declaration, Lisogurski's detection signals have a signal-to-noise ratio. Lisogurski, 14:49-50 (“This may have a detrimental effect on *the signal-to-noise ratio of the detection signal*”), 9:46-52 (noting the detected signal may include “background noise” and that the light drive parameters of the LEDs may be modified to “*improve the signal-to-noise ratio*”); '484-Anthony, ¶117. Lisogurski further discloses the “processed signals” originate from those “detection signals.” Lisogurski, 12:42-45

(“[F]ront 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.”), 9:46-60, 11:20-27, 14:49-50; ’484-Anthony, ¶117. Accordingly, a person of ordinary skill in the art “would have recognized that both the processed and detection signal ha[ve] its own signal-to-noise ratio (that can be improved).” ’484-Anthony, ¶117. Consistent with that understanding, a person of ordinary skill in the art would have understood that Lisogurski’s dark signal, which is generated from the “dark signal portion of the detection signal” and is used by dark subtractor 162 to “reduce the effect of the dark signal on the peak,” likewise has a signal-to-noise ratio. Lisogurski, 13:60-14:10, 16:51-54, 17:8-10; Anthony, ¶195. Because the dark signal itself is a measured signal component and used in the generation of the dark-subtracted signals, a person of ordinary skill in the art would have understood that it possesses its own signal-to-noise ratio. A person of ordinary skill in the art therefore would have understood, and at minimum found obvious, that removing ambient and background noise through dark subtraction improves the signal-to-noise ratio of the resulting adjusted signal relative to both the original signal containing that noise and the dark signal used to remove it. Anthony, ¶247.

86. This understanding is also consistent with the ’475 Patent specification, which discusses improving signal-to-noise ratio by capturing signals with the light source on and off and then differencing those signals, without separately addressing

whether the off-signal itself has a signal-to-noise ratio or requiring any comparison with the off-signal's signal-to-noise ratio. '475, 58:1-22, 70:8-27. Moreover, Patent Owner's and Dr. Efimov's position (POR, 46-47; Efimov, ¶¶199-200) contradict Patent Owner's own district-court contention that the claimed limitation is satisfied through "ambient light cancellation," which allegedly "increase[s] the SNR, by comparing the measured signal when the LED sources are off ('first signal') and the measured signal when the LED sources are on ('second signal')." Ex. 2116, 157. That contention relies, without more, on the same LED-off/LED-on comparison that Patent Owner and Dr. Efimov now argue cannot support the claimed comparison between the first and second output signals, and their resulting signal-to-noise ratios.

87. **Second**, Patent Owner and Dr. Efimov incorrectly contend that Petitioners and I do not identify signals in Lisogurski that are both "output signal[s]" and "responsive to the light source being on" or "off," as required by limitations [8.d]-[8.f]. Efimov, ¶¶202-208; POR, 47-50. According to Patent Owner and Dr. Efimov, my analysis improperly cross-references and combines my discussions of limitations [1.f] and [1.l] because those discussions refer to different types of signals. Efimov, ¶¶202-205. I disagree.

88. Patent Owner's and Dr. Efimov's analyses mischaracterize both my mapping and Lisogurski's description of its signals. As I explain in detail below, Petitioners and I consistently map the claimed first, second, and third output signals

to signals generated by the front-end processing circuitry included within the Board-approved modified sensor. Anthony, ¶¶145-152, 182-189, 236-247. In particular, my analysis of limitation [8.d] refers to my discussion of limitation [1.f], which addresses the claimed “output signal” requirement by identifying Lisogurski's processed signals as the claimed output signals. Anthony, ¶¶145-152, 237. My analysis of limitation [8.d] also refers to my discussions of limitations [1.k] and [1.l], which address the additional requirement that particular output signals (i.e., Lisogurski's processed signals) be generated responsive to the LEDs being off and on, respectively. Anthony, ¶¶182-189, 237. Read together, these discussions consistently identify processed signals generated by front-end processing circuitry 150 as the claimed output signals.

89. Patent Owner and Dr. Efimov specifically contend that my discussion of limitation [1.l] relies on a detection signal rather than a processed signal because it references the Board's finding that “front end processing circuitry measur[es] the signal when at least one LED is on to capture a portion of the optical beam.” POR, 48; Efimov, ¶204. That characterization is incomplete. In my analysis of limitation [8.d], I expressly relied on both my discussion of limitation [1.f] and my discussion of limitation [1.l] in addressing limitation [8.d]. Anthony, ¶237. My discussion of limitation [1.f] identifies Lisogurski's processed signals generated by front-end processing circuitry 150 as the claimed output signals. Anthony, ¶¶145-152. My

discussions of limitations [1.k] and [1.l] then address the circumstances under which those output signals are generated, namely during the LED-off and LED-on periods. Anthony, ¶¶182-189.

90. For example, in my discussion of limitation [1.k], I cited the Board's determination that Petitioner had demonstrated that "Lisogurski [] disclos[es] the front end processing uses the current measured when the LEDs are off *to generate a dark signal* representative of ambient light." Anthony, ¶183; '484-FWD, 43-44. Likewise, in my discussion of limitation [1.l], I cited the Board's determination that Petitioner had demonstrated that "Lisogurski [] disclos[es] the front end processing circuitry measuring the signal when at least one LED is on to capture a portion of the optical beam, e.g., a red signal and an IR signal, reflected from the tissue," and thereby "*generat[ing] a second signal responsive to light when at least one of the LEDs is on.*" Anthony, ¶187; '484-FWD, 43-44. As such, when read together, my discussions clearly establish these determinations as describing how front-end processing circuitry 150 generates signals based on measurements obtained during the LED-off and LED-on periods, respectively—there is no inconsistency in my analysis identifying processed signals generated by front-end processing circuitry 150 as the claimed output signals, and explaining that those processed signals are responsive to the LED-off and LED-on conditions recited in the claim.

91. Dr. Efimov's discussion of Figure 2B similarly takes my analysis out

of context. Efimov, ¶205. I cited Figure 2B to illustrate Lisogurski's dark-subtraction technique and to show how Lisogurski's detectors and front-end processing circuitry generate signals. Anthony, ¶¶184, 188. I did not state that the detector-current waveform shown in Figure 2B itself corresponds directly to the claimed first or second output signal. To the contrary, my annotations explicitly identify the signals depicted in Figure 2B as detector currents, and my analysis explains how front-end processing circuitry 150 utilizes those measurements to generate the processed signals relied upon for limitations [8.d]-[8.f]. Anthony, ¶¶184, 188.

92. I also disagree with Patent Owner's Dr. Efimov's assertion that the claimed output signal and the signal responsive to the LEDs being on are necessarily different signals such that neither can satisfy limitation [8.d]. POR, 47-48; Efimov, ¶205. Neither Patent Owner nor Dr. Efimov provides any explanation why a processed signal generated by front-end processing circuitry 150 is not also responsive to the LEDs being on or off. As explained in my Declaration and above, the signals generated by front-end processing circuitry 150 during the LED-on periods correspond to the claimed first output signal, while the signals generated during the LED-off periods correspond to the claimed second output signal. Anthony, ¶¶183, 187, 236-243. Indeed, the Board determined that Petitioner had demonstrated that "Lisogurski [] disclos[es] the front end processing uses the current

measured when the LEDs are off to generate a dark signal representative of ambient light” and that “Lisogurski [] disclos[es] the front end processing circuitry measuring the signal when at least one LED is on to capture a portion of the optical beam, e.g., a red signal and an IR signal, reflected from the tissue.” Anthony, ¶¶183, 187; '484-FWD, 43-44. As such, the relevant output signals generated by front-end processing circuitry 150 (i.e., processed signals) are responsive to the LED-off and LED-on conditions recited in the claims.

93. Patent Owner's and Dr. Efimov's criticism of my analysis of limitation [8.f] is similarly misplaced. Efimov, ¶206; POR, 49. My analysis expressly identifies the claimed third output signal as the processed signal generated after application of Lisogurski's dark-subtraction technique. Anthony, ¶246 (“Lisogurski discloses generating a third output signal (e.g., an output signal generated after application of a dark subtraction technique that ‘subtract[s] dark values from the Red and IR components to generate adjusted Red and IR signals,’ to ‘remove ambient and background signals’ ...).”). The fact that Lisogurski discusses red and IR components of detector measurements does not change my analysis. To the contrary, a person of ordinary skill in the art would have understood that the red and IR components measured by the system are processed by front-end processing circuitry 150 to generate corresponding processed signals, and that those processed signals are then used to generate adjusted red and IR signals through dark

subtraction. Anthony, ¶¶240-247. Consistent with my explanation and the Board's findings, a person of ordinary skill in the art would have understood, and at minimum found obvious, that the resulting adjusted processed signal constitutes the claimed third output signal with an improved signal-to-noise ratio. Anthony, ¶247; '484-FWD, 44.

