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.,

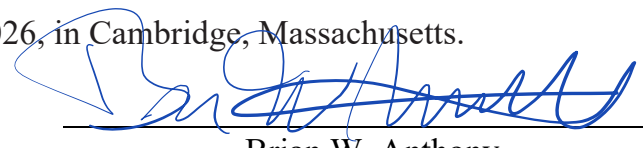
Patent Owner.

Case IPR2025-01250

Patent No. 9,651,533

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

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TABLE OF EXHIBITS

Exhibit No.	DESCRIPTION
1001	U.S. Patent No. 9,651,533 ("'533")
1002	File History of U.S. Application No. 14/875,709 ("'533FH")
1003	Declaration of Brian Anthony in Support of Petition for *Inter Partes* Review of U.S. Patent No. 9,651,533 ("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	*Apple Inc. v. Omni Medsci, Inc.*, No. IPR2019-00916, Paper 1 (PTAB Apr. 10, 2019) ("'533-Pet.")
1007	*Apple Inc. v. Omni Medsci, Inc.,* No. IPR2019-00916, Paper 16 (PTAB Oct. 18, 2019) ("'533-Inst.")
1008	*Apple Inc. v. Omni Medsci, Inc.*, No. IPR2019-00916, Paper 39 (PTAB Oct. 14, 2020) ("'533-FWD")
1009	*Omni MedSci, Inc. v. Apple Inc.*, No. 21-01229, ECF 69 (Fed. Cir. June 8, 2022)
1015	*Apple Inc. v. Omni Medsci, Inc.*, No. IPR2021-00453, Paper 22 (PTAB Aug. 3, 2022) ("'484-FWD")
1018	*Omni MedSci, Inc. v. Apple Inc.*, 2:18-cv-00134-RWS, Dkt. No. 211 (E.D. Tex. June 24, 2019)
1019	*Omni MedSci, Inc. v. Apple Inc.*, 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. *Omni MedSci, Inc. v. Samsung Electronics Co.*, Ltd. et al., No. 2:24-cv-01070-JRG-RSP (E.D. Tex.)
1025	U.S. Patent No. 9,241,676 ("Lisogurski")
1028	U.S. Patent Pub. No. 2005/0049468 ("Carlson")
1030	U.S. Patent No. 7,029,628 ("Tam")
1031	U.S. Patent No. 8,050,730 ("Zhang")

Exhibit No.	DESCRIPTION
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, Light-Emitting Diodes (Cambridge Univ. Press, 2nd ed. reprinted 2014)
1038	"The Biomedical Engineering Handbook," by Joseph D. Bronzino (1995)
1059	U.S. Patent No. 5,497,769 ("Gratton")
1060	U.S. Patent No. 5,827,182 ("Raley")
1061	U.S. Patent No. 7,764,982 ("Dalke")
1071	U.S. Patent No 7,005,679 ("Tarsa")
1072	U.S. Patent Publication No. 2010/0249550 ("Lovejoy")
1073	U.S. Patent Publication No. 2015/0057511 ("Basu")
1074	U.S. Patent Publication No. 2013/0327966 ("Fidler")
1075	U.S. Patent Publication No. 2011/0267688 ("Kleppe")
1076	U.S. Patent Publication No. 2005/0133691 ("Doppke")
1077	U.S. Patent Publication No. 2006/0184040 ("Keller")
1079	U.S. Patent No. 6,339.715 ("Bahr")
1080	U.S. Patent No. 8,417,307 ("Presura")
1085	*Apple Inc. v. Omni Medsci, Inc.*, No. IPR2019-00916, Paper 10 (PTAB Jul. 22, 2019) ("'533-POPR")
1119	Claim Construction Order, *Omni MedSci, Inc. v. Samsung Electronics Co., Ltd. et al.*, No. 2:24-cv-01070-JRG-RSP, Dkt.

Exhibit No.	DESCRIPTION
	No. 154 (E.D. Tex. Mar. 24, 2026)
1127	Transcript of Igor Efimov, Ph.D. (July 16, 2026)
1128	Transcript of the Deposition of Mohammed Islam, Sc.D. (July 23, 2026)

TABLE OF ABBREVIATIONS

ABBREVIATION	DESCRIPTION
'533	U.S. Patent No. 9,651,533 (Ex. 1001)
Challenged Claims	Claims 6, 11-12, 14, and 18 of the '533
Cancelled Independent Claims	Claims 5 and 13 of the '533
IPR	*Inter Partes* 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
POSITA	Person of Ordinary Skill in the Art
Board	Patent Trial and Appeal Board
Pet.	*Samsung Electronics Co., Ltd. et al. v. Omni MedSci, Inc.*, No. IPR2025-01250, Pap. 1 (PTAB Aug. 5, 2025)
POR	*Samsung Electronics Co., Ltd. et al. v. Omni MedSci, Inc.*, No. IPR2025-01250, Pap. 29 (PTAB May 7, 2026)
POPR	Patent Owner Preliminary Response
FWD	Final Written Decision
Texas Case	*Omni MedSci, Inc. v. Samsung Electronics Co., Ltd. et al.*, No. 2:24-cv-01070-JRG-RSP (E.D. Tex.)

ABBREVIATION	DESCRIPTION
'484	U.S. Patent No. 10,517,484
'533-FWD	*Apple Inc. v. Omni Medsci, Inc.*, No. IPR2019-00916, Paper 39 (PTAB Oct. 14, 2020) (Ex. 1008)
'484-FWD	*Apple Inc. v. Omni Medsci, Inc.*, No. IPR2021-00453, Paper 22 (PTAB Aug. 3, 2022) (Ex. 1015)
Lisogurski	U.S. Patent No. 9,241,676 (Ex. 1025)
Carlson	U.S. Patent Pub. No. 2005/0049468 (Ex. 1028)
Tam	U.S. Patent No. 7,029,628 (Ex. 1030)
Tarsa	U.S. Patent No 7,005,679 (Ex. 1071)
Fidler	U.S. Patent Publication No. 2013/0327966 (Ex. 1074)

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 IPR2025-01250 regarding U.S. Patent No. 9,651,533 ("the '533 patent").

3. My experience, qualifications, and compensation are provided in my August 5, 2025 Declaration and **Appendix A** thereto. Anthony, ¶¶6, 14, 16-26, 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 6, 11-12, 14, 18 of the '533 patent ("Challenged Claims") as anticipated and/or rendered obvious based on all grounds (Grounds 1-4) set forth in my prior Declaration. Anthony, ¶¶11-12, 70-75.

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 which I have relied upon or considered 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 '533 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 ¶56. Patent Owner and Dr. Efimov applied the same definition (POR, 4; Efimov, ¶¶53-54), 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, ¶¶59-69. 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.) construed certain claim terms. Ex. 1119. 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. I note Patent Owner and Dr. Efimov's agreement that no construction is necessary. POR, 8-9; Efimov, ¶70.

IV. LISOGURSKI DISCLOSES AND RENDERS OBVIOUS "A BANDWIDTH BETWEEN 20 NANOMETERS TO 40 NANOMETERS" (GROUNDS 1-2, CLAIMS 6, 14)

9. As I explained in my Declaration, Lisogurski discloses and renders obvious "at least one of the light emitting diodes emits light with a bandwidth between 20 nanometers to 40 nanometers." Anthony, ¶¶138-143; *see also* Anthony, ¶¶154-158.

