

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of: Smith et al.
U.S. Patent No.: 10,984,911 Attorney Docket No.: 50095-0136IP2
Issue Date: April 20, 2021
App. Serial No.: 17/028,655
Filing Date: September 22, 2020
Title: MULTIPLE WAVELENGTH SENSOR EMITTERS

SUPPLEMENTAL DECLARATION OF DR. THOMAS W. KENNY

I declare that all statements made herein on 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 20, 2025

By:  _____

Thomas W. Kenny, Ph.D.

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I. INTRODUCTION

1. I have been retained by Fish & Richardson, P.C., on behalf of Apple Inc. (“Petitioner”), as an independent expert consultant in this *inter partes* review (“IPR”) proceeding before the United States Patent and Trademark Office.

2. I understand that this declaration will be submitted in support of Petitioner’s Reply to Patent Owner’s Response to the Petition for *inter partes* review of the ’911 patent (U.S. Patent No. 10,984,911). This declaration supplements, and is intended to be read in conjunction with, my declaration in support of Apple’s Petition (APPLE-1003, “my First Declaration”). In my First Declaration, I address many topics, including (but not limited to) my background and qualifications, the level of skill in art, an overview of the ’911 patent, certain legal standards explained to me by Apple’s counsel, and a detailed analysis of the prior art against the ’911 patent’s claims. The opinions and explanations expressed in my First Declaration apply equally here.

3. In writing this Supplemental Declaration, I have considered the following: my own knowledge and experience, including my teaching and work experience in the above fields; and my experience of working with others involved in those fields.

4. I have no financial interest in either party or in the outcome of this proceeding. I am being compensated for my work as an expert on an hourly basis, for all tasks involved. My compensation is not dependent on the outcome of these proceedings

or on the content of my opinions.

II. LEVEL OF ORDINARY SKILL IN THE ART

5. As stated in my First Declaration, a person of ordinary skill in the art relating to the subject matter of the '911 patent as of March 1, 2005 (“POSITA” or “one of ordinary skill”) would have had a Bachelor of Science degree in electrical engineering, mechanical engineering, biomedical engineering, computer engineering, physics, or a related field, with at least one to two years of relevant work experience with capture and processing of data or information including but not limited to physiological information, or equivalents thereof. A greater amount of education, *i.e.*, a doctorate in electrical engineering, mechanical engineering, biomedical engineering, computer engineering, physics, or a related field would also qualify for the hypothetical person of ordinary skill in the art in lieu of fewer years of work experience. Additional education or industry experience may compensate for a deficit in one of the other aspects of the requirements stated above.

6. Patent Owner and Dr. Madisetti propose a different level of skill. POR, 10-11; EX2079, ¶37. In its Institution Decision, the Board indicated that these differences are not material, particularly because the optical sensors and technologies at issue are those used in physiological monitoring technologies, and both parties agree that the POSITA would have a working knowledge of physiological monitoring technologies. ID, 16-17. In adopting Patent Owner’s

proposed definition, the Board noted that they “would reach the same outcome under either definition of the POSITA.” *Id.*

7. In its Response, Patent Owner mischaracterizes my testimony regarding a POSITA’s understanding and capabilities. POR, 11. Specifically, Patent Owner states that:

Also, Apple’s expert (Kenny) assumes in his analysis that a POSITA would have had a particular understanding or capabilities because he or she had “already developed a system such as described by Abdul-Hafiz.” EX1003 ¶42. But Abdul-Hafiz is a pulse oximetry system, and Kenny conceded that he’s never developed a pulse oximeter or even published in the field. EX2080, 151:19-152:6. Accordingly, Kenny himself does not have the level of understanding or capability presumed in his declaration.

POR, 11. But Patent Owner ignores that I clarified during my deposition that a POSITA would not have had to already develop a system such as described by Abdul-Hafiz. EX2080, 92:16-93:5, 22:7-20. For example, the following was my response to questioning by Patent Owner’s counsel regarding my definition of a POSITA:

Q. So you agree a person who had a doctorate degree in one of the disciplines in paragraph 22 could meet your definition of a POSITA even if they had no experience capture and processing physiological information?