94. Finally, Patent Owner and Dr. Efimov contend that the dark signal is a “detection signal,” rather than an “output signal.” Efimov, ¶¶207-208; POR, 49-50. That argument misunderstands both my usage and Lisogurski's terminology. In that instance, I used the term “detection signal” consistently with Lisogurski's own disclosure, which explains that “[t]he term ‘detection signal,’ as used herein, may refer to any of the signals generated within front end processing circuitry 150 as it processes the output signal of detector 140.” Lisogurski, 12:45-48; *see* Anthony, ¶243. Thus, Lisogurski itself uses the term broadly to encompass signals generated throughout the front-end processing chain, not merely raw detector outputs. To avoid any possible confusion, however, my opinions in this proceeding consistently map the claimed first, second, and third output signals to signals generated by front-end processing circuitry 150 (i.e., processed signals). Anthony, ¶¶240-247. Those signals are generated in response to measurements obtained by detector 140 during the LED-on and LED-off periods and are therefore responsive to detector outputs. But they are also *processed* signals generated within front-end processing circuitry

150. Indeed, Lisogurski expressly contemplates multiple versions of processed signals being generated as the detector output is processed by front-end processing circuitry 150. Lisogurski, 12:42-48, 13:7-14:10. Accordingly, my identification of the claimed output signals and Lisogurski's use of the term "detection signal" are consistent.

95. In sum, my opinion remains the same that Lisogurski discloses, and at minimum renders obvious, a first and second output signal responsive to light source being on and off, and a third output signal based on the first and second output signal having a third signal-to-noise ratio that is greater than those of the first and second output signal.

**F. LISOGURSKI DISCLOSES AND RENDERS OBVIOUS
THE MEMORY LIMITATION (GROUNDS 2, 4, 6, 8;
CLAIM 5)**

96. As I explained in my Declaration, Lisogurski discloses and renders obvious claim 5's limitation that "the apparatus further comprises a processor configured to be coupled to a non-transitory computer readable medium" (i.e. the "memory limitation"). Anthony, ¶¶238, 286-289.

97. Patent Owner and Dr. Efimov argue that Lisogurski does not disclose or render obvious the memory limitation because Lisogurski does not expressly disclose a memory associated with front-end processing circuitry 150 and because a person of ordinary skill in the art allegedly would not have understood, or found

obvious, that front-end processing circuitry 150 includes or is coupled to a non-transitory computer-readable medium. POR, 50-53; Efimov, ¶¶217-229. I disagree.

98. Patent Owner and Dr. Efimov assert that Lisogurski does not disclose the memory limitation because Figure 1 does not expressly identify a memory associated with front-end processing circuitry 150, and further contends that Petitioners and I failed to explain why a person of ordinary skill in the art would have understood, and at minimum found obvious, that front-end processing circuitry 150 includes memory. POR, 51-52; Efimov, ¶¶220-225. I disagree. Patent Owner's and Dr. Efimov's position rests on the premise that the only memory disclosed in Lisogurski's system 100 is memory 174 within back-end processing circuitry 170. That premise is incorrect on the face of the reference: Lisogurski separately contemplates "non-volatile calibration memory included in the sensor." Lisogurski, 7:13-37. Their arguments also focus narrowly on what is expressly labeled in Figure 1 and ignore what a person of ordinary skill in the art would have understood from Lisogurski's disclosure as a whole.

99. As explained in my Declaration, Lisogurski discloses that front-end processing circuitry 150 "perform[s] various analog and digital processing" of signals received from detector 140. Lisogurski, 12:42-50; Anthony, ¶¶238, 289. A person of ordinary skill in the art would have understood, and at minimum found obvious, that circuitry performing such digital-processing functions would be

coupled to memory resources, even if those resources are not separately depicted in Figure 1. Anthony, ¶¶238, 289. Indeed, as I explained during my deposition, “there would be processing and memory in the front end circuitry as well, because there's digital conditioning, which requires some type of processor and also, some type of memory.” Ex. 2045, 54:19-55:1. I further explained that “the digital conditioner” and other digital-processing components require “memory and processing” to perform their described functions. Ex. 2045, 55:13-18. Thus, my opinion is not based merely on the existence of memory 174 elsewhere in Lisogurski; rather, it is based on what a person of ordinary skill in the art would have understood to be used to implement the digital-processing functions that Lisogurski expressly assigns to front-end processing circuitry 150. Anthony, ¶¶238, 289.

100. Patent Owner and Dr. Efimov further assert that memory 174 is specific to back-end processing circuitry 170, that front-end processing circuitry 150 is fundamentally different because it contains specialized signal-conditioning components rather than a processor, and that the portions of Lisogurski cited in my Declaration therefore do not support the presence of memory in front-end processing circuitry 150. Efimov, ¶¶222-228; POR, 53. I disagree. For the reasons discussed above, a person of ordinary skill in the art would have understood that the front-end processing circuitry includes a memory. Further, Patent Owner's and Dr. Efimov's analysis adopts an unduly rigid reading of Figure 1 that is inconsistent with

Lisogurski's express teachings regarding implementation flexibility.

101. As explained in my Declaration, a person of ordinary skill in the art would have understood, and at minimum found obvious, that front-end processing circuitry 150 functions as a processor. Anthony, ¶238. Lisogurski discloses that front-end processing circuitry 150 performs “various analog and digital processing” and further teaches that “the functionality of some of the components may be combined in a single component” and that “the functionality of front end processing circuitry 150 and back end processing circuitry 170 may be combined in a single processor system.” Lisogurski, 12:42-50, 15:66-16:16; Anthony, ¶¶238, 289. Accordingly, the fact that processor 172 and memory 174 are expressly depicted in back-end processing circuitry 170 would not have led a person of ordinary skill in the art to conclude that processor and memory resources are absent from front-end processing circuitry 150. Rather, consistent with Lisogurski's repeated teachings that functionality may be combined, rearranged, and implemented in processor circuitry, a person of ordinary skill in the art would have understood, and at minimum found obvious, that processor and memory functionality would likewise be in front-end processing circuitry 150. Anthony, ¶289.

102. Finally, Patent Owner and Dr. Efimov contend that front-end processing circuitry 150 receives, processes, conditions and forwards a signal, and therefore has no need for memory. POR, 53; Efimov, ¶¶227-229. I disagree.

Lisogurski discloses that front-end processing circuitry 150 performs numerous digital-processing operations, including analog-to-digital conversion, demultiplexing, digital conditioning, decimation/interpolation, and dark subtraction. Lisogurski, 13:7-14:10. A person of ordinary skill in the art would have understood that such functions utilize memory resources to store information such as sampled signal data, timing information, filter coefficients, calibration information, intermediate processing values, lookup-table data, and other information used during signal processing. For example, Lisogurski discloses that demultiplexer 156 may use timing-control signals to identify and separate different portions of the detector signal, that decimator/interpolator 160 operates on signal samples, and that dark subtractor 162 determines subtraction amounts from dark-signal portions and applies those values to generate adjusted Red and IR signals. Lisogurski, 13:25-14:10. These operations would use memory resources to store the information used during processing. For example, demultiplexer 156 would need to store timing-control information, decimator/interpolator 160 would need to store signal samples being processed, and dark subtractor 162 would need to store dark-signal values and corresponding subtraction amounts so that the adjusted Red and IR signals can be generated. Lisogurski further contemplates that system corrections may be determined using “lookup tables,” “empirical data,” and information stored in “non-volatile calibration *memory included in the sensor.*” Lisogurski, 7:13-37. These

disclosures are consistent with my opinion that a person of ordinary skill in the art would have understood, and at minimum found obvious, that memory is included in the processor functionality performing Lisogurski's front-end processing operations. Anthony, ¶289. Moreover, Lisogurski expressly teaches that "[t]he components of front end processing circuitry 150 are merely illustrative and any suitable components and combinations of components may be used to perform the front end processing operations." Lisogurski, 14:11-14. Accordingly, I do not agree with Dr. Efimov's suggestion that a person of ordinary skill in the art would have understood front-end processing circuitry 150 as lacking memory resources associated with its disclosed digital-processing functionality.