10. Patent Owner and Dr. Efimov assert that Lisogurski does not disclose "at least one of the light emitting diodes emits light with a bandwidth between [approximately] 20 nanometers to [approximately] 40 nanometers" because Lisogurski does not expressly identify the bandwidth of its LEDs. POR, 11-14;

Efimov, ¶93. They further assert that Petitioners and I fail to explain how Lisogurski's disclosure on "Red and IR light emitting diodes (LEDs)" (Lisogurski, 10:48-56) discloses an LED with a bandwidth between 20 nanometers to 40 nanometers. POR, 12; Efimov, ¶93. I disagree. As I explained in my Declaration, "Red and IR light emitting diodes (LEDs)" that Lisogurski discloses (Lisogurski, 10:48-56) were well known in the art to exhibit bandwidths in the claimed 20-40 nm range. Anthony, ¶¶142-143; Tam, 9:57-60 ("A 40 nm bandwidth is representative of current LED sources in the red to near infrared range, and about 20 nm bandwidth is representative for the lower visible wavelengths."); Tarsa (Ex. 1071), 2:22-24 ("In the case of the red+green+blue LED lamps, the spectral emission lines of the component LEDs are typically narrow (e.g. 10-30 nm full width at half maximum (FHWM))."); '533, 20:1-11 ("LED[s] are solid state components that emit a wavelength band that is of moderate width, typically between about 20 nm to 40 nm."). Accordingly, a person of ordinary skill in the art reading Lisogurski's disclosure of red and infrared LEDs would have understood those LEDs to have the bandwidth characteristics conventional for such devices at the time, and would at minimum have found it obvious to use conventional red and infrared LEDs—which exhibited bandwidths in the claimed 20-40 nm range—in Lisogurski's system.

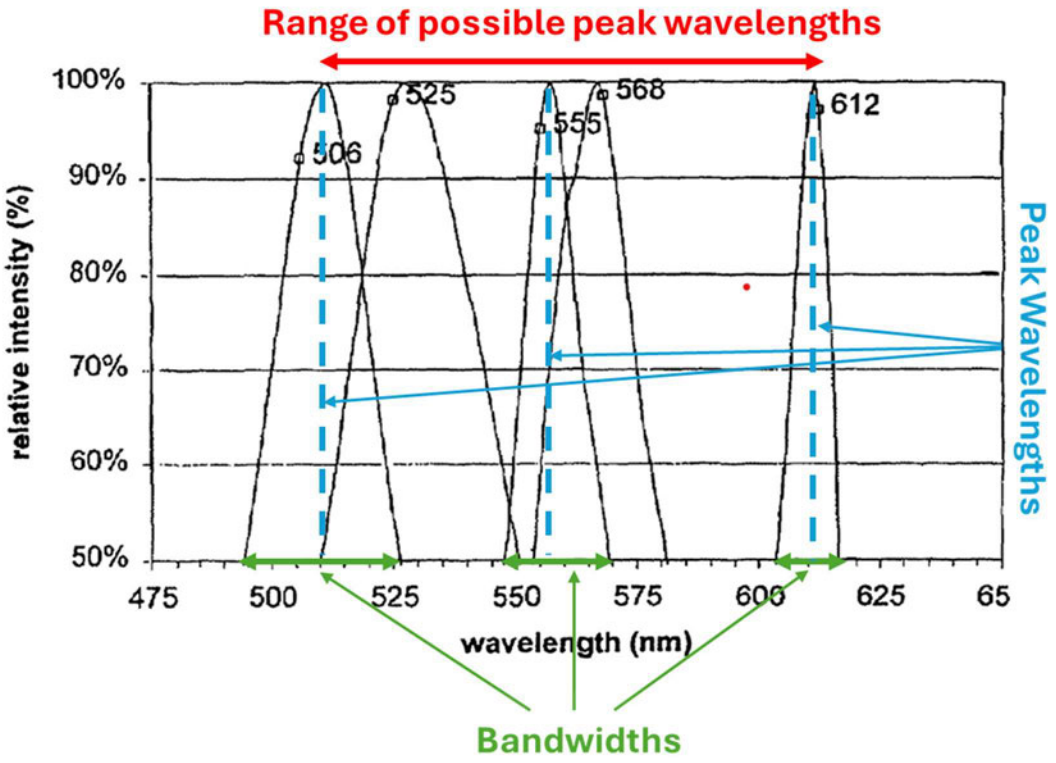
11. Dr. Efimov misunderstands my opinion. In disagreeing with my opinion, Dr. Efimov asserts a POSITA would understand Lisogurski's disclosure

that "the Red wavelength may be between about 600 nm and about 700 nm and the IR wavelength may be between about 800 nm and about 1000 nm" (Lisogurski, 10:56-58) as referring "merely" to emitted wavelengths rather than to a narrow bandwidth. Efimov, ¶93. He further states that "[t]his description does not expressly disclose what the bandwidth of the LEDs would be." Efimov, ¶94. But, my opinion is not based on Lisogurski's disclosure of the wavelength ranges for red and IR light at 10:56-58 that Dr. Efimov discusses. Instead, my opinion is based on what a person of ordinary skill in the art would have understood, and at least found obvious, regarding the bandwidth characteristics of the red and infrared LEDs that Lisogurski discloses. Anthony, ¶¶142-143. In particular, I explained that red and infrared LEDs were well known in the art to exhibit bandwidths within the claimed range of 20 nm to 40 nm, and a POSITA would have understood, and at least found obvious that, Lisogurski's disclosed LEDs to possess those bandwidth characteristics. Anthony, ¶¶142-143.

12. I further disagree with the inference that Patent Owner and Dr. Efimov draw from Lisogurski's disclosure of the wavelength ranges for Red and IR light. POR, 13; Efimov, ¶94. Specifically, after recognizing that the disclosed wavelength ranges are not bandwidths, Dr. Efimov nevertheless relies on those disclosures to suggest, through hypothetical examples, that the LEDs could have bandwidths of 100 nm and 200 nm. Efimov, ¶94 ("[I]f an LED emits light having a wavelength

between 600 nm at the low end and 700 nm at the high end, the bandwidth for that LED would be 100 nm"). Patent Owner then goes further, relying on Dr. Efimov's hypothetical to argue that a person of ordinary skill in the art would have understood Lisogurski's red LEDs to have bandwidths of about 100 nm and its infrared LEDs to have bandwidths of about 200 nm, even though Dr. Efimov does not offer such an opinion. POR, 13; Efimov, ¶94. I disagree. Dr. Efimov's inference conflates two distinct concepts: (1) the range of possible peak wavelengths (also referred to as nominal center wavelengths) that may be selected for an LED, and (2) the bandwidth of an individual LED. Lisogurski's disclosed ranges identify possible peak wavelength ranges for selecting red and infrared light, not the bandwidths of individual LEDs. As I explained, the disclosed ranges correspond to nominal center wavelengths associated with different light color selections (Ex. 2046, 343:19–344:20), whereas bandwidth refers to the spectral spread around a particular peak wavelength, typically measured as the full width at half maximum ("FWHM"). *See e.g.,* Tam, 1:59-60 ("LEDs are available in various sizes, bandwidths and peak wavelengths"), 7:65-66 ("The emission of a LED is specified as its peak wavelength and bandwidth."), 14:3-7 ("An LED radiates light at a certain peak wavelength and around that peak wavelength to varying degrees. The point(s) or wavelength range at which 50% of the peak output…may be considered the bandwidth of the LED. "); Tarsa, 2:22–24 ("In the case of the red+green+blue LED lamps, the spectral emission

lines of the component LEDs are typically narrow (e.g. 10–30 nm full width at half maximum (FWHM)"). The distinction is illustrated in the annotated version of Tam's Figure 2 below, which shows the emission spectra of individual LEDs, each with a peak wavelength and a bandwidth centered around that peak wavelength, across a range of possible peak wavelengths.