A. I think the simple answer is yes, that's what that sentence says. I think someone with that education would be prepared to read and understand the '911 patent and the claims and the prior art references, would along the way in the course of that education have gained experience in things such as sensors, optics, signal processing, et cetera, that are relevant for the '911 patent at the level necessary to understand the claims.

EX2080, 22:7-20.

Q. A requirement of your definition of a POSITA is that the person must have already developed a system such as described by Abdul-Hafiz; is that right?

A. No, I don't think so.

EX2080, 92:16-20. I further clarified that:

That sentence at the top of this page is true, someone who's actually taken most of the steps towards that combination would be able to finish it. But I don't mean to say that someone must have already taken most of the steps in order to be able to consider adding two more LEDs to the disclosure of Abdul-Hafiz.

I think other statements scattered around these paragraphs make that broader assertion, and that's my opinion, that a person of ordinary skill in the art, as we've defined it, could read Abdul-Hafiz and understand what are the important issues and details of that disclosure, also read Raley, understand the details and issues of that disclosure, and would find it straightforward to add a pair of LEDs to the system described by Abdul-Hafiz, and that there would be sufficient motivation to do that.

EX2080, 93:10-94:5. In light of this discussion, the important result is that, under either definition of the qualifications of a POSITA, it is possible to read and understand the features and claims of the '911 patent and the prior art.

III. TECHNICAL DISCUSSION

8. The analysis and opinions expressed in my First Declaration fully explain why each and every feature of the '911 patent's Challenged Claims is provided in the

prior art. As I previously explained with reference to the applied prior art and corroborating references, the Challenged Claims would have been obvious to a POSITA. I understand that Patent Owner and Dr. Madisetti have considered my opinions and offered their own, some of which are inconsistent with my view. Below, I provide further testimony in response to Patent Owner's and Dr. Madisetti's arguments. The fact that I have not addressed all of Patent Owner's and Dr. Madisetti's opinions should not be interpreted as agreement with them.

A. Raley teaches a "cavity."

9. As described in my initial declaration,

"The light transmitted" from the four emitters "passes through window or opening 26 and window 16 in probe-end and impinges on the tissue of the patient." APPLE-1005, 4:63-67. A POSITA would have understood or at least found it obvious that the **four LEDs are recessed into a cavity** covered by window/opening 26 of the interconnect cable segment 20 and that the interconnect cable segment 20 with the four LEDs is **recessed into a cavity** formed in connector and covered by window 16, as shown below, which provides the benefit of "protecting the patient from excess heat" emitted by the LEDs. APPLE-1005, 5:38-51.

APPLE-1003, ¶79. Important aspects of this description and explanation include that the light from the four emitters "passes through **window or opening 26...**", which necessarily requires a specific geometric relationship between the elements, and the structures around the elements. For the case of a window, a POSITA would

understand that the emitters must be recessed in a cavity below the **window** 26 in order to accommodate the finite thickness of the emitters and the finite thickness of the window, and for light emitted by an emitter to pass from the emitter through the window to the rest of the system. So, in this case, the cavity is required to be at least as deep as the thickness of the emitters and the thickness of the window. Alternately, in the case of an opening, a POSITA would understand that the emitters must be recessed in a cavity within and below the top surface of the **opening** 26 in order to accommodate the thickness of the emitters and for the light from the emitters to pass through opening 26. However, Patent Owner relies on an interpretation of figure 3 and an otherwise unsupported assertion that the emitters 21, 22, 23, and 24 are flush with the upper surface of the window/opening and the surrounding surface:

Pet. 29, 31 (Masimo's annotations to EX1005, FIG. 3). But Raley shows above that the surface of the LEDs (21-24) is on the same level as the window/opening (26) and the surrounding flat surface of the interconnect cable segment (20). EX1005, FIG. 3; EX2079 ¶64. Therefore, Raley's LEDs are not "recessed." *Id.*; EX2079 ¶64. Further, Apple agrees the LEDs (21-24) are "flush with" the window/opening (26). Paper 6, 5. Because Raley's LEDs are "flush with" the window/opening (26), they are not "in a hollowed-out-space." EX1005, FIG. 3; EX2079 ¶64.