103. In sum, my opinion remains the same that Lisogurski in view of Tran renders obvious the memory limitation.

**G. LISOGURSKI DISCLOSES AND RENDERS OBVIOUS,
ALONE AND IN VIEW OF LEBOEUF, THE ARC
LIMITATION (GROUNDS 1-8; CLAIMS 6-7)**

104. As I explained in my Declaration, Lisogurski discloses and renders obvious, alone and in view of LeBoeuf, Claim 6's arc limitation, requiring "the detection system comprises the plurality of detectors arranged along an arc," and therefore also claim 7, which depends from claim 6. Anthony, ¶¶199-202, 209-211, 300-306. Patent Owner and Dr. Efimov argue otherwise. POR, 32-34, 55-67; Efimov, ¶¶134-143, 237-288. Below, I first address their arguments regarding

Lisogurski's disclosures alone and then address their arguments regarding Lisogurski's disclosures in view of LeBoeuf.

105. With respect to Lisogurski, Patent Owner and Dr. Efimov assert that Lisogurski does not disclose or render obvious arranging a plurality of detectors along an arc because Lisogurski does not expressly depict an arc arrangement and because Lisogurski's disclosure that "[a]ny suitable configuration" of detectors may be used allegedly does not suggest any particular detector arrangement. POR, 32-34; Efimov, ¶¶134-143. I disagree.

106. As explained in my Declaration, Lisogurski discloses that "[o]ne or more detector 318" may be arranged in "[a]ny suitable configuration." Lisogurski, 17:39-43; Anthony, ¶209. While Dr. Efimov reads that disclosure in vacuum, a person of ordinary skill in the art would have understood that this disclosure encompasses known detector arrangements, including arc arrangements, and at least found such arrangements obvious in view of the known design considerations applicable to physiological monitoring systems. Anthony, ¶209.

107. In particular, a person of ordinary skill in the art would have appreciated that light emitted into biological tissue undergoes scattering and absorption and that reflected or backscattered light exits the tissue over a range of locations and directions. Anthony, ¶209. As a result, detector arrangements that cover a broader area can capture more of the reflected and backscattered light and thereby improve

the amount of useful signal collected and reduce the effects of local tissue inhomogeneity. Anthony, ¶209 (citing Ex. 1045, 4:14-65); *id.* ¶¶304-305; Ex. 1045, 4:59-62 (a radially symmetric photodetector array helps to “maximize the detection of backscattered light from the skin and minimize differences from local tissue inhomogeneity”). A person of ordinary skill in the art therefore would have understood that Lisogurski's disclosure of “[a]ny suitable configuration” encompasses known detector arrangements, including arc arrangements, and at least would have found such arrangements obvious. Indeed, arc detector arrangements and their corresponding benefits were well known in the art. For example, Ex. 1045 (“Mendelson”) discloses “a sensor having six photodiodes arranged symmetrically around the LEDs” whose outputs are combined “in order to maximize the fraction of backscattered light collected by the sensor.” Ex. 1045, 4:13-14, 4:22-27; Anthony, ¶¶209, 304-305. Thus, a person of ordinary skill in the art would have recognized that arranging detectors along an arc increases the amount of reflected and backscattered light detected, thereby improving signal quality and the resulting physiological measurements. Anthony, ¶209.

108. Patent Owner and Dr. Efimov contend that neither Lisogurski nor Mendelson discusses “angled light” and that my rationale improperly assumes that an arc arrangement would be selected over other possible detector arrangements. POR, 33-34; Efimov, ¶¶140-143. I disagree. First, as discussed above, a person of

ordinary skill in the art would still have understood that light emitted into biological tissue undergoes scattering and absorption and that reflected or backscattered light returns from a range of locations and directions within the tissue at a wide range of angles. Anthony, ¶209; Ex. 1045, 4:14-65. Second, I did not assume that an arc arrangement was the only alternative detector arrangement available. Rather, my opinion is that arc-shaped and radially symmetric detector arrangements were well known in the art and provided recognized benefits for collecting reflected physiological signals that would have motivated a person of ordinary skill to use the arrangement. Anthony, ¶¶209, 211. For example, and again as discussed above, Mendelson discloses “a sensor having six photodiodes arranged symmetrically around the LEDs” and explains that this arrangement is used “to maximize the fraction of backscattered light collected by the sensor.” Ex. 1045, 4:14-28. Mendelson further explains that “a radially-symmetric photodetector array can help to maximize the detection of backscattered light from the skin.” Ex. 1045, 4:54-59. Thus, my opinion is not based on an arbitrary selection among possible arrangements. Rather, it is based on the known benefits of arc-shaped and radially symmetric detector configurations for collecting reflected physiological signals, which would have provided a person of ordinary skill in the art with a reason to implement one of the detector configurations that Lisogurski expressly permits through its disclosure that “[a]ny suitable configuration” may be used. Anthony,

¶209. Dr. Efimov mischaracterizes both my Declaration and my deposition testimony by suggesting that I do not rely on Lisogurski alone to disclose detectors arranged along an arc. Efimov, ¶¶237-238. As discussed above, my Declaration expressly explains why a person of ordinary skill in the art would have understood, and at minimum found obvious, arranging Lisogurski's detectors along an arc in view of the known design considerations applicable to physiological monitoring systems. Anthony, ¶209.

109. The cited deposition testimony (Efimov, ¶238) likewise does not contradict that opinion. Rather, the cited testimony arose in a line of questioning specifically directed to my opinions regarding whether Lisogurski in view of LeBoeuf renders obvious detectors or emitters arranged along an arc. Ex. 2045, 161:25-162:6, 163:11-24. In responding to that questioning, I explained that I was discussing the Lisogurski in view LeBoeuf and was not relying solely on Lisogurski in the context of that combination analysis. Ex. 2045, 161:25-162:6, 163:11-24. Thus, neither my Declaration nor my testimony supports Dr. Efimov's suggestion that Lisogurski does not disclose or render obvious the arc limitation.

110. To the extent Lisogurski alone does not disclose or render obvious the claimed arc arrangement, I further explained in my Declaration that Lisogurski in view of LeBoeuf renders the arc limitation obvious. Anthony, ¶¶300-306. Patent Owner and Dr. Efimov challenge my motivation-to-combine analysis, dispute my

reliance on Mendelson and the known benefits of arc detector arrangements, and argue that LeBoeuf's Figure 8B arrangement would not have been applied to Lisogurski. POR, 54-67; Efimov, ¶¶237-288. For the reasons I explain below, I disagree.

111. As I further explained in my Declaration, to the extent additional disclosure is needed, Lisogurski in view LeBoeuf—and specifically the application of LeBoeuf's teachings regarding arc arrangements of emitters and detectors to Lisogurski's detector 140—renders obvious the claimed arc limitation. Anthony, ¶¶300-305. Additionally, as I explain in my Declaration and below, and contrary to Dr. Efimov, a person of ordinary skill in the art would have been motivated to implement LeBoeuf's arc arrangement teachings in Lisogurski because such arrangements improve the collection of reflected and backscattered light, thereby improving signal quality and the accuracy and reliability of physiological measurements. Anthony, ¶¶303-305.

112. Patent Owner and Dr. Efimov assert that my motivation-to-combine analysis was generic and unsupported by Lisogurski or LeBoeuf. POR, 55-60; Efimov, ¶¶247-252, 259. I disagree. My motivation-to-combine analysis was based on the disclosures of the references themselves and the knowledge of a person of ordinary skill in the art regarding the behavior of light in biological tissue. As I explained in my Declaration, Lisogurski discloses a physiological-monitoring

device that emits light into biological tissue and detects reflected light, while LeBoeuf teaches detector arrangements positioned along arcs. Anthony, ¶¶303-304; Lisogurski, 11:9-27; LeBoeuf, Fig. 8B. As discussed above, a person of ordinary skill in the art would have understood that light emitted into biological tissue undergoes significant scattering and absorption and that reflected light exits the tissue over a broad range of angles and locations. Anthony, ¶304. Accordingly, as also discussed above a person of ordinary skill in the art would have understood that arranging detectors along an arc increases collection of reflected and backscattered light, while reducing the effects of local tissue inhomogeneity, thereby improving signal quality and the accuracy and reliability of physiological measurements. Anthony, ¶¶209, 304-305; Ex, 1045, 4:14-65 (explaining that such configurations “maximize the detection of backscattered light from the skin and minimize differences from local tissue inhomogeneity”). This is further supported by Lisogurski's disclosure that “[a]ny suitable configuration of light source 316 and detector 318 may be used,” allowing flexibility in configuring the light source and detectors consistent with the knowledge of a person of ordinary skill in the art. Lisogurski, 17:42-45; Anthony, ¶303. Dr. Efimov's effort to read that disclosure in isolation thus fails. Efimov, ¶259.

113. Indeed, contemporary art confirms my opinion. For example, and again as discussed above, Mendelson discloses “a sensor having six photodiodes arranged

symmetrically around the LEDs” and explains that this arrangement is used “to maximize the fraction of backscattered light collected by the sensor.” Ex. 1045, 4:14-28. Mendelson further explains that “a radially-symmetric photodetector array can help to maximize the detection of backscattered light from the skin.” Ex. 1045, 4:54-59. This confirms the benefits of arranging detectors in arc arrangement, particularly to improve measurement accuracy. Anthony, ¶209.