Tam, Figure 2 (annotated); *see also* Tam, 3:11-14 ("FIG. 2 shows representative output spectra for typical LED light sources in the visible region of the electromagnetic spectrum. The bandwidths (center wavelength) range from 12-36 nm."). Consistent with this distinction, Lisogurski's disclosure of red wavelengths "between about 600 nm and about 700 nm" and IR wavelengths "between about 800

nm and about 1000 nm" identifies ranges for selecting suitable red and infrared light based on their peak wavelengths, not the bandwidths of individual LEDs. Lisogurski, 10:56-58. Had Lisogurski intended to describe LED bandwidths, it would have discussed the spectral width of an individual LED emission profile rather than broad wavelength ranges encompassing numerous commercially available red and infrared LED peak wavelengths. Accordingly, those disclosures do not to suggest LED bandwidths of 100 nm or 200 nm.

13. Dr. Efimov also suggests that 100 nm or 200 nm bandwidth values are "consistent with what a person of ordinary skill in the art would expect for red and IR LEDs as infrared LEDs tend to have broader spectra with a bandwidth extending beyond 100 nm." Efimov, ¶94. However, he provides no support for this assertion and does not explain why a POSITA would attribute such bandwidths to the conventional red and infrared LEDs disclosed in Lisogurski. Efimov, ¶94.

14. Further, even under Patent Owner's and Dr. Efimov's interpretation of Lisogurski's wavelength disclosures, I still disagree with his assertion that those disclosures do not render obvious the claimed bandwidth range of 20-40 nm. Lisogurski states that the red wavelength ***may*** be between 600 nm and 700 nm and the infrared wavelength ***may*** be between 800 nm and 1000 nm. Lisogurski, 10:56–58. Thus, even under Dr. Efimov's incorrect interpretation, Lisogurski discloses ranges that encompass the claimed 20-40 nm range. Dr. Efimov does not explain

why the claimed 20-40 nm range is technically critical or why a person of ordinary skill in the art would have regarded that range as meaningfully distinct from neighboring values within the broader disclosed ranges.

15. To the contrary, the intrinsic record indicates that the claimed range reflects conventional LED characteristics rather than a critical or unique bandwidth range. For example, during prosecution, the Examiner found, and the Applicant did not dispute, that Fidler teaches that "conventional LEDs have a bandwidth of approximately 30 nm," which falls within the claimed 20–40 nm range. *See* Anthony, ¶197; '533FH, 723. Likewise, the '533 patent itself states that "LED's are solid state components that emit a wavelength band that is of moderate width, typically between about 20 nm to 40 nm." '533 Patent, 20:2-4. In my opinion, these disclosures reinforce that the claimed range was a characteristic of conventional LEDs and not a technically critical range possessing any special significance that would have altered a person of ordinary skill in the art's understanding of Lisogurski or the obviousness analysis.

16. Patent Owner and Dr. Efimov further assert that Lisogurski's LEDs could be super-luminescent LEDs and therefore could possess bandwidths exceeding the claimed 20-40 nm range. POR, 15; Efimov, ¶¶95-96. I disagree. Nothing in Lisogurski identifies its LEDs as super-luminescent LEDs. Instead, Lisogurski simply refers to red and infrared LEDs, which a person of ordinary skill

in the art would have understood as conventional LEDs with 20-40nm bandwidths. The '533 patent itself distinguishes ordinary LEDs—which it describes as "typically between about 20 nm to 40 nm"—from "super-luminescent LEDs" that "may even emit over a much wider wavelength range." '533 Patent, 20:2-9. Consistent with that distinction, Lisogurski's generic reference to red and infrared LEDs refers to conventional LEDs rather than the specialized super-luminescent devices identified separately in the '533 patent.

17. Patent Owner and Dr. Efimov note that certain references disclose LEDs with broader bandwidths, including up to 50 nm or even 100 nm. POR 15; Efimov, ¶¶95-96. But, as detailed above, my opinion is that the conventional and commonly used red and infrared LEDs relevant to physiological monitoring applications were known to exhibit bandwidths within the claimed 20-40 nm range. As I further discussed in my Declaration (Anthony, ¶142), Tam explains that "a 40 nm bandwidth is representative of current LED sources in the red to near infrared range, and about 20 nm bandwidth is representative for the lower visible wavelengths." Tam, 9:57-60. Likewise, Tarsa notes that component LEDs typically have spectral emission widths of approximately 10-30 nm FWHM, equivalent to bandwidth. Tarsa, 2:22-24. The existence of broader-bandwidth LEDs does not undermine the fact that LEDs within the claimed range were conventional and typical.

18. Patent Owner and Dr. Efimov characterize my opinions as relying on inherency because I stated that "[s]tandard commercial LEDs designed for medical and physiological monitoring applications, such as those described by Lisogurski, inherently exhibit these bandwidth characteristics." POR, 13-15; Efimov, ¶96; Anthony, ¶¶32, 143. I disagree with that characterization. The quoted statement referred to the well-known bandwidth characteristics of standard commercial LEDs used in medical and physiological monitoring applications, not to whether Lisogurski inherently discloses the claimed bandwidth limitation. My opinion, as explained in my Declaration (Anthony, ¶¶142-143), is that a person of ordinary skill in the art would have understood Lisogurski's disclosed red and infrared LEDs to possess conventional bandwidth characteristics and, at a minimum, would have found it obvious to employ conventional LEDs that were widely available and commonly used in physiological monitoring systems. I did not opine that every standard LED necessarily possessed a bandwidth between 20 nm and 40 nm. Efimov, ¶99. Rather, my opinion is that LEDs within that range were conventional, common, and well known at the time. *See*, e.g., Tam, 9:57-60; Tarsa, 2:22-24.

19. Patent Owner and Dr. Efimov assert that the Petitioners and I do not explain why a person of ordinary skill in the art would have been motivated to use LEDs having bandwidths between 20 nm and 40 nm, rather than LEDs having broader bandwidths, such as 50 nm. POR, 15-18; Efimov, ¶97. That criticism

misses the point of my obviousness analysis. Anthony, ¶¶142-143; Petition, 41-42. My opinion is not that a person of ordinary skill in the art would have preferred LEDs having bandwidths between 20 nm and 40 nm over all alternative bandwidths. Rather, my opinion is that LEDs having bandwidths within the claimed range were conventional, commercially available, and widely used, and therefore would have been an obvious design choice for use in Lisogurski's system to reduce development risk, simplify procurement, lower cost, and improve reliability due to their well-established specifications and performance characteristics. Anthony, ¶¶142-143. As explained above, contemporaneous references describe bandwidths of approximately 20 nm to 40 nm as representative of commonly used LED sources. Accordingly, a person of ordinary skill in the art would have understood LEDs within the claimed range to be suitable for incorporation into Lisogurski's monitoring system.

