

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of: Bilal Muhsin, et al.
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Title: PHYSIOLOGICAL MONITOR WITH MOBILE COMPUTING
 DEVICE CONNECTIVITY

SECOND DECLARATION OF DR. THOMAS W. KENNY

I currently hold the opinions set expressed in this declaration. But my analysis may continue, and I may acquire additional information and/or attain supplemental insights that may result in added observations.

I hereby declare that all statements made of my own knowledge are true and that all statements made on information and belief are believed to be true. I further declare 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 the Title 18 of the United States Code.

Dated: January 13, 2025

By: 
Thomas W. Kenny, Ph.D.

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I. QUALIFICATIONS AND BACKGROUND INFORMATION

1. My education and experience are described in my previously filed First Declaration in this proceeding (EX1003) as well as my curriculum vitae, attached as Appendix A to EX1003.

2. In addition to any materials cited in the present declaration, I have also reviewed the following documents and references:

- Paper 17: Masimo's Patent Owner Response
- Paper 18: Masimo's Patent Owner's Contingent Motion to Amend
- EX2037: Declaration of R. James Duckworth, Ph.D.
- EX2038: Declaration of Bilal Muhsin
- APPLE-1087: Transcript of the Deposition of Dr. R. James Duckworth (December 20, 2024)
- APPLE-1107: Transcript of the Deposition of Bilal Muhsin (January 8, 2025)
- EX2029: Joint Claim Construction Briefing (August 31, 2023) in *Apple Inc. v. Masimo Corp et al.*, C.A. 22-1378-MN-JLH
- APPLE-1005: U.S. Patent Application Pub. No. 2008/0004904 to Tran ("Tran")
- APPLE-1006: U.S. Patent No. 6,658,276 to Kianl et al. ("Kianl")

- APPLE-1007: Lorenzo T. D'Angelo, et al., A Sensor Network to iPhone Interface Separating Continuous and Sporadic Processes in Mobile Telemedicine, 33rd Annual International Conference of the IEEE EMBS Boston, Massachusetts USA, August 30 - September 3, 2011 ("D'Angelo")
- APPLE-1008: U.S. Patent No. 7,812,826 to Ording et al. ("Ording")
- APPLE-1009: U.S. Patent Application Pub. No. 2007/0093786 to Goldsmith et al. ("Goldsmith")
- APPLE-1011: Y. Mendelson, et al., A Wearable Reflectance Pulse Oximeter for Remote Physiological Monitoring, Proceedings of the 28th IEEE EMBS Annual International Conference New York City, USA, Aug 30-Sept 3, 2006
- APPLE-1091: U.S. Patent Application Pub. No. 2006/0253010 to Brady et al. ("Brady")
- APPLE-1092: U.S. Patent No. 7,598,878 to Goldreich ("Goldreich")
- APPLE-1093: U.S. Patent Application Pub. No. 2013/0069431 to Tseng et al. ("Tseng")
- APPLE-1094: J. Hudson, et al., Usability Testing of a Prototype Phone Oximeter with Healthcare Providers in High- and Low-Medical Resource Environments, 67 Anaesthesia 957-67 (2012) ("Hudson")

- APPLE-1106: Arpita Shah, PDA based ambulatory pulse oximeter, New Jersey Institute of Technology, May 2006 (“Shah”)
- I have also reviewed various supporting references and other documentation as further noted in my opinions below.

3. Counsel has informed me that I should consider these materials through the lens of one of ordinary skill in the art related to the '507 Patent at the time of the earliest possible priority date of the '507 Patent, and I have done so during my review of these materials. The '507 Patent claims the benefit of priority to a provisional application filed September 20, 2012. Substitute claim 21 recites a “**wristwatch** mobile pulse oximetry system” and “a mobile computing device comprising the **wristwatch**,” and substitute claim 29 recites “a **wristwatch** system” and a “**wristwatch** mobile computing device.” However, the provisional application *never* discloses a “wristwatch,” a “watch,” or a “wrist.” Without specificity, 8 of the 13 cited pages and *all* of the figures of the provisional application do not support the amended features. EX2046, 1, 4-7, 10, 12-13; FIGS 1-3. Although the provisional application states that the “the physiological sensor system may be one of a wide range of mobile devices such as a laptop, tablet computer, netbook, PDA, media player, mobile game console, or other microprocessor based device configured to interface with a physiological sensor,” (EX2046, 4), neither this cited portion of the provisional application nor other cited

portions of the provisional application support a wristwatch mobile pulse oximetry system or a wristwatch MCD. Generic disclosures would not have been sufficient for a POSITA to have distinguished the alleged '507 invention from non-wristwatch devices and systems. *See* MTA, 7. For these reasons, I agree with Counsel's assessment that (1) the provisional application does not include any description of a wristwatch device or system, and (2) the first introduction of such disclosure was on September 20, 2013—the filing date of U.S. Patent App. No. 14/033,315 (EX2047). Therefore, Counsel has informed me that the appropriate Critical Date (representing the earliest possible priority date to which the challenged claims of '507 Patent are entitled) is September 20, 2013, and I have therefore used that Critical Date in my analysis below. My analysis and conclusions in this Declaration, however, would remain the same if the Critical Date were as early as September 20, 2012.

4. I have no financial interest in the parties or in the outcome of this proceeding. I am being compensated for my work as an expert on an hourly basis. My compensation is not dependent on the outcome of these proceedings or the content of my opinions.

5. In writing this declaration, I have considered the following: my own knowledge and experience, including my work experience in the fields of mechanical engineering, computer science, biomedical engineering, and electrical

engineering; my experience in teaching those subjects; and my experience in working with others involved in those fields. In addition, I have analyzed various publications and materials, in addition to other materials I cite in both this declaration and my First Declaration.

6. My opinions, as explained below, are based on my education, experience, and expertise in the fields relating to the '507 Patent. Unless otherwise stated, my testimony below refers to the knowledge of one of ordinary skill in the art as of the Critical Date, or before. Any figures that appear within this document have been prepared with the assistance of Counsel and reflect my understanding of the '507 Patent and the prior art discussed below.

II. OVERVIEW OF CONCLUSIONS FORMED

7. This declaration explains the conclusions that I have formed based on my analysis. To summarize those conclusions, based upon my knowledge and experience and my review of the prior art publications listed above, I believe that:

- Mendelson provides, or at least renders obvious, elements [1b] and [13a] under the plain and ordinary meaning of the term “one or more signals”
- None of the reasons identified by Masimo and Dr. Duckworth would have dissuaded a POSITA from applying the teachings of D'Angelo to the system of Mendelson as described in my First Declaration (EX1003).

- None of the reasons identified by Masimo and Dr. Duckworth would have dissuaded a POSITA from applying the teachings of Goldsmith to the system resulting from the combination of Mendelson with D'Angelo as described in my First Declaration (EX1003).

- Substitute claim 29 is broader than original claim 13;
- The term “non-wireless”/“nonwireless” in claims 21 and 29 makes the claims unclear;

- A person of ordinary skill in the art (“POSITA”) would understand claim 21 as requiring the mobile computing device to be separate and distinct from the processing board of the SpO₂ measurement system;

- The '507 Patent does not include any written description of a wristwatch mobile computing device that encompasses the SpO₂ measurement system;

- Claims 29-31, 33-34 are obvious over Brady, Goldsmith, and D'Angelo;

- Claims 32, 34-35 are obvious over Brady, Goldsmith, D'Angelo, and Tran;

- Claims 30, 33 are obvious over Brady, Goldsmith, D'Angelo, and Kianl;

- Claims 21-22, 25, 27-28, 36 are obvious over Brady, Goldsmith, D'Angelo, and Goldreich;
- Claim 23 is obvious over Brady, Goldsmith, D'Angelo, Goldreich, and Ording;
- Claims 24, 26, 28 are obvious over Brady, Goldsmith, D'Angelo, Goldreich, and Tran;
- Claims 22, 27 are obvious over Brady, Goldsmith, D'Angelo, Goldreich, and Kianl;
- Claims 29-31, 33-34 are obvious over Brady, Goldsmith, D'Angelo, and Tseng;
- Claims 32, 34-35 are obvious over Brady, Goldsmith, D'Angelo, Tseng, and Tran;
- Claims 30, 33 are obvious over Brady, Goldsmith, D'Angelo, Tseng, and Kianl;
- Claims 21-22, 25, 27-28, 36 are obvious over Brady, Goldsmith, D'Angelo, Tseng, and Goldreich;
- Claim 23 is obvious over Brady, Goldsmith, D'Angelo, Tseng, Goldreich, and Ording;
- Claims 24, 26, 28 are obvious over Brady, Goldsmith, D'Angelo, Tseng, Goldreich, and Tran;

- Claims 22, 27 are obvious over Brady, Goldsmith, D'Angelo, Tseng, Goldreich, and Kianl;
- Claims 29-31, 33-34 are obvious over Hudson, Goldsmith, and Brady;
- Claims 32, 34-35 are obvious over Hudson, Goldsmith, Brady, Tran;
- Claims 21-22, 25, 27-28, 36 are obvious over Hudson, Goldsmith, Brady, and Goldreich;
- Claim 23 is obvious over Hudson, Goldsmith, Brady, Goldreich, and Ording;
- Claims 24, 26, 28 are obvious over Hudson, Goldsmith, Brady, Goldreich, and Tran.

8. I address each of these conclusions in the following sections. My analysis in Sections III-V address the application of the prior art identified in my First Declaration to the original claims of the '507 patent. In Sections VI-X, I address the proposed substitute claims included in Masimo's Contingent Motion to Amend.

III. MENDELSON PROVIDES ELEMENTS [1B] AND [13A]

9. Mendelson (APPLE-1011) demonstrates that elements [1b] and [13a] were known in the prior art because Mendelson describes an SpO2 measurement system and the Sensor Module of Mendelson's SpO2 measurement system is an optical sensor that outputs one or more signals responsive to light from a light

source attenuated by tissue of the user at a measurement site, with the said one or more signals being responsive to an oxygen saturation of the tissue. APPLE-1011, 1-4; APPLE-1003, ¶¶53-56. As I described in my First Declaration, Mendelson describes that the Sensor Module outputs the signals to the Receiver Module which processes the signals to identify physiological parameters which it then communicates to the PDA:

A Sensor Module, consisting of the optical transducer, a stack of round PCBs, and a coin-cell battery. The information acquired by the Sensor Module is transmitted wirelessly via an RF link over a short range to a body-worn Receiver Module. The data processed by the Receiver Module can be transmitted wirelessly to a PDA.

APPLE-1011, 2. This and other disclosures of Mendelson demonstrate that Mendelson's system includes the claimed optical sensor that outputs the claimed "one or more signals responsive to light from a light source attenuated by tissue of the user at a measurement site" under the plain and ordinary meaning of that term.

A. MENDELSON PROVIDES ELEMENTS [1B] AND [13A] UNDER THE PLAIN AND ORDINARY MEANING OF THE CLAIM LANGUAGE

10. Element [1b] recites:

an optical sensor configured to output one or more signals responsive to light from a light source attenuated by tissue of the user at a measurement site, said one or

more signals responsive to an oxygen saturation of said tissue; and

APPLE-1001, 20:30-34.

11. Element [13a] includes a highly similar recitation:

outputting, from an optical sensor of an SpO₂ measurement system, one or more signals responsive to light from a light source attenuated by tissue of the user at a measurement site, said one or more signals responsive to an oxygen saturation of said tissue; and

APPLE-1001, 21:45-49.

12. As I discussed in my First Declaration (APPLE-1003, ¶¶53-56, 137) Mendelson provides elements [1b] and [13a] because Mendelson's Sensor Module comprises a sensor and outputs signals that are responsive to changes in, and indicative of, light measured by the photodiode of the Sensor Module that is emitted by the red and infrared LEDs of Mendelson's Sensor Module and attenuated by tissue of the user at a measurement site on the user's body. A POSITA would have known this is true because of the description of these signals in Mendelson, and because these signals from the sensor module are used by the Receiver Module to produce the "...red and IR PPG signals..." and "...compute SpO₂ and HR...", and therefore must contain the signals from the photodetector. As such, under the plain and ordinary meaning of the term "one or more signals

responsive to light” and the remaining recitations of elements [1b] and [13a], the functionality described by Mendelson satisfies those claim elements.

13. I understand that Masimo and Dr. Duckworth have proposed that “the plain and ordinary meaning of ‘one or more signals responsive to light’ output by the optical sensor refers to *data that is actually acquired* with the optical sensor.” POR, 18 (emphasis original); EX2037, ¶124. Without expressing agreement or disagreement with this articulation of the plain and ordinary meaning of the term “one or more signals responsive to light,” I can state that Mendelson clearly discloses this claim term under Masimo’s expression of the plain and ordinary meaning because Mendelson’s Sensor Module outputs the data actually acquired by the Sensor Module to the Receiver Module, and these data are sufficient to compute red and IR PPGs as well as SpO2 and HR. Indeed, Mendelson makes this express:

A *Sensor Module*, consisting of the optical transducer, a stack of round PCBs, and a coin-cell battery. The *information acquired by the Sensor Module is transmitted* wirelessly via an RF link over a short range *to a body-worn Receiver Module*. The data processed by the Receiver Module can be transmitted wirelessly to a PDA.¹

APPLE-1011, 2.

¹ All emphasis added unless otherwise noted.

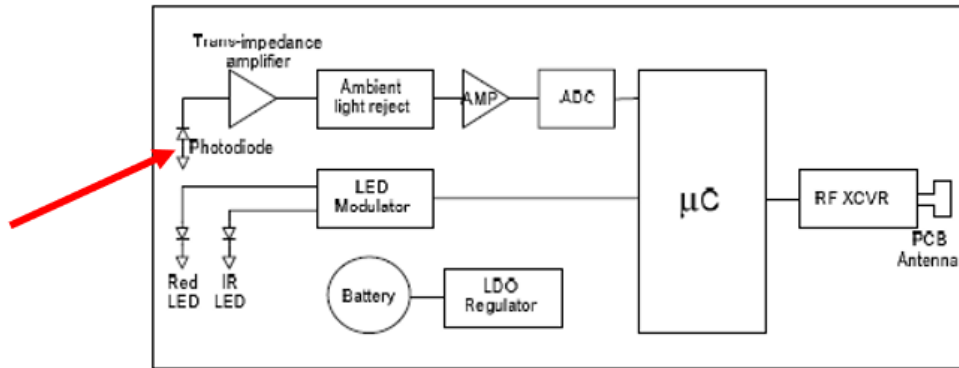
14. Mendelson could not be more clear that the Sensor Module outputs the data that is actually acquired by the Sensor Module. As I discussed in my First Declaration, the “*light emitted from the LEDs is diffused by the skin and subcutaneous tissues.*” *Id.*, 3. Mendelson describes that “[t]he Sensor Module was positioned on the forehead using an elastic headband” to capture “simultaneous HR and SpO₂ measurements.” *Id.*, 4.

15. In a similar disclosure, Mendelson describes that the information received at the Receiver Module that has been output by the Sensor Module is the data that is actually acquired by the Sensor Module:

Signals acquired by the Sensor Module are received by the embedded microcontroller [of the Receiver Module] which synchronously converts the *corresponding PD* output to R and IR PPG signals. Dedicated software is used to filter the signals and compute SpO₂ and HR based on the relative amplitude and frequency content of the reflected PPG signals.

APPLE-1011, 2.

16. Here, the abbreviation “PD” refers to a “photodetector.” APPLE-1011, 1. In the primary example described in Mendelson, this photodetector is a photodiode:



APPLE-1011, 2.

17. Mendelson is clear: The Sensor Module includes a Photodiode (“PD”). The PD detects light that from the red and IR LEDs that is attenuated by tissue. The PD output signals are acquired by the Sensor Module and these PD output signals are transmitted to the Receiver Module. The Receiver Module receives these PD output signals from the Sensor Module and converts these PD output signals to R and IR PPG signals, and computes SpO₂. The computation of SpO₂ in the Receiver Module is based on the relative amplitude and frequency content of the PD output signals produced by the PD in the Sensor Module. These multiple examples of Mendelson thus demonstrate that Mendelson provides elements [1b] and [13a] under Masimo’s interpretation of the plain and ordinary meaning of the claim language.

18. These disclosures of Mendelson also confirm that Mendelson provides these claim elements under the inventor’s interpretation of the claims.

Specifically, Bilal Muhsin, the first named inventor of the ’507 patent, described in

his declaration that the original prototype described in his declaration satisfies these claim elements simply because “the sensor *generated one or more signals based on* the light it detected, and output those one or more signals”. Therefore, according to Muhsin, signals need only be “based on the light it detected” in order to satisfy these claim elements. EX2038, ¶13. Mendelson makes it clear that the PD output signals output by the Sensor Module are at least “based on” the light detected by the photodiode of the Sensor Module. APPLE-1011, 2.

19. In addition to disclosing elements [1b] and [13a] under the plain and ordinary meaning of the claim language as expressed by Masimo in the Patent Owner Response and by Mr. Muhsin in his declaration, Mendelson also provides these claim elements under the plain and ordinary meaning of the claim language as expressed by Masimo in the Joint Claim Construction Brief from the related district court proceeding. I have reviewed portions of that Joint Claim Construction Brief and note that Masimo stated in that brief that “data in the form of an output signal indicative of an amount of attenuation of predetermined wavelengths (ranges of wavelengths) of light by body tissues” falls within the scope of the claimed “one or more signals responsive to light from a light source attenuated by tissue of the user at a measurement site.” EX2029, 34.

20. As I discussed above, Mendelson describes that the Sensor Module outputs “information acquired by the Sensor Module” to the Receiver Module and

that this information includes “corresponding PD output” that the Receiver Module processes to determine red and infrared PPG signals. APPLE-1011, 2. This disclosure of Mendelson falls directly within the scope of the term “one or more signals” as expressed by Masimo in the Joint Claim Construction Brief.

21. I also note that Masimo clearly expresses in the Joint Claim Construction Brief that signals that have been preprocessed prior to being output to the claimed processing board fall within the scope of elements [1b] and [13a] because, as Masimo states “[p]reprocessed signals are ‘responsive to’ detected light.” EX2029, 38. Masimo similarly asserts that “[t]he specification does not limit the signals to one type only” and that both digital and analog signals would fall within the scope of the claimed “one or more signals. *Id.* 38-39. Under these very broad assertions by Masimo regarding the plain and ordinary meaning of the term “one or more signals,” Mendelson once again clearly provides elements [1b] and [13a] because the Sensor Module outputs “information acquired by the Sensor Module” to the Receiver Module and that this information includes “corresponding PD output” that the Receiver Module processes to determine red and infrared PPG signals. APPLE-1011, 2.

**B. DR. DUCKWORTH’S DESCRIPTIONS OF THE
PROCESSING PERFORMED BY MENDELSON’S**

SENSOR MODULE ARE NOT SUPPORTED BY THE ACTUAL DISCLOSURES OF MENDELSON

22. In his declaration, Dr. Duckworth provides a description of what he refers to as the functions performed by Mendelson's Sensor Module "when in operation." However, I find no support for the majority of the functionality that Dr. Duckworth attributes to the Sensor Module anywhere within the actual disclosures of Mendelson. These descriptions of alleged additional processing performed by Mendelson's Sensor Module appear to be derived from, at best, Dr. Duckworth's 18+ year old recollections of how the system worked due to his role as a co-author of the Mendelson paper. I am willing to accept that Dr. Duckworth has detailed knowledge of systems that he and Mendelson worked on together that cannot be accommodated within the page limit of the IEEE Conference paper format. Nevertheless, my analysis here is based on what was revealed to the public (and therefore to a POSITA) based on the disclosure that is actually stated within the Mendelson reference, and on what a POSITA would understand to be necessary to implement this disclosure. I find no explicit support in the disclosure of Mendelson for Masimo's assertions that "the Sensor Module computes and outputs average red and infrared PPG samples to the Receiver Module." POR, 21. Further, a POSITA would not necessarily assume that such averaging was implicitly required in order to implement the disclosure of Mendelson, or that the

particular averaging scheme that Duckworth describes in his declaration would be specifically required or even understood to be present.

23. To be clear, there is simply no disclosure in Mendelson itself of any summing or averaging of collected signals. Indeed, as I discussed in the previous section, Mendelson expressly states ” ***Signals acquired by the Sensor Module are received*** by the embedded microcontroller [of the Receiver Module] which synchronously converts the ***corresponding PD*** output to R and IR PPG signals”. APPLE-1011, 1-2. In fact, Dr. Duckworth admitted that the additional functionality of summing and averaging signals that he included in his declaration “is not described in the Mendelson paper.” APPLE-1087, 104:3-18.

24. Looking at Dr. Duckworth’s descriptions of the supposed functionality of Mendelson’s Sensor module in more detail, Dr. Duckworth states that “a POSITA would have understood” that Mendelson’s Sensor Module “only outputs ***only*** average red and infrared PPG samples to the Receiver Module,” despite no discussion of such averaging anywhere in Mendelson. EX2037, ¶126. Dr. Duckworth states that “when in operation, the Sensor Module of Mendelson first turns on the red LED for a short period.” *Id.* He then states that “[w]hile the red LED is on, the microcontroller of the Sensor Module takes five consecutive samples of red light intensity using the module’s photodiode” and that “[t]hose five red light intensity samples are amplified, filtered, amplified, and converted by the

Sensor Module's ADC converter into five red PPG samples" and then summed by the microcontroller. *Id.* He then asserts that the same process is performed for the infrared LED and that "this cycle repeats very quickly, many times per second." *Id.*, ¶¶126-127. In describing this functionality, Dr. Duckworth not only attributes an averaging process to Mendelson's Sensor Module that is described nowhere in Mendelson itself, but asserts that these very specific details, such as the numbers of samples taken prior to averaging and the time windows between each sample when doing so, as if a POSITA would read the disclosure and arrive at these same details. For example, Dr. Duckworth specifies that exactly five samples each of the red and infrared measurement samples are taken and averaged per cycle, that this measurement cycle "repeats every 12.5ms (i.e., at 80 Hz)" and that the Sensor module "transmits the average PPG samples to the Receiver Module every 0.5s (i.e., at 2 Hz)." *Id.*, ¶¶126-128. As mentioned above, this functionality and the specific numbers referred to by Dr. Duckworth are "not described in the Mendelson paper." APPLE-1087, 104:3-18.

25. Dr. Duckworth insists that the additional functionality that he attributes to Mendelson's Sensor Module is what "a POSITA would have understood" regarding the disclosures of Mendelson. *Id.*, ¶126. I disagree. Dr. Duckworth's assertions regarding the preprocessing performed by Mendelson's Sensor Module appear to be based on his access to information regarding the

specific design of the prototype implementation of Mendelson's system, using the tools and instruments available in Mendelson's lab (not disclosed in the Mendelson paper), and operating in the specific noise environment (also not disclosed in the Mendelson paper) of the Mendelson lab that were familiar to Dr. Duckworth as a co-author of the Mendelson paper that would not have been available to a POSITA. EX2037, ¶¶11, 108, 125. For example, Dr. Duckworth stated that his descriptions of this additional functionality of Mendelson's Sensor Module are based on the fact that he "designed the system" and was "an author of the Mendelson paper and someone who was integral to the development of the system it describes." APPLE-1087, 108:17-109:5; EX2037, ¶125.

26. As one example, Dr. Duckworth asserts that "...a POSITA would have known that the distal signal averaging I'm describing there would be part of the processing." APPLE-1087, 105:1-3. However, a POSITA would not automatically believe that the "distal signal averaging" that is not mentioned in the Mendelson paper would necessarily be part of the processing. For this to be true, a POSITA would need to read the Mendelson paper and then make a particular series of assumptions and decisions that are unrelated to the explicit disclosure of Mendelson. These would include:

- Somehow, a POSITA would understand from the disclosure of Mendelson that single-sampling of the PD signals in the Mendelson

system as disclosed would not provide a sufficient signal/noise ratio to successfully implement the system described in the paper. In other words, a POSITA would have to decide that there must be some unacceptable characteristics of the result of single-sampling, requiring the use of additional undisclosed averaging, beyond anything stated or hinted at in Mendelson in order to deliver the results shown. I see no reason for a POSITA to make this leap of interpretation.