114. I disagree with Patent Owner's mischaracterization of my testimony as if I had not reviewed documents cited in Mendelson. POR, 57. Instead, I testified: “I believe I've reviewed that document in the past. I don't recall the last time I reviewed it.” Ex. 2045, 199:6-7. Regardless, Mendelson itself discloses and confirms the knowledge of a person of ordinary skill in the art as discussed above, and whether or not I reviewed the documents cited in Mendelson does not impact my opinion.

115. Patent Owner and Dr. Efimov also assert the fact that both Lisogurski and LeBoeuf disclose physiological-monitoring devices that may be worn on the body does not support the motivation to combine. POR, 57; Efimov, ¶258. To the extent Dr. Efimov suggests that this observation was not part of my analysis (Efimov, ¶¶258, 283), I disagree. As explained in my Declaration, LeBoeuf, like Lisogurski, is directed to physiological monitoring and is reasonably pertinent to the same problems addressed by the '475 patent, including improving optical

physiological monitoring. Anthony, ¶302. Further, my motivation-to-combine analysis was not based solely on the fact that both references disclose wearable physiological-monitoring systems. Rather, as explained in my Declaration, a person of ordinary skill in the art would have been motivated to apply LeBoeuf's arc-arrangement teachings to Lisogurski because such arrangements improve the collection of reflected and backscattered light from biological tissue, thereby improving signal quality and measurement accuracy. Anthony, ¶¶303-305. The fact that both references disclose optical physiological-monitoring devices worn at a measurement site on the body further supports the applicability of LeBoeuf's teachings to Lisogurski. Lisogurski, 4:6-20. Anthony, ¶¶302-305.

116. Patent Owner and Dr. Efimov also assert that neither Lisogurski nor LeBoeuf provides the motivation to combine because they do not expressly recite an arc arrangement (POR, 56, 58-59; Efimov, ¶¶252-256), but my opinions are based on what a person of ordinary skill in the art would have understood based on Lisogurski's and LeBoeuf's disclosures as a whole, which include more than just the text of those references. For example, as I explained in my Declaration and as I testified during my deposition, Fig. 8B of LeBoeuf discloses photodetectors arranged in arcs and Mendelson, which reflects the knowledge of a person of ordinary skill in the art, demonstrates that it was known that configurations such as photodetectors arranged in arcs would increase the accuracy of a measurement.

Anthony, ¶¶301, 303-305; Ex. 2045, 191:16-192:8, 193:12-194:20, 195:5-196:6; see also LeBoeuf Fig. 8B, ¶123. Specifically, I testified that LeBoeuf “certainly in the figures and in the -- the text highlight some -- show emitters and detectors arranged about an arc” (Ex. 2045, 193:7-9), and that “Mendelson, for example, further teaches the benefit of having things about an arc, about a center,” so that “a person of ordinary skill would have been motivated to modify Lisogurski with LeBoeuf teaching as in the figures he arranged spatially separate detectors and light sources on one or more arcs,” “[w]ith a reasonable chance of success” (Ex. 2045, 194:11-23).

117. Patent Owner and Dr. Efimov raise a similar criticism with respect to Mendelson, arguing that Mendelson does not expressly discuss arc arrangement or “angles.” POR, 56-57, 59; Efimov, ¶¶257, 267-268. However, Mendelson discusses the collection of “backscattered light,” and a person of ordinary skill in the art would have understood that “backscattered” light exits biological tissue over a range of angles. Anthony, ¶¶304-305; Ex. 1045, 4:14-65. Consistent with that understanding, Mendelson explains that “[a]nother approach is based on the use of a sensor having six photodiodes arranged symmetrically around the LEDs ... in order to maximize the fraction of backscattered light collected by the sensor.” Mendelson, 4:14-29. Thus, Mendelson directly links the collection of backscattered light with a range of angles to an arc or radially symmetric detector arrangement. Mendelson

therefore supports my opinion that a person of ordinary skill in the art would have recognized the benefits of LeBoeuf's arc arrangement and would have been motivated to apply that arrangement to Lisogurski to improve the collection of reflected and backscattered light and, in turn, the accuracy and reliability of the resulting physiological measurements. Anthony, ¶¶303-305.

118. Moreover, Patent Owner and Dr. Efimov argue that my rationale regarding the collection of reflected and backscattered light does not support implementing LeBoeuf's Figure 8B arrangement in Lisogurski. Efimov, ¶¶262-265; POR, 59-60. I disagree with each of their rationale. First, as discussed above, a person of ordinary skill in the art would have understood that light emitted into biological tissue undergoes scattering and absorption and that reflected light exits the tissue over a range of locations and angles. Anthony, ¶304; see also Lisogurski, 11:16-20. Thus, contrary to Dr. Efimov's suggestion (Efimov, ¶265), my discussion of reflected and backscattered light was not dependent on either reference expressly using the word "angle." Rather, my opinion is based on what a person of ordinary skill in the art would have understood regarding the behavior of light reflected from biological tissues, namely that reflected and backscattered light exits tissue over a range of locations and angles and that arc and radially symmetric detector arrangements improve the collection of that light. Anthony, ¶¶304-305.

119. Second, Patent Owner and Dr. Efimov argue that my rationale relates

only to detector placement and does not independently support the emitter arrangement shown in LeBoeuf's Figure 8B. Efimov, ¶¶263-264; POR, 58. However, as discussed above, Mendelson teaches the benefits of arranging photodetectors around light sources to improve the collection of backscattered light and the quality of physiological measurements. Mendelson, 4:14-65; Anthony, ¶¶304-305. Further, Mendelson teaches that "four R and four IR LEDs are spaced at 90-degree intervals around the substrate and at an equal radial distance from the photodiode," thereby disclosing a radially arranged emitter configuration similar to that shown in LeBoeuf's Figure 8B. Mendelson, 4:36-44. Thus, Mendelson describes both radially arranged (i.e., in arc) emitter configurations and photodetector arrays arranged symmetrically around the light sources, forming arcs. Mendelson, 4:14-65, 4:36-44. Mendelson further explains that a "radially-symmetric photodetector array can help to maximize the detection of backscattered light from the skin and minimize differences from local tissue inhomogeneity." Mendelson, 4:54-59. A person of ordinary skill in the art therefore would have recognized that arrangements such as those shown in LeBoeuf's Figure 8B improve the collection of reflected and backscattered light and the accuracy of resulting physiological measurements. *Contra* Efimov, ¶267, Those teachings would have provided a person of ordinary skill in the art with a reason to implement the Figure 8B arrangement in Lisogurski. Moreover, claim 6's arc limitation requires only that

“the detection system comprises the plurality of detectors arranged along an arc”; it imposes no requirement as to the particular arrangement of the light emitters. ’475, Claim 6. Accordingly, even if Dr. Efimov were correct that the motivation reflected in Mendelson is directed primarily to detector placement, that would not undermine the motivation to adopt the claimed detector arrangement.

120. Additionally, Patent Owner and Dr. Efimov criticize Petitioners' and my explanation that “a linear or closely grouped detector arrangement would fail to capture much of the angularly scattered light” (Petition, 68-69; Anthony, ¶304), arguing that the cited portions of Mendelson (Ex. 1045 at 4:14-65) do not support that conclusion because Mendelson does not expressly discuss light exiting tissue at different angles. Efimov, ¶268; POR, 58-59. I disagree. Mendelson explains that the described arc configuration “essentially creates a large area photodetector made of six discrete photodiodes” which “maximize[s] the fraction of backscattered light collected by the sensor” and that increasing the area of measurement “minimize[s] differences from local tissue inhomogeneity.” Ex. 1045 at 4:14-65. A person of ordinary skill in the art would have understood from these disclosures that increasing the spatial coverage of the photodetectors allows the sensor to collect reflected and backscattered light over a wider range of locations and angles, increases the amount of useful light detected, reduces sensitivity to localized variations in the tissue, and improves the detection of scattered light exiting the tissue at different angles and

locations. Anthony, ¶304. Accordingly, a person of ordinary skill in the art would have recognized the benefits of arc detector arrangements for physiological monitoring. Anthony, ¶304 (explaining that LeBoeuf's detector "enhances the amount of scattered light from biological tissue detected, thereby improving the signal relative to background noise and resulting in an increased signal-to-noise ratio"); *see also* Lisogurski, 9:50-52 (explaining that its system "increase[s] the brightness of the light sources in response to the noise to improve the signal-to-noise ratio"). Moreover, in view of Lisogurski's teaching that "[t]he light intensity may be directly related to the absorbance and/or reflectance of light in the tissue," a person of ordinary skill in the art would have been further motivated to arrange the LEDs and detectors in an arc to increase the amount of light on an area of interest and to improve detection of such light scattered from the area of interest, as disclosed in LeBoeuf. Anthony, ¶304; Lisogurski, 11:16-20.