20. Patent Owner and Dr. Efimov further dispute that LEDs having bandwidths between 20 nm and 40 nm were industry-standard or off-the-shelf components, and why using such LEDs would simplify design, integration, procurement, cost, or reliability. POR, 16-17; Efimov, ¶¶98-102. I disagree. With respect to whether LEDs having bandwidths between 20 nm and 40 nm were industry-standard or off-the-shelf components, Dr. Efimov points to references disclosing LEDs with bandwidths outside the claimed range, including LEDs with

bandwidths up to 50 nm in the Biomedical Engineering Handbook (EX1038) and, in an unrelated context, a broader range of 7 nm to 100 nm in Tam. Efimov, ¶¶99-100, 103. First, the existence of LEDs outside the claimed range does not undermine my opinion. I did not opine that every commercially available LED necessarily had a bandwidth between 20 nm and 40 nm. Rather, I opined that LEDs within that range were conventional and commonly used at least to reduce development risk and improve reliability. Anthony, ¶¶142-143. For example, Tam states that "a 40 nm bandwidth is representative of current LED sources in the red to near infrared range, and about 20 nm bandwidth is representative for the lower visible wavelengths." Tam, 9:57-60. Likewise, Tarsa explains that LED emission lines are "typically" about 10-30 nm FWHM. Tarsa, 2:22-24. Moreover, Tam's 7-100 nm range cited by Dr. Efimov comes from a separate discussion in Tam concerning operation without additional optical components and is not presented as a description of typical LED bandwidths. Tam, 13:45-52 ("It is clear that small ***optical components alone***, such as LEDs having bandwidths from about 7 to 100 nm, would not allow accurate measurements or even have the capability of distinction between hemoglobin derivatives. It is for this reason that co-oximeters of the past have relied upon tightly controlled optical components requiring diffraction gratings, tight bandpass filters, tightly controlled laser diodes and the like as the optical components of choice."). Thus, Tam's reference to a broad range of possible LED bandwidths does not

contradict its separate teaching that bandwidths of about 20 nm and 40 nm were representative of then-current LED sources. Tam, 9:57-60. To the contrary, these disclosures address different issues: one discussing representative LED bandwidths and the other discussing the limitations of relying on LEDs alone without additional optical filtering or wavelength-selection components.

21. Patent Owner and Dr. Efimov dispute that LEDs having bandwidths between 20 nm and 40 nm were conventional components and contend that I do not explain why the use of such LEDs would be practical, technically advantageous, or reduce development risk and improve reliability. POR, 16-17; Efimov, ¶¶101-102. I disagree. I explained in my Declaration that LEDs within this range were conventional components having well-established specifications, performance criteria, and histories of use in physiological monitoring applications. Anthony, ¶143. Those characteristics provide practical and technical advantages because system designers can rely on known optical outputs, known electrical operating characteristics, and established performance expectations when designing and validating physiological monitoring systems. I further explained that the use of such components reduces development risk by minimizing uncertainty during design and validation and improves reliability because the components and their performance characteristics are already well understood. Anthony, ¶143. Accordingly, I concluded that a person of ordinary skill in the art would have recognized the use of

such conventional LEDs in Lisogurski's system as a practical and technically desirable design choice. Anthony, ¶143.

22. Patent Owner and Dr. Efimov further assert that I did not explain why using LEDs within the claimed range would simplify procurement or reduce system cost and, in doing so, relied on Dr. Efimov's misunderstanding that Lisogurski and Tam teach LED bandwidths broader than the claimed range and the availability of tighter bandwidths at a premium price. POR, 16-18; Efimov, ¶¶99, 102. I disagree with Dr. Efimov's mischaracterization of Lisogurski, Tam and my analysis. I did not propose modifying Lisogurski to replace broad-bandwidth LEDs with specially selected narrow-bandwidth LEDs. Rather, my opinion is that a person of ordinary skill in the art would have understood, and at minimum found obvious, Lisogurski's red and infrared LEDs to be conventional LEDs of the type commonly available at the time, including LEDs having bandwidths typically within the 20-40 nm range. Anthony, ¶¶142-143. As I explain above, and contrary to Patent Owner (POR, 16-18), Lisogurski does not teach or suggest LED bandwidths of 100 nm or 200 nm. Likewise, Tam's statement regarding premium pricing concerns selected LEDs with tighter bandwidths compared to those LEDs with a bandwidth of 20-40nm. Tam, 9:61-62. It does not undermine my opinion that conventional LEDs having bandwidths in the 20-40 nm range were commercially available and commonly used. Further, because such LEDs were standard commercial components with known

specifications and established supply sources, a person of ordinary skill in the art would have expected their use to simplify procurement and integration and to avoid the costs and risks often associated with developing or sourcing non-standard components.

23. In sum, my conclusion remains the same: Lisogurski discloses, and at minimum renders obvious, the bandwidth limitation of claims 6 and 14.

V. LISOGURSKI IN VIEW OF TAM RENDERS OBVIOUS "A BANDWIDTH BETWEEN 20 NANOMETERS TO 40 NANOMETERS" (GROUNDS 3-4, CLAIMS 6, 14)

24. As I explained in my Declaration, even if additional disclosure of the claimed 20-40 nm bandwidth range were required, Lisogurski (either alone or in view of Carlson) in view of Tam renders that limitation obvious. Anthony, ¶¶192-199.

25. Patent Owner and Dr. Efimov assert that applying Tam's teachings to Lisogurski's LEDs would not reduce manufacturing cost based on their understanding that Lisogurski discloses LEDs with bandwidths broader than the claimed 20-40 nm range, while Tam discloses LEDs with narrower bandwidths come at a premium price. POR, 39; Efimov, ¶¶140-141. This assertion rests on the same incorrect premise I addressed above—namely, Dr. Efimov's assumption that Lisogurski's disclosure of red wavelengths between 600-700 nm and infrared wavelengths between 800-1000 nm suggests LED bandwidths of approximately 100

nm and 200 nm. For the reasons discussed above, I do not agree with that interpretation. First, those disclosures identify ranges of possible peak wavelengths of light, not LED bandwidths. Thus, I do not agree with Dr. Efimov's premise that applying Tam's teachings to Lisogurski would require replacing broad-bandwidth LEDs with substantially narrower LEDs. Dr. Efimov's analysis also mischaracterizes Tam's teaching. As I explained in my Declaration, Tam identifies bandwidths of approximately 20-40 nm as representative of conventional LED sources, particularly for red and IR LEDs used in Lisogurski. Tam, 9:57-60; Lisogurski, 10:52-58; Anthony, ¶196. Tam's discussion of premium pricing refers to LEDs having bandwidths tighter than those representative sources. Tam, 9:61-62. Accordingly, Tam teaches the use of conventional LEDs having well-known bandwidth characteristics while avoiding the additional cost associated with specialty LEDs having even narrower bandwidths.

26. Patent Owner and Dr. Efimov assert that Tam's teaching of LEDs having bandwidths from about 7 nm to 100 nm not allowing accurate measurements covers the claimed range of 20-40 nm bandwidth and therefore undermine my motivation to combine analysis. POR, 40-41; Efimov, ¶142. In my opinion, Dr. Efimov takes Tam's disclosure out of context. Tam explains that "small optical components ***alone***, such as LEDs having bandwidths from about 7 to 100 nm," may not permit accurate distinction between hemoglobin derivatives and then explains

that narrowing the effective bandwidth improves measurement performance. Tam, 13:45-14:10. For example, Tam discusses the use of a "40 nm bandpass filter" and explains that narrowing the bandwidth of light reaching the detector improves measurement quality. Tam, 13:45-14:10. Thus, Tam does not teach that every bandwidth between 7 nm and 100 nm is equally unsuitable. Rather, Tam teaches that broader bandwidths can present accuracy challenges and that narrowing the effective bandwidth, including around 40 nm, improves measurement performance. Dr. Efimov further asserts that Tam's discussion of a "40 nm bandpass filter" concerns a filter rather than an LED. Efimov, ¶142. Dr. Efimov, however, fails to explain why the "40 nm bandpass filter" undermines my opinion, especially when Tam's primary teaching I relied upon is its express statement that "a 40 nm bandwidth is representative of current LED sources in the red to near infrared range, and about 20 nm bandwidth is representative for the lower visible wavelengths." Tam, 9:57-60; Anthony, ¶194. Tam's discussion of the 40 nm bandpass filter is consistent with that teaching by further demonstrating the suitability of bandwidths around 40 nm for optical measurement systems, reinforcing my opinion that a person of ordinary skill in the art would have been motivated to employ LEDs having bandwidths in the 20-40 nm range.