- The POSITA would then need to understand from the disclosure of Mendelson that an improvement in the signal/noise ratio for the PD signals of approximately 2.5 (which would be gained with 5X distal signal averaging) would be sufficient to successfully implement the system described in the paper, overcome the undisclosed problem and deliver the results shown in the paper. I see no reason for a POSITA to make this leap of interpretation.
- The POSITA would then be required to consider all the ways that an improvement of a factor of 2.5 could be achieved, including increasing the LED brightness, improving the optical shielding around the PD, increasing the size of the PD, adjusting the filtering of the signal at the output of the PD, or “distal signal averaging” (taking 5 samples and averaging the result, because sampling and averaging can

improve the S/N ratio roughly as the square root of the number of samples). After all of this consideration, the POSITA would have to decide that 5X distal signal averaging was the preferred solution implemented by Mendelson and Duckworth without any written description.

27. All of these steps would be necessary for Dr. Duckworth's assertion that "...a POSITA would have known that the distal signal averaging I'm describing there would be part of the processing." to be correct. In my opinion, this is all far too much to expect a POSITA reading this paper to automatically expect. From the Mendelson paper, as written, there's no indication that single A/D conversions of the signal would be inadequate, there's no indication that a modest 2.5X improvement in SNR would solve the imaginary problem, and, there's no indication that "distal signal averaging" is the only or the best way to solve this imaginary, modest problem.

28. Setting aside Dr. Duckworth's detailed assertions that 5X sampling would be expected by a POSITA, there is no reason a POSITA would assume distal signal averaging to be required at all. Such an assumption would require a determination that the explicit disclosure of Mendelson produces inadequate signal quality because of some undisclosed problem, that distal signal averaging would be the preferred approach to fixing this undisclosed problem. There are no indications

in Mendelson that there would be any need for any additional processing beyond what is disclosed in the description of the Sensor Module, which already includes an amplifier, ambient light rejection, amplification and an ADC, to overcome an undisclosed problem. A POSITA reading Mendelson would understand that this system that is described is sufficient to produce the results shown in the paper and that there are no hidden, undisclosed problems. Mendelson has a very long record of published results on pulse oximeters, dating to at least 18 years prior to this 2006 paper (Mendelson and Ochs, “Noninvasive Pulse Oximetry Utilizing Skin Reflectance Photoplethysmography”, IEEE Transactions on Biomedical Engineering, 35,10, P798-805 (1988).) and a well-earned reputation for providing clear and useful descriptions of the important elements of these pulse oximeter systems.

29. In fact, a POSITA examining figure 4, which shows very clean measurements of SpO₂ and HR, would not think that the successful result shown in the figure would be dependent on an undisclosed system to produce a 2.5X improvement in the S/N ratio, or that this would necessarily be achieved by implementation of a distal signal averaging with only 5 samples. The signals in Figure 4 have a very high S/N ratio, and a POSITA would not automatically assume that the system included an undisclosed 5-sample “distal signal averaging” in order to produce the results in this figure. Nowhere is there any indication that

there is an additional, modest problem to be solved, and that 5-sample “distal signal averaging” would necessarily be present in this system.

30. A POSITA reading Mendelson would understand and appreciate that all of the important and necessary details are explicitly provided. A POSITA would understand that there are some details that are to be worked out, such as selecting the gain of the amplifier, etc., but that otherwise the system disclosed in the Mendelson paper would be capable of producing the results shown in the Mendelson paper. It is certainly possible for a POSITA to build a system based on the Mendelson paper, and then make some adjustments as needed to make it work well. All of this is fair and reasonable. However, there is no basis for the assertion that a POSITA would automatically understand that there must be distal signal processing in a system based on the Mendelson disclosure.

31. What is clear is that Mendelson discloses a Sensor Module which includes a Photodiode (“PD”). The PD output signals are acquired by the Sensor Module and these PD output signals are transmitted to the Receiver Module. The Receiver Module receives these PD output signals from the Sensor Module and converts these PD output signals to R and IR PPG signals, and computes SpO₂. The computation of SpO₂ in the Receiver Module is based on the relative amplitude and frequency content of the PD output signals produced by the PD in the Sensor Module.

C. MASIMO’S ASSERTIONS ABOUT THE AMOUNT AND TYPE OF PREPROCESSING CONDUCTED BY THE CLAIMED OPTICAL SENSOR THAT FALLS WITHIN THE SCOPE OF THE CLAIMS IS NOT SUPPORTED BY THE RECORD

32. As I discussed above, Masimo indicates in the Joint Claim Construction Brief from the district court proceeding involving the ’507 patent that the plain and ordinary meaning of the term “one or more signals” is inclusive of signals that have undergone “preprocessing” by the optical sensor. For example, Masimo states that “[p]reprocessed signals are ‘responsive to’ detected light” and therefore signal preprocessing conducted by the optical sensor falls within the scope of the claims under Masimo’s claim interpretation. EX2029, 38. Masimo does not put any constraints on this “preprocessing” in the Joint Claim Construction Brief and certainly gives no examples of types of preprocessing that would fall outside of the scope of the claims. *Id.* However, in an attempt to distinguish the claims from the alleged and undisclosed “distal signal averaging” of Mendelson’s Sensor Module (which, as discussed above, is not actually described anywhere in the Mendelson paper, and would not be viewed as inherently disclosed by the Mendelson paper), Masimo now draws an arbitrary line between what it appears to consider to be preprocessing that falls within the scope of the claims and preprocessing that falls outside of the scope of the claims. Specifically, Masimo appears to identify preprocessing that involves amplifying the signal,

filtering the signal, and converting the signal from analog to digital as falling into the first category while insisting that preprocessing that involves averaging samples falls outside of the scope of the claimed “one or more signals.” POR, 20-21, 23. I find this arbitrary line between acceptable preprocessing and unacceptable preprocessing advanced by Masimo to be completely unsupported by the ’507 patent or any other evidence or record.

33. It is important to remember that the claims merely recite that signals provided to the processing board be “...responsive to light from a light source attenuated by tissue.” *See* Elements [1b] and [13a]. As such, under the plain and ordinary meaning of this claim language, the signals resulting from the system of Mendelson are responsive to light from a light source attenuated by tissue and captured and output by the photodiode. If this were not the case, the PDA of Mendelson would be unable to display SpO₂ values that Mendelson and Duckworth report in the Mendelson paper. The effort by Masimo and Dr. Duckworth to distinguish the current signal at the terminal of a detector from processed versions of the same signal (converted from current to voltage, amplified, filtered and digitally sampled) are inconsistent with the understanding of a POSITA of what is required by being responsive to light from a light source attenuated by tissue under the plain and ordinary meaning of the claims. In fact, the processing of signals such as disclosed in Mendelson would be understood as

obviously intended to result in signals which are more clearly responsive to light from a light source attenuated by tissue.

34. If we accept Dr. Duckworth's speculation from his deposition that the detector in the finger clip sensor of the Muhsin prototype video is a Photodiode, a POSITA would have appreciated that such a device would probably be configured with a DC voltage bias, and that the absorption of light would cause current to flow in proportion to the intensity of the light. The next most likely circuit element would be a trans-impedance amplifier, such as was implemented without fanfare by Duckworth and Mendelson in the Mendelson paper, and this device converts current to voltage with a fixed $I \rightarrow V$ ratio determined by a resistor. Alternatively, the current from the photodetector could simply pass from the sensor to ground through a resistor, creating a voltage across the resistor according to Ohm's Law ($V = IR$). In either case, a person of ordinary skill in the art would have recognized that this conversion from current to voltage conveys the signal from the photodiode to the next stages in the system in the form of a voltage with variations that are exactly proportional to the current variations that came from the photodetector. In making this transformation from current to voltage, a POSITA would appreciate that the voltage signals after the conversion provide one or more signals responsive to light, as required by the claim. In the context of this claim language, there is no meaningful distinction between a current that varies with detected light and a

voltage that varies with detected light. And, for the same reasons, there is no meaningful distinction between a voltage that varies with detected light and an amplified voltage that varies with detected light, and there is no meaningful distinction between a voltage that varies with detected light and a numerical representation of that voltage which also varies with detected light. A POSITA would understand that there is no meaningful distinction between these initial and processed signals from the PD – all of them vary with detected light, and all of them contain the information that allows determination of the SpO2 signals.

35. Muhsin states that “The detector of the sensor generated one or more signals **based on** the light it detected, and output those one or more signals to the processing module...”. Duckworth writes, “I understand the prototype system’s optical sensor also contained a detector that received emitted light after it passed through and was attenuated by the user’s finger. The detector of the sensor generated one or more signals **based on** the light it detected and output those one or more signals to the processing board via the cable.” These two statements provide guidance as to the scope of the claim terms as applied by Muhsin (an author of the patent) and Duckworth (Masimo’s expert); we see that the determination that the system in the prototype video meets the limitation of the claims simply because the signal is “**based on**” the light that is detected. Muhsin and Duckworth do not apply any more restrictive interpretation of the claim

language in this case. A POSITA would understand that signals that have been converted from current to voltage, amplified, filtered and converted from analog to digital form are still “**based on**” the light that is detected. Furthermore, even if Mendelson did disclose the signal summing and averaging functionality attributed to the Sensor Module by Dr. Duckworth, it is my opinion that such functionality would still fall within the plain and ordinary meaning of the claim language as conveyed by Muhsin and Duckworth on behalf of Masimo because such signals would still be “**based on**” the light measured by Mendelson’s photodiode that has been emitted by the red and infrared LEDs and attenuated by the user’s tissue at the measurement site.

IV. A POSITA WOULD HAVE BEEN MOTIVATED TO APPLY THE TEACHINGS OF D’ANGELO TO THE SYSTEM OF MENDELSON IN THE MANNER DESCRIBED IN THE PETITION

36. In my First Declaration, I described that a POSITA would have been prompted to apply the teachings of D’Angelo to the physiological monitoring system of Mendelson to beneficially implement Mendelson’s PDA as a smartphone, to include a configuration that allows Mendelson’s Receiver Module (equivalent to D’Angelo’s management device) to draw power from the smartphone in at least some scenarios, and to include various user interface screens for displaying physiological data and receiving user input as described by D’Angelo in addition to or in place of the user interface screens described by

Mendelson. APPLE-1003, ¶¶121-129. As part of this analysis, I identified seven reasons that would have prompted a POSITA to apply the teachings of D'Angelo to the system of Mendelson in such a manner. *Id.* This included recognizing that a POSITA would have known that applying D'Angelo's teachings to Mendelson's physiological monitoring system to configure Mendelson's Receiver Module (the claimed processing board) to be able to draw power from the smartphone in at least some scenarios would have provided the additional and beneficial functionality for the measured physiological data to be read from the Receiver Module "even when its battery is empty." APPLE-1007, 1530. Such a modification to Mendelson's systems based on the straightforward teachings of D'Angelo would have provided crucial backup functionality for collecting important physiological data, including SpO₂ readings, even in scenarios in which the Receiver Module of Mendelson has lost power, which could facilitate potentially lifesaving interventions based on the physiological data read from the Receiver Module. As I discussed in my deposition, this would be applicable to both situations in which "data that's been buffered and stored for some maybe lengthy period of time. And it could include the realtime data that's flowing from the sensor to the management device and available for transfer." EX2044, 56:2-9. For example, I stated that "I think a person of ordinary skill in the art would consider modifying Mendelson so that the power connection from the PDA to the receiver module could allow download of

physiological data, and that that would include data that's been stored, as well as the current flow of data.” *Id.*, 55:15-20.

37. I have reviewed the assertions of Masimo and Dr. Duckworth alleging that a POSITA would have somehow been dissuaded from including this additional, beneficial functionality in the system resulting from the combination of Mendelson with D’Angelo. For the reasons discussed below, I disagree. None of the reasons advanced by Masimo or Dr. Duckworth would have dissuaded from applying the teachings of D’Angelo to Mendelson’s system to configure Mendelson’s Receiver Module (the claimed processing board) to be able to draw power from the smartphone in at least some scenarios.

A. APPLYING THE TEACHINGS OF D’ANGELO TO THE SYSTEM OF MENDELSON WOULD NOT HAVE DEFEATED MENDELSON’S INTENDED PURPOSE

38. Dr. Duckworth asserts that “modifying Mendelson’s Receiver Module to draw power from the PDA to read out ‘the current flow of data’ (i.e., ongoing or new measurements) after the Receiver Module’s battery had died, which Apple calls ‘crucial backup functionality,’ would defeat Mendelson’s intended purpose.” EX2037, ¶142. Dr. Duckworth bases this assertion on what he describes as “the intended purpose” of Mendelson’s system, namely “keeping the medic using it out of harm’s way by allowing them to remotely monitor injured people.” *Id.* While I agree that the ability to remotely monitor soldiers or first responders in potentially

hazardous situations is *one* of the intended purposes of Mendelson’s system, Mendelson does not limit its system to use in such scenarios and indeed describes other non-dangerous uses for its system (which I will discuss more below). However, more importantly, the modification to Mendelson’s system based on the teachings of D’Angelo that I proposed in my First Declaration would not have removed *any* of Mendelson’s remote monitoring capability. As such, the system resulting from the combination of Mendelson with D’Angelo would have been not only just as suitable for conducting the remote monitoring functionality described by the unmodified Mendelson, but actually would have been even more suitable for such scenarios due to the added beneficial functionality that I discussed in my First Declaration, including the ability to provide backup power from the PDA/smartphone to a Receiver Module that has lost battery power. APPLE-1003, ¶¶121-129.

39. To be clear, this additional functionality described by D’Angelo is intended for use only when the Receiver Module’s “battery is empty,” thus providing a crucial, but highly beneficial, backup power source in situations in which the wearer of the device may be facing life-threatening injuries or a similarly serious medical emergency. APPLE-1007, 3; APPLE-1003, ¶124. Dr. Duckworth’s assertions that providing this additional, backup functionality would “would defeat Mendelson’s intended purpose” ignores the fact that the remote

monitoring functionality of Mendelson's system would be fully retained in the proposed system resulting from the combination of Mendelson with D'Angelo. Alternately, in the situation where the receiver module's battery is empty, the system becomes completely useless unless it includes a capability for drawing power from the PDA. So, rather than defeating the purpose of the Mendelson device, the ability to draw power from the PDA provides an essential mechanism to allow the device of Mendelson to continue fulfilling any/all of its purpose. Simply, providing this capability is additive: all of the disclosed functionality of Mendelson is preserved, and all of Mendelson's operating scenarios are still enabled, and some useful additional capability that would be appreciated by a POSITA is provided.

40. Dr. Duckworth goes on to assert that there would never be a scenario in which the person holding the PDA/smartphone would be in close proximity to the person wearing the Sensor Module and Receiver Module because Mendelson describes example use cases of "combat casualty care, such as for remote triage, and by first responders, such as firefighters." EX2037, ¶142. Dr. Duckworth asserts that in such scenarios it is important to "keep[] the medic using it out of harm's way." *Id.* However, Mendelson also expressly describes uses for its system that do not involve warzones or other hazardous conditions and therefore, in such scenarios, there would be little or no danger to the medic or other person in

possession of the PDA/smartphone from being in close proximity to the person wearing the Sensor Module and Receiver Module. For example, Mendelson describes using its system including “to monitor soldiers *during training exercises.*” APPLE-1011, 4, 1. Mendelson also describes that wearable, portable, vital sign measuring systems such as the system described in Mendelson (and the system resulting from combining Mendelson with D’Angelo) would have been beneficially deployed for use with “patients during emergency transport as they are being moved from a remote location to a hospital, or between hospital wards.” APPLE-1011, 2. A POSITA would have recognized that medical personnel would be in close physical proximity to such patients during transport and that medical personnel would not have been in danger from such close proximity to the patient. I note that Mendelson includes disclosure that expressly describes scenarios in which “medical personnel” are in close physical proximity to casualties in combat zones to “distribute sensors,” presumably after the immediate threat has ended. APPLE-1011, 3. Numerous other non-hazardous scenarios in which it would have posed little or no risk to the medic to be in close proximity to the person wearing the Sensor Module and Receiver Module would have been readily recognized by a POSITA. As such, a POSITA would have recognized that such non-hazardous scenarios would have benefited from use of Mendelson’s mobile monitoring system as modified by D’Angelo. Simply put, a POSITA would have recognized

that Mendelson's system is useful in "dangerous scenarios," including some scenarios disclosed by Mendelson, and others that a POSITA would be interested in addressing. However, the system disclosed by Mendelson is not limited to use in "dangerous scenarios" as Dr. Duckworth asserts and that numerous non-hazardous uses would have been apparent including those disclosed in Mendelson, and others that a POSITA would be motivated to address. EX2037, ¶142.

41. Dr. Duckworth's assertion that a medic in close physical proximity to a person wearing the Sensor Module and Receiver Module "would directly monitor the person right before them using ordinary medical equipment" also would not have dissuaded a POSITA from applying the teachings of D'Angelo to Mendelson in the manner I described in my First Declaration. EX2037, ¶146. For one reason, such a solution would have required the medic to carry this additional "ordinary medical equipment" in addition to the PDA/smartphone. Dr. Duckworth's assertion also overlooks that "ordinary medical equipment" typically requires 120V power sources such as in a hospital where such ordinary medical equipment is typically used, and that typical or "ordinary medical equipment" is generally heavy, and inconvenient to use outside of the typical medical situation, and may not be designed to operate in the environment of such situations. As another reason, this solution proposed by Dr. Duckworth also would have required using the same equipment on multiple different casualties. Such cross use of medical

equipment between persons who may be injured and bleeding could potentially spread blood or other body fluid between patients which could potentially spread infections or bloodborne illnesses between patients. an outcome prevented by providing backup power to each individual Receiver Module. Additionally, carrying a collection of bulky medical equipment (and long power cords) from patient to patient would obviously be avoided in favor of using a system such as the one disclosed in Mendelson. Furthermore, at most, this would have been an alternative solution to the problem of a Receiver Module with a depleted battery. The fact that other possible solutions existed would not have dissuaded a POSITA from implementing the straightforward solution to such scenarios described by D'Angelo.

42. Dr. Duckworth also suggests that rather than powering the Receiver Module with the PDA/smartphone for the brief amount of time required to receive vital sign readings from the Receiver Module, a POSITA would have instead recommended that “the medic would have just replaced the Receiver Module’s AA batteries.” EX2037, ¶146. However, this proposed alternative solution would have required the medic to carry a potentially large amount of AA batteries on their person, and to execute disassembly, battery extraction and insertion, and reassembly, under battlefield or other stressful conditions. And, as mentioned above, at most, the solution represented by the Mendelson-D’Angelo combination

would have been an alternative solution to the problem of a Receiver Module with a depleted battery. The fact that other possible solutions existed would not have dissuaded a POSITA from implementing the straightforward solution to such scenarios described by D'Angelo.

43. Dr. Duckworth further asserts that adding the functionality of the D'Angelo to Duckworth would result in “making the Receiver Module larger, heavier and more expensive” because of the additional components. This statement overlooks that the Receiver Module disclosed by Mendelson **already includes a connector** that could be used to provide power, and that the additional elements needed (voltage regulator, etc) would easily fit within the open space in the Receiver Module as shown in Figure 1. In fact, because the connector is already present, a POSITA would have been directly motivated to use this connector to provide back-up power consistent with the Mendelson-D'Angelo combination simply to make good use of an element already present in Mendelson.

B. APPLYING THE TEACHINGS OF D'ANGELO TO THE SYSTEM OF MENDELSON WOULD HAVE ALLOWED THE PDA TO READ REALTIME VITAL SIGN DATA FROM THE RECEIVER MODULE

44. As I discussed in my deposition, the ability to provide backup power from the PDA/smartphone to the Receiver Module in scenarios in which the battery of the Receiver Module had become depleted would have been applicable to both situations in which “data that's been buffered and stored for some maybe

lengthy period of time” and to scenarios in which “the realtime data that's flowing from the sensor to the management device and available for transfer” as detected by the Sensor Module and read from the Receiver Module while the backup power is being supplied. EX2044, 56:2-9. A POSITA would have been aware that receiving the necessary vital sign data to make important triage decisions regarding a patient would have been able to be performed in a quick amount of time. As such, as I previously stated in my deposition, “I think a person of ordinary skill in the art would consider modifying Mendelson so that the power connection from the PDA to the receiver module could allow download of physiological data, and that that would include data that's been stored, *as well as the current flow of data.*” *Id.*, 55:15-20. As such, Dr. Duckworth’s assertion that “Mendelson does not disclose or suggest that its Receiver Module stores measurements, or that the Receiver Module included a storage device that could be “read out” by the PDA after the Receiver Module’s battery had died” would not have dissuaded a POSITA from modifying Mendelson’s system based on D’Angelo because such backup power functionality would have been equally useful for reading realtime vital sign information in the form of current measurements from the Receiver Module while the Receiver Module is receiving backup power from the PDA/smartphone. EX2037, ¶147.

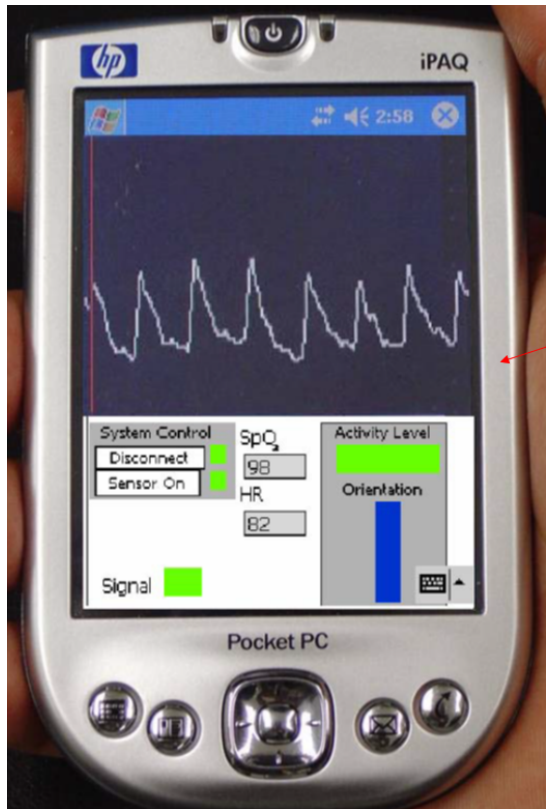
45. Additionally, although not a required part of the proposed combination of Mendelson with D'Angelo, such backup power functionality would have been beneficial in scenarios in which previously measured and stored vital sign information is read from the Receiver Module to the PDA/smartphone. Dr. Duckworth asserts that "Mendelson does not disclose or suggest that its Receiver Module stores measurements" but D'Angelo does disclose such well-known and straightforward functionality. Specifically, D'Angelo discloses that its management device (equivalent to Mendelson's Receiver Module) includes a microSD card for storing collected vital sign information. APPLE-1007, 1-3. Such storage functionality would have been readily applicable to Mendelson's system to ensure that recorded vital sign information is not lost as the result of the Receiver Module's battery running empty.

**C. MENDELSON'S UNMODIFIED SYSTEM PRESENTS
VITAL SIGN INFORMATION FOR ONLY A SINGLE
USER AT ANY GIVEN TIME**

46. Dr. Duckworth asserts that implementing Mendelson's Receiver Module to be capable of drawing backup power from the PDA/smartphone (based on the teachings of D'Angelo) "would have eliminated functionality that Mendelson's system was intended to include" of "monitor[ing] multiple injured people remotely at the same time." EX2037, ¶151. However, even in the unmodified version of Mendelson's system, the PDA only presents vital sign

information for a single person at any given time. As such, implementing Mendelson's system to allow the PDA to provide backup power to a Receiver Module having a depleted battery would not have hindered the functionality of Mendelson's system and certainly would not have "eliminated functionality" as Dr. Duckworth insists. Rather, the medic or other person in possession of the PDA would be able to attach the PDA to a Receiver Module having a depleted battery, read that person's vital sign information, and then detach the PDA to allow for remote monitoring of other Receiver Modules (one at a time) that do not have depleted batteries.

47. Turning to the actual disclosures of Mendelson, the paper describes that that the medic or other person in possession of the PDA must select "*a specific wearable unit*" and "connect[] to *the* remote device" to view "the subject's vital signs." APPLE-1011, 3. In other words, Mendelson's PDA functions by connecting to a single Receiver Module at a time. Furthermore, as shown in Figure 3, the user interface of the PDA displays only information for a single user at a time (i.e., the user wearing the Receiver Module that the PDA has connected to at the time). Specifically, Figure 3 shows a PPG waveform, SpO₂ and Heartrate values, activity level, orientation, and on-screen controls for a single user/Receiver Module.



All displayed parameters
and controls for a single
person

APPLE-1011, 3.