121. Patent Owner and Dr. Efimov also argue that Mendelson does not support my opinion that a person of ordinary skill in the art would have been motivated to apply LeBoeuf's arc arrangement teachings to Lisogurski because, according to Dr. Efimov, Mendelson discusses sensor configurations different from LeBoeuf's Figure 8B and therefore does not demonstrate any advantage associated with LeBoeuf's arc arrangement. Efimov, ¶¶257, 267-268; POR, 59. I disagree. As an initial matter, as discussed above, Mendelson reflects the same design principle

embodied in LeBoeuf's Figure 8B. Further, I opined on Mendelson because it reflects the knowledge of a person of ordinary skill in the art regarding the benefits of arranging photodetectors around light sources to improve the collection of backscattered light. Anthony, ¶¶304-305. For example, Mendelson explains that a sensor having "six photodiodes arranged symmetrically around the LEDs" was used "in order to maximize the fraction of backscattered light collected by the sensor." Mendelson, 4:14-29. Mendelson further teaches that a "radially-symmetric photodetector array can help to maximize the detection of backscattered light from the skin and minimize differences from local tissue inhomogeneity." Mendelson, 4:14-65. Thus, the relevance of Mendelson is that it confirms the known benefits of detector arrangements that increase the collection of backscattered light. A person of ordinary skill in the art would have recognized those same benefits in LeBoeuf's Figure 8B arrangement and therefore would have been motivated to apply that arrangement to Lisogurski. Anthony, ¶¶303-305.

122. Patent Owner and Dr. Efimov also rely on other detector arrangements, including those disclosed in LeBoeuf, to contend that a person of ordinary skill in the art would not have selected the arc arrangement shown in Figure 8B. POR, 59; Efimov, ¶¶260-261, 266. But, the fact that other detector configurations were also available, including those disclosed elsewhere in LeBoeuf, does not negate the known advantages of arranging LEDs and detectors in arc as discussed above, or

undermine the motivation to implement the arc arrangement taught by Figure 8B. Rather, as I explained in my Declaration, Lisogurski expressly contemplates that “[a]ny suitable configuration of light source 316 and detector 318 may be used” and that “sensor unit 312 may include multiple light sources and detectors, which may be spaced apart.” Anthony, ¶303; Lisogurski, 17:42-45. A person of ordinary skill in the art therefore would have recognized the benefits provided by LeBoeuf's arc arrangement and would have been motivated to apply that arrangement to Lisogurski in order to improve the collection of reflected and backscattered light and thereby improve measurement accuracy and reliability. Anthony, ¶¶303-305.

123. Patent Owner and Dr. Efimov further incorrectly assert that my description of Mendelson is inaccurate. Efimov, ¶¶269-270; POR, 59-60. While Patent Owner and Dr. Efimov focus on whether particular statements in Mendelson are associated with different underlying publications, they overlook Mendelson's broader discussion regarding the benefits of radially symmetric photodetector arrangements. For example, Mendelson discusses a sensor having “six photodiodes arranged symmetrically around the LEDs.” Mendelson, 4:14-16. Mendelson also explains that, “[a]ccording to this approach, in order to maximize the fraction of backscattered light collected by the sensor,” the outputs of the photodiodes are combined to create what is “essentially ... a large area photodetector.” Mendelson, 4:23-27. Most notably, Mendelson expressly teaches that “a radially-symmetric

photodetector array can help to maximize the detection of backscattered light from the skin and minimize differences from local tissue inhomogeneity.” Mendelson, 4:54-59. Accordingly, regardless of the criticism of my description of Mendelson, Mendelson expressly associates radially symmetric photodetector arrangements with improved detection of backscattered light. A person of ordinary skill in the art therefore would have recognized the benefits of detector arrangements such as those disclosed in LeBoeuf's Figure 8B, which is consistent with my opinion that a person of ordinary skill in the art would have been motivated to apply LeBoeuf's arc-arrangement teachings to Lisogurski. Anthony, ¶¶303-305.

124. Patent Owner and Dr. Efimov further argue that a person of ordinary skill in the art would not have been motivated to apply LeBoeuf's arc-arrangement teachings to Lisogurski because the detector arrangement shown in Figure 8B is allegedly dependent upon various earbud-specific components, including housing 16, cover 18, speaker 22, base 50, and light-guiding region 19. Efimov, ¶¶255, 260-261, 271-279, 283-286; POR, 58, 61-62. However, the motivation I opined is not to directly insert LeBoeuf's earbud into Lisogurski's sensor—instead, my opinion was that a person of ordinary skill in the art would have been motivated to **implement** LeBoeuf's **teaching** of an arc arrangement of detectors in Lisogurski to improve measurement accuracy. Anthony, ¶¶303-305. Similarly, Patent Owner and Dr. Efimov argue that light guide 18 (also referred to as cover 18 (LeBoeuf, ¶103)) and

light-guiding region 19 are what enables detection of scattered light by optical detector 26 (POR, 62-63; Efimov, ¶255), but they ignore LeBoeuf's disclosure that the cover 18 on which he relies is optional. LeBoeuf, ¶103 ("it should be noted that, in other embodiments, the earbud housing 16 may also serve as a light guide without the need for cover 18"). More fundamentally, the known benefits of arc-arranged detectors discussed above arise from improved collection of reflected and backscattered light over a larger detection area and are not dependent upon the presence of the particular earbud-specific structures identified by Dr. Efimov. Accordingly, a person of ordinary skill in the art would have recognized the detector arrangement itself as beneficial and suitable for implementation in other physiological-monitoring systems, including Lisogurski. In that regard, and contrary to Patent Owner's mischaracterization (POR, 61), I did not agree that the arc arrangement cannot be realized without LeBoeuf's other components—at most, I acknowledged that LeBoeuf discloses those components. Ex. 2045, 168:18-169:18.

125. Further, contrary to Patent Owner's (POR, 58, 64-67) and Dr. Efimov's arguments (Efimov, ¶¶279-282, 287-288), the geometry of LeBoeuf, or the disclosure of different configurations in LeBoeuf's other embodiments, does not negate a person of ordinary skill in the art's motivation to apply LeBoeuf's teaching of an arc arrangement of the LEDs and detectors to Lisogurski. Anthony, ¶¶303-

305; Lisogurski, 17:42-45 (“[a]ny suitable configuration” of light sources and detectors may be used). I also do not agree with Dr. Efimov’s suggestion that the arrangement shown in Figure 8B would have been understood merely as a byproduct of the geometry of LeBoeuf’s earbud embodiment. Efimov, ¶279. Rather, as discussed above, a person of ordinary skill in the art would have recognized the known benefits associated with arc and radially symmetric detector arrangements, including improved collection of reflected and backscattered light and improved measurement reliability. Anthony, ¶¶303-305; Mendelson, 4:14-65.

126. Similarly, the fact that LeBoeuf discloses alternative detector configurations in other embodiments does not diminish those known benefits or undermine a person of ordinary skill in the art’s motivation to implement the Figure 8B arrangement. Nor does LeBoeuf tie the benefit of the arrangement depicted in Figure 8B to the earbud context; the reasons that arrangement improves the collection of returning light apply to any system that uses emitters and detectors to perform reflectance physiological measurements. Importantly, as discussed above, I do not propose inserting LeBoeuf’s earbud embodiment physically into Lisogurski—again, my opinion is that a person of ordinary skill in the art would have implemented LeBoeuf’s arc arrangement teachings in Lisogurski’s sensor to achieve their corresponding benefits of improved measurements. Exs. 2045-2046, 205:6-25, 336:1-338:4. As I put it at my deposition, “I’m not wholesale copying

one embodiment or the other. But I'm highlighting the teachings of Lisogurski in view of LeBoeuf. And the teachings of a concentric arc, the teachings of ... the cladding material, the reflective surface." Ex. 2045, 182:20-24.

127. In sum, my opinion remains the same that Lisogurski discloses and renders obvious, alone and in view of LeBoeuf, Claim 6's arc limitation, requiring "the detection system comprises the plurality of detectors arranged along an arc."