27. Moreover, Patent Owner and Dr. Efimov do not meaningfully address my opinion that a person of ordinary skill in the art would have had a reasonable

expectation of success in applying Tam's teachings to Lisogurski's system. POR, 38-41; Anthony, ¶197. As discussed above, Tam expressly identifies bandwidths of approximately 20 nm and 40 nm as representative of conventional LED sources and further explains that bandwidths around 40 nm are suitable for accurate hemoglobin measurements. Tam, 9:57-60, 13:45-14:10. I likewise explained in my Declaration that LEDs having bandwidths within the claimed range were well known and conventional at the relevant time. Anthony, ¶197. Consistent with that understanding, during prosecution, the Examiner found that Fidler teaches that "conventional LEDs have a bandwidth of approximately 30 nm, falling between 20 nm to 40 nm," and Applicant did not substantively dispute that factual finding. Anthony, ¶197; '533FH, 723. The '533 patent itself similarly states that LEDs "typically" emit a wavelength band between about 20 nm and 40 nm. '533 Patent, 20:1-11. In view of these teachings, a person of ordinary skill in the art would have had a reasonable expectation of success in employing LEDs having bandwidths in the claimed range in Lisogurski's system.

28. Patent Owner and Dr. Efimov's arguments regarding Ground 4, which additionally address Carlson, rely on the same criticisms he raises against Ground 3. POR, 41-42; Efimov, ¶144. My opinions likewise remain the same. Carlson does not alter the teachings of Tam concerning LED bandwidths or the reasons a person of ordinary skill in the art would have found it obvious to employ conventional LEDs

having bandwidths in the 20-40 nm range. Accordingly, the motivations and reasonable expectation of success discussed above apply equally to the combination of Lisogurski, Carlson, and Tam. Anthony, ¶198.

29. In sum, my opinion remains the same that, at a minimum, Lisogurski in view of Tam—and likewise Lisogurski in view of Carlson and further in view of Tam—renders obvious the claimed limitation requiring that at least one LED emit light with a bandwidth between 20 nanometers and 40 nanometers.

VI. LISOGURSKI DISCLOSES AND RENDERS OBVIOUS "THE OUTPUT SIGNAL[] GENERATED IN PART BY COMPARING SIGNALS AT DIFFERENT WAVELENGTHS" (GROUNDS 1-2, CLAIM 12)

30. As I explained in my Declaration, Lisogurski discloses, and at minimum renders obvious, the limitation requiring that "the output signal is generated in part by comparing signals at different optical wavelengths." Anthony, ¶¶148-153, 180.

31. Several aspects of my analysis are not disputed by Patent Owner or Dr. Efimov. They do not dispute that, under the Board's prior analysis, Lisogurski's "processed signals" correspond to the claimed "output signal." POR, 18-21; Efimov, ¶¶105-106; '533-FWD, 37-39. Nor do they dispute that Lisogurski determines blood oxygen saturation by comparing the intensities of different wavelengths, such as red and infrared wavelengths. POR, 18-21; Efimov, ¶¶107-109; Lisogurski, 4:42-56.

They likewise do not dispute the Board-approved modification implementing front-end processing circuitry at the sensor. POR, 18-21; Anthony, ¶94; '533-FWD, 23. Rather, Patent Owner and Dr. Efimov's arguments focus only on where within Lisogurski's system the wavelength comparison would occur. POR, 20-24; Efimov, ¶¶107-109.

32. Patent Owner and Dr. Efimov assert that Lisogurski does not disclose that its "processed signal" is generated in part by comparing signals at different optical wavelengths because, in their view, the comparison must occur in back-end processing circuitry 170 after the processed signal has already been generated. POR, 22-24; Efimov, ¶¶108-109. I disagree. The portions of Lisogurski cited by Dr. Efimov do not identify where particular processing operations, including wavelength comparisons, must occur. For example, Dr. Efimov relies on Lisogurski's statement that "[p]rocessor 172 ***may*** receive and process physiological signals received from front end processing circuitry 150." Lisogurski, 14:60-64; Efimov, ¶109. However, this disclosure merely states that processor 172 ***may*** process physiological signals; it does not ***require*** that wavelength comparisons to determine physiological parameters, let alone any signal processing, be performed in processor 172 or exclusively within back-end processing circuitry 170.

33. To the contrary, Lisogurski expressly teaches that, after detector 140 generates a detection signal, the signal "may be preprocessed by sensor 102 before

being transmitted to monitor 104," and further explains that physiological-parameter calculations, including calculations for blood oxygen saturation, "may be performed on the sensor units . . . and the result of the calculations may be passed to monitor 314." Lisogurski, 11:20-27, 17:62-18:3; Anthony, ¶¶81, 99, 149. Consistently, the Board found that Lisogurski "expressly suggests the modification by teaching embodiments in which 'the functionality of some of the components may be combined in a single component' and embodiments in which 'the functionality of some of the components of monitor 104 . . . may be divided over multiple components.'" '533-FWD, 23 (quoting Lisogurski, 16:2-4, 16:7-9); *see* Lisogurski, 15:66-16:9; Anthony, ¶¶92-94. The Board further recognized that a person of ordinary skill in the art would have been motivated to relocate front-end processing functionality to the sensor itself, consistent with industry trends improving the capabilities of wearable sensors for sports and personal fitness applications and wirelessly connecting wearable sensors to networks for remote health monitoring. '533-FWD, 23, 38; Anthony, ¶94.

34. Relatedly, I further explained that a person of ordinary skill in the art would have understood that preprocessing signals at the sensor, particularly at the front end processing circuitry 150 of the Board-approved modified sensor, including amplification, filtering, analog-to-digital conversion, and related signal processing functions, provides significant technical advantages by reducing signal degradation,

minimizing interference, improving signal fidelity, and enabling more reliable wireless communication. Anthony, ¶101. Based on these teachings and understandings of a person of ordinary skill in the art, I expressly opined that the "processed signals" generated by "front end processing circuitry 150" are generated in part by comparing the intensities of different wavelengths to determine physiological parameters. Anthony, ¶152. Thus, as I opined and contrary to Dr. Efimov's assertion (Efimov, ¶108), a person of ordinary skill in the art would have understood, and at minimum found obvious, that the front-end processing circuitry 150 generates output signal at least in part by comparing signals at different wavelengths. Anthony, ¶¶149-153.

35. Patent Owner and Dr. Efimov also rely on my deposition testimony, asserting that I could not identify which component performs the comparison of different wavelengths. POR, 22-23; Efimov, ¶109. That is not an accurate characterization of my testimony. When asked which component a person of ordinary skill in the art would understand to perform the comparison of intensities of two different wavelengths, I testified that the front-end processing circuitry would detect the signals and perform the comparison under the Board-modified rearrangement of Lisogurski discussed in my Declaration:

> **Q.** . . . My question is: Which component in Lisogurski would a person of skill in the art understand performs the comparison between — comparison of intensities of two different wavelengths?