D. THE BATTERY CAPACITY OF MENDELSON'S SENSOR MODULES AND RECEIVER MODULES WOULD NOT HAVE DISSUADED A POSITA FROM APPLYING D'ANGELO TO MENDELSON'S SYSTEM

48. In his alleged fourth reason against applying D'Angelo's straightforward teachings to Mendelson's system, Dr. Duckworth proposes yet another alternative solution to the problem of Receiver Modules with depleted batteries by suggesting that the persons in charge of managing the system would have simply ensured that each device had a full battery prior to every deployment or use. EX2037, ¶152. Dr. Duckworth insists that "a POSITA would have understood that the Receiver Module already had plenty of power to keep the

device operational throughout any of the emergency-type events that it was used to monitor” thus rendering D’Angelo’s backup power solution “redundant.” *Id.*

49. However, such an alternative solution would have required ensuring that every Receiver Module had full batteries before every use event, including unexpected emergencies. To implement this proposed alternative solution presented by Dr. Duckworth, the person or persons in charge of maintaining the system would have needed to replace the batteries of each Receiver Module prior to the battery being fully depleted to ensure that the battery would not become depleted during training, combat, or another use scenario. This alternative solution would have resulted in significant waste as batteries would need to be replaced long before being depleted to ensure viability. And, as mentioned above, at most, this would have been an alternative solution to the problem of a Receiver Module with a depleted battery. The fact that other possible solutions existed would not have dissuaded a POSITA from implementing the straightforward solution to such scenarios described by D’Angelo.

50. Additionally, a POSITA would have recognized that even if the need for supplying backup power to the Receiver Modules from the PDA/smartphone were rare, it would still be extremely helpful in applicable scenarios, especially in situations in which the wearer of the device may be facing life-threatening injuries or a similarly serious medical emergency. Again, as with the other concerns raised

by Duckworth, the ability to draw power from the PDA is provided as a back-up capability to all of the features disclosed by Mendelson. None of the disclosed features are disabled by the added capability, and operations through complicated and unexpected circumstances are possibly enabled or improved.

51. Finally, Duckworth's proposal to make sure that all such systems are fully-charged prior to use overlooks all scenarios where unexpected events and circumstances extend the situation beyond the life of fully-charged batteries. As a POSITA would appreciate, as well as anyone using battery-powered hand-held devices at the time of the '507, it is not unusual for everyday situations to lead to a need for back-up power. In the cases of systems intended for use in the battlefield or other hazardous scenarios, there should be an even greater appreciation that things will not go as planned, and back-ups are wise and useful.

**E. THE POWER DRAWN FROM THE PDA BY THE
RECEIVER MODULE WOULD HAVE BEEN
NEGLIGIBLE COMPARED TO THE TOTAL BATTERY
CAPACITY OF THE PDA**

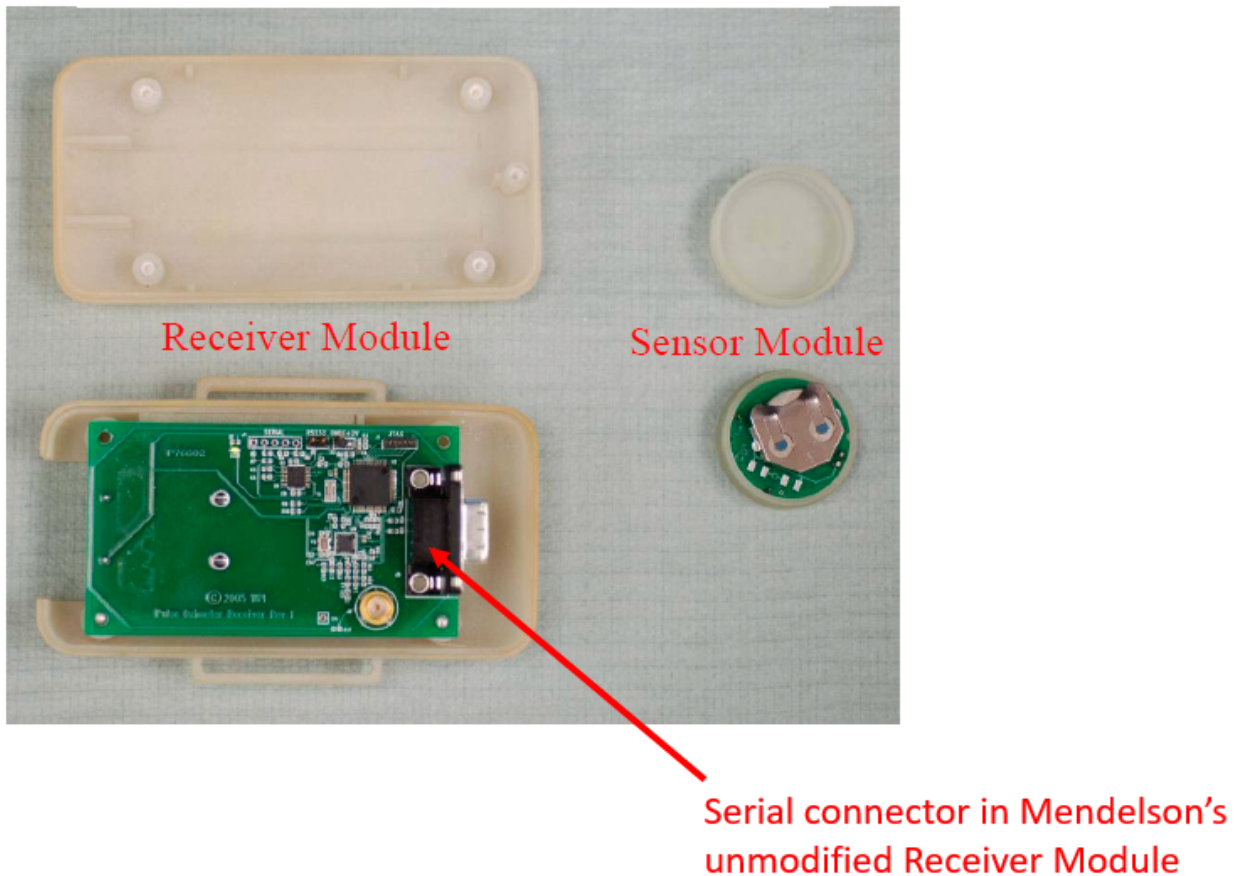
52. Dr. Duckworth testified that the Receiver Module in the Mendelson system drew very little power and therefore could operate continuously for five days on only two AA batteries. EX2037, ¶152. Given this small amount of power required by the Receiver Module, a POSITA would have recognized that the amount of power drawn from the PDA/cellphone to provide the backup power functionality described in D'Angelo for the short amount of time required to read

vital sign information would have been negligible when compared to the overall battery capacity of the PDA/smartphone. A POSITA would have known that by the late timeframe of 2012, smartphones and other PDAs generally had a “long battery life” and substantially large batteries sufficient for powering all of the functions of the cellphone and therefore would have had more than enough power to provide brief, backup power to a Receiver Module with a depleted battery. APPLE-1094, 8; APPLE-1097, 6.

53. Additionally, a POSITA would have recognized that applying D’Angelo’s teachings to Mendelson’s system would have merely provided medics and other users of the PDA with the *option* to provide backup power to a Receiver Module with a depleted battery. The medic or other user of the PDA would not have been forced to utilize the PDA to provide backup power to the Receiver Module in every scenario. The medic or other user of the PDA would simply have the option and could choose to use the added, backup power functionality depending on the current charge level of the PDA and other relevant factors of a given scenario, such as the degree to which the person wearing the Receiver Module is injured. A POSITA would have recognized that a skilled medic would have had the knowledge and experience to use such discretion wisely and would have benefited from the additional backup power functionality described by D’Angelo in at least some scenarios.

**F. THE MODIFICATIONS TO MENDELSON'S SYSTEM
TO IMPLEMENT D'ANGELO'S SUGGESTIONS
WOULD NOT HAVE BEEN OVERLY BURDENSOME.**

54. Dr. Duckworth asserts that a POSITA would have been dissuaded from applying D'Angelo's teachings to Mendelson's system because "the modification would require adding components that make the Receiver Module larger, heavier, and more expensive to manufacture." EX2037, ¶155. However, this argument overlooks that the receiver module shown in Figure 1 of Mendelson already includes a connector for a connection to the PDA, and this connector is larger, heavier and more expensive than the other elements (voltage regulator, other wires, etc) needed to manage a wired power connection:



APPLE-1011, Figure 1. As such, the proposed modification would not have led to the burdensome weight or expense that Dr. Duckworth contemplates but merely would have required routine adjustments that would have been known to a POSITA to swap the already existing data connector included in Mendelson's Receiver Module for a data connector having a charging pin, as described in D'Angelo. APPLE-1011, 2; APPLE-1007, 3. Indeed, D'Angelo confirms that a configuration having a power pin for powering the Receiver Module from the PDA/smartphone can be included in a receiver module/management device having a compact and lightweight formfactor:



APPLE-1007, 3. Additionally, even if Dr. Duckworth's assertions were true, such a modification merely represents a tradeoff that would have led to the known benefits that I discussed in my First Declaration.

**G. MY STATEMENTS DURING MY DEPOSITION
SUPPORT THE MOTIVATION TO APPLY
D'ANGELO'S TEACHINGS TO MENDELSON'S
SYSTEM**

55. Masimo's arguments relating to my statements during my deposition regarding what a POSITA "might" or "would consider" doing, or what "could be useful" do not detract from the straightforward benefits of applying D'Angelo to Mendelson described both here and in my First Declaration. POR, 43-44. During the discussion captured in the transcript of my deposition, I was positing on the

various benefits and use cases that a POSITA would have understood from reviewing the prior art of record. As I stated in my deposition, a POSITA would have considered making the proposed modifications to Mendelson based on the teachings of D'Angelo (and the other cited prior art) because such modifications would have resulted in known benefits. For example, I made clear in my deposition that that a POSITA would have understood that “[i]t could be useful to read out previously captured and stored data as well as whatever the current measurements are” in at least some use scenarios. EX2044, 55:5-11. My statement here clearly indicates that it would have been useful in at least some scenarios to read out previously captured and stored data as well as whatever the current measurements are. Assertions that such statements during my deposition somehow contradict the straightforward benefits that would have been achieved from applying D'Angelo to Mendelson are baseless.

V. A POSITA WOULD HAVE BEEN MOTIVATED TO APPLY THE TEACHINGS OF GOLDSMITH TO THE SYSTEM RESULTING FROM THE COMBINATION OF MENDELSON WITH D'ANGELO IN THE MANNER DESCRIBED IN THE PETITION

56. In arguing that a POSITA would not have been motivated to apply Goldsmith's teachings to the Mendelson-D'Angelo combination to implement the mobile device as a smartwatch (aka, a PDA having the form-factor of a watch), Dr. Duckworth largely repeats the complaints he made with respect to the proposed

Mendelson-D'Angelo system. EX2037, ¶¶161-165. For example, Dr. Duckworth once again asserts that "Apple's proposed modification would require the medic carrying the PDA (or wearing the PDA-turned-wristwatch) to enter the dangerous scenario and co-locate with the injured person." *Id.*, ¶163. These assertions by Dr. Duckworth would not have dissuaded a POSITA from applying the teachings of D'Angelo and Goldsmith to Mendelson in the proposed manner for the same reasons that I discussed earlier with respect to the Mendelson-D'Angelo combination and as such, I will not repeat them here.

57. Dr. Duckworth similarly repeats his assertion that in the proposed combination of Mendelson with D'Angelo and Goldsmith, "the medic would not be using the PDA-turned-wristwatch to monitor 'multiple' injured people at the same time." EX2037, ¶163. As I discussed above, the unmodified Mendelson system only connects to one Receiver Module at a time and displays vital sign and other information for only the one person at a time. As such, this argument also fails to demonstrate that a POSITA would have been dissuaded from making the proposed combination for the same reasons that I discussed earlier with respect to the Mendelson-D'Angelo combination and as such, I will not repeat them here.

58. Dr. Duckworth goes on to assert that "Mendelson's system would provide no monitoring functionality at all without the PDA." EX2037, ¶165. However, the resulting Mendelson-D'Angelo-Goldsmith system would retain the

functionality of Mendelson's PDA but simply implement it in a smartwatch, which is a type of PDA having a wristwatch formfactor. As I discussed during my deposition with respect to the proposed combination of Mendelson with D'Angelo and Goldsmith, "I think the proposed combination contemplates replacing the PDA with a wristwatch. It might *have all the same functions of a PDA and might even still call it a PDA*, but it would have the form, shape of a wristwatch." EX2044, 75:19-76:1. Furthermore, as I discussed in my First Declaration, "a POSITA would have recognized that implementing the wristwatch display device described by Goldsmith to provide a power output pin for the Receiver Module/management device would have achieved the same benefits of allowing read out even when the Receiver Module device battery is empty that I discussed in Ground 1D." APPLE-1003, ¶209.

59. Next, turning to Dr. Duckworth's assertion that "the PDA-turned-wristwatch was a small device with a very limited battery capacity, which a POSITA would have understood was not suitable for powering the Receiver Module or other devices," I don't believe that the disclosures of Goldsmith or any other art of record support such an assertion and furthermore, it is my opinion that a POSITA would have found that smartwatches that were commercially available by 2012 would have had sufficient battery capacity to provide the negligible amount of power required to provide the backup power functionality described in

D'Angelo for the short amount of time required to read vital sign information from the Receiver Module. EX2037, ¶165.

60. In fact, Goldsmith itself demonstrates that the smartwatch implementation of the PDA in the resulting Mendelson-D'Angelo-Goldsmith system would have had sufficient power to provide power to ancillary devices, including backup power for a Receiver Module having a depleted battery. Specifically, Goldsmith describes embodiments in which its “controller device” provides power to or is otherwise in wired connection to a “sensing device.” APPLE-1009, [0052], [0018], [0050], [0086]-[0087]. For example, Goldsmith describes various “sensors included in” and therefore drawing power from “the device” which, as I discussed in my First Declaration, includes an implementation having a wristwatch formfactor. APPLE-1003, ¶¶200-202; APPLE-1009, [0082]-[0085], [0095]. As I discussed in my First Declaration, one of the parameters sensed by Goldsmith’s sensors is blood-oxygen level and as such, a POSITA would have recognized that the battery of Goldsmith’s wristwatch PDA had sufficient power to supply power to a blood-oxygen sensor system component such as Mendelson’s Receiver Module. APPLE-1009, [0037]-[0038], [0085]-[0090], [0050]. Goldsmith also expressly contemplates powering the various devices in its system (e.g., the “controller device” having a wristwatch formfactor, the sensors, and other components) using a single battery. *Id.*, [0041], [0053]. Goldsmith

further describes that the smartwatch PDA of the resulting system can include “a removable battery and an internal backup battery” which would alleviate the power concerns raised by Dr. Duckworth as the backup battery could be employed in emergency situations. *Id.* Other evidence of record demonstrates that a wristwatch would have had sufficient battery capacity to provide power to a blood oxygen sensing system that includes a processing board for calculating blood oxygen level. For example, Brady describes a wrist-worn watch having an “optical sensor;” a “pulse oximetry board” for calculating blood oxygen levels, and a separate “microprocessor board” for conducting other processing functions of the watch. APPLE-1091, ¶¶[0046]-[0058]. The pulse oximetry board can receive “radiation-induced current” from the optical sensor and process the signals to generate “blood oxygenation level” data. *Id.* Brady discloses that the microprocessor board can “receive[] data from the pulse oximetry board and process[] the data to display...pulse rate, blood oxygenation levels, calories expended by the user of a pre-set time period, target zone activity, time and dynamic blood pressure” on a display member of the watch. *Id.* As such, Brady demonstrates that as early as 2006, smartwatches had sufficient battery power to continuously power a blood oxygen detection system and as such, certainly had sufficient battery power to provide temporary backup power to a Receiver Module with a depleted battery.

61. Furthermore, the proposed modification would have merely provided medics and other users of the smartwatch PDA with the *option* to provide backup power to a Receiver Module with a depleted battery using the smartwatch PDA. The medic or other user of the smartwatch PDA would not have been forced to utilize the smartwatch PDA to provide backup power to the Receiver Module in every scenario. The medic or other user of the smartwatch PDA would simply have the option and could choose to use the added, backup power functionality depending on the current charge level of the smartwatch PDA (which, as discussed above included both a main battery and backup battery) and other relevant factors of a given scenario, such as the degree to which the person wearing the Receiver Module is injured. A POSITA would have recognized that a skilled medic would have had the knowledge and experience to use such discretion wisely and would have benefited from the additional backup power functionality described by D'Angelo in at least some scenarios when implementing the PDA to have the wristwatch formfactor described in Goldsmith.

VI. SUBSTITUTE CLAIM 29 IS BROADER THAN ORIGINAL CLAIM 13

62. In my opinion, substitute claim 29 is broader than original claim 13, which Counsel has informed me is impermissible. In particular, while claim 13 requires that the claimed mobile computing device is separate and distinct from the claimed processing board, claim 29 is broader since it also covers embodiments in

which the processing board is within the mobile computing device (e.g., as a component of the mobile computing device).

63. My opinion is informed by a plain reading of the claims. For example, original claim 13 recites “via a processing board of the SpO₂ measurement system, the processing board *in data communication with* ... a mobile computing device ... [,] outputting the SpO₂ measurement values *to* the mobile computing device” (emphases added). It is apparent that a device or component can only be “in data communication with” and output values “to” another device if those devices are separate and distinct. Therefore, in order for original claim 13 to make sense, a POSITA would understand that the claim must require the processing board to be separate and distinct from the mobile computing device. This is further evident from the fact that the ’507 Patent *exclusively* describes embodiments where the processing board is separate and distinct from the mobile computing device. *See, e.g.*, EX1001, 2:21-26; 3:57-62; 4:67-5:14; 5:25-27; 5:40-44; 6:23-7:17; 7:26-8:2; 9:1-20; 9:47-65; 10:28-34; 10:55-61; 16:43-17:6; 17:22-25; *id.*, FIGS. 1A-1C, 5A-5C. A POSITA would have no reason to interpret the original claim 13 any more expansively, and especially not to interpret the original claim 13 to encompass both embodiments where the processing board is separate from the mobile computing device -and- embodiments where the processing board is incorporated into the mobile computing device.

64. In contrast with claim 13, substitute claim 29 is broader since it no longer limits the invention to embodiments where the processing board is separate and distinct from the mobile computing device. Instead, claim 29 expands claim 13 to cover embodiments where the processing board is *within* the mobile computing device, for example, as an internal component of the mobile computing device. Specifically, claim 29 recites that the processing board “output[s] the SpO₂ measurement values to one or more hardware processors of the wristwatch mobile computing device.” By amending the claim language to say that the processing board outputs the SpO₂ measurement values to “*one or more hardware processors* of the ... mobile computing device” rather than simply “to the mobile computing device,” claim 29 only requires that the processing board be separate and distinct from the other *hardware processors* of the mobile computing device and *not* from the mobile computing device itself. That is, claim 29—unlike claim 13—covers embodiments where mobile computing device *encompasses* the processing board. Embodiments where the mobile computing device encompasses the processing board are nowhere discussed, illustrated, or implied by any of the disclosure of the ‘507 patent. Counsel has informed me, and I understand, that such broadening of the claims is impermissible.

VII. THE TERM “NON-WIRELESS”/“NONWIRELESS” IN CLAIMS 21 AND 29 MAKES THE CLAIMS UNCLEAR

65. Counsel has also asked me to opine on what the terms “non-wireless”/“nonwireless” should mean in substitute claims 21 and 29. I do not believe these terms are clear with any reasonable certainty. This term is never used in the ’507 Patent, and it is unclear to me why Masimo now proposes the term “nonwireless” over the much simpler and less awkward term “wired,” which *is* used repeatedly in the ’507 Patent. *See, e.g.,* APPLE-1001, 5:65-67, 5:35-39, 2:29-32, 4:39-45, 10:17. Indeed, I understand that even Masimo’s expert was “confused” by Masimo’s use of the term. APPLE-1087, 25:2-11, 27:3-5, 28:6-29:3.

66. To the extent that Masimo intends for “non-wireless”/“nonwireless” to mean anything *other* than “wired”—for example, to potentially expand the scope of the claim to cover things like optical fibers, sonic cables or buses on a printed circuit board—such embodiments are unsupported by the specification and would make the bounds of the claim entirely unclear. Therefore, if the term “non-wireless”/“nonwireless” is to be given any meaning at all, it should simply mean “wired” and nothing more.

**VIII. A POSITA WOULD UNDERSTAND CLAIM 21 AS
REQUIRING THE MOBILE COMPUTING DEVICE TO BE
SEPARATE AND DISTINCT FROM THE PROCESSING
BOARD OF THE SpO₂ MEASUREMENT SYSTEM**

67. As I explained with respect to claim 13 in Section VI, *supra*, claim 21 would likewise be understood by a POSITA as (1) requiring the processing board of the SpO₂ measurement system to be separate and distinct from the mobile computing device and (2) excluding embodiments where the processing board is within the mobile computing device. This is because a POSITA would understand claim 21’s recitation that “the processing board is configured to ... **output** the SpO₂ measurement values nonwirelessly **to** the mobile computing device” as necessitating that the processing board and mobile computing device be distinct items that are separate from each other. Once again, a device or component can only output values “to” another device if those devices are separate and distinct. *See supra* §VI. Interpreting claim 21 in any other way—for example, to allow the processing board to be a component **within** the mobile computing device that “outputs” measurement values to the very mobile computing device that it is already part of—would be a completely unnatural reading of the claim language and would make very little sense indeed. This would have the mobile computing device outputting measurement values to itself. Such a reading would also reach well beyond the scope of the ’507 Patent, which **exclusively** describes embodiments where the processing board is separate and distinct from the mobile

computing device, and where outputting from the processing board to the mobile computing device is clear and sensible. *See, e.g.*, EX1001, 2:24-29 (“a physiological monitoring system ... with a processing board ... can be connectable *to* a mobile computing device”); 7:26-36 (“processing board 134 is the portion of the module 130 that communicates ... *with* the second cable 140 and mobile computing device”); *see also id.*, 2:21-26; 3:57-62; 4:67-5:14; 5:25-27; 5:40-44; 6:23-7:17; 7:26-8:2; 9:1-20; 9:47-65; 10:28-34; 10:55-61; 16:43-17:6; 17:22-25; *id.*, FIGS. 1A-1C, 5A-5C. Furthermore, I have noted that Masimo’s expert seems to agree to this understanding. EX2037, ¶60 (stating the “main purpose of the inventions” was to perform all signal processing with a processing board separate from the MCD); *see also id.*, ¶¶84, 106-107, 12.

IX. THE '507 PATENT DOES NOT INCLUDE ANY WRITTEN DESCRIPTION OF A WRISTWATCH MOBILE COMPUTING DEVICE THAT ENCOMPASSES THE SpO₂ MEASUREMENT SYSTEM

68. Consistent with my analysis above, it is my opinion that claim 21 would be understood by a POSITA as requiring a mobile computing device (comprising a wristwatch) that is *separate and distinct* from the SpO₂ measurement system while claim 29 has been improperly broadened to additionally cover a wristwatch mobile computing device that *encompasses* a processing board of the SpO₂ measurement system. *See supra* §§VI and VIII. Nevertheless, to the extent that *any* of these claims (or their dependent claims) are interpreted as covering

embodiments in which the SpO₂ measurement system is encompassed by (e.g., integrated into) the mobile computing device, those claims must be invalid since the '507 Patent lacks any such description.

69. The '507 mentions a “wristwatch” only a single time (2:2), and only as an example of a mobile computing device 160 alongside a sensor 110 and a processing board 130, all three of which are distinct elements as described and drawn throughout the '507. The '507 Patent is completely silent with respect to any direct or indirect disclosure of a wristwatch mobile computing device that encompasses an optical sensor and/or a processing board of an SpO₂ measurement system. Nor does the '507 Patent include even a hint that the named “inventors” had thought of—much less had “possession” of—such an embodiment. On the contrary, the '507 Patent unambiguously and exclusively teaches that the SpO₂ processing board is separate and distinct from the claimed mobile computing device. *See, e.g.*, EX1001, 2:21-26; 3:57-62; 4:67-5:14; 5:25-27; 5:40-44; 6:23-7:17; 7:26-8:2; 9:1-20; 9:47-65; 10:28-34; 10:55-61; 16:43-17:6; 17:22-25; *id.*, FIGS. 1A-1C, 5A-5C.