VI. SECONDARY CONSIDERATIONS

128. As I set forth under My Understanding of Obviousness in the Legal Understanding Section of my Declaration, I understand that certain objective factors called "secondary considerations" or "objective indicia" of nonobviousness, if they are present, may be considered in determining whether the claimed invention would have been obvious to a person of ordinary skill in the art. Anthony, ¶39. I also understand, however, that for such secondary considerations to be relevant to the obviousness of a claim, there must be a causal relationship, or a "nexus," between the claim and the evidence, and that this nexus must be based on a novel element of the claim rather than something in the prior art.

129. Here, I have considered Patent Owner's and Dr. Efimov's assertion of secondary considerations, in addition to Dr. Islam's supporting declarations, and it is my opinion that there is no evidence of secondary considerations or any nexus between any alleged evidence that Patent Owner, Dr. Efimov, and Dr. Islam identify

and the '475 claims. Patent Owner's, Dr. Efimov's, and Dr. Islam's assertion of copying and long-felt need in the industry are without sufficient basis in my opinion, and I disagree with their assertions. POR, 69-74; Efimov, ¶¶313-350; Ex. 2100, ¶¶6-34.

130. First, regarding copying, Patent Owner asserts and Dr. Efimov opines that Samsung was directly exposed to and implemented technology disclosed by Dr. Islam and that this alleged implementation supports the non-obviousness of the challenged claims. Efimov, ¶¶346-333; Ex. 2100, ¶¶7-21. In support of that opinion, Dr. Efimov and Dr. Islam together identify several alleged techniques that they contend were disclosed to Samsung, which Dr. Efimov contends were later implemented in Samsung products, [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

Efimov, ¶¶321, 328, 331 (collectively referring to them as "SNR-improvement techniques"); Ex. 2100, ¶¶13, 16; POR, 69-71.

131. As an initial matter, and further to the fact that not all such features are relevant to the Claims, Dr. Efimov appears to assume that those techniques were proprietary to Omni because Dr. Islam characterized them as such and because they

Declaration of Brian Anthony in Support of Petitioners’ Reply
to Patent Owner’s Response, U.S. Patent No. 12,268,475 (IPR2025-01254)

are purportedly “covered by” Omni’s patents. Ex. 1127, 58:6-10; 60:3-11, 117:18-118:3; Efimov, ¶¶323, 328-331, 333; Ex. 2100, ¶¶8-13. I disagree that either basis supports the allegations that Samsung copied the SNR-improvement techniques, or that any such techniques were in fact proprietary. As a preliminary matter, when asked about these techniques, Dr. Islam testified that he did not know if they were used in prior art wearable devices (Ex. 1128, 48:8-49:3, 74:1-14, 85:7-17, 99:9-101:4, 104:22-105:26, 139:8-15), but conceded that they were generally known in the field (Ex. 1128, 30:1-15, 87:6-22, 104:4-20, 132:10-133:16). Indeed, each of Dr. Islam’s alleged “proprietary” “SNR-improvement techniques” was already disclosed in the prior art, as the Board found previously and as shown in the table below. Dr. Efimov’s analysis does not address these prior-art teachings or the Board’s findings.

Feature identified by Dr. Efimov	The Board’s relevant prior finding
[REDACTED]	[REDACTED]
	[REDACTED]
	[REDACTED]
	[REDACTED]

Declaration of Brian Anthony in Support of Petitioners' Reply
to Patent Owner's Response, U.S. Patent No. 12,268,475 (IPR2025-01254)

[REDACTED]	[REDACTED] [REDACTED]
[REDACTED]	[REDACTED] [REDACTED]

■ The Challenged Claims do not require [REDACTED]
[REDACTED].

² While alleging “[REDACTED]” technique, Patent Owner, Dr. Islam, and Dr. Efimov tie it to [REDACTED]
[REDACTED] only. POR, 43; Efimov, ¶¶158, 161, 166; Ex. 2100, ¶13.

Declaration of Brian Anthony in Support of Petitioners' Reply
to Patent Owner's Response, U.S. Patent No. 12,268,475 (IPR2025-01254)

132. Furthermore, Dr. Islam provides no allegation as to which of his SNR-

Improvement techniques, if any, was implemented in Samsung's products, and Dr. Efimov likewise does not provide his independent analysis as to Samsung's alleged practice of the SNR-improvement techniques—rather, Dr. Efimov appears to rely primarily on Omni's infringement contentions as evidence that Samsung products allegedly implement the functionalities identified above. Efimov, ¶¶328-331, 333; *see generally* Ex. 2100. Dr. Efimov's deposition testimony also confirms the lack of his independent analysis. During his deposition, Dr. Efimov admitted that he did not examine the Samsung Accused Products, did not review Samsung source code, and did not review Samsung internal technical documents concerning the operation of those products. Ex. 1127, 81:11-20, 87:7-20, 97:22-98:3, 98:20-99:7, 114:19-20.

133. Contrary to his cursory opinion on copying based solely on the Patent Owner's infringement contentions, Dr. Efimov, along with Dr. Islam, further agreed that assessing the features and operation of a product ordinarily requires review of the product itself or technical information describing its operation. Ex. 1127, 169:16-170:5; Ex. 1128, 34:6-50:19, 74:17-76:12, 78:9-79:12, 82:12-83:3, 88:2-89:3, 118:12-119:18. I agree that one cannot confirm what features a product has without at least testing the product or confirming technical descriptions of the product, and cannot confirm how the features are implemented without reviewing the source code or detailed technical descriptions of such features specific to the product at issue.

134. Despite such requirements, and based on my review of the infringement contentions available at Exhibit 2116, the infringement contentions claim charts upon which Dr. Efimov exclusively bases his copying opinion primarily cite datasheets describing capabilities of third-party components rather than evidence demonstrating which Samsung products use those components or how those components actually operate within Samsung products. *See, e.g.*, Ex. 2116, 65-80, 80-88, 131-165. These allegations simply do not show that any of the SNR-improvement limitations are met. For example, to support the allegation that Samsung's products [REDACTED] the infringement contentions cite documents for multiple processing circuitries, some of which indicates that LED current is programmable. Ex. 2116, 65-80. In my opinion, that disclosure establishes only that certain processing circuitry is capable of driving LEDs at different current levels; it does not establish whether or how those circuitries are implemented in Samsung's products, or that Samsung's products actually [REDACTED], as alleged. Indeed, the infringement contentions in Exhibit 2116 do not identify whether those processing circuitries, each identified as having different features purportedly satisfying limited parts of the claim limitations, are all implemented in an accused product, let alone how the circuitry or which available feature of the circuitry is implemented. The remaining citations identified in connection with that functionality are either not

specific to the Samsung products or consist of marketing materials that do not provide technical details regarding product operation. *See, e.g.*, Ex. 2116, 65-80, 80-88, 131-165.

135. Patent Owner and Dr. Efimov further asserts that “Samsung took the information it learned from Dr. Islam regarding the technologies disclosed and claimed in the ’475 Patent and implemented those teachings into its own Accused Products.” Efimov, ¶160; POR, 70-71. However, neither Dr. Efimov nor Dr. Islam identifies technical evidence demonstrating that Samsung implemented specific features from the materials provided by Omni or that Samsung was not already using any accused functionalities. Based on my review of [REDACTED] and presentation materials identified by Dr. Islam (Ex. 2100, ¶8 (citing Exs. 2101-2107)) and cited by Dr. Efimov (Efimov, ¶¶317-329), those materials describe the identified functionalities at a high level and do not provide detailed technical guidance regarding their implementation beyond what the Board already found was known in the art.

136. I also note that the presentation materials themselves acknowledge that several of the identified signal-to-noise-ratio improvement techniques were already known and being used in commercial wearable devices before the alleged disclosures to Samsung. *See, e.g.*, Ex. 2106, OMS_SAM0031852 [REDACTED]
[REDACTED]. I agree that the

SNR-improvement techniques identify well-known generic concepts only, as the Board already found.

137. Notably, despite asserting Samsung's copying, Patent Owner, Dr. Islam, and Dr. Efimov do not explain how the alleged presence of known techniques in Samsung products constitutes evidence that Samsung copied those techniques from Omni rather than independently implemented concepts already known in the art. *See generally* Efimov, ¶¶316-333; POR, 69-71; Ex.2100, ¶¶7-21. Likewise, and as discussed above, other than high-level communications concerning the generic, well-known techniques that the Board already found to be met by the prior art, Dr. Islam fails to identify any proprietary technique that he shared with Samsung or that Samsung could have copied. *See* Ex. 2100. In fact, I note that Dr. Efimov and Dr. Islam fail to identify evidence showing what proprietary information was actually received by Petitioners Samsung Electronics Co., Ltd. or Samsung Electronics America, Inc., how any such entities or individuals were involved in Samsung's wearable-device development efforts, or whether any information presented by Omni was ever incorporated into Samsung products. Ex. 1127, 107:15-111:4, 126:2-137:14; *see generally* Ex. 2100; POR, 69-71. I have not seen any evidence tying the development or operation of Samsung's products to Dr. Islam's alleged disclosure of the '533 patent or known SNR improvement techniques.