> **A:** A processor would determine that. And, as we've discussed extensively, Lisogurski teaches processing being able to be put in a number of different places. But certainly ***the front-end processing, as I opined in the . . . motivation to modify, would . . . detect the signals and calculate the comparisons***.

Ex. 2046, 362:21-363:3; *see also* Ex. 2046, 362:21-363:3, 366:7-20. Dr. Efimov instead focuses on a subsequent line of questioning in which I was expressly asked to assume the unmodified embodiment of Lisogurski depicted in Figure 1::

> **Q.** . . . I want you to assume that this question pertains to the exact configuration shown in Figure 1, not rearranging it.
>
> In the system shown in Figure 1, in this arrangement, a person of ordinary skill in the art would understand the back-end processing circuitry 170 performs the comparison between different intensities. Correct?

Ex. 2046, 364:2-366:18. That question explicitly ignores the Board-approved modification of Lisogurski and posited a different scenario from the one underlying my opinion. My opinion for this claim element is based on the Board-approved modification relocating front-end processing circuitry to the sensor. Anthony, ¶¶147-149. Consistent with that opinion, I testified that front-end processing circuitry would perform the wavelength comparison. Ex. 2046, 362:21-363:3. That back-end circuitry may perform certain processing functions in the unmodified Figure 1 embodiment (Ex. 2046, 364:2-366:18) does not change my opinion that, under the modified Lisogurski configuration that I apply in my analysis, the comparison of different wavelengths is performed by the front-end processing

circuitry within the modified sensor as part of generating the processed signals. Indeed, doing so "enhances signal integrity, reduces noise and signal degradation, improves data reliability and accuracy, simplifies sensor-to-monitor communication, and ensures system responsiveness," further confirming that the output signal would be generated in part by comparing signals at different optical wavelengths at the front-end processing circuitry. Anthony, ¶101.

36. In sum, my opinion remains the same that Lisogurski discloses, and at minimum renders obvious, the limitation requiring that "the output signal is generated in part by comparing signals at different optical wavelengths."

37. Patent Owner and Dr. Efimov likewise offer no separate analysis for claims 6, 12, and 14 in Ground 2 and instead incorporates the same arguments regarding Lisogurski alone. POR, 24-25; Efimov, ¶113. As explained in my Declaration, the Board previously determined that Lisogurski in view of Carlson independently renders obvious claims 5 and 13, from which claims 6, 12, and 14 depend. Anthony, ¶180; '533-FWD, 25-43. Therefore, for the same reasons discussed above with respect to claim 12 and Lisogurski, and for the same reasons the Board found obvious claims 5 and 13, my opinion remains that claims 6, 12, and 14, are additionally rendered obvious by Lisogurski in view of Carlson.

VII. LISOGURSKI IN VIEW CARLSON RENDERS OBVIOUS THE "FILTER" LIMITATION (GROUND 2, CLAIMS 11 AND 18)

38. As I explained in my Declaration, Lisogurski in view of Carlson renders obvious the limitation requiring "one or more filters in front of one or more detectors to select a fraction of the one or more optical wavelengths." Anthony, ¶¶170-171, 181-190.

39. Patent Owner and Dr. Efimov do not dispute that Carlson discloses optical wavelength filters positioned in front of a photo detecting element. POR, 25-26; Efimov, ¶¶117-121; Carlson, [0056]-[0062]. Nor do they dispute that Carlson's filters selectively transmit a fraction of optical wavelengths while preventing other optical wavelengths from reaching the detector. POR, 25-26; Efimov, ¶¶117-121; Carlson, [0056]-[0062]. Patent Owner and Dr. Efimov also acknowledge that my analysis relies on Lisogurski in view of Carlson, rather than Lisogurski alone, for the claimed filter limitation. POR, 25-26; Efimov, ¶¶118-121. Rather, their criticisms are directed primarily to whether a person of ordinary skill in the art would have been motivated to apply Carlson's filtering teachings to Lisogurski's physiological monitoring system. POR, 26-38; Efimov, ¶¶122-136.

40. Patent Owner and Dr. Efimov suggest that my motivation-to-combine analysis lacks support from the references. POR, 26-28; Efimov, ¶¶122-125, 130. I disagree. As explained in my Declaration, my opinion was based on the fact that

both Lisogurski and Carlson recognize the adverse effects that unwanted optical signals can have on physiological measurements and disclose techniques directed to improving measurement quality by reducing those unwanted contributions. Anthony, ¶¶164, 168, 170, 186-188. For example, Lisogurski discusses the need to "remove ambient and background signals," explains that "ambient light" may have "a detrimental effect on the signal-to-noise ratio of the detection signal," and seeks to improve the signal-to-noise ratio of its measurements. Lisogurski, 6:7-31, 9:46-60, 11:9-27, 14:40-55, 26:5-14; Anthony, ¶¶164, 170. Carlson likewise teaches using "optical wavelength filters to suppress by geometric and/or optical means the parasitic contribution of environmental radiation," preventing "stray light" from reaching the "photo detecting element," and increasing the "Signal-to-Background ratio." Carlson, [0026], [0054], [0059], [0063]; Anthony, ¶¶164, 170, 186-187. These disclosures provide direct support for my opinion that a person of ordinary skill in the art would have recognized Carlson's filters as a useful technique for improving the optical measurements performed by Lisogurski, and therefore, would have been motivated to apply Carlson's filter teachings to Lisogurski's sensor to filter out unwanted background noise and ambient light, thereby increasing the signal-to-noise ratio of the detected signal.

41. Patent Owner and Dr. Efimov are incorrect in asserting that my Declaration provides no support from Lisogurski or Carlson for my opinion that a

person of ordinary skill in the art would have been motivated to apply Carlson's filtering teachings to Lisogurski's system to reduce interference from ambient, background, environmental, and stray light and improve signal quality. POR, 26-28; Efimov, ¶124. In making that assertion, Patent Owner and Dr. Efimov selectively quote my Declaration while omitting the portions that discuss specific disclosures from Lisogurski and Carlson. POR, 26-28; Efimov, ¶124; Anthony, ¶170 (citing Lisogurski, 6:7-31, 14:46-55, 12:42-49, 11:9-27, which discuss removing ambient and background signals, explain that ambient light can have a detrimental effect on the signal-to-noise ratio of the detection signal, and describe improving measurement quality by increasing signal-to-noise ratio; and Carlson, [0059], [0062], [0063], which discuss using optical wavelength filters to suppress the parasitic contribution of environmental radiation, prevent stray light from reaching the photo detecting element, and increase the Signal-to-Background ratio). Patent Owner and Dr. Efimov also ignore that Paragraph 170 in my Declaration expressly incorporates my discussions in Sections IX.A.1 and IX.B.1, where I discuss the relevant disclosures of Lisogurski and Carlson in detail. Anthony, ¶¶90, 163, 170. Moreover, Patent Owner and Dr. Efimov do not address my additional discussion of Carlson's filtering teachings and their benefits in Paragraphs 185-188 of my Declaration. Anthony, ¶¶164, 185-187; POR, 26-28; Efimov, ¶¶122-136. There, I explain that Carlson discloses an "optical wavelength filter or double pass

filter" that permits only selected wavelengths to reach the detector, works in conjunction with baffles to prevent stray light from reaching the photo detecting element, and increases the Signal-to-Background ratio by reducing unwanted optical contributions. Anthony, ¶¶185-187 (citing Carlson, [0056], [0059], [0062], [0063]). These teachings further support my opinion that a person of ordinary skill in the art would have recognized Carlson's filters as a beneficial technique for reducing ambient and background light interference and further improving the quality of optical measurements in systems such as Lisogurski's. Anthony, ¶188.