70. Moreover, the '507 Patent makes clear that the separation of the SpO₂ processing board is more than an optional feature—it is *essential* to the very purpose of the alleged invention. The '507 Patent boasts that the described technology overcomes the issues of (1) “processing overhead” for “implementing

physiological measurement technology on mobile computing devices,” and (2) the smaller size of mobile devices, “which limits the number of processors that can be included in the device.” EX1001, 7:22-27, 7:64-67. Furthermore, the ’507 Patent goes on to say that the invention of the ’507 patent was to provide “a *separate* processing module 130 to mediate the data flow from the sensor 110 to the mobile device 160” and to “mov[e] the signal processing calculations *away* from the mobile CPU.” *Id.*, 7:3-10 (emphases added). Yet now—over a *decade* after the Critical Date—Masimo appears to be seeking to use the IPR process to re-write an old claim so as to obtain new coverage for an undisclosed embodiment that puts the processing board back *inside* the mobile computing device and cuts against the very core of what the ’507 Patent is all about.

X. PRIOR ART ANALYSIS

71. As I described above, claim 21 would be understood by a POSITA as requiring a mobile computing device (comprising a wristwatch) that is *separate and distinct* from the SpO₂ measurement system while claim 29 has been improperly broadened to additionally cover a wristwatch mobile computing device that *encompasses* a processing board of the SpO₂ measurement system. *See supra* §§VI and VIII. Under this correct interpretation of the claims, all of claims 21-36 are invalid because they were all obvious as of the Critical Date. *See infra* §§X.A-X.N. Moreover, even if the claims are interpreted *incorrectly*, all of them would

still be invalid. *Id.* As I demonstrate below, the prior art rendered obvious all of claims 21-36 as of the Critical Date ***regardless*** of whether or not the mobile computing device is required to be separate from the SpO₂ measurement system.

Id.

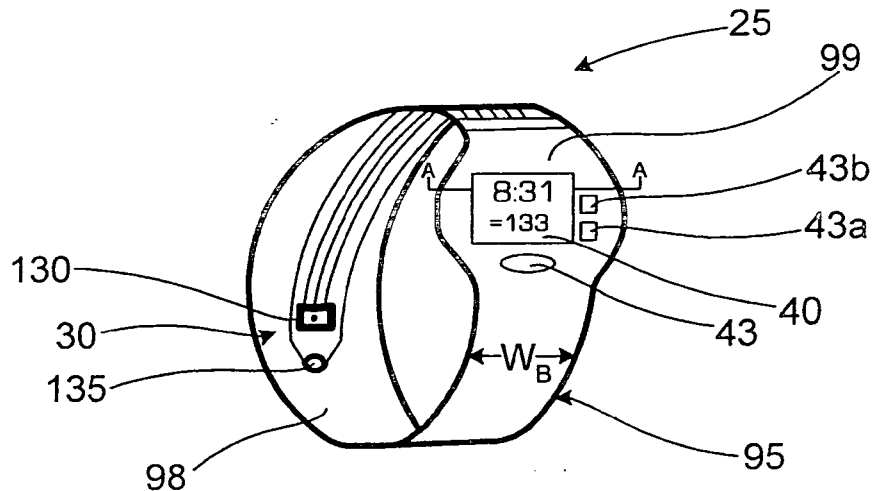
A. [GROUND 1A] – CLAIMS 29-31, 33-34 ARE OBVIOUS OVER BRADY, GOLDSMITH, AND D’ANGELO

72. The sections below provide a brief introduction to Brady, Goldsmith, and D’Angelo; discuss their combination; and explain their application to the claims.

1. Overview of Brady

73. Brady discloses a monitoring device as shown in Figure 1 (below). “This monitoring device (20) is preferably a watch 25) with an optical sensor (30) disposed on the band of the watch, a circuitry assembly (35) embedded in the main body of the watch (25), a display member (40) disposed on an exterior surface of the main of the watch, and a control component (43).” (abstract). The optical

sensor (30) is a pulse oximetry device, including two LEDs and a photodiode [paragraphs 53 and 54].



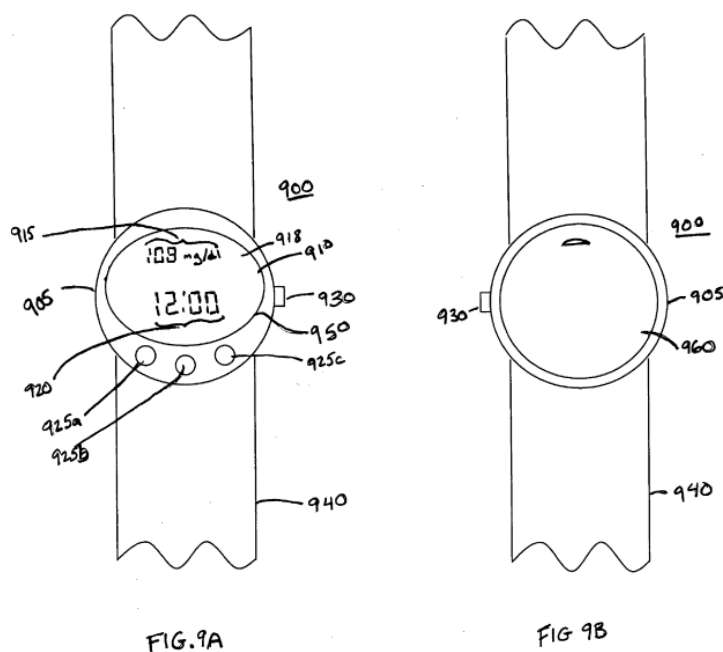
74. Brady describes a wrist-worn watch having three major components: (1) an “optical sensor;” (2) a “pulse oximetry board” and (3) a “microprocessor board.” APPLE-1091, ¶¶[0046]-[0058]. The pulse oximetry board can receive “radiation-induced current” from the optical sensor and process the signals to generate “blood oxygenation level” data. *Id.* Brady discloses that the microprocessor board can “receive[] data from the pulse oximetry board and process[] the data to display...pulse rate, blood oxygenation levels, calories expended by the user of a pre-set time period, target zone activity, time and dynamic blood pressure” on a display member of the watch. *Id.* Brady also discloses that, in some implementations, the watch can include a transceiver for transmitting information “to a handheld device or a computer.” *Id.*, ¶[0062]. Brady further discloses that the watch can display alerts “when a user enters or

exits a target zone” for certain physiological parameters such as a heart rate. *Id.*, ¶¶[0058], [0064]-[0065], [0072]-[0079].

2. Overview of Goldsmith

75. Goldsmith generally describes an infusion system that includes “a watch controller device and a communication system to transmit the communications from the watch controller device” and an infusion system.

APPLE-1009, Abstract. The watch controller provides “convenient *monitoring* and control” of the infusion system. *Id.* For example, Goldsmith describes a medical watch controller device 900. APPLE-1009, ¶¶[0085], [0095], [0098], [0104], [0010], claim 6, FIGS. 9A, 9B.



APPLE-1009, FIGs. 9A, 9B.

76. As illustrated in Goldsmith’s Figures 9A and 9B, reproduced above, the watch controller device 900 can be “used with any number of ... diagnostic devices” and sensors to obtain various physiological measurements, such as user oxygen level. *Id.*, ¶¶[0037], [0038], [0082]. The controller device 900 includes a wrist band 940 that enables it to be worn “like a watch.” *Id.*, ¶¶[0082]-[0085], [0095], claims 25, 26, 27.

77. In more detail, Goldsmith’s device 900 includes a display 910 for displaying data “received from a sensor transmitter on the patient’s skin,” from “any number of therapy/diagnostic devices,” and/or from user input. *Id.*, ¶¶[0082], [0087], [0095], [0102]. Goldsmith’s device can, for example, conveniently monitor and display “concentration, levels, or quantities of ... oxygen.” *Id.*, ¶¶[0014], [0037], [0038]. A POSITA would have recognized this disclosure of monitoring the concentration of oxygen in a user’s blood as indicating measurement and monitoring of blood oxygenation levels (SpO₂) such as through pulse oximetry.

78. Elsewhere, Goldsmith describes: “In further embodiments, the display is a touchscreen display that may be activated by a users hand, stylus, or other implement.” [paragraph 86]

3. Overview of D’Angelo

79. D’Angelo is a paper that was presented at the 33rd IEEE EMBS Annual International Conference in Boston, MA held August 30 to September 3,

2011 and published in the collected proceedings of the conference. D'Angelo describes a physiological monitoring system to facilitate mobile telemedicine that includes "a new concept for interfacing sensor network nodes (motes) and smartphones." APPLE-1007, Abstract.

The presented system allows receiving and storing data continuously using a mote and visualizing or sending it on the go using the smartphone as user interface only when desired. Thus, the processes of data reception and storage run on a safe system consuming less energy and the smartphone's potential along with its battery are not demanded continuously. Both, system concept and realization with an Apple iPhone are presented.

APPLE-1007, Abstract.

80. D'Angelo describes that its physiological measurement system includes a pulse oximeter for measuring SpO₂. APPLE-1007, 1529. D'Angelo's system "employs a dedicated device, called management device, which is part of the sensor network used to acquire health information and a smartphone. The management device can receive data from a variety of sensors, e.g. the Eventlogger presented in [12] for behavior recognition, the sensor unit described in [13] for car-embedded vital parameter acquisition or the garment described in [14] for fall detection." *Id.* D'Angelo describes that "[t]he continuous processes, e.g. data acquisition, processing and time-stamped storage, run on the management device." *Id.* The smartphone acts as the user interface for displaying the physiological

parameters calculated by the management device and for receiving user inputs for interacting with the system. *Id.*, 1529-31.

81. Figure 1 of D'Angelo shows interactions between the various sensors, the management device and the smartphone:

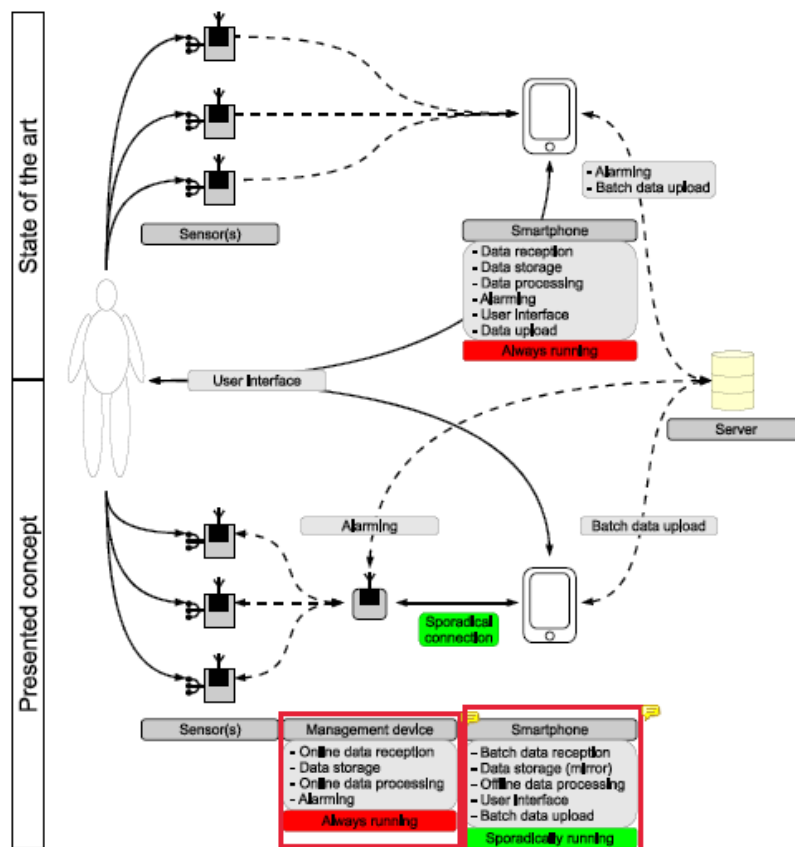


Fig. 1 Comparison between presented concept (bottom) and state of the art (top) in mobile telemedicine systems with smartphone-based visual user interface.

APPLE-1007, Fig. 1.

82. D'Angelo goes on to describe “a connection between the smartphone’s power output pin and the management device’s charging pin, allowing to read out the management device with the smartphone even when its

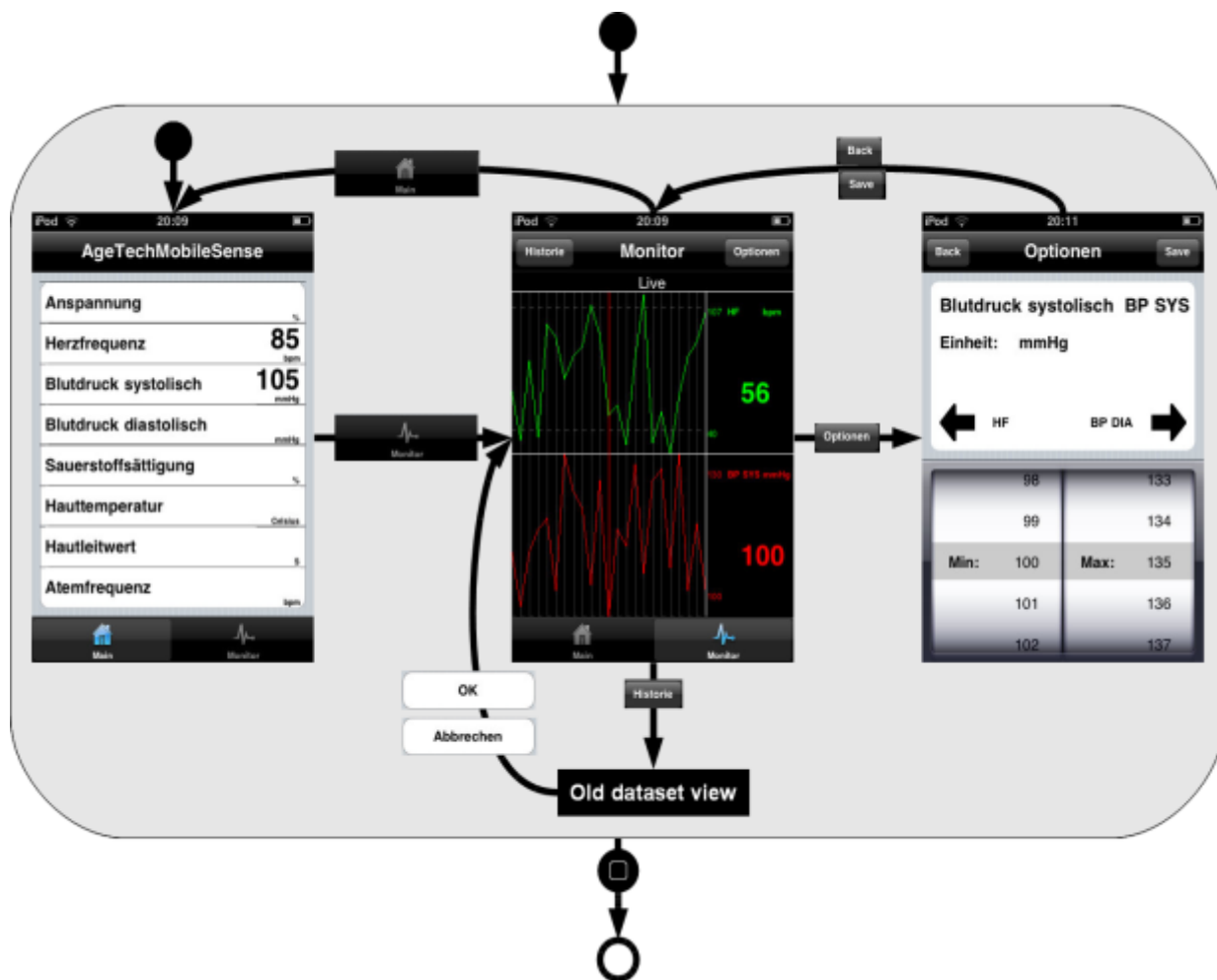
battery is empty.” APPLE-1007, 1530. “The management device has a built-in connector which is compatible with the Apple Dock Connector. In addition to this, some pins can be used to program and debug the management device’s microcontroller using the Joint Test Action Group (JTAG) interface.” *Id.*

83. D’Angelo describes two configurations for how the management device interacts with the smartphone (in this implementation, an iPhone 3G):

The management device has been built in two variants; the first one enables continuous connection between iPhone and management device. The second one is an adapter transforming the Eventlogger presented in [12] into a management device just during the connection with the iPhone, i.e. containing the additional components needed to use the Eventlogger as a management device. Prototypes of both devices are shown in Fig. 4.

APPLE-1007, 1530.

84. D’Angelo describes a user interface displayed by the smartphone that includes multiple views for displaying measured physiological parameters including numerical values for each variable along with “upper and lower limits” for the variables, a “graph view” which shows multiple rows associated with various variables, and an “options view” that allows the user to set upper and lower limits for each variable using a picker wheel. APPLE-1007, 1530-31.



APPLE-1007, FIG. 5. The graph view allows users to view minimum and maximum recorded values and “scroll through current and older values.” APPLE-1007, 1530-31. The measured values include SpO₂. *Id.*, 1529.

4. *The Combination of Brady, Goldsmith, and D’Angelo*

85. In my opinion, a POSITA would have been motivated to modify Brady’s watch to (1) include a touch screen (as taught by Goldsmith and D’Angelo), (2) include multiple display portions, including a portion for SpO₂ values and a portion for user inputs (as taught by D’Angelo), and (3) output alarms

to the user or a third-party care provider regarding abnormal SpO₂ readings that fall outside of an expected range (based on Goldsmith). The POSITA would have been prompted to do so for multiple reasons.

86. As a first reason, Brady is similar to Goldsmith in that it discloses watch displays for presenting representations of physiological measurements including SpO₂ measurements. A POSITA would therefore have recognized that making the display touch sensitive, as taught by Goldsmith, would be an obvious variant to the user interface of Brady's watch. Indeed, it would have been desirable to include a touch sensitive display because such a display would provide an intuitive user interface and because touchscreens were commonly used in consumer products at the time. APPLE-1091, ¶[0058]; APPLE-1009, ¶[0086].

87. As a second reason, the concept of using a portion of the screen for displaying user inputs would have been obvious in view of Goldsmith's teaching of activating a touchscreen device by a user's hand. A POSITA would also have applied D'Angelo, which discloses a user interface that displays physiological measurements while maintaining separate display portions for allowing the user to interact with the device. A POSITA would have been motivated to do this to allow the user to interact with the watch device in various ways, including altering a view of the display or accessing application options or historic information, as taught in

D'Angelo and explained in the Petition. *See* Pet., §III.D.3.[1j]; APPLE-1003, ¶¶121-129.

88. As a third reason, applying Goldsmith to Brady's watch to output alarms to the user or a third-party care provider regarding abnormal SpO₂ readings that fall outside of an expected range would have been beneficial for monitoring a user's condition. It also would have been beneficial to provide assistance in the event of a medical emergency. Brady describes measuring blood oxygenation levels and displaying alerts "when a user enters or exits a target zone" for certain physiological parameters such as a heart rate. APPLE-1091, ¶¶[0058], [0064]-[0065], [0072]-[0079]. Similarly, Goldsmith discloses a watch that measures oxygen levels and uses alarms to indicate "high or low" analyte levels. Goldsmith further discloses that that a "cellular network could be used to notify parents, physicians, or emergency services of alarms or alert states" based on an abnormal analyte level. APPLE-1009, ¶¶[0017], [0037], [0072]-[0073], [0085], [0092]. Therefore, a POSITA would have found it predictable to implement similar alarms for SpO₂ measurements and to modify Brady's watch to notify third-party care providers of alarms to achieve the same benefits as described in Goldsmith. The POSITA would have implemented this with a reasonable expectation of success given the many similarities between the devices of Brady and Goldsmith and the

wide usage of cellular networks to send notifications/alerts at the time of the Critical Date.

5. *Application of Brady-Goldsmith-D'Angelo to the Claims*

(i) Claim 29

89. As I discussed above, Claim 29 has been improperly broadened in an apparent attempt to read on both systems in which the optical sensor and processing board are separate and external from the mobile computing device (that is now recited to be a wristwatch) and systems in which the optical sensor and the processing board could be internal components contained within the mobile computing device (that is now recited to be a wristwatch). Should Masimo be allowed to maintain this improperly broadened (and unsupported) claim scope, the Brady-Goldsmith-D'Angelo combination renders such a broad interpretation of the claim obvious, as I discuss below.

[29pre] A computer-implemented method of using a wristwatch system to inform ~~informing~~ a user of mobile measurement of oxygen saturation (“SpO₂”), the computer-implemented method comprising:

90. Brady describes methods of using a “watch” that “securely attach[es] to a user’s wrist” and “act[s] as a monitoring device.” APPLE-1091, ¶¶[0047]-[0048]. According to Brady, the watch can include an optical sensor (which Brady describes as “a pulse oximetry device”), “a flexible pulse oximetry board,” a “microprocessor board” which processes data from a pulse oximetry board and a

display member that can display “blood oxygenation levels.” *Id.*, ¶¶[0052],[0058].

A POSITA would have recognized that this disclosure corresponds to “*a computer-implemented method of using a wristwatch system to inform a user of mobile measurement of oxygen saturation (“SpO₂”).*”

[29a] outputting, from an optical sensor of an SpO₂ measurement system, one or more unprocessed nonwireless signals responsive to light from a light source attenuated by tissue of the user at a measurement site, said one or more unprocessed nonwireless signals responsive to an oxygen saturation of said tissue; and

91. The watch device described by Brady includes “an optical sensor 30” that can be a “pulse oximetry device with a light source.” APPLE-1091 ¶[0052]. According to Brady, “[a]s the heart pumps blood through the arteries in the wrist of the user, blood cells absorb and transmit varying amounts of the red and infrared radiation [from the light source] depending on how much oxygen binds to the cells’ hemoglobin.” *Id.* A photodetector (described as part of the optical sensor) “detects transmission at the red and infrared wavelengths, and in response generates a radiation-induced signal.” *Id.*, ¶¶[0051]-[0056]. Brady does not describe that this signal is processed in any way prior to being output from the sensor, and thus a POSITA would have recognized the signal to be an “unprocessed” signal due to being directly output from the photodetector. *Id.* In fact, Brady discloses that the photodiode “generates a radiation-induced current that travels through the connection wires 45 to the circuitry assembly 35.”

APPLE-1091, ¶¶[0054], [0049], [0058]. Thus, a POSITA would have recognized that this current from the photodiode is the direct output of the operation of the photodiode, in which incident photons are absorbed and release electrons which become the raw output photocurrent, prior to any processing. In this regard, the signal described by Brady is a “signal responsive to light from a light source attenuated by tissue of the user at a measurement site” under all of the interpretations of this term raised by both parties in all matters related to the ‘507. This output current signal is not just “unprocessed,” but is also “nonwireless”, to the extent that an electric signal on a wire is at least one (if not the only possible) example of the possible meaning of “nonwireless.” In view of this disclosure, the POSITA would have recognized that Brady’s disclosure corresponds to *“outputting, from an optical sensor of an SpO₂ measurement system, one or more unprocessed nonwireless signals responsive to light from a light source attenuated by tissue of the user at a measurement site, said one or more unprocessed nonwireless signals responsive to an oxygen saturation of said tissue.”*

[29b] via a processing board of the SpO₂ measurement system, the processing board in nonwireless data communication with the optical sensor and with a wristwatch mobile computing device including a display, the processing board powered by the wristwatch mobile computing device:

92. Brady discloses “a flexible pulse oximetry board” in the circuitry assembly 35 or, alternatively, a “BCI MICRO POWER oximetry board,” (APPLE-1091, ¶[0058]), and a POSITA would have recognized this board as corresponding

to “*a processing board of the SpO₂ measurement system.*” Brady additionally describes that the optical sensor is “preferably connected to the circuitry assembly 35 by the connection wires,” APPLE-1091, ¶¶[0049], [0054], [0058], and that the circuitry assembly 35 of the watch includes both (1) the “pulse oximetry board” and (2) a “flexible microprocessor board” that “receives data from the pulse oximetry board and processes the data to display on the display member 40.” *Id.*, ¶¶[0049], [0054], [0058], FIG. 1A. Therefore, a POSITA would have understood (or at least found it obvious, e.g., by common sense) that, in Brady, the “flexible microprocessor board” is a component of the wristwatch MCD in nonwireless data communication with the “pulse oximetry board” (i.e., “*a processing board of the SpO₂ measurement system*”), which is also in nonwireless data communication with the optical sensor.

93. Brady discloses that the watch further includes the display member 40 (e.g., a liquid crystal display). Therefore, Brady’s watch device (including the microprocessor board) corresponds to *a wristwatch MCD including a display*, the wristwatch MCD being *in non-wireless data communication* with Brady’s pulse oximetry board.