138. Patent Owner, Dr. Efimov, and Dr. Islam further assert that the '475 patent addressed a long-felt but unresolved need relating to motion artifacts, ambient-light interference, and signal-to-noise ratio in wearable physiological monitoring systems. Efimov, ¶¶334-350; Ex. 2100, ¶¶22-34; POR, 71-74. In particular, Patent Owner, Dr. Efimov, and Dr. Islam together identify (1) increasing signal-to-noise ratio by increasing light intensity; (2) increasing signal-to-noise ratio by increasing pulse rate³; (3) the detection system configured to be synchronized to the light source; (4) change detection; (5) spatially separated detectors; (6) wavelength comparison⁴, and (7) detectors arranged along an arc, as purportedly solving the unresolved needs he describes. Efimov, ¶¶336, 350; Ex. 2100, ¶¶24-31; POR, 71-74. I disagree that any such generic, well-known techniques would have resolved any alleged industry need relating to motion artifacts, ambient-light interference, or signal-to-noise ratio in wearable physiological monitoring systems that were not resolved before—indeed, as noted above and consistent with my opinion, the Board already found (as shown in the table above) that each of these

³ The Challenged Claims do not require increasing signal-to-noise ratio by increasing LED pulse rate.

⁴ The Challenged Claims do not require wavelength comparison.

functionalities was known in the prior art. *See also*, Section V.G above; Anthony, ¶¶209-211, 300-316.

139. Notably, none of Dr. Efimov's, Dr. Islam's, or Patent Owner's analyses explains why these known techniques, either individually or in the combinations recited by the Challenged Claims, would have solved a long-felt need in a manner not already known by a person of ordinary skill in the art. Efimov, ¶¶334-350; Ex. 2100, ¶¶22-33; POR, 71-74. Notably, Dr. Islam admitted that, while some of these techniques were generally known in the field of optical sensing (Ex. 1128, 30:1-15, 87:6-22, 104:4-20, 112:18-113:20, 114:14-115:1, 132:10-133:16), he did not know whether or to what degree these techniques were already being used in wearable devices as of the priority date (Ex. 1128, 48:8-49:3, 74:1-14, 85:7-17, 99:9-101:4, 104:22-105:26, 139:8-15), thereby failing to show that his alleged inventions provided any solution, let alone a novel one, to the industry's alleged long felt needs. Further, Dr. Islam's own evidence states that some of these techniques were being used in commercial wearable devices by 2017 (Ex. 2103, OMS_SAM0031785 ("Some of these techniques are already being used in premium wearable devices.")) and yet the "SNR ... problem" was still not "solved" in those devices (Ex.2100, ¶¶31-33). Such techniques, therefore, in fact did not result in any resolution of the purported industry needs per Dr. Islam's own allegation, and could not have newly

resolved any such needs because they were all known techniques in the industry.

POR, 91-72; Efimov, ¶¶335, 347; Ex. 2100, ¶31-33.

140. Patent Owner, Dr. Efimov, and Dr. Islam further characterize some of these functionalities as “coordinated” and as “a suite of integrated hardware and signal processing techniques.” POR, 72-73; Efimov, ¶¶332, 336 (“a suite of integrated hardware and signal processing techniques, including ambient light cancellation through change detection schemes, synchronization of LED transmitters and receivers, and dynamic adjustment of LED light intensity”), 348 (“an integrated suite of hardware and SNR-improvement techniques . . . including (1) increasing LED light intensity to improve SNR; (2) ambient light cancellation through change detection (differencing signals with LEDs on and off); (3) spatially separated detectors; and (4) synchronization of the detection system with the light source”), 349; Ex. 2100, ¶30. Again, I disagree that any such generic, well-known concepts would have resolved any industry needs. Further, I note that none of Patent Owner, Dr. Efimov, or Dr. Islam provides any technical evidence demonstrating that the alleged benefits identified are attributable to the claimed combinations themselves, rather than to the known benefits associated with the individual techniques that comprise those combinations.

141. Even to the extent any alleged industry needs were resolved, I see no technical evidence in Patent Owner's, Dr. Efimov's, or Dr. Islam's analysis and

allegations showing that any alleged resolution of the need is attributable to features unique to the Challenged Claims. For example, Patent Owner, Dr. Efimov, and Dr. Islam assert that the Challenged Claims enabled sufficiently accurate physiological measurements during daytime use and exercise. POR, 71-74; Efimov, ¶¶336, 345, 379; Ex. 2100, ¶30. However, I do not see any technical analysis comparing the performance of the Challenged Claims against prior systems, quantifying any alleged improvement, or demonstrating that the claimed combinations uniquely achieved the results described in the declarations. Rather, Patent Owner, Dr. Efimov, and Dr. Islam appear to infer that the claimed combinations produced the alleged benefits because they include techniques directed to improving signal-to-noise ratio. Again, these techniques were well-known in the art as of the priority date, yet none of Patent Owner, Dr. Efimov, or Dr. Islam explains why the alleged industry need persisted, especially in light of Dr. Islam's own evidence allegedly indicating that such industry need still existed in 2017. POR, 71-74; Efimov, ¶¶334-350; Ex. 2100, ¶¶31-33; Ex. 2103, OMS_SAM0031785.

142. Accordingly, while Patent Owner, Dr. Efimov, and Dr. Islam cite references discussing motion artifacts, ambient-light interference, and signal-to-noise ratio (POR, 71-72; Efimov, ¶¶337-350; Ex. 2100, ¶¶22-30), their analyses do not establish that the Challenged Claims uniquely solved those issues, that any alleged benefits are attributable to features unique to the Challenged Claims, or that

the claimed combinations achieved results not already expected from their constituent techniques. To the contrary, the techniques identified by Patent Owner, Dr. Efimov, and Dr. Islam were not only individually known in the art, as discussed above, but were also known, or at least obvious, to be used in combinations, as the Board previously found. For example, the Board previously found that the prior art disclosed combinations including increasing signal-to-noise ratio by increasing light intensity, increasing signal-to-noise ratio by increasing pulse rate, and the detection system configured to be synchronized to the light source. *See* '533-FWD, 26-39. Similarly, the Board separately found that the prior art disclosed combinations including increasing signal-to-noise ratio by increasing light intensity, increasing signal-to-noise ratio by increasing pulse rate, the detection system configured to be synchronized to the light source, change detection based on light-on/light-off measurements, and spatially separated detectors. *See* '484-FWD, 23-48. Further, as discussed in my Declaration and in this Reply Declaration, combining these same techniques further with an arc configuration of detectors were also taught and at least rendered obvious by the prior art. *See* Section V.G above; Anthony, ¶¶209-211, 300-316.

143. As such, the techniques identified by Patent Owner, Dr. Efimov, and Dr. Islam, whether used individually or in the combinations identified above, were already known in the art and were understood to provide their corresponding

benefits, including improvements in signal quality and the accuracy and reliability of physiological measurements, as of the priority date. To the extent any such benefits were achieved, they would have been attributable to the known operation of those techniques and combinations, rather than to any feature unique to the Challenged Claims. Further, the fact that some of these techniques were reportedly being used in commercial wearable devices years later while the alleged signal-to-noise-ratio problems purportedly persisted confirms that the use of such known techniques, whether individually or in combination, did not uniquely solve the alleged industry problems. Accordingly, in my opinion, the evidence does not establish that the Challenged Claims uniquely solved the alleged industry problems, that any alleged benefits are attributable to features unique to the Challenged Claims, or that the claimed combinations achieved results beyond the known and expected benefits of their constituent techniques.

144. In sum, Patent Owner's, Dr. Efimov's, and Dr. Islam's contentions regarding copying and long-felt need do not alter my conclusion that the Challenged Claims would have been obvious to a person of ordinary skill in the art.

VII. CONCLUSION

145. In summary, and as outlined in my Declaration and set forth above, I have concluded that claims 1, 5-8, 11-13 of the '475 patent are anticipated and/or rendered obvious over the prior art references discussed in my Declaration and

herein. As discussed above, I disagree with Omni's and Dr. Efimov's arguments, and none of their arguments alters my opinions expressed in my previous Declaration.

146. I reserve the right to supplement my opinions in the future to respond to any arguments that Patent Owner or its expert(s) may raise and to consider new information as it becomes available to me.

147. In signing this declaration, I recognize that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office.

148. I hereby declare that all statements made herein of my own knowledge are true and that 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.