42. Patent Owner and Dr. Efimov further assert that Carlson and Lisogurski address different problems. POR, 28-34; Efimov, ¶¶125-129. I disagree. According to Patent Owner and Dr. Efimov, Carlson's optical filtering technique selectively permits only particular wavelength ranges to pass, whereas Lisogurski's disclosed techniques remove ambient-light and background-noise contributions irrespective of wavelength, such as through ambient-light measurement, dark subtraction, and signal processing. POR, 29-34; Efimov, ¶¶126-129. Patent Owner and Dr. Efimov therefore contend that Carlson's filter would not solve the problem addressed by Lisogurski and that a person of ordinary skill in the art would instead rely on Lisogurski's disclosed signal-processing techniques. POR, 29-34; Efimov, ¶¶126-129. But, neither Lisogurski nor Carlson defines the relevant problem so narrowly. Rather, both Lisogurski and Carlson recognize that unwanted optical contributions

can adversely affect physiological measurements and seek to improve signal quality and signal-to-noise ratio. Lisogurski, 1:67-2:3, 6:7-31, 9:46-60, 14:46-55, 37:6-18; Carlson, [0014], [0026], [0063], [0069]; Anthony, ¶¶164, 168, 170. And nothing in either reference suggests that Carlson's wavelength-dependent filtering is incompatible with, or diminishes the usefulness of, Lisogurski's wavelength-independent noise-reduction techniques. To the contrary, while the references employ different techniques, a person of ordinary skill in the art would have viewed those techniques as complementary, rather than mutually exclusive, because Lisogurski and Carlson further the same objective of improving physiological measurements by increasing signal-to-noise ratio in different ways. For example, Lisogurski recognizes that environmental conditions may change over time, explaining that "the system may detect a change in background noise, a change in ambient light, a change in the available power, other suitable changes, or any combination thereof." Lisogurski, 37:8-11. As such, the accuracy of Lisogurski's background-subtraction method, which subtracts the background signal from the detected optical signal (Lisogurski, 6:7-31), would be reduced if ambient-light or background-noise conditions change after the background measurement is taken, causing the measured background signal to no longer accurately reflect the actual background contribution. A person of ordinary skill in the art therefore would have recognized that Carlson's filtering technique provides an additional and

complementary way of reducing unwanted optical contributions by preventing wavelengths outside the selected wavelength bands from reaching the detector in the first place. Thus, even if ambient-light or background-noise conditions change after Lisogurski's background measurement is taken, Carlson's filters would continue to reduce the amount of unwanted ambient and background light reaching the detector, thereby improving the quality of the detected signal before any background subtraction is performed. A person of ordinary skill in the art therefore would have recognized that applying Carlson's filters would further improve the quality and signal-to-noise ratio of the signals used by Lisogurski by improving not just the post-processing signal, but also the pre-processing signal.

43. Patent Owner and Dr. Efimov also assert that a person of ordinary skill in the art would not have looked to Carlson because Lisogurski already discloses several techniques for reducing ambient light and background noise. POR, 34-38; Efimov, ¶¶131-136. I disagree. As discussed above, Carlson's wavelength-dependent filtering and Lisogurski's wavelength-independent noise-reduction techniques address the same general objective of improving signal quality and signal-to-noise ratio through different, complementary approaches. A person of ordinary skill in the art therefore would not have viewed Carlson's filters as unnecessary or redundant simply because Lisogurski discloses other noise-reduction techniques. To the contrary, as discussed above, a person of ordinary skill in the art

would have understood that Carlson's filters would further improve the quality and signal-to-noise ratio of the signals used in Lisogurski by excluding wavelengths outside selected wavelength bands, thereby reducing unwanted optical contributions even before applying Lisogurski's teachings to remove environmental contributions. Anthony, ¶170. Thus, even if Lisogurski already disclosed techniques for addressing ambient light and background noise, a person of ordinary skill in the art would still have recognized value in applying Carlson's filtering teachings together with those techniques to further improve physiological measurements.

44. In sum, my opinion remains the same that Lisogurski in view of Carlson renders obvious the limitation requiring "one or more filters in front of one or more detectors to select a fraction of the one or more optical wavelengths."

VIII. SECONDARY CONSIDERATIONS

45. 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.

46. 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 '533 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, 42-46; Efimov, ¶¶145-180; Ex. 2100, ¶¶6-34.

47. 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, ¶¶146-163; 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]

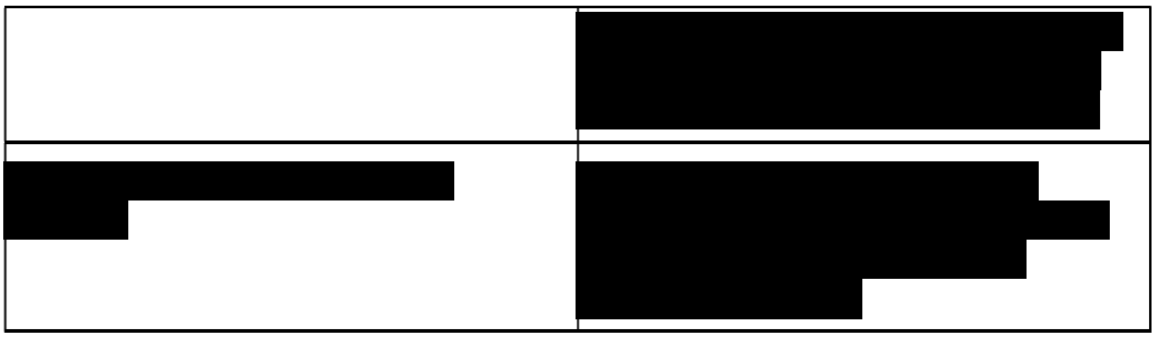
Efimov, ¶¶151, 158, 161 (collectively referring to them as "SNR-improvement techniques"); Ex. 2100, ¶¶13, 16; POR, 42-43.

48. 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 are purportedly "covered by" Omni's patents. Ex. 1127, 58:6-10; 60:3-11, 117:18-118:3; Efimov, ¶¶153, 158-161, 163; 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]

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

[2] The Challenged Claims do not require [redacted].



49. 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, ¶¶158-161, 163; *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.

50. 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.

51. 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, 19-33, 61-96. 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, 19-33. 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, 19-33; 61-96.

52. 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, 42-43. 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, ¶¶147-159), 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.

53. 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]. I agree that the SNR-improvement techniques identify well-known generic concepts only, as the Board already found.

54. 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 generallly* Efimov, ¶¶146-163; POR, 42-43; 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, 42-43. 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.

55. Dr. Efimov and Dr. Islam further assert that the '533 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, ¶¶164-180; Ex. 2100, ¶¶22-34. 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 rate; (3) the detection system configured to be synchronized to the light source; (4) change detection[3]; (5) spatially separated detectors; and (6) wavelength comparison as purportedly solving the unresolved needs he describes. Efimov, ¶¶166, 180; Ex. 2100, ¶¶24-31; POR, 44-46. 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

[3] The Challenged Claims do not require change detection (i.e. comparing light-on and light-off measurements).

table above) that each of these functionalities was known in the prior art. *See also,* Section VI above; Anthony, ¶¶148-153, 180.