94. Brady’s device 20 is “preferably powered by a power source positioned on the watch 25” such as “a battery accessible at an interior surface of the main body portion,” and Brady further discloses that the power source is

“preferably connected to the circuit assembly 35,” which includes the pulse oximetry board. APPLE-1091, ¶¶[0061]. Therefore, a POSITA would have recognized that Brady teaches “*the processing board powered by the wristwatch mobile computing device.*”

[29c] receiving said one or more unprocessed nonwireless signals from the optical sensor;

95. Brady’s optical sensor “detects transmission at the red and infrared wavelengths, and in response generates a radiation-induced current that travels through the connection wires 45 to the circuitry assembly 35,” which includes the “pulse oximetry board.” APPLE-1091, ¶¶[0054], [0058]. As I mentioned above, Brady discloses the raw output current of a photodiode as the signal, and does not disclose any processing of this signal prior to the pulse oximetry board, and consequently, a POSITA would understand that Brady discloses (or at least renders obvious) that the pulse oximetry board *receives one or more unprocessed nonwireless signals from the optical sensor.*

[29d-29e] processing said one or more unprocessed nonwireless signals to generate the SpO₂ measurement values; and nonwirelessly outputting the SpO₂ measurement values to one or more hardware processors of the wristwatch mobile computing device; and

96. Brady states that an example of the pulse oximetry board is a “BCI MICRO POWER oximetry board, which is a low power, micro-size easily integrated board which *provides blood oxygenation level,*” as well as other

physiological measurements. APPLE-1091, ¶[0058]. Therefore, a POSITA would recognize that Brady discloses “*processing said one or more unprocessed nonwireless signals to generate the SpO₂ measurement values.*” Furthermore, Brady discloses that “the microprocessor board [i.e., a hardware processor of the wristwatch mobile computing device] *receives data from the pulse oximetry board*” and “processes the data to display ... blood oxygenation levels” as well as other physiological measurements on the display member of the watch. *Id.* Therefore, a POSITA would recognize that Brady also discloses “*outputting the SpO₂ measurement values to one or more hardware processors of the wristwatch mobile computing device.*” And once again, FIG. 1A (shown above) of Brady shows the pulse oximetry board and microprocessor board connected as a single circuitry assembly block 35. *See id.*, FIG. 1A. As such, a POSITA would have understood Brady as disclosing (or at least rendering obvious) that the pulse oximetry board *nonwirelessly* outputs the SpO₂ measurement values to one or more hardware processors.

[29f] via an application configured to execute commands on the one or more hardware processors of the wristwatch mobile computing device:

97. As I explained above, a POSITA would have recognized that Brady’s watch device (including the microprocessor board) corresponds to the claimed “*wristwatch mobile computing device.*” *Supra* §X.5.(i).[29b]. Brady discloses that the microprocessor board “receives data from the pulse oximetry board,”

“processes the data to display on the display member,” and “can also store data.”

APPLE-1091, ¶[0058]. In my opinion, a POSITA would have recognized this disclosure as corresponding to *an application configured to execute commands on the one or more hardware processors of the wristwatch mobile computing device.*

Or, at the very least, a POSITA would have found this claim limitation obvious in view of Brady since it was widely known at the time that applications could be used to execute commands on hardware processors (including hardware processors of mobile computing devices) to perform various processing and data storage operations.

[29g] generating a wristwatch graphical user interface on a touch sensitive screen and having a plurality of display portions;

98. Brady discloses that the microprocessor board “processes the data [received from the pulse oximetry board] to display on the display member,” and can include “pulse rate, blood oxygenation levels, calories expended by the user of a pre-set time period, target zone activity, time and dynamic blood pressure.”

APPLE-1091, ¶[0058]. Furthermore, Brady discloses that the display member can include a portion for displaying a time (e.g., 8:31) and another portion for displaying a physiological measurement (e.g., a heart rate of 133). *Id.*, FIG. 1. A POSITA would have recognized this disclosure as corresponding to “*generating a wristwatch graphical user interface ... having a plurality of display portions.*”

99. To the extent that Brady does not explicitly disclose that its display member is a “touch sensitive screen,” Goldsmith describes an analogous watch controller device with “a touchscreen display” for displaying physiological measurements including “oxygen level.” APPLE-1009, ¶¶[0037]-[0038], [0086], Claim 28. Thus, for the reasons I discuss above, a POSITA would have found it predictable to modify Brady’s display member to incorporate a touch sensitive screen, as taught by Goldsmith, to allow a user to interact with the watch in a well-known, intuitive fashion. *Supra* §X.A.4.

[29h] displaying, in at least one portion of the plurality of display portions, a representation of a physiological parameter of a plurality of physiological parameters comprising at least the SpO₂ measurement values; and

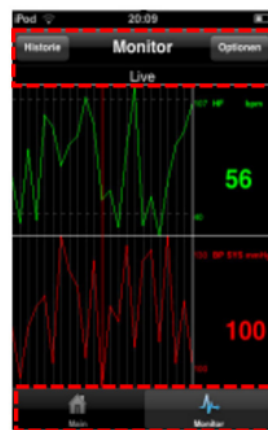
100. For the reasons I discuss above, Brady describes a graphical user interface that includes a plurality of display portions, including a portion that displays physiological measurements such as “blood oxygenation levels.” *Supra* §X.A.5.(i).[29g]; APPLE-1091, ¶[0058]. A POSITA would have recognized that this corresponds to “*displaying, in at least one portion of the plurality of display portions, a representation of a physiological parameter of a plurality of physiological parameters comprising at least the SpO₂ measurement values.*”

[29i] displaying, in a different portion of the plurality of portions, a plurality of user inputs configured to allow the user to interact via the touch sensitive screen with at least one of the plurality of display portions or the application.

101. For the reasons I discussed above, a touch sensitive screen having a plurality of display portions was obvious at the Critical Date in view of Brady-Goldsmith, (*supra* Elements [29g], [29h]). Therefore, a POSITA would also have found it obvious, in the context of a watch with a touch sensitive screen, to include a display portion with a plurality of user inputs, and to allow the user to interact with at least one of the plurality of display portions or an application via the touch sensitive screen. Indeed, being able to interact with a display is one of the key purposes of implementing a touch sensitive screen.

102. Nevertheless, even if this limitation is not explicitly described in Brady or Goldsmith, it is disclosed in D’Angelo. Pet., §§III.D.3.[1h] and III.D.3.[1j]. As shown to the right,

D’Angelo teaches a “Graph View” with several display portions, including portions for displaying physiological measurements and separate



Display Portion with user inputs allowing access application options or historic information (old dataset view)

Display Portion with user inputs for accessing application main menu or switching to other views

portions for allowing the user to interact with the display portions and the application via a touch screen. *Id.*; APPLE-1007, 1530-31. In my opinion, a

POSITA would have found it obvious to implement the touch screen user interface taught by D'Angelo with the touchscreen watch device of Brady-Goldsmith, for example, to allow a user to interact with the device to alter a view of the display or to access application options or historic information, as taught in D'Angelo. *Supra* §X.A.4. A POSITA would have done this for the same reasons that such features would have been beneficially added to Mendelson in Ground 1D of the Petition (and as discussed in my First Declaration). Pet, 40-43; APPLE-1003, ¶¶121-129.

(ii) Claim 30

[30] The computer-implemented method of claim [[13]]29, further comprising, via the application: performing a trend analysis on received SpO₂ measurement values; and displaying results of the trend analysis in at least one portion of the plurality of display portions.

103. D'Angelo discloses displaying a “Graph view” that includes determined physiological parameters in an automatically scrolling graph that depicts changes in the measured value over time, or “trends”. Pet., §III.D.3[2]; APPLE-1007, 1530-31. Furthermore, SpO₂ values are one of the values displayed as part of the resulting combination of Brady-Goldsmith-D'Angelo. APPLE-1091 ¶[0058]; APPLE-1009, ¶[0037]. Therefore, a POSITA would have recognized that D'Angelo provides “*via the application: performing a trend analysis on received SpO₂ measurement values; and displaying results of the trend analysis in at least one portion of the plurality of display portions.*”

(iii) Claim 31

[31] The computer-implemented method of claim [[13]]29, further comprising, via the application, outputting one or more alarms associated with SpO₂ measurement values that are above or below threshold SpO₂ measurement values.

104. Brady's watch device can measure blood oxygenation levels and display alerts "when a user enters or exits a target zone" for certain physiological parameters such as a heart rate. APPLE-1091, ¶¶[0058], [0064]-[0065], [0072]-[0079]. Goldsmith similarly discloses a watch that measures oxygen levels and uses alarms to indicate "high or low" analyte levels. APPLE-1009, ¶¶[0037], [0085], [0092]. In view of these disclosures, and for reasons I discussed above, a POSITA would have found it obvious to combine the teachings of Brady and Goldsmith to alert users or third-party care providers when a user's SpO₂ measurement values unexpectedly fall outside of a particular range. *Supra* §X.A.4.

(iv) Claim 33

[33] The computer-implemented method of claim [[13]]29, further comprising, via the application, updating the representation of the physiological parameter to comprise one or more of a plurality of graphical representations of the SpO₂ measurement values, the plurality of graphical representations comprising at least one of bar graphs or charts.

105. As described in the Petition and for reasons provided in my First Declaration, D'Angelo provides this element. Pet., §III.D.3.[7]; APPLE-1003, ¶159; APPLE-1007, 1529-31.

(v) Claim 34

[34] The computer-implemented method of claim [[13]]29, further comprising, via the application, outputting an alert, via a network to a designated physician or other care provider, regarding abnormal SpO₂ readings.

106. For reasons I provided above, the Brady-Goldsmith-D’Angelo system outputs one or more alarms associated with SpO₂ measurement values that are above or below threshold SpO₂ measurement values. *Supra* §X.A.5.(iii).[31]. Additionally, Goldsmith discloses that a “cellular network could be used to notify parents, physicians, or emergency services of alarms or alert states” based on an abnormal analyte level. APPLE-1009, ¶¶[0017], [0072]-[0073], [0085], [0092]. Therefore, a POSITA would have recognized that the Brady-Goldsmith-D’Angelo combination renders obvious “*via the application, outputting an alert, via a network to a designated physician or other care provider, regarding abnormal SpO₂ readings.*”

B. [GROUND 1B] – CLAIMS 32, 34-35 ARE OBVIOUS OVER BRADY, GOLDSMITH, D’ANGELO, AND TRAN

107. The sections below provide a brief introduction to Tran; discuss its combination with Brady-Goldsmith-D’Angelo; and explain the resulting combination’s application to the claims.

1. Overview of Tran

108. Tran describes a “patient monitoring system.” APPLE-1005, [0054]. The system can include multiple physiological sensors, including “a blood pressure

monitor, heart rate monitor, weight scale, thermometer, spirometer, single or multiple lead electrocardiograph (ECG), a pulse oxymeter, a body fat monitor, a cholesterol monitor, a signal from a medicine cabinet, a signal from a drug container, a signal from a commonly used appliance such as a refrigerator/stove/oven/washer, or a signal from an exercise machine, such as a heart rate.” *Id.* For example, the system can include “a blood oxygen saturation monitor, using an infra-red or laser source, to alert the user if the patient's blood in the brain or some brain region is deoxygenated.” *Id.*, [0335], [0057] (describing detecting “blood-oxygen levels and pulse rate.”).

109. Figure 1A shows an example system for monitoring physiological parameters of a user via body worn sensors.

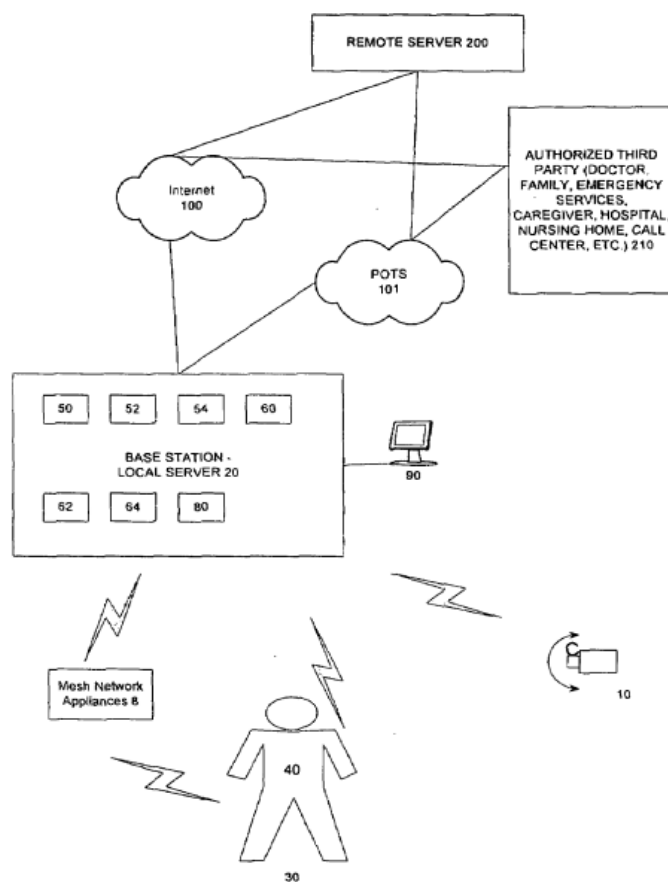


FIG. 1

APPLE-1005, Figure 1A.

110. Tran describes allowing users to “set up alerts or reminders that are triggered when one or more reading meet a certain set of conditions, depending on parameters defined by the user.” *Id.*, [0255]. When the system determines that a physiological parameter (such as blood oxygen level) exceeds a predetermined value, the system can issue an alert to a caregiver. *Id.*, [0260]. A user can

designate authorized individuals, such as clinicians or caregivers, to receive alerts and set reminders and alerts. *Id.*, [0257], [0261].

111. Notably, in Fig. 6A and 6B, Tran shows an example of a wristwatch-based device and a wireless mesh network that would work with the wristwatch to capture signals from the sensor module and transmit information to the internet, including to third parties, which could include hospitals, caregivers and others.

2. *The Combination of Brady, Goldsmith, D’Angelo, and Tran*

112. As I discussed above, the watch of the Brady-Goldsmith-D’Angelo system—similarly to the system in Mendelson—outputs one or more alarms associated with SpO₂ measurement values that are above or below threshold SpO₂ measurement values. *Supra* X.A.5.(iii).[31]; Pet. §III.B.2; APPLE-1003, ¶¶84-94. In my opinion, a POSITA would have applied Tran to the Brady-Goldsmith-D’Angelo system in the same way as applied to Mendelson in the Petition (and as described in my First Declaration) to output reminders to the user to take SpO₂ measurements, allow the user to set such reminders to take future measurements, and to output an alert via a network to a designated physician or other care provider in response to abnormal SpO₂ readings. *See* Pet., §III.B.2, APPLE-1003, ¶¶84-94.

3. *Application of Brady-Goldsmith-D'Angelo-Tran to the Claims*

(i) Claim 32

[32] The computer-implemented method of claim [[13]]29, further comprising, via the application, outputting one or more reminders to use the optical sensor ~~optical sensor~~ to take measurements of SpO₂ measurement values at predetermined times or cycles.

113. For the reasons described in the Petition and in my First Declaration, a POSITA would have applied Tran to the Brady-Goldsmith-D'Angelo combination in the same way as they would have applied Tran to Mendelson to provide this feature. *See* Pet., §III.B.3.[16]; APPLE-1003, ¶¶95-96; APPLE-1005, ¶¶[0054], [0246], [0255].

(ii) Claim 34

[34] The computer-implemented method of claim [[13]]29, further comprising, via the application, outputting an alert, via a network to a designated physician or other care provider, regarding abnormal SpO₂ readings.

114. For the reasons described in the Petition and in my First Declaration, a POSITA would have applied Tran to the Brady-Goldsmith-D'Angelo combination in the same way as they would have applied Tran to Mendelson to provide this feature. *See* Pet., §III.B.3.[18]; APPLE-1003, ¶97; APPLE-1005, ¶¶[0255], [0252], [0054], [0246], [0335], [0417].

(iii) Claim 35

[35] The computer-implemented method of claim [[13]]29, further comprising, via the application, enabling the user to set reminders to take future measurements.

115. For the reasons described in the Petition and in my First Declaration, a POSITA would have applied Tran to the Brady-Goldsmith-D’Angelo combination in the same way as they would have applied Tran to Mendelson to provide this feature. *See* Pet., §III.B.3.[20]; APPLE-1003, ¶¶98; APPLE-1005, ¶¶[0255], [0257], [0418].

C. [GROUND 1C] – CLAIMS 30, 33 ARE OBVIOUS OVER BRADY, GOLDSMITH, D’ANGELO, AND KIANL

116. The sections below provide a brief introduction to Kianl; its combination with Brady-Goldsmith-D’Angelo; and an explanation of the resulting combination’s application to the claims.

1. Overview of Kianl

117. Kianl describes a blood oxygen saturation measurement system that includes “[a] pulse oximetry user interface ha[ving] a display and a plurality of views each configured to occupy the display.” APPLE-1006, Abstract. Kianl describes the various views for displaying the pulse oximetry information, describing that “[o]ne of the views is a pleth view that presents a pulse waveform. *Another one of the views is a trend view that presents a trend graph.* At least one of the icons can be selected so as to switch the display between the pleth view and

the trend view.” *Id.* Kianl describes that “[e]ach of the views are adapted to present data responsive to a physiological signal. A plurality of icons are configured to occupy a portion of the views and adapted to designate the content of the views.” *Id.*, 2:18-23. Specifically, “[a]t least one of the icons can be selected so as to *switch the display between the pleth view and the trend view.*” *Id.*, 2:29-31.

118. Kianl provides many examples of display configurations that include a variety of arrangements of different combinations of numerical and graphical displays, which can be applied to other instruments. For example, FIG. 4 shows a user interface that includes a chart of SpO₂ readings, a numeric value for SpO₂, and input keys for switching between the views.

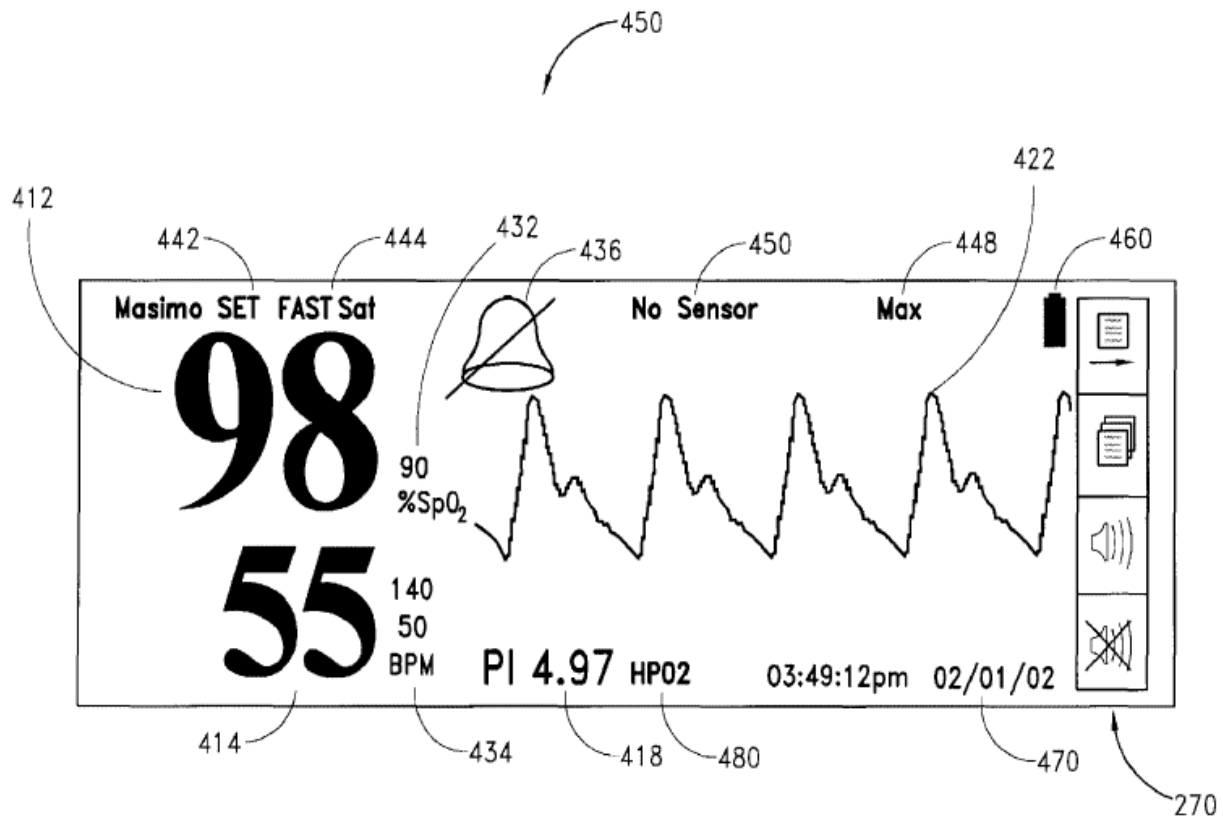


FIG. 4

APPLE-1006, FIG. 4.

119. In describing FIG. 4, Kianl describes that “[t]he oxygen saturation 412 displays a functional arterial hemoglobin oxygen saturation measurement in units of percentage SpO₂.” APPLE-1006, 6:1-3. The display also includes a “pulse waveform 422” of blood oxygen level. *Id.*, 6:10-15. FIG. 10 shows another example display that includes “*a pulse rate trend graph 1050*” along with blood oxygen trend information over time. APPLE-1006, 11:6-49, 12:18-26.

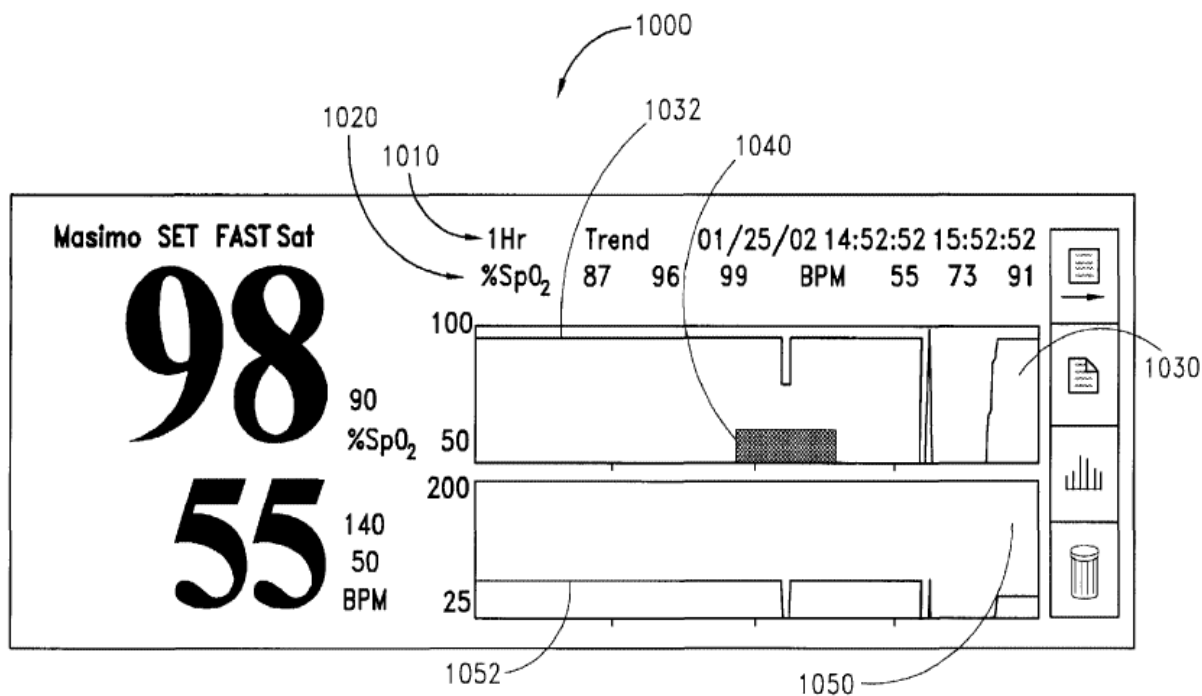


FIG. 10

APPLE-1006, FIG. 10. Kianl further describes a trend setup menu with respect to FIG. 19 that allows the user to identify which trend analyses should be performed on the SpO₂ data. *Id.*, 15:10-56. As Kianl describes “FIG. 19 illustrates a **trend setup menu** 1900 having %SpO₂ max and min 1910, BPM max and min 1920, default view 1930, trend action 1940 and trend period 1950 items.” *Id.* Kianl describes that the trend analysis is customizable describing that “[t]he trend setup menu **1900** allows the user to set the default trend settings and to clear the trend data or download the trend data to the serial port.” *Id.* Kianl also describes

printing trend data and other data collected and generated by the system in various analog charts, including “printing” such information to various “trend views” of the system displayed on the user device, as shown, for example, in FIG. 10. *Id.*

2. *The Combination of Brady, Goldsmith, D’Angelo, and Kianl*

120. In my opinion, a POSITA would have been prompted to modify the Brady-Goldsmith-D’Angelo system based on Kianl in the same way as the Petition describes with respect to Mendelson (and as described in my First Declaration) to perform a trend analysis on received SpO₂ data, display the trend analysis results, and to display SpO₂ measurement values in a plurality of graphical representations including charts. *See* Pet., § III.C.2; APPLE-1003, ¶¶103-109. As I described in detail in my First Declaration, a POSITA would have been prompted to make this combination—with a reasonable expectation of success—in order to (1) improve the identification by health practitioners of abnormal patterns, conditions, and other health concerns based on SpO₂ data; (2) enable switching between various data views; (3) allow healthcare providers and other users to more easily mentally process SpO₂ data; and (4) improve the overall usability of the system. *See* Pet., § III.C.2; APPLE-1003, ¶¶103-109.