Declaration of Brian Anthony in Support of Petitioners' Reply
to Patent Owner's Response, U.S. Patent No. 12,268,475 (IPR2025-01254)

APPENDIX A (LIST OF MATERIALS CONSIDERED)

Exhibit No.	DESCRIPTION
1001	U.S. Patent No. 12,268,475 ("475")
1002	File History of U.S. Application No. 18/927,698 ("475FH")
1003	Declaration of Brian Anthony in Support of Petition for Inter Partes Review of U.S. Patent No. 12,268,475 ("Anthony")
1004	Declaration of Brian Anthony in Support of Petition for Inter Partes Review of U.S. Patent No. 9,651,533 submitted in IPR2019-00916, Ex. 1003 ("533-Anthony")
1005	<i>Apple Inc. v. Omni Medsci, Inc.</i> , No. IPR2019-00916, Paper 1 (PTAB Apr. 10, 2019) ("533-Pet.")
1008	<i>Apple Inc. v. Omni Medsci, Inc.</i> , No. IPR2019-00916, Paper 39 (PTAB Oct. 14, 2020) ("533-FWD")
1009	<i>Omni MedSci, Inc. v. Apple Inc.</i> , No. 21-01229, ECF 69 (Fed. Cir. June 8, 2022)
1010	Declaration of Brian Anthony in Support of Petition for Inter Partes Review of U.S. Patent No. 10,517,484 submitted in IPR2021-00453, Ex. 1003 ("484-Anthony")
1011	<i>Apple Inc. v. Omni Medsci, Inc.</i> , No. IPR2021-00453, Paper 1 (PTAB Jan. 22, 2021) ("484-Pet.")
1013	<i>Apple Inc. v. Omni Medsci, Inc.</i> , No. IPR2021-00453, Paper 7 (PTAB Aug. 6, 2021) ("484-Inst.")
1015	<i>Apple Inc. v. Omni Medsci, Inc.</i> , No. IPR2021-00453, Paper 22 (PTAB Aug. 3, 2022) ("484-FWD")

Declaration of Brian Anthony in Support of Petitioners' Reply
to Patent Owner's Response, U.S. Patent No. 12,268,475 (IPR2025-01254)

Exhibit No.	DESCRIPTION
1016	<i>Apple Inc. v. Omni Medsci, Inc.</i> , No. IPR2021-00453, Paper 26 (PTAB Feb. 14, 2025) (“484-RFWD”)
1018	<i>Omni MedSci, Inc. v. Apple Inc.</i> , 2:18-cv-00134-RWS, Dkt. No. 211 (E.D. Tex. June 24, 2019)
1019	<i>Omni MedSci, Inc. v. Apple Inc.</i> , 2:18-cv-00429-RWS, Dkt. No. 152 (E.D. Tex. Aug. 14, 2019)
1023	Defendants’ Supplemental Invalidity and Subject Matter Eligibility Contentions, July 18, 2025. <i>Omni MedSci, Inc. v. Samsung Electronics Co., Ltd. et al.</i> , No. 2:24-cv-01070-JRG-RSP (E.D. Tex.)
1025	U.S. Patent No. 9,241,676 (“Lisogurski”)
1026	U.S. Patent Pub. No. 2010/0217102 (“LeBoeuf”)
1027	U.S. Patent No. 8,108,036 (“Tran”)
1028	U.S. Patent Pub. No. 2005/0049468A1 (“Carlson”)
1031	U.S. Patent No. 8,050,730 (“Zhang”)
1033	U.S. Patent Pub. No. 2011/0237911 (“Lamego”)
1034	U.S. Patent No. 5,942,749 (“Takeuchi”)
1035	U.S. Patent No. 5,822,473 (“Magel”)
1036	US Patent 5,592,124 (“Mullins”)
1037	E.F. Schubert, <i>Light-Emitting Diodes</i> (Cambridge Univ. Press, 2nd ed. reprinted 2014)
1038	“The Biomedical Engineering Handbook,” by Joseph D. Bronzino (1995)

Declaration of Brian Anthony in Support of Petitioners' Reply
to Patent Owner's Response, U.S. Patent No. 12,268,475 (IPR2025-01254)

Exhibit No.	DESCRIPTION
1039	U.S. Patent No. 8,079,735 ("Vakil")
1044	U.S. Patent No. 5,511,553 ("Segalowitz")
1045	U.S. Patent No. 6,801,799 ("Mendelson")
1048	U.S. Pat. No. 9,239,951 ("Hoffberg")
1049	U.S. Pat. Pub. 2007/0194939 ("Alvarez")
1052	U.S. Patent No. 8,996,088 ("Dasco")
1053	U.S. Patent Pub. No. 2007/0149868 ("Blank")
1054	U.S. Patent No. 8,852,103 ("Rothberg")
1057	U.S. Patent No. 8,922,788 ("Addison")
1058	JP3552090 ("Denso") (Certified English Translation)
1059	JP3552090 ("Denso")
1064	U.S. Patent No. 5,554,273 ("Demmin")
1065	U.S. Patent No. 5,953,713 ("Behbehani")
1081	U.S. Patent No. 9,651,533 ("533")
1082	U.S. Patent No. 10,517,484 ("484")
1083	Declaration of Brian Anthony in Support of Petition for Inter Partes Review of U.S. Patent No. 9,861,286 submitted in IPR2019-00914, Ex. 1003
1122	Claim Construction Order, <i>Omni MedSci, Inc. v. Samsung Electronics Co., Ltd. et al.</i> , No. 2:24-cv-01070-JRG-RSP, Dkt. No. 154 (E.D. Tex. Mar. 24, 2026)

Declaration of Brian Anthony in Support of Petitioners' Reply
to Patent Owner's Response, U.S. Patent No. 12,268,475 (IPR2025-01254)

Exhibit No.	DESCRIPTION
1127	Transcript of Igor Efimov, Ph.D. (July 16, 2026) [CONFIDENTIAL]
1128	Transcript of the Deposition of Mohammed Islam, Sc.D. (July 23, 2026)
2043	Declaration of Prof. Igor Efimov, Ph.D. dated May 7, 2026
2044	<i>Curriculum vitae</i> of Prof. Igor Efimov, Ph.D.
2045	Transcript of Apr. 17-18, 2026 Deposition of Dr. Brian W. Anthony (Part I)
2046	Transcript of Apr. 17-18, 2026 Deposition of Dr. Brian W. Anthony (Part II)
2100	Declaration of Dr. Mohammed Islam
2101	OMS_SAM0031768
2102	OMS_SAM0031776
2103	OMS_SAM0031782
2104	OMS_SAM0031797
2105	OMS_SAM0031867
2106	OMS_SAM0031851
2107	OMS_SAM0031961
2108	U.S. Patent No. 5,632,272 to Diab et al. ("Masimo '272 Patent")
2109	U.S. Patent No. 7,738,935 to Turcott ("Pacesetter '935 Patent")
2110	U.S. Patent No. 6,126,595 to Amano et al.

Declaration of Brian Anthony in Support of Petitioners' Reply
to Patent Owner's Response, U.S. Patent No. 12,268,475 (IPR2025-01254)

Exhibit No.	DESCRIPTION
2111	Fitbit '854 Publication
2112	GE Dash 2000 Patient Monitor Operating Manual
2113	Accuracy in wrist-worn, sensor-based measurements of heart rate and energy expenditure in a diverse cohort, Scherbina et. al, (Stanford 2016)
2114	Are Currently Available Wearable Devices for Activity Tracking and Heart Rate Monitoring Accurate, Precise, and Medically Beneficial" El-Amrawy et al., Healthcare Informatics Research (2015)
2115	A review of wearable sensors and systems with application in rehabilitation, Patel et. al, Journal of Neuroengineering and Rehabilitation, 2012
2116	Corrected Samsung Watch Infringement Claim Chart [IPR2025-01254]
	<i>Samsung Electronics Co., Ltd. et al v. Omni MedSci, Inc.</i> , No. IPR2025-01254 Paper 1 (PTAB Aug. 5, 2025) (Petition for Inter Partes Review)
	<i>Samsung Electronics Co., Ltd. et al. v. Omni MedSci, Inc.</i> , No. IPR2025-01254, Pap. 14 (PTAB Nov. 12, 2025) (Patent Owner's Preliminary Response)
	<i>Samsung Electronics Co., Ltd. et al. v. Omni MedSci, Inc.</i> , No. IPR2025-01254, Pap. 23 (PTAB Mar. 31, 2026) (Patent Owner's Notice of Deposition of Brian W. Anthony)
	<i>Samsung Electronics Co., Ltd. et al. v. Omni MedSci, Inc.</i> , No. IPR2025-01254, Pap. 29 (PTAB May 7, 2026) (Patent Owner Response)