56. 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, ¶¶164-180; Ex. 2100, ¶¶22-33; POR, 43-46. 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, 44-45; Efimov, ¶¶165, 177; Ex. 2100, ¶31-33.

57. 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, 44-46; Efimov, ¶¶162, 166 ("a suite of integrated hardware and signal processing techniques, including synchronization of LED transmitters and receivers, and dynamic adjustment of LED light intensity"), 178 ("an integrated suite of hardware and SNR-improvement techniques . . including (1) increasing LED light intensity to improve SNR; (2) increasing LED pulse rate to improve SNR; and (3) synchronization of the detection system with the light source"), 179; 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.

58. 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, 44-46; Efimov, ¶¶166, 175, 179; 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, 43-46; Efimov, ¶¶164-180; Ex. 2100, ¶¶31-33; Ex. 2103, OMS_SAM0031785.

59. Accordingly, while Patent Owner, Dr. Efimov, and Dr. Islam cite references discussing motion artifacts, ambient-light interference, and signal-to-noise ratio (POR, 43-44; Efimov, ¶¶167-180; 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 the wavelength comparison technique were also taught and at least rendered obvious by the prior art. *See* Section VI above; Anthony, ¶¶148-153, 180.

60. 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.

61. 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.

IX. CONCLUSION

62. In summary, and as outlined in my Declaration and set forth above, I have concluded that claims 6, 11-12, 14, 18 of the '533 patent are 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.

63. 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.

64. 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.

65. 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.

APPENDIX A (LIST OF MATERIALS CONSIDERED)

Exhibit No.	DESCRIPTION
1001	U.S. Patent No. 9,651,533 ("'533")
1002	File History of U.S. Application No. 14/875,709 ("'533FH")
1003	Declaration of Brian Anthony in Support of Petition for *Inter Partes* Review of U.S. Patent No. 9,651,533 ("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	*Apple Inc. v. Omni Medsci, Inc.*, No. IPR2019-00916, Paper 1 (PTAB Apr. 10, 2019) ("'533-Pet.")
1007	*Apple Inc. v. Omni Medsci, Inc.,* No. IPR2019-00916, Paper 16 (PTAB Oct. 18, 2019) ("'533-Inst.")
1008	*Apple Inc. v. Omni Medsci, Inc.*, No. IPR2019-00916, Paper 39 (PTAB Oct. 14, 2020) ("'533-FWD")
1009	*Omni MedSci, Inc. v. Apple Inc.*, No. 21-01229, ECF 69 (Fed. Cir. June 8, 2022)
1015	*Apple Inc. v. Omni Medsci, Inc.*, No. IPR2021-00453, Paper 22 (PTAB Aug. 3, 2022) ("'484-FWD")
1018	*Omni MedSci, Inc. v. Apple Inc.*, 2:18-cv-00134-RWS, Dkt. No. 211 (E.D. Tex. June 24, 2019)
1019	*Omni MedSci, Inc. v. Apple Inc.*, 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. *Omni MedSci, Inc. v. Samsung Electronics Co.*, Ltd. et al., No. 2:24-cv-01070-JRG-RSP (E.D. Tex.)
1025	U.S. Patent No. 9,241,676 ("Lisogurski")
1028	U.S. Patent Pub. No. 2005/0049468 ("Carlson")
1030	U.S. Patent No. 7,029,628 ("Tam")
1031	U.S. Patent No. 8,050,730 ("Zhang")

Exhibit No.	DESCRIPTION
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, Light-Emitting Diodes (Cambridge Univ. Press, 2nd ed. reprinted 2014)
1038	"The Biomedical Engineering Handbook," by Joseph D. Bronzino (1995)
1059	U.S. Patent No. 5,497,769 ("Gratton")
1060	U.S. Patent No. 5,827,182 ("Raley")
1061	U.S. Patent No. 7,764,982 ("Dalke")
1071	U.S. Patent No 7,005,679 ("Tarsa")
1072	U.S. Patent Publication No. 2010/0249550 ("Lovejoy")
1073	U.S. Patent Publication No. 2015/0057511 ("Basu")
1074	U.S. Patent Publication No. 2013/0327966 ("Fidler")
1075	U.S. Patent Publication No. 2011/0267688 ("Kleppe")
1076	U.S. Patent Publication No. 2005/0133691 ("Doppke")
1077	U.S. Patent Publication No. 2006/0184040 ("Keller")
1079	U.S. Patent No. 6,339.715 ("Bahr")
1080	U.S. Patent No. 8,417,307 ("Presura")
1085	*Apple Inc. v. Omni Medsci, Inc.*, No. IPR2019-00916, Paper 10 (PTAB Jul. 22, 2019) ("'533-POPR")
1119	Claim Construction Order, *Omni MedSci, Inc. v. Samsung Electronics Co., Ltd. et al.*, No. 2:24-cv-01070-JRG-RSP, Dkt.

Exhibit No.	DESCRIPTION
	No. 154 (E.D. Tex. Mar. 24, 2026)
1127	Transcript of Igor Efimov, Ph.D. (July 16, 2026)
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 (CONFIDENTIAL)
2044	Updated *curriculum vitae* of Prof. Igor Efimov, Ph.D.
2045	Transcript of Apr. 17, 2026 Deposition of Dr. Brian W. Anthony
2046	Transcript of Apr. 18, 2026 Deposition of Dr. Brian W. Anthony
2047	2026-01-30 - Exhibit A to the P.R. 4-5 Joint Claim Construction Chart, *Omni MedSci, Inc. v. Samsung Electronics Co. Ltd. et al.*, 2:24-cv-01070-JRG-RSP (E.D. Tex.)
2100	Declaration of Dr. Mohammed Islam (CONFIDENTIAL)
2101	OMS_SAM0031768 (CONFIDENTIAL)
2102	OMS_SAM0031776 (CONFIDENTIAL)
2103	OMS_SAM0031782 (CONFIDENTIAL)
2104	OMS_SAM0031797 (CONFIDENTIAL)
2105	OMS_SAM0031867 (CONFIDENTIAL)
2106	OMS_SAM0031851 (CONFIDENTIAL)
2107	OMS_SAM0031961 (CONFIDENTIAL)
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")

Exhibit No.	DESCRIPTION
2110	U.S. Patent No. 6,126,595 to Amano et al.
2111	U.S. Patent Publication No. 2014/0275854 ("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	Samsung Watch Infringement Claim Chart
	Samsung Electronics Co., Ltd. et al. v. Omni MedSci, Inc., No. IPR2025-01250, Pap. 1 (PTAB Oct. 7, 2025) (Petition for Inter Partes Review)
	Samsung Electronics Co., Ltd. et al. v. Omni MedSci, Inc., No. IPR2025-01250, Pap. 12 (PTAB Nov. 7, 2025) (Patent Owner's Preliminary Response)
	Samsung Electronics Co., Ltd. et al. v. Omni MedSci, Inc., No. IPR2025-01250, Pap. 23 (PTAB Apr. 10, 2026) (Patent Owner's Notice of Deposition of Brian W. Anthony)
	Samsung Electronics Co., Ltd. et al. v. Omni MedSci, Inc., No. IPR2025-01250, Pap. 29 (PTAB May 7, 2026) (Patent Owner's Response)