3. *Application of Brady-Goldsmith-D'Angelo- Kianl to the Claims*

(i) Claim 30

[30] The computer-implemented method of claim [[13]]29, further comprising, via the application: performing a trend analysis on received SpO₂ measurement values; and displaying results of the trend analysis in at least one portion of the plurality of display portions.

121. For the reasons described in the Petition and in my First Declaration, a POSITA would have applied Kianl to the Brady-Goldsmith-D'Angelo combination in the same way as they would have applied Kianl to Mendelson to provide this feature. *See* Pet., §III.C.2.[14]; APPLE-1003, ¶110; APPLE-1006, 2:32-36, 11:6-31, 15:11-40, FIG. 10.

(ii) Claim 33

[33] The computer-implemented method of claim [[13]]29, further comprising, via the application, updating the representation of the physiological parameter to comprise one or more of a plurality of graphical representations of the SpO₂ measurement values, the plurality of graphical representations comprising at least one of bar graphs or charts.

122. For the reasons described in the Petition and in my First Declaration, a POSITA would have applied Kianl to the Brady-Goldsmith-D'Angelo combination in the same way as they would have applied Kianl to Mendelson to provide this feature. *See* Pet., §III.C.2.[17]; APPLE-1003, ¶¶111-112; APPLE-1006, 2:18-31, 1:33-37, 5:65-6:15, 11:6-49, 6:1-3.

D. [GROUND 1D] – CLAIMS 21-22, 25, 27-28, 36 ARE OBVIOUS OVER BRADY, GOLDSMITH, D’ANGELO, AND GOLDREICH

123. The sections below provide a brief introduction to Goldreich; discuss its combination with Brady-Goldsmith-D’Angelo; and explain the resulting combination’s application to the claims.

1. Overview of Goldreich

124. Goldreich discloses a “wrist-mounted device for measuring at least one physiological parameter of the user” including “oxygen saturation in the blood.” APPLE-1092, 3:25-52. In an example, the device includes sensors that are connected to a microprocessor. *Id.*, 4:34-36. The microprocessor “operates a software program to process and analyze the data which is collected [from the sensors] in order to compute medical information,” and can then transfer the extracted information to a “gateway device” for communicating with a contact center (e.g., via a cellular telephone connection), or to a “remote server.” *Id.*, 2:63-65, 4:34-42.

125. According to Goldreich, the processor that “extracts medical information from the measurement of the physiological parameter” can be “mounted on a PCB board 308.”

Goldreich further explains that a cover 304 and case 306 of the device can be brought together, with a waterproof sealing between them, to contain the components of the device (including the PCB 308).

Id., 10:52-53, 11:6-24, FIG. 2 (right).

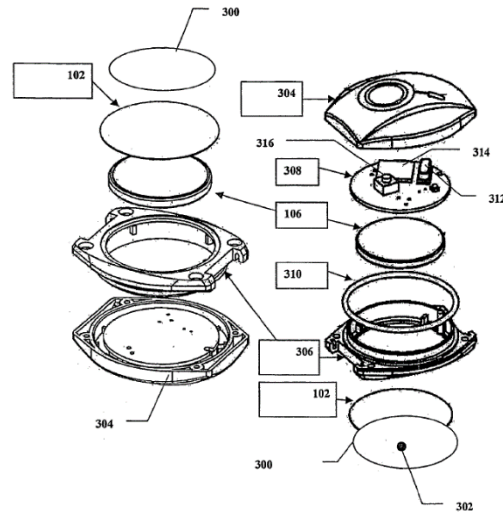


FIG. 2

2. *The Combination of Brady, Goldsmith, D’Angelo, and Goldreich*

126. Multiple reasons would have prompted a POSITA to apply the teachings of Goldreich to the Brady-Goldsmith-D’Angelo system to provide—with a reasonable expectation of success—a watch with impact resistant upper and lower shells that form a substantially water-tight enclosure for at least the processing board. As a first reason, a POSITA would have recognized that such modifications would make the device more durable and enable the device to be used in the presence of water. Both of these were common and desirable features for similar wrist-worn watch devices as of the Critical Date. *See, e.g.*, APPLE-1095, 14-15 (describing shock resistance and water resistance as functional requirements of a wearable pulse oximeter design). As a second reason, a POSITA

would have recognized that the enclosure taught by Goldreich was readily applicable to Brady's watch with a reasonable expectation of success since the enclosure would operate in the same way to achieve similar and predictable results of making the main body of the watch modular and easy to disassemble for maintenance.

127. Should Claim 21 be interpreted to encompass both systems in which the optical sensor and processing board are separate and external from the mobile computing device (that is now recited to be a wristwatch) and systems in which the optical sensor and the processing board could be internal components contained within the mobile computing device (that is now recited to be a wristwatch), the Brady-Goldsmith-D'Angelo-Goldreich combination renders such a broad interpretation of the claim obvious, as I discuss below.

3. *Application of Brady-Goldsmith-D'Angelo-Goldreich to the Claims*

(i) Claim 21

[21pre] A wristwatch mobile pulse oximetry system for informing a user of mobile measurement of oxygen saturation ("SpO₂"), the wristwatch mobile pulse oximetry system comprising:

128. For the same reasons I discuss above, the Brady-Goldsmith-D'Angelo-Goldreich combination renders this feature obvious. *See supra* §X.A.5.(i).[29pre].

[21a] an SpO₂ measurement system including:

129. For the same reasons I discuss above, the Brady-Goldsmith-D’Angelo-Goldreich combination renders this feature obvious. *See supra* §X.A.5.(i).[29pre].

[21b] an optical sensor configured to output one or more signals responsive to light from a light source attenuated by tissue of the user at a measurement site, said one or more signals responsive to an oxygen saturation of said tissue; and

130. For the same reasons I discuss above, the Brady-Goldsmith-D’Angelo-Goldreich combination renders this feature obvious. *See supra* §X.A.5.(i).[29a].

[21c] a processing board in non-wireless data communication with the optical sensor and non-wireless data communication with a mobile computing device comprising the wristwatch, which includes including a display and cellular communication capabilities, wherein the processing board is configured to:

131. For the same reasons I discuss above, the Brady-Goldsmith-D’Angelo-Goldreich combination renders this feature obvious. *See supra* §X.A.5.(i).[29b]. However, to the extent that this feature further requires “a mobile computing device comprising the wristwatch, which includes a display and *cellular communication capabilities*,” the Brady-Goldsmith-D’Angelo-Goldreich combination renders this obvious as well.

132. Brady’s watch includes a transceiver that can operate on a wireless protocol “such as that used in cordless telephones” to communicate with external devices including laptop computers or cellular telephones. APPLE-1091,

¶¶[0046], [0059], [0063]. Furthermore, even if this wireless protocol does not constitute “cellular communication capabilities,” Goldsmith similarly discloses that “the watch controller device may further be adapted to include cellular phone, PDA and/or smart phone capabilities.” Cellular communication capabilities were commonplace as of the Critical Date, and a POSITA would have applied Goldsmith’s teaching to Brady to predictably achieve the same benefits of enabling the watch device to communicate with external devices such as cellular telephones. APPLE-1009, ¶[0097]. As such, Brady’s watch device (including the microprocessor board), or alternatively, Brady’s watch device modified by Goldsmith correspond to *a mobile computing device comprising the wristwatch, which includes a display and cellular communication capabilities* and with which Brady’s pulse oximetry board (the “*processing board*”) is *in non-wireless data communication*.

[21d] receive [[said]] one or more unprocessed signals through a non-wireless connection from the optical sensor;

133. For the same reasons I discuss above, the Brady-Goldsmith-D’Angelo-Goldreich combination renders this feature obvious. *See supra* §X.A.5.(i).[29c].

[21e-21f] process said one or more unprocessed signals to generate SpO₂ measurement values; and output the SpO₂ measurement values nonwirelessly to the mobile computing device; and

134. For the same reasons I discuss above, the Brady-Goldsmith-D'Angelo-Goldreich combination renders this feature obvious. *See supra* §X.A.5.(i).[29d-29e].

[21g] one or more hardware processors of the mobile computing device configured to execute an application, the application configured to execute commands to:

135. For the same reasons I discuss above, the Brady-Goldsmith-D'Angelo-Goldreich combination renders this feature obvious. *See supra* §X.A.5.(i).[29f].

[21h] generate a graphical user interface of the wristwatch having a plurality of display portions;

136. For the same reasons I discuss above, the Brady-Goldsmith-D'Angelo-Goldreich combination renders this feature obvious. *See supra* §X.A.5.(i).[29g].

[21i] display on a touch sensitive screen, in at least one portion of the plurality of display portions, a representation of a physiological parameter of a plurality of physiological parameters comprising at least the SpO₂ measurement values; and

137. For the same reasons I discuss above, the Brady-Goldsmith-D'Angelo-Goldreich combination renders this feature obvious. *See supra* §X.A.5.(i).[29h].

[21j] display on the touch sensitive screen, in a different portion of the plurality of display portions, a plurality of user inputs, the touch sensitive screen configured to allow the user to interact with at least one of the plurality of display portions or the application;

138. For the same reasons I discuss above, the Brady-Goldsmith-D'Angelo-Goldreich combination renders this feature obvious. *See supra* §X.A.5.(i).[29i].

[21k] wherein the processing of the one or more signals to generate SpO₂ measurement values is performed only on the processing board, thereby freeing up memory available to the mobile computing device; and

139. The Brady-Goldsmith-D'Angelo-Goldreich combination renders this feature obvious. Brady explains that the pulse oximetry board can be a “BCI MICRO POWER oximetry board, which ... provides blood oxygenation level,” (corresponding to “*SpO₂ measurement values*”) as well as other physiological measurements based on signals received from an optical sensor. APPLE-1091, ¶[0058]. Further, Brady’s microprocessor board can be a distinct component from the pulse oximetry board that later “receives data from the pulse oximetry board.” *Id.* Therefore, a POSITA would have recognized that the Brady-Goldsmith-D'Angelo-Goldreich combination provides for “*processing of the one or more signals to generate SpO₂ measurement values is performed ... on the processing board.*” Indeed, a POSITA would have further understood Brady as disclosing (or at least would have found it obvious) that Brady’s processing of signals to SpO₂ measurement values generate occurs *only* on the pulse oximetry processing board

prior to sending the data to the microprocessor board. This is because Brady does not mention the need or use of processing assistance by any other components to provide “blood oxygenation level,” and a POSITA would have recognized that there was no need to do so. In fact, a POSITA would have recognized that it could be *advantageous* to perform the processing exclusively on the processing board since it would have freed up memory and processing capacity of the mobile device, including the separate microprocessor board, since the microprocessor board would not have to generate these measurements. A POSITA would have recognized this benefit as matter of simple common sense.

[21I] wherein the processing board is configured to draw all power for operation from the mobile computing device;

140. For the same reasons I discuss above, the Brady-Goldsmith-D’Angelo-Goldreich combination renders this feature obvious. *See supra* §X.A.5.(i).[29b]. To the extent this claim limitation differs from limitation [29b] by requiring the processing board to be configured to draw *all* power for operation from the mobile computing device, the Brady-Goldsmith-D’Angelo-Goldreich combination renders this obvious as well. Brady does not disclose any power source for the pulse oximetry board (“*the processing board*”) *other* than the “power source positioned on the watch 25” in Brady’s preferred embodiment. APPLE-1091, ¶[0061]. Therefore, a POSITA would have understood that, in Brady, the power source positioned on Brady’s watch (i.e., the mobile computing

device) was the exclusive source of power for components such as the claimed processing board. As such, it would have been obvious to a POSITA that the Brady-Goldsmith-D'Angelo-Goldreich system includes a processing board *“configured to draw all power for operation from the mobile computing device.”*

[21m] the wristwatch mobile pulse oximetry system further comprising a substantially water-tight enclosure for at least the processing board, the enclosure including impact resistant upper and lower shells.

141. Brady discloses a “main body portion” of its watch, (APPLE-1091, ¶[0047]), but it does not explicitly state that main body portion has a “substantially water-tight enclosure for at least the processing board” that “includ[es] impact resistant upper and lower shells.” Goldreich, however, discloses this feature. Goldreich’s wrist-mounted device includes a cover 304 and case 306 that come together to hold the components of the device (including a PCB 308) with a “waterproof sealing” between them. APPLE-1092, 10:52-53, 11:6-24, FIG. 2; *supra* §X.D.1. And for the reasons I discussed above, a POSITA would have found it obvious to combine the Brady-Goldsmith-D'Angelo-Goldsmith system with Goldreich to (1) improve the waterproofing and durability of the system—properties which were well-known to be desirable characteristics for wrist-worn devices used for physiological measurements—and (2) to make the main body of Brady’s watch easy to disassemble for maintenance. *Supra* §X.D.2; APPLE-1095, 14-15. Additionally, to the extent the cover and case taught by Goldreich do not

render obvious *impact resistant* upper and lower shells, it would have been obvious to a POSITA to select the materials and shape of Goldreich's cover and case to make them impact resistant, as was already being done for analogous devices prior to the Critical Date. APPLE-1095, 54-58. It was entirely obvious at the time that impact resistance was a desirable characteristic of watch-like devices, and this would have been even more true of devices that include sensitive electronic assemblies, such as the ones at issue here.

(ii) Claim 22

[22] The mobile pulse oximetry system of claim 21, wherein the application is configured to execute commands to: perform a trend analysis on received SpO₂ measurement values; and display results of the trend analysis in at least one portion of the plurality of display portions.

142. For the same reasons I discuss above, the Brady-Goldsmith-D'Angelo-Goldreich combination renders this feature obvious. *See supra* §X.A.5.(ii).[30].

(iii) Claim 25

[25] The mobile pulse oximetry system of claim 21, wherein the application is configured to execute commands to output one or more alarms associated with SpO₂ measurement values that are above or below threshold SpO₂ measurement values.

143. For the same reasons I discuss above, the Brady-Goldsmith-D'Angelo-Goldreich combination renders this feature obvious. *See supra* §X.A.5.(iii).[31].

(iv) Claim 27

[27] The mobile pulse oximetry system of claim 21, wherein the application is configured to execute commands to update the representation of the physiological parameter to comprise one or more of a plurality of graphical representations of the SpO₂ measurement values, the plurality of graphical representations comprising at least one of bar graphs or charts.

144. For the same reasons I discuss above, the Brady-Goldsmith-D'Angelo-Goldreich combination renders this feature obvious. *See supra* §X.A.5.(iv).[33].

(v) Claim 28

[28] The mobile pulse oximetry system of claim 21, wherein the application is configured to execute commands to output an alert, via a network to a designated physician or other care provider, regarding abnormal SpO₂ readings.

145. For the same reasons I discuss above, the Brady-Goldsmith-D'Angelo-Goldreich combination renders this feature obvious. *See supra* §X.A.5.(v).[34].

(vi) Claim 36

[36] The computer-implemented method of claim 29, wherein wristwatch system comprises impact resistant upper and lower shells that help enclose at least the processing board in a substantially water-tight manner.

146. For the same reasons I discuss above, the Brady-Goldsmith-D'Angelo-Goldreich combination renders this feature obvious. *See supra* §X.D.3.(i).[21m].

E. [GROUND 1E] – CLAIM 23 IS OBVIOUS OVER BRADY, GOLDSMITH, D'ANGELO, GOLDREICH, AND ORDING

147. The sections below provide a brief introduction to Ording; discuss its combination with Brady-Goldsmith-D'Angelo-Goldreich; and explain the resulting combination's application to claim 23.

1. Overview of Ording

148. Ording describes a “portable communication device” having a touchscreen that includes “multi-touch input” that detects “one or more multi-touch contacts and motions” to perform various operations on objects displayed on the screen. APPLE-1008, Abstract. These various multi-touch user inputs include an input in which a user uses their index finger 108 and thumb 110 to make a “pinch” or “de-pinch” motion with respect to one or more displayed objects that causes the user interface to change the dimension of the object such as by zooming the displayed view in or out. *Id.*, 4:40-47, 7:63-64, 8:2-3. Figure 1 shows an example of such a gesture (in this case a de-pinching gesture):

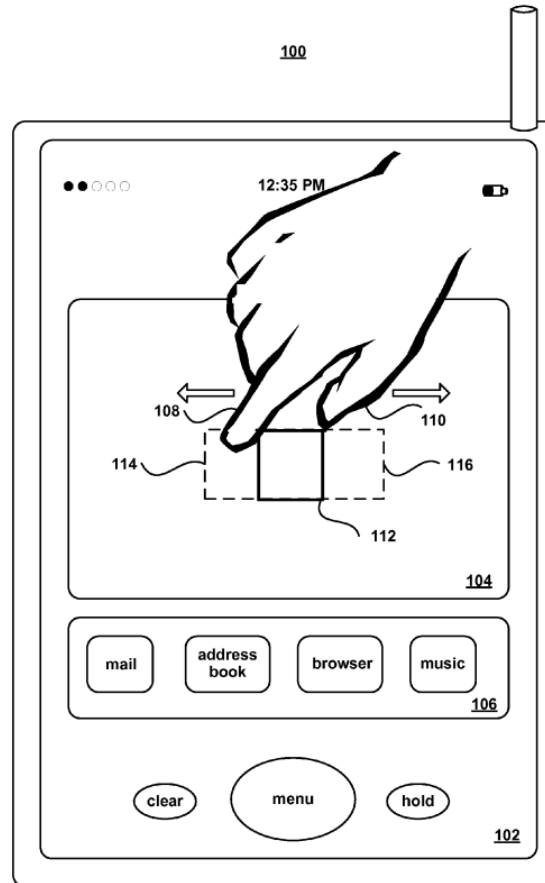


Figure 1

APPLE-1008, Figure 1.

2. *The Combination of Brady, Goldsmith, D'Angelo, Goldreich, and Ording*

149. Just like the Mendelson-D'Angelo system discussed in the Petition and in my First Declaration, the watch of the Brady-Goldsmith-D'Angelo-Goldreich system includes a touchscreen interface. *See supra* §§X.A.4, X.D.2; Pet., §III.E.2; APPLE-1003, ¶¶173-181. Therefore, a POSITA would have been prompted to modify the Brady-Goldsmith-D'Angelo-Goldreich system based on

Ording in the same way as the Petition describes (and for the same reasons I provide in my First Declaration) with respect to the Mendelson-D'Angelo system to provide claim [23] to allow users to manipulate and navigate the display of physiological parameter information through use of touchscreen gestures including a pinch gesture to narrow or expand displayed results. *See* Pet., §III.E.2; APPLE-1003, ¶¶173-181.

3. *Application of Brady-Goldsmith-D'Angelo-Goldreich-Ording to Claim 23*

(i) Claim 23

[23] The mobile pulse oximetry system of claim 22, ~~wherein the display is touch-sensitive, and~~ wherein the application is configured to execute commands to narrow or expand the displayed results of the trend analysis in response to the user using a pinch gesture.

150. As discussed above, a POSITA would have been prompted to modify the Brady-Goldsmith-D'Angelo-Goldreich system based on Ording in the same way as the Petition describes (and for the same reasons I provide in my First Declaration) with respect to the Mendelson-D'Angelo system to provide claim [23] to allow users to manipulate and navigate the display of physiological parameter information through use of touchscreen gestures including a pinch gesture to narrow or expand displayed results. *See* Pet., §III.E.2, APPLE-1003, ¶¶173-181.

151. Ording teaches that the resulting display device would have included functionality for zooming in and out using de-pinching and pinching touch inputs. APPLE-1008, 4:14-47, 7:61-67, 8:2-3, 9:24-29. A POSITA would have applied

Ordering to the Brady-Goldsmith-D'Angelo-Goldreich system for the reasons described above to allow for zooming in and out (narrow and expand) the displayed graph of SpO₂ values using a pinch gesture in the resulting combination. A POSITA would have recognized that such zooming in or out provides narrowing or expanding the displayed results of the trend analysis in response to the user using a pinch gesture.

**F. [GROUND 1F] – CLAIMS 24, 26, 28 ARE OBVIOUS
OVER BRADY, GOLDSMITH, D'ANGELO,
GOLDREICH, AND TRAN**

152. The sections below discuss the combination of Tran with Brady-Goldsmith-D'Angelo-Goldreich and explain the resulting combination's application to the claims.

***1. The Combination of Brady, Goldsmith, D'Angelo,
Goldreich, and Tran***

153. A POSITA would have applied Tran to the Brady-Goldsmith-D'Angelo-Goldreich combination for the reasons I discussed in Ground 1B, *supra*. *See supra* §X.B.

2. Application of Brady-Goldsmith-D'Angelo-Goldreich-Tran to the Claims

(i) Claim 24

[24] The mobile pulse oximetry system of claim 21, wherein the application is configured to execute commands to set reminders to take future measurements.

154. For the same reasons I discuss above, the Brady-Goldsmith-D'Angelo-Goldreich-Tran combination renders this feature obvious. *See supra* §X.B.3.(iii).[35].

(ii) Claim 26

[26] The mobile pulse oximetry system of claim 21, wherein the application is configured to execute commands to output one or more reminders to use the optical sensor to take measurements of SpO₂ measurement values at predetermined times or cycles.

155. For the same reasons I discuss above, the Brady-Goldsmith-D'Angelo-Goldreich-Tran combination renders this feature obvious. *See supra* §X.B.3.(i).[32].

(iii) Claim 28

[28] The mobile pulse oximetry system of claim 21, wherein the application is configured to execute commands to output an alert, via a network to a designated physician or other care provider, regarding abnormal SpO₂ readings.

156. For the same reasons I discuss above, the Brady-Goldsmith-D'Angelo-Goldreich-Tran combination renders this feature obvious. *See supra* §X.B.3.(ii).[34].

**G. [GROUND 1G] – CLAIMS 22, 27 ARE OBVIOUS OVER
BRADY, GOLDSMITH, D’ANGELO, GOLDREICH, AND
KIANL**

157. The sections below discuss the combination of Kianl with Brady-Goldsmith-D’Angelo-Goldreich and explain the resulting combination’s application to the claims.

1. *The Combination of Brady, Goldsmith, D’Angelo, Goldreich, and Kianl*

158. A POSITA would have applied Kianl to the Brady-Goldsmith-D’Angelo-Goldreich combination for the reasons I discussed in Ground 1C, *supra*. *See supra* §X.C.

2. *Application of Brady-Goldsmith-D’Angelo-Goldreich-Kianl to the Claims*

(i) Claim 22

[22] The mobile pulse oximetry system of claim 21, wherein the application is configured to execute commands to: perform a trend analysis on received SpO₂ measurement values; and display results of the trend analysis in at least one portion of the plurality of display portions.

159. For the same reasons I discuss above, the Brady-Goldsmith-D’Angelo-Goldreich-Kianl combination renders this feature obvious. *See supra* §X.C.3.(i).[30].

(ii) Claim 27

[27] The mobile pulse oximetry system of claim 21, wherein the application is configured to execute commands to update the representation of the physiological parameter to comprise one or more of a plurality of graphical representations of the SpO₂ measurement values, the plurality of graphical representations comprising at least one of bar graphs or charts.

160. For the same reasons I discuss above, the Brady-Goldsmith-D'Angelo-Goldreich-Kianl combination renders this feature obvious. *See supra* §X.C.3.(ii).[33].

H. [GROUND 2A] – CLAIMS 29-31, 33-34 ARE OBVIOUS OVER BRADY, GOLDSMITH, D'ANGELO, AND TSENG

161. As I discussed above in Grounds 1A-1G, I believe that all claims of the '507 Patent are rendered obvious by the various reference combinations that I described in Grounds 1A-1G. However, I have been asked to review each combination from Grounds 1A-1G in additional combination with Tseng (APPLE-1093) with respect to each of the claims. It is my opinion that each of the combinations described with respect to Grounds 2A-2G, which rely on Brady-Goldsmith-D'Angelo in view of Tseng (and one or more additional references for Grounds 2B-2G) render obvious each of the claims of the '507 Patent.

162. Specifically, to the extent that independent claims 21 and/or 29 are interpreted to require the MCD to be separate and distinct from the processing board (i.e., excluding embodiments in which the MCD encompasses the SpO₂ processing board), Tseng has been added to each of the combinations of Ground

1A-1G to provide this additional disclosure and form Grounds 2A-2G. Other than the addition of Tseng to the respective combinations to demonstrate how the combinations disclose such embodiments, the remainder of my analysis of the respective combinations remains the same as Grounds 1A-1G.

1. Overview of Tseng

163. Tseng discloses medical and health care-related expansion hardware that can be connected by wire to a separate mobile device 150 and a power module 110 secured to the

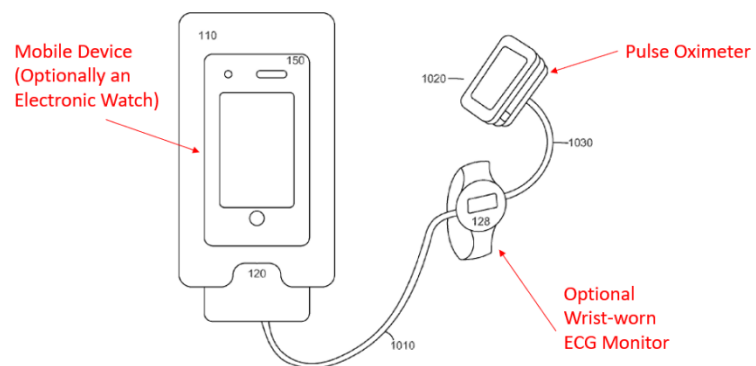


FIG. 10

mobile device. APPLE-1093, ¶¶[0036], [0062], FIG. 10. In one disclosed embodiment, Tseng teaches that the expansion hardware can include a pulse oximeter 1020 and, optionally, a wrist-worn ECG monitor 128 for collecting a user's health activity information and oximeter information and sending the information to the mobile device. *Id.*, ¶¶[0062]-[0063], FIG. 10 (above).

According to Tseng, the expansion hardware can be powered by either a battery within the power module 110 or by the internal built-in battery of the mobile device. *Id.*, ¶[0064]. Furthermore, Tseng explains that, in addition to the

expansion hardware potentially including a wrist-worn device (such as the wrist-worn ECG monitor 129), in some instances the separate and distinct mobile device 150 can itself be an electronic watch. *Id.*, ¶[0047]. In other words, Tseng teaches that both the mobile device and/or the external accessories can be watch or wrist-worn device. According to Tseng, prior to the Critical Date it was already known to use external accessories that interface with mobile devices “to add functionalities or enhance existing functionalities for mobile devices” including “abilities to detect and upload information to the mobile devices, as well as abilities to download and present information from the mobile device.” *Id.*, ¶[0004]. FIG. 10.

2. *The Combination of Brady, Goldsmith, D’Angelo, and Tseng*

164. In my opinion, a POSITA would have been motivated to apply Tseng to the Brady-Goldsmith-D’Angelo system to provide a system that relies on a SpO₂ measurement system (including Brady’s optical sensor and pulse oximetry board) which is separate from the wristwatch MCD as non-wirelessly connected yet distinct devices. Tseng teaches that such an arrangement was well-known to expand the functionalities of MCDs. APPLE-1093, ¶[0004]. As such, a POSITA would have had taken this motivation and found a reasonable expectation of success in implementing such a configuration. A POSITA would also have recognized that such an arrangement could decrease the hardware required to be

included in the MCD, thereby reducing the size, complexity, and power requirements of the MCD. This would provide even further motivation for POSITA to combine Tseng with Brady, Goldsmith, and D'Angelo, and would have enabled SpO₂ measurement using a wider variety of smartwatches.

**3. *Application of Brady-Goldsmith-D'Angelo-Tseng to
Claims 29-31, 33-34***

165. In my opinion, the correct interpretation of Claim 29 is that it can be met by an integrated wristwatch system incorporating the processing board and the MCD, or by a system with the processing board separate from the MCD, and in grounds X.A-G above, I explain how Claim 29 is invalid if correctly interpreted. To the extent claim 29 is (incorrectly) construed to require that the optical sensor and the processing board of the SpO₂ measurement system are separate and distinct from the wristwatch MCD, Tseng discloses such configurations. *See supra* §X.H.1; APPLE-1093, ¶¶[0036], [0047], [0062]-[0063], FIG. 10. A POSITA would have found it predictable to combine the teachings of Tseng with the Brady-Goldsmith-D'Angelo system to achieve this arrangement with a reasonable expectation of success as I described in Section X.H.2, *supra*. *See supra* §X.H.2. The Brady-Goldsmith-D'Angelo-Tseng combination provides (or at least renders obvious) all other elements of claims 29-31 and 33-34 for the reasons I discuss above with respect to Ground 1A, *supra*. *See supra* §X.A.

I. [GROUNDS 2B-2G] – THE MODIFICATIONS OF THE BRADY-GOLDSMITH-D’ANGELO COMBINATION IN VIEW OF TSENG RENDER OBVIOUS THE REMAINING CLAIMS

166. In my opinion, a POSITA would have been prompted to apply the teachings of Tran, Kianl, Goldreich, and Ording to the Brady-Goldsmith-D’Angelo-Tseng combination in the same manner and for the same reasons I discussed with respect to Grounds 1B-1G to achieve the combinations identified for Grounds 2B-2G identified in Section X, *supra*, and would have had a reasonable expectation of success in doing so. All elements of the claims identified with respect to Grounds 2B-2G are disclosed by the respective combinations for the reasons I discussed in respective grounds 1B-1G.

J. [GROUND 3A] – CLAIMS 29-31, 33-34 ARE OBVIOUS OVER HUDSON, GOLDSMITH, AND BRADY

167. The sections below provide a brief introduction to Hudson; discuss its combination with Goldsmith and Brady; and explain the resulting combination’s application to the claims.

1. Overview of Hudson

168. Hudson discloses a pulse oximeter that interfaces to a separate mobile phone. Hudson specifically points out the advantage of this configuration due to the “high-density power storage,” “integrated display,” and “power-efficient processing capabilities [of mobile phones] suitable for the processing and analysis of oximetry signals.” APPLE-1094, 957-58. In particular, Hudson discloses an

example embodiment using a 2nd generation iPod Touch® as the mobile device “hardwired to a certified Xpod® OEM pulse oximeter module.”

Id., 958, FIG.1 (above). Hudson then explains that “[t]he Xpod module *provides the raw photoplethysmography waveform and processed trend values for oxygen saturation* and heart rate in a serial data format.” *Id.*, 958.



169. Hudson shows and discusses various user interface screens for the system that are displayed on the mobile phone. For example, the user interface is can include display parameters such as “heart rate, oxygen saturation and respiratory rate” on the screen of the iPod Touch, and can include, among other things, “a trend graph ... for each parameter,” “[a]larm thresholds,” corresponding to upper and lower limits of parameter values, and “touch icons” to navigate between various tabs of the application and adjust settings. *Id.*, 959, 962, FIGS. 2-3 (reproduced below).



Figure 2 The graphical user interface of the first prototype of the Phone Oximeter is composed of four tabs, which can be selected from the bottom bar (left to right): *Home*, *Settings*, *Messages* and *Power-saver* (not shown).



Figure 3 The second Phone Oximeter graphical user interface prototype as used in Phase II of the study. Visual changes made to the interface are highlighted in blue: (1) new signal quality indicator; (2) improved visual alert for alarms; and (3) improved icon for the trend line indicator.

2. *The Combination of Hudson, Goldsmith, and Brady*

170. In my opinion, a POSITA would have been motivated to replace the 2nd generation iPod Touch® (mobile device) of Hudson’s system with a touch-screen wristwatch, as taught by Goldsmith, and would have done so with a reasonable expectation of success. As of the Critical Date, wristwatch mobile devices had (and were well-known to have) many of the same benefits of portability, “high-density power storage,” “an integrated display,” and “power-efficient processing capabilities” as the iPod Touch used in Hudson. Indeed,

Hudson itself describes that “[t]he ultimate goal ... is to make the Phone Oximeter compatible with a variety of mobile phone platforms,” APPLE-1094, 958, 964; APPLE-1009, [0085]-[0105], and a POSITA would have recognized that a wristwatch device (e.g., a wristwatch device with cellular capabilities) could be included in this set of devices for which compatibility would be desirable to achieve. More specifically, a POSITA would have recognized that the touch screen watch controller device of Goldsmith would be fully compatible with Hudson’s system (for the same reasons that Goldsmith is compatible with Mendelson-D’Angelo, as described in the Petition and in my First Declaration), and would yield benefits such as increasing the ease of use of Hudson’s system. *See* Pet., §III.I.2; APPLE-1003, ¶¶203-209. As a matter of fact, Goldsmith itself discloses that its wristwatch controller is, for all intents and purposes, a PDA having a wristwatch formfactor with all capabilities of a smartphone in “a more socially acceptable embodiment ... because it is common for people to wear watches.” APPLE-1009, [0085]-[0105]. Furthermore, even Masimo’s own position appears to be that the ’507 Patent’s single mention of a “wristwatch” as the mobile device (with no discussion of any modifications that would be needed for known smartwatches) suggests a POSITA would have recognized that wristwatches were capable of performing all functions of a smartphone/PDA. APPLE-1001, 3:65-4:4. For all of these reasons, a POSITA would have applied

Goldsmith to Hudson in the same way as they would have applied Goldsmith to the Mendelson-D'Angelo combination, as described in the Petition and in my First Declaration. *See* Pet., §III.I.2; APPLE-1003, ¶¶203-209.

171. Furthermore, a POSITA would have found it natural to apply Goldsmith's disclosure of outputting alarms to a third-party care provider in the combination since Hudson's pulse oximetry system already outputs alarms to a user when abnormal SpO₂ readings fall outside of an expected range (*see supra* §X.J.1). Like Hudson, Goldsmith discloses a watch that measures oxygen levels and uses alarms to indicate "high or low" analyte levels, and Goldsmith additionally discloses that that a "cellular network could be used to notify parents, physicians, or emergency services of alarms or alert states" based on an abnormal analyte level. APPLE-1009, ¶¶[0017], [0037], [0072]-[0073], [0085], [0092]. A POSITA would have recognized the advantages of implementing alarm notifications to third-party care providers in the Hudson-Goldsmith-Brady combination to improve the monitoring of a user's condition and to aid in the event of a medical emergency. And a POSITA would have implemented these notifications with a reasonable expectation of success without significantly altering or impeding the functions performed by Hudson's system. APPLE-1011, 2; APPLE-1005, [0255]-[0257], [0260]-[0261].

172. To the extent that Hudson-Goldsmith does not explicitly provide technical details about how the Xpod OEM pulse oximeter module calculates SpO₂ values, such details about the Xpod module and other similar pulse oximetry systems (including optical sensors and SpO₂ processing boards) were well-known before the Critical Date. APPLE-1106; APPLE-1097; APPLE-1098; APPLE-1099. For example, Shad discloses that the Xpod Pulse Oximeter “allows the user to add an oximetry sensor option externally” and “cost effective and an easy plug and play device.” APPLE-1106, 21 (*see* Fig. 2.1), 24-32, 30 (Fig. 2.9), 31 (“The calculations for extracting the heart rate, SpO₂ and PPG waveform is the same as that done by the software of the Xpod”), *id.* (Fig. 2.10). Also, in another example, Brady discloses an optical sensor and pulse oximetry board, and Brady provides specific details about how these components operate to calculate SpO₂ measurement values. *Supra* §X.A.1; APPLE-1091, ¶¶[0046]-[0058]. A POSITA would have recognized that the implementation details taught by Brady would be readily applicable with a reasonable expectation of success to the analogous sensor and XPod OEM pulse oximeter module shown and described in Hudson to achieve the same effect. Indeed, applying Brady to the Hudson-Goldsmith system would have simply involved applying a known technique to a known system ready for improvement to yield predictable results.

3. *Application of Hudson-Goldsmith-Brady to the Claims*

(i) Claim 29

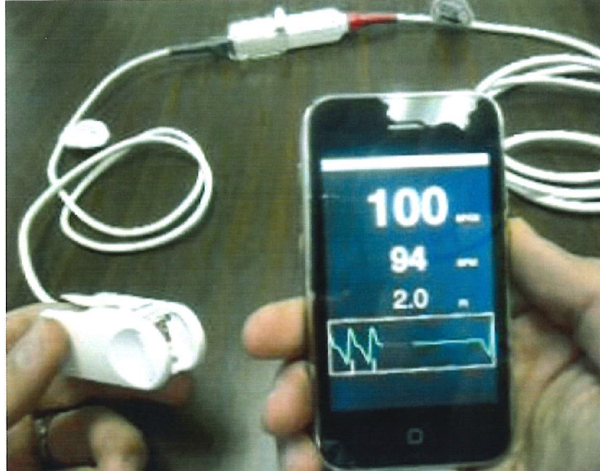
[29pre] A computer-implemented method of using a wristwatch system to inform ~~informing~~ a user of mobile measurement of oxygen saturation (“SpO₂”), the computer-implemented method comprising:

173. Hudson discloses methods of using a system that includes an “iPod Touch hardwired to a Nonin Xpod OEM pulse oximeter module” to display mobile measurements of SpO₂ (oxygen saturation) to a user. APPLE-1094, 958; *supra* §X.J.1. As I discussed above, Hudson-Goldsmith-Brady provides a “*wristwatch system*” because a POSITA would have been motivated to replace Hudson’s iPod Touch with Goldsmith’s wrist-worn watch controller device with a reasonable expectation of success. *Supra* §X.J.2.

[29a] outputting, from an optical sensor of an SpO₂ measurement system, one or more unprocessed nonwireless signals responsive to light from a light source attenuated by tissue of the user at a measurement site, said one or more unprocessed nonwireless signals responsive to an oxygen saturation of said tissue; and

174. Hudson discloses a finger-worn pulse oximetry sensor connected by wire to a Nonin Xpod OEM pulse oximeter module. APPLE-1094, 958, FIG. 1. Notably, the configuration shown in Hudson not only closely matches the system depicted in the figures of the ’507 patent but also has the equivalent configuration to the system shown in the Prototype Video (EX2039) that Masimo has relied upon as allegedly providing all features of original claims 1 and 13. As such, to the

extent the device in the prototype video meets these limitations, the device in Hudson also meets these limitations in these revised claims.



EX2039, 0:27



APPLE-1094, 958

175. Additionally the sensor in the Hudson-Goldsmith-Brady combination is an optical sensor and the sensor outputs unprocessed signals responsive to light from a light source attenuated by tissue indicative of blood oxygen, as taught by Brady's implementation details. *See supra* §X.A.5.(i).[29a]. A POSITA, therefore, would have recognized that the Hudson-Goldsmith-Brady renders obvious this claim limitation.

[29b] via a processing board of the SpO₂ measurement system, the processing board in nonwireless data communication with the optical sensor and with a wristwatch mobile computing device including a display, the processing board powered by the wristwatch mobile computing device:

176. Hudson discloses a finger-worn pulse oximetry sensor connected by wire to a Nonin Xpod OEM pulse oximeter module that is itself “hardwired” to an iPod Touch (a “*mobile computing device including a display*”). APPLE-1094, 958, FIG. 1. The Shah thesis shows the internal processing board of the Nonin Xpod Pulse Oximeter:



Figure 2.1 Nonin Xpod Pulse Oximeter [18].

APPLE-1106, 21.

177. As I discussed in Section X.J.2, Hudson-Goldsmith-Brady provides a *wristwatch mobile computing device*. *Supra* §X.J.2. To the extent that Hudson does not explicitly disclose all of the necessary details about the processing board of the Xpod OEM pulse oximeter module, Brady provides these features, for the same reasons I discussed in Section X.A.5.(i).[29b] above. *Supra* §X.A.5.(i).[29b]. Therefore, a POSITA would recognize that Hudson-Goldsmith-Brady provides

“via a processing board of the SpO₂ measurement system, the processing board in nonwireless data communication with the optical sensor and with a wristwatch mobile computing device including a display.”

178. In my opinion, a POSITA would also have recognized that Hudson and Brady disclose or at least render obvious that the Xpod OEM pulse oximeter module is *powered by the wristwatch MCD* in the Hudson-Goldsmith-Brady combination. Hudson discusses the “high-density power storage” of mobile phones as a reason for using them in Hudson’s pulse oximetry system, and further describes a “power-save mode” that “turns off the screen” of the mobile device. APPLE-1094, 958-959; *see also supra* §X.A.5.(i).[29b]. Therefore, a POSITA would have understood that Hudson discloses or at least strongly suggests that the claimed processing board is *“powered by the wristwatch mobile computing device.”*

[29c] receiving said one or more unprocessed nonwireless signals from the optical sensor;

179. Hudson describes and shows that the optical sensor and the Xpod are connected by wire. APPLE-1094, 958, FIG. 1. Hudson also explains that the Xpod module “provides the raw photophethysmograph” to the mobile device, which a POSITA would understand as suggesting that the Xpod module receives the unprocessed signal from the optical sensor. APPLE-1094, 958, FIG. 1. In the Hudson-Goldsmith-Brady combination, the unprocessed nature of signals from the

optical sensor would have also been rendered obvious based on the SpO₂ measurement implementation details provided by Brady, as I discussed with respect to Ground 1A above. *Supra* §X.A.5.(i).[29c]. Therefore, a POSITA would have recognized that the Hudson-Goldsmith-Brady combination renders obvious “*receiving said one or more unprocessed nonwireless signals from the optical sensor.*”

[29d-29e] processing said one or more unprocessed nonwireless signals to generate the SpO₂ measurement values; and nonwirelessly outputting the SpO₂ measurement values to one or more hardware processors of the wristwatch mobile computing device; and

180. Hudson discloses that “[t]he Xpod module provides the raw photoplethysmography waveform *and processed trend values for oxygen saturation*” via the “hardwired” connection to the mobile device. APPLE-1094, 958. Therefore, a POSITA would have recognized the Hudson-Goldsmith-Brady combination as rendering obvious “*processing said one or more unprocessed nonwireless signals to generate the SpO₂ measurement values; and nonwirelessly outputting the SpO₂ measurement values to one or more hardware processors of the ... mobile computing device.*” And, for the same reasons as I described above, in the Hudson-Goldsmith-Brady combination, Goldsmith provides that the mobile computing device can be a *wristwatch* mobile computing device, (*supra* §X.J.2), while Brady discloses relevant implementation features of this claim limitation (*supra* §X.A.5.(i).[29d-29e]).

[29f] via an application configured to execute commands on the one or more hardware processors of the wristwatch mobile computing device:

181. Hudson discloses that its mobile device runs a “Phone Oximeter application,” (APPLE-1094, 965, FIGS. 1-3), and Brady similarly discloses this feature (*supra* §X.A.5.(i).[29f]). Applications such as Hudson’s “Phone Oximeter application” were well-known to execute commands on hardware processors of mobile computing devices as of the Critical Date. *See supra* §X.A.5.(i).[29f]. Therefore, a POSITA would have recognized that the Hudson-Goldsmith-Brady combination renders obvious “*an application configured to execute commands on the one or more hardware processors of the wristwatch mobile computing device.*”

[29g] generating a wristwatch graphical user interface on a touch sensitive screen and having a plurality of display portions;

182. Hudson discloses generating various user interface displays that are shown on the touch sensitive screen of an iPod Touch, and Hudson further discloses that the user interface has several display portions including a SpO₂

measurement portion,

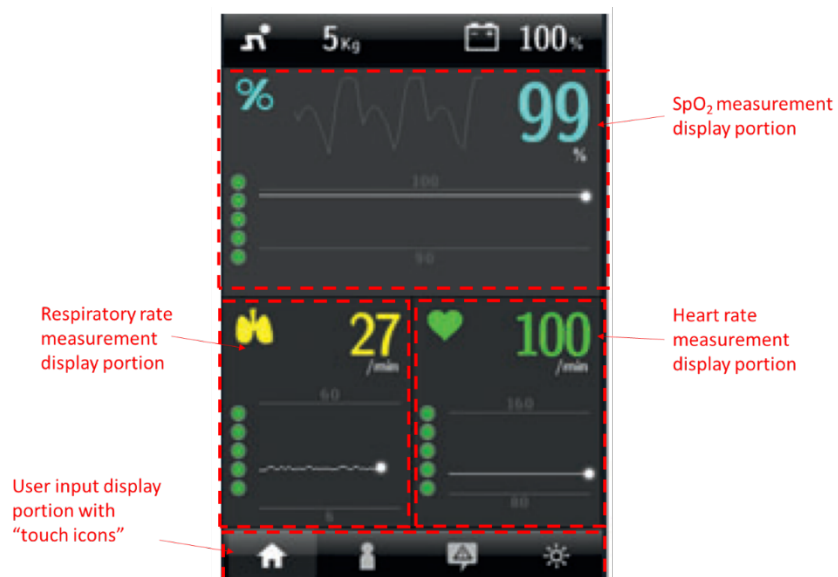
a respiratory rate

measurement portion,

a heart rate

measurement portion,

and a user input



portion of the display with “touch icons.” APPLE-1094, FIG. 2 (annotated, right).

And, as I discussed above, Goldsmith provides a wristwatch mobile computing device with a similar touchscreen display. *Supra* §X.J.2. Therefore, a POSITA would have found it obvious to combine the teachings of Hudson and Goldsmith in the Hudson-Goldsmith-Brady combination to provide “*generating a wristwatch graphical user interface on a touch sensitive screen and having a plurality of display portions.*” *See id.*

[29h] displaying, in at least one portion of the plurality of display portions, a representation of a physiological parameter of a plurality of physiological parameters comprising at least the SpO₂ measurement values; and

183. For similar reasons as I discuss above, this claim limitation is provided by the Hudson-Goldsmith-Brady combination. *See supra* §X.J.3.(i).[29g]. In particular, the SpO₂ measurement display portion of the user interface in Hudson provides this element, displaying *a representation of a physiological parameter of a plurality of physiological parameters comprising at least the SpO₂ measurement values.* APPLE-1094, FIG. 2.

[29i] displaying, in a different portion of the plurality of portions, a plurality of user inputs configured to allow the user to interact via the touch sensitive screen with at least one of the plurality of display portions or the application.

184. For similar reasons as I discuss above, this claim limitation is provided by the Hudson-Goldsmith-Brady combination. *See supra* §X.J.3.(i).[29g]. In particular, the user input display portion with “touch icons” in

Hudson's user interface provides this element, allowing a user to *interact via the touch sensitive screen with at least one of the plurality of display portions or the application*. APPLE-1094, 959, FIG. 2.

(ii) Claim 30

[30] The computer-implemented method of claim ~~[[13]]~~29, further comprising, via the application: performing a trend analysis on received SpO₂ measurement values; and displaying results of the trend analysis in at least one portion of the plurality of display portions.

185. For similar reasons as I discuss above, this claim limitation is provided by the Hudson-Goldsmith-Brady combination. *See supra* §X.J.3.(i).[29g]. As shown in the SpO₂ measurement display portion of Hudson's user interface, a trend analysis on received SpO₂ measurement values is performed and the results are displayed. APPLE-1094, FIGS. 2; *see id.*, 3; *id.*, 958 ("The Xpod module provides ... processed trend values for oxygen saturation ... in a serial data format"); *id.*, 959 ("a trend graph [was] incorporated for each parameter"); *id.*, 962 ("shows variable trends over time"). Therefore, a POSITA would have recognized that Hudson-Goldsmith-Brady renders obvious "*via the application: performing a trend analysis on received SpO₂ measurement values; and displaying results of the trend analysis in at least one portion of the plurality of display portions.*"

(iii) Claim 31

[31] The computer-implemented method of claim [[13]]29, further comprising, via the application, outputting one or more alarms associated with SpO₂ measurement values that are above or below threshold SpO₂ measurement values.

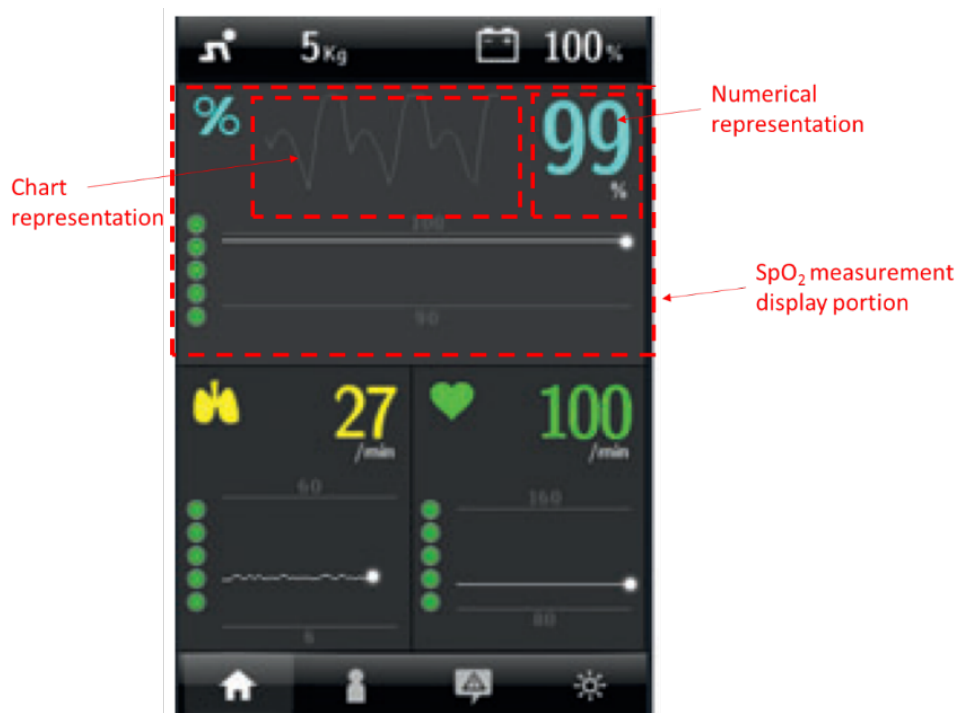
186. Hudson’s “Phone Oximeter software ... collects ... *sensor alarms* and stores them in a file on the device.” APPLE-1094, 958-59. Hudson also discloses that “alarm thresholds” can be set through the application and are represented as “horizontal lines on the trend graphs” to represent an “upper limit” and/or “lower limit” for physiological parameters such as O₂ saturation and heart rate. *Id.*, 959, 962, Table 1. Hudson further discloses “alarms and warnings” that can be displayed when the parameter values are above the upper alarm limit or below the lower alarm limit. *Id.*, 959-60, 962-63, FIG. 3. In view of this disclosure in Hudson, a POSITA would have recognized that Hudson-Goldsmith-Brady renders obvious “*via the application, outputting one or more alarms associated with SpO₂ measurement values that are above or below threshold SpO₂ measurement values.*”

(iv) Claim 33

[33] The computer-implemented method of claim [[13]]29, further comprising, via the application, updating the representation of the physiological parameter to comprise one or more of a plurality of graphical representations of the SpO₂ measurement values, the plurality of graphical representations comprising at least one of bar graphs or charts.

187. For similar reasons as I discuss above, this claim limitation is provided by the Hudson-Goldsmith-Brady combination. *See supra*

§X.J.3.(i).[29g]. In particular, as Hudson shows in the SpO₂ measurement display portion of the user interface, measured SpO₂ values are shown in various graphical representations including (1) a chart that shows values plotted over time and (2) a numerical value. APPLE-1094, 959, FIG. 2. Therefore, a POSITA would have recognized that Hudson-Goldsmith-Brady renders obvious “*via the application, updating the representation of the physiological parameter to comprise one or more of a plurality of graphical representations of the SpO₂ measurement values, the plurality of graphical representations comprising at least one of bar graphs or charts.*”



(v) Claim 34

[34] The computer-implemented method of claim [[13]]29, further comprising, via the application, updating the representation of the physiological parameter to comprise one or more of a plurality of graphical representations of the SpO₂ measurement values, the plurality of graphical representations comprising at least one of bar graphs or charts.

188. For the reasons I discussed above with respect to claim 31, the Hudson-Goldsmith-Brady system outputs one or more alarms associated with SpO₂ measurement values that are above or below threshold SpO₂ measurement values. *Supra* §X.J.3.(iii).[31]. The Hudson-Goldsmith-Brady combination also renders obvious that these alerts of abnormal SpO₂ readings are output *via a network to a designated physician or other care provider*. For example, Goldsmith teaches that a “cellular network could be used to notify parents, physicians, or emergency services of alarms or alert states” based on an abnormal analyte level. APPLE-1009, ¶¶[0017], [0072]-[0073], [0085], [0092]. Therefore, as I discussed above, a POSITA would have found it obvious to apply the teachings of Goldsmith to the Hudson-Goldsmith-Brady system to provide this claim limitation. *Supra* §X.J.2.

K. [GROUND 3B] – CLAIMS 32, 34-35 ARE OBVIOUS OVER HUDSON, GOLDSMITH, BRADY, AND TRAN

189. The sections below discuss the combination of Tran with Hudson-Goldsmith-Brady and explain the resulting combination’s application to the claims.

1. *The Combination of Hudson, Goldsmith, Brady, and Tran*

190. As I discussed above, the watch of the Hudson-Goldsmith-Brady system—similarly to the system in Mendelson—outputs one or more alarms associated with SpO₂ measurement values that are above or below threshold SpO₂ measurement values. *Supra* §X.J.3.(iii).[31]; Pet. §III.B.2; APPLE-1003, ¶¶84-94. In my opinion, a POSITA would have applied Tran to the Hudson-Goldsmith-Brady system in the same way as applied to Mendelson in the Petition (and as described in my First Declaration) to output reminders to the user to take SpO₂ measurements, allow the user to set such reminders to take future measurements, and to output an alert via a network to a designated physician or other care provider in response to abnormal SpO₂ readings. *See* Pet., §III.B.2, APPLE-1003, ¶¶84-94.

2. *Application of Hudson-Goldsmith-Brady-Tran to the Claims*

(i) Claim 32

[32] The computer-implemented method of claim [[13]]29, further comprising, via the application, outputting one or more reminders to use the optical sensor ~~optical sensor~~ to take measurements of SpO₂ measurement values at predetermined times or cycles.

191. For the reasons described in the Petition and in my First Declaration, a POSITA would have applied Tran to the Hudson-Goldsmith-Brady combination in the same way as they would have applied Tran to Mendelson to provide this

feature. *See* Pet., §III.B.3.[16]; APPLE-1003, ¶¶95-96; APPLE-1005, ¶¶[0054], [0246], [0255].

(ii) Claim 34

[34] The computer-implemented method of claim [[13]]29, further comprising, via the application, outputting an alert, via a network to a designated physician or other care provider, regarding abnormal SpO₂ readings.

192. For the reasons described in the Petition and in my First Declaration, a POSITA would have applied Tran to the Hudson-Goldsmith-Brady combination in the same way as they would have applied Tran to Mendelson to provide this feature. *See* Pet., §III.B.3.[18]; APPLE-1003, ¶97; APPLE-1005, ¶¶[0255], [0252], [0054], [0246], [0335], [0417].

(iii) Claim 35

[35] The computer-implemented method of claim [[13]]29, further comprising, via the application, enabling the user to set reminders to take future measurements.

193. For the reasons described in the Petition and in my First Declaration, a POSITA would have applied Tran to the Brady-Goldsmith-D'Angelo combination in the same way as they would have applied Tran to Mendelson to provide this feature. *See* Pet., §III.B.3.[20]; APPLE-1003, ¶98; APPLE-1005, ¶¶[0255], [0257], [0418].

**L. [GROUND 3C] – CLAIMS 21-22, 25, 27-28, 36 ARE
OBVIOUS OVER HUDSON, GOLDSMITH, BRADY,
AND GOLDBREICH**

194. The sections below discuss the combination of Goldreich with Hudson-Goldsmith-Brady; and explain the resulting combination's application to the claims.

1. *The Combination of Hudson, Goldsmith, Brady, and Goldreich*

195. Multiple reasons would have prompted a POSITA to apply the teachings of Goldreich to the Hudson-Goldsmith-Brady system to provide—with a reasonable expectation of success—a watch with impact resistant upper and lower shells that form a substantially water-tight enclosure for at least the processing board. As a first reason, a POSITA would have recognized that such modifications would make the device more durable and enable the device to be used in the presence of water. Both of these were common and desirable features for similar wrist-worn watch devices as of the Critical Date. *See, e.g.*, APPLE-1095, 14-15 (describing shock resistance and water resistance as functional requirements of a wearable pulse oximeter design). As a second reason, a POSITA would have recognized that the enclosure taught by Goldreich was readily applicable to the wristwatch of the Hudson-Goldsmith-Brady system with a reasonable expectation of success since the enclosure would operate in the same way to achieve similar

and predictable results of making the main body of the watch modular and easy to disassemble for maintenance.

2. *Application of Hudson-Goldsmith-Brady-Goldreich to the Claims*

(i) Claim 21

[21pre] A wristwatch mobile pulse oximetry system for informing a user of mobile measurement of oxygen saturation (“SpO₂”), the wristwatch mobile pulse oximetry system comprising:

196. For the same reasons I discuss above, the Hudson-Goldsmith-Brady-Goldreich combination renders this feature obvious. *See supra* §X.J.3.(i).[29pre].

[21a] an SpO₂ measurement system including:

197. For the same reasons I discuss above, the Hudson-Goldsmith-Brady-Goldreich combination renders this feature obvious. *See supra* §X.J.3.(i).[29pre].

[21b] an optical sensor configured to output one or more signals responsive to light from a light source attenuated by tissue of the user at a measurement site, said one or more signals responsive to an oxygen saturation of said tissue; and

198. For the same reasons I discuss above, the Hudson-Goldsmith-Brady-Goldreich combination renders this feature obvious. *See supra* §X.J.3.(i).[29a].

[21c] a processing board in non-wireless data communication with the optical sensor and non-wireless data communication with a mobile computing device comprising the wristwatch, which includes ~~including~~ a display and cellular communication capabilities, wherein the processing board is configured to:

199. For the same reasons I discuss above, the Hudson-Goldsmith-Brady-Goldreich combination renders this feature obvious. *See supra* § X.J.3.(i).[29b].

However, to the extent that this feature further requires “a mobile computing device comprising the wristwatch, which includes a display and *cellular communication capabilities*,” the Hudson-Goldsmith-Brady- Goldreich combination renders this obvious as well.

200. Hudson and Goldsmith disclose the “cellular communication capabilities” feature. Hudson states that the “ultimate goal ... is to make the Phone Oximeter compatible with a variety of mobile phone platforms, which would reflect the actual market availability and variability of mobile phones and their use in different regions of the world.” APPLE-1094, 964. Therefore, it would have been readily apparent to a POSITA that this disclosure includes mobile phones with cellular communication capabilities. Furthermore, Goldsmith discloses that its “watch controller device may further be adapted to include cellular phone, PDA and/or smart phone capabilities.” APPLE-1009, ¶[0097]. In view of this disclosure, a POSITA would have recognized that Hudson-Goldsmith-Brady-Goldreich renders obvious “*a mobile computing device comprising the wristwatch, which includes a display and cellular communication capabilities.*”

[21d] receive [[said]] one or more unprocessed signals through a non-wireless connection from the optical sensor;

201. For the same reasons I discuss above, the Hudson-Goldsmith-Brady-Goldreich combination renders this feature obvious. *See supra* §X.J.3.(i).[29c].

[21e-21f] process said one or more unprocessed signals to generate SpO₂ measurement values; and output the SpO₂ measurement values nonwirelessly to the mobile computing device; and

202. For the same reasons I discuss above, the Hudson-Goldsmith-Brady-Goldreich combination renders this feature obvious. *See supra* §X.J.3.(i).[29d-29e].

[21g] one or more hardware processors of the mobile computing device configured to execute an application, the application configured to execute commands to:

203. For the same reasons I discuss above, the Hudson-Goldsmith-Brady-Goldreich combination renders this feature obvious. *See supra* §X.J.3.(i).[29f].

[21h] generate a graphical user interface of the wristwatch having a plurality of display portions;

204. For the same reasons I discuss above, the Hudson-Goldsmith-Brady-Goldreich combination renders this feature obvious. *See supra* §X.J.3.(i).[29g].

[21i] display on a touch sensitive screen, in at least one portion of the plurality of display portions, a representation of a physiological parameter of a plurality of physiological parameters comprising at least the SpO₂ measurement values; and

205. For the same reasons I discuss above, the Hudson-Goldsmith-Brady-Goldreich combination renders this feature obvious. *See supra* §X.J.3.(i).[29h].

[21j] display on the touch sensitive screen, in a different portion of the plurality of display portions, a plurality of user inputs, the touch sensitive screen configured to allow the user to interact with at least one of the plurality of display portions or the application;

206. For the same reasons I discuss above, the Hudson-Goldsmith-Brady-Goldreich combination renders this feature obvious. *See supra* §X.J.3.(i).[29i].

[21k] wherein the processing of the one or more signals to generate SpO₂ measurement values is performed only on the processing board, thereby freeing up memory available to the mobile computing device; and

207. The Hudson-Goldsmith-Brady-Goldreich combination renders this feature obvious. Hudson explains that “[t]he Xpod module provides the ... *processed* trend values for oxygen saturation ... in a serial data format” to the mobile device (i.e., the iPod Touch) via a wired connection. Therefore, a POSITA would have understood Hudson’s disclosure—which does not disclose any further processing on the mobile computing device to generate SpO₂ values—as teaching that all the processing of the one or more signals to generate the oxygen saturation measurements is performed on the pulse oximetry board prior to sending the data to the mobile device. Moreover, a POSITA would have understood Brady’s disclosure as teaching this feature as well. *See supra* §X.D.3.(i).[21k]. Since the built-in processors of the mobile device would not have to generate the SpO₂ measurements, a POSITA would further have recognized that this configuration would have advantageously freed up memory and processing capacity of the mobile device, as recited in limitation [21k].

[21l] wherein the processing board is configured to draw all power for operation from the mobile computing device;

208. For the same reasons I discuss above, the Hudson-Goldsmith-Brady-Goldreich combination renders this feature obvious. *See supra* §X.J.3.(i).[29b]. To the extent this claim limitation differs from limitation [29b] by requiring the processing board to be configured to draw *all* power for operation from the mobile computing device, the Hudson-Goldsmith-Brady-Goldreich combination renders this obvious as well. Hudson does not disclose any power source for the Xpod module (containing “*the processing board*”) *other* than the mobile computing device. Therefore, a POSITA would have understood, in Hudson, the mobile computing device was the exclusive source of power for Xpod module. Brady also provides this limitation. *See supra* §X.D.3.(i).[21l]. As such, it would have been obvious to a POSITA that the Hudson-Goldsmith-Brady-Goldreich system includes a processing board “*configured to draw all power for operation from the mobile computing device.*”

[21m] the wristwatch mobile pulse oximetry system further comprising a substantially water-tight enclosure for at least the processing board, the enclosure including impact resistant upper and lower shells.

209. As I discussed above, the Hudson-Goldsmith-Brady system includes a wristwatch mobile computing device, (*see supra* §X.J.2), and Goldsmith discloses that the housing of the watch can be a “water resistant or waterproof housing” (APPLE-1009, ¶[0041]). To the extent Hudson, Goldsmith, and Brady do not

explicitly disclose that the watch includes a “substantially water-tight enclosure for at least the processing board, the enclosure including impact resistant upper and lower shells,” Goldreich discloses this feature. Goldreich’s wrist-mounted device includes a cover 304 and case 306 that come together to hold the components of the device (including a PCB 308) with a “waterproof sealing” between them. APPLE-1092, 10:52-53, 11:6-24, FIG. 2; *supra* §X.D.1. And for the reasons I discussed above, a POSITA would have found it obvious to combine the Hudson-Goldsmith-Brady system with Goldreich to (1) improve the waterproofing and durability of the system—properties which were well-known to be desirable characteristics for wrist-worn devices used for physiological measurements—and (2) to make the main body of Brady’s watch easy to disassemble for maintenance. *Supra* §X.L.1; APPLE-1095, 14-15. Additionally, to the extent the cover and case taught by Goldreich do not render obvious ***impact resistant*** upper and lower shells, it would have been obvious to a POSITA to select the materials and shape of Goldreich’s cover and case to make them impact resistant, as was already being done for analogous devices prior to the Critical Date. APPLE-1095, 54-58. It was entirely obvious at the time that impact resistance was a desirable characteristic of watch-like devices, and this would have been even more true of devices that include sensitive electronic assemblies, such as the ones at issue here.

(ii) Claim 22

[22] The mobile pulse oximetry system of claim 21, wherein the application is configured to execute commands to: perform a trend analysis on received SpO₂ measurement values; and display results of the trend analysis in at least one portion of the plurality of display portions.

210. For the same reasons I discuss above, the Hudson-Goldsmith-Brady-Goldreich combination renders this feature obvious. *See supra* §X.J.3.(ii).[30].

(iii) Claim 25

[25] The mobile pulse oximetry system of claim 21, wherein the application is configured to execute commands to output one or more alarms associated with SpO₂ measurement values that are above or below threshold SpO₂ measurement values.

211. For the same reasons I discuss above, the Hudson-Goldsmith-Brady-Goldreich combination renders this feature obvious. *See supra* §X.J.3.(iii).[31].

(iv) Claim 27

[27] The mobile pulse oximetry system of claim 21, wherein the application is configured to execute commands to update the representation of the physiological parameter to comprise one or more of a plurality of graphical representations of the SpO₂ measurement values, the plurality of graphical representations comprising at least one of bar graphs or charts.

212. For the same reasons I discuss above, the Hudson-Goldsmith-Brady-Goldreich combination renders this feature obvious. *See supra* §X.J.3.(iv).[33].

(v) Claim 28

[28] The mobile pulse oximetry system of claim 21, wherein the application is configured to execute commands to output an alert, via a network to a designated physician or other care provider, regarding abnormal SpO₂ readings.

213. For the same reasons I discuss above, the Hudson-Goldsmith-Brady-Goldreich combination renders this feature obvious. *See supra* §X.J.3.(v).[34].

(vi) Claim 36

[36] The computer-implemented method of claim 29, wherein wristwatch system comprises impact resistant upper and lower shells that help enclose at least the processing board in a substantially water-tight manner.

214. For the same reasons I discuss above, the Hudson-Goldsmith-Brady-Goldreich combination renders this feature obvious. *See supra* §X.L.2.(i).[21m].

M. [GROUND 3D] – CLAIM 23 IS OBVIOUS OVER HUDSON, GOLDSMITH, BRADY, GOLDREICH, AND ORDING

215. The sections below discuss the combination of Ording with Hudson-Goldsmith-Brady-Goldreich and explain the resulting combination's application to claim 23.

1. *The Combination of Hudson, Goldsmith, Brady, Goldreich, and Ording*

216. Just like the Mendelson-D'Angelo system discussed in the Petition and in my First Declaration, the watch of the Hudson-Goldsmith-Brady-Goldreich system includes a touchscreen interface. *See supra* §§X.J.2, X.L.1; Pet., §III.E.2; APPLE-1003, ¶¶173-181. Therefore, a POSITA would have been prompted to

modify the Hudson-Goldsmith-Brady-Goldreich system based on Ording in the same way as the Petition describes (and for the same reasons I provide in my First Declaration) with respect to the Mendelson-D'Angelo system to provide claim [23] to allow users to manipulate and navigate the display of physiological parameter information through use of touchscreen gestures including a pinch gesture to narrow or expand displayed results. *See* Pet., §III.E.2, APPLE-1003, ¶¶173-181.

2. *Application of Hudson-Goldsmith-Brady-Goldreich-Ording to Claim 23*

(i) Claim 23

[23] The mobile pulse oximetry system of claim 22, ~~wherein the display is touch-sensitive, and~~ wherein the application is configured to execute commands to narrow or expand the displayed results of the trend analysis in response to the user using a pinch gesture.

217. As discussed above, a POSITA would have been prompted to modify the Hudson-Goldsmith-Brady-Goldreich system based on Ording in the same way as the Petition describes (and for the same reasons I provide in my First Declaration) with respect to the Mendelson-D'Angelo system to provide claim [23] to allow users to manipulate and navigate the display of physiological parameter information through use of touchscreen gestures including a pinch gesture to narrow or expand displayed results. *See* Pet., §III.E.2, , APPLE-1003, ¶¶173-181.

218. Ording teaches that the resulting display device would have included functionality for zooming in and out using de-pinching and pinching touch inputs. APPLE-1008, 4:14-47, 7:61-67, 8:2-3, 9:24-29. A POSITA would have applied

Ordering to the Hudson-Goldsmith-Brady-Goldreich system for the reasons described above to allow for zooming in and out (narrow and expand) the displayed graph of SpO₂ values using a pinch gesture in the resulting combination. A POSITA would have recognized that such zooming in or out provides narrowing or expanding the displayed results of the trend analysis in response to the user using a pinch gesture.

**N. [GROUND 3E] – CLAIMS 24, 26, 28 ARE OBVIOUS
OVER HUDSON, GOLDSMITH, BRADY, GOLDRICH,
AND TRAN**

219. The sections below discuss the combination of Tran with Hudson-Goldsmith-Brady-Goldreich and explain the resulting combination's application to the claims.

***1. The Combination of Hudson, Goldsmith, Brady,
Goldreich, and Tran***

220. A POSITA would have applied Tran to the Hudson-Goldsmith-Brady-Goldreich combination for the reasons I discussed in Ground 3B, *supra*. See *supra* §X.K.

2. *Application of Hudson-Goldsmith-Brady-Goldreich-Tran to the Claims*

(i) Claim 24

[24] The mobile pulse oximetry system of claim 21, wherein the application is configured to execute commands to set reminders to take future measurements.

221. For the same reasons I discuss above, the Hudson-Goldsmith-Brady-Goldreich-Tran combination renders this feature obvious. *See supra* §X.K.2.(iii).[35].

(ii) Claim 26

[26] The mobile pulse oximetry system of claim 21, wherein the application is configured to execute commands to output one or more reminders to use the optical sensor to take measurements of SpO₂ measurement values at predetermined times or cycles.

222. For the same reasons I discuss above, the Hudson-Goldsmith-Brady-Goldreich-Tran combination renders this feature obvious. *See supra* §X.K.2.(i).[32].

(iii) Claim 28

[28] The mobile pulse oximetry system of claim 21, wherein the application is configured to execute commands to output an alert, via a network to a designated physician or other care provider, regarding abnormal SpO₂ readings.

223. For the same reasons I discuss above, the Hudson-Goldsmith-Brady-Goldreich-Tran combination renders this feature obvious. *See supra* §X.K.2.(ii).[34].

XI. Other References Material to Patentability

224. Additional features of Masimo's amended claims are further disclosed by a host of additional references, as I have indicated in the sections below:

- Non-wireless connections between an optical sensor, a processing board, and a mobile computing device: APPLE-1010, ¶¶[0010], [0013], [0060], [0120]; APPLE-1097, 2-3, FIG. 1; APPLE-1101, 14:40-50, 16:4-5; APPLE-1093, ¶¶[0063]-[0064], FIG. 10.
- Receiving unprocessed signals from the optical sensor: APPLE-1010, ¶¶[0013],[0060]; APPLE-1102, 12:30-64; FIG. 7, FIGS. 10-11.
- Processing board drawing all power from the mobile computing device: APPLE-1013, 2:24-26, 5:14-26, FIG. 1; APPLE-1097, 3, 6.
- Wrist-worn/wristwatch mobile computing devices with cellular communication capabilities and touch sensitive screens: APPLE-1010, ¶¶[0023], [0125], [0136]; APPLE-1100, Abstract; APPLE-1103, ¶¶[0002]-[0008], [0092]-[0093].
- Water-tight enclosures including impact resistant upper and lower shells: APPLE-1095, 14-15; APPLE-1104, ¶[0098], FIG. 18; APPLE-1105, ¶¶[0065], [0134]-[0135].

XII. CONCLUSION

225. I reserve the right to supplement my opinions to address any information obtained, or positions taken, based on any new information introduced throughout this proceeding.

226. I declare under penalty of perjury that the foregoing is true and accurate to the best of my ability.