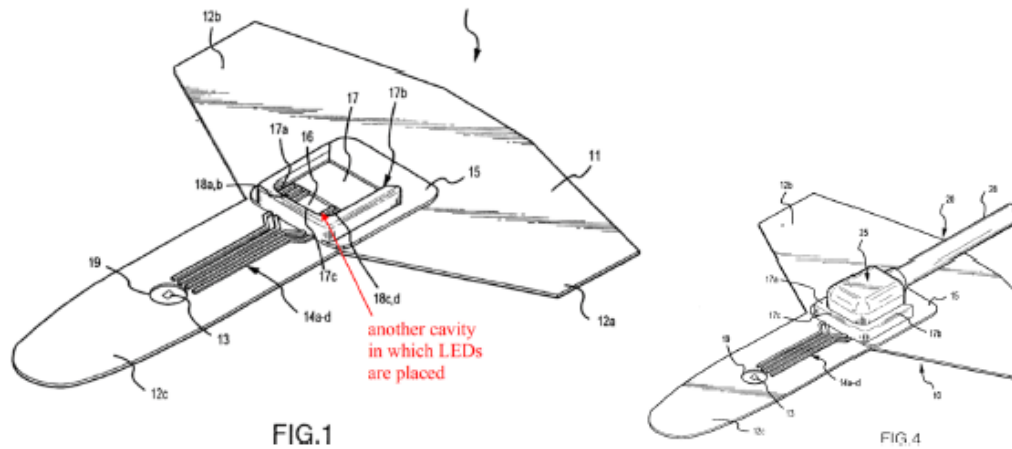
POR, 17-18. There are at least two problems with this argument. First, Raley discloses "a window or opening 26" in this structure, which necessarily discloses an embodiment in which 26 is a **window**. A POSITA would have understood that a

window would be a transparent structural element with a finite thickness, and the surface of the emitters could not be on the same level of the upper surface of a window that they are beneath. Therefore, Raley necessarily discloses a cavity with a depth that accommodates the finite thickness of the emitters beneath the window, as well as the finite thickness of the window itself, in order for the upper surface of the window to be at the same level as the surrounding surface. Alternately, in disclosing “a window or opening 26”, Raley discloses an embodiment with an **opening** which would accommodate the emitters, which would necessarily require a cavity in order to have the upper surface of the emitters at the same level as the surrounding surface or somewhat below the level of the surrounding flat surface, because the emitters obviously have a finite thickness. A POSITA would understand that a physical cavity of finite depth is geometrically necessary to accommodate emitters with finite thickness and an upper surface at the same level as the surrounding flat surface. More generally, a POSITA would have understood that the upper surface of the “window or opening” cannot protrude above the surrounding surface or there would be damage to the structures during assembly/disassembly of the two elements of this system. Of course, a POSITA would also have understood that the upper surface of the emitters cannot protrude above the surrounding surface or there would be damage to these structures during assembly/disassembly. So, regardless of whether 26 is a window or an opening, a POSITA would have

understood from Raley that a cavity is required in order to accommodate the LEDs, and is therefore obviously present as disclosed by Raley. As Patent Owner acknowledges, the emitters 21-24 “are flush” with (i.e., not protruding from) the window/opening 26 and therefore are recessed in a hollowed-out space that accommodates the emitters in the window/opening 26. In the Institution Decision, the Board agreed that “in order for emitters 21, 22, 23, 24 to be flush with opening 26, emitters 21, 22, 23, 24 must be recessed in a hollowed-out space in connector-end 25 to accommodate the thickness of the emitters.” ID, 35.

10. Patent Owner also argues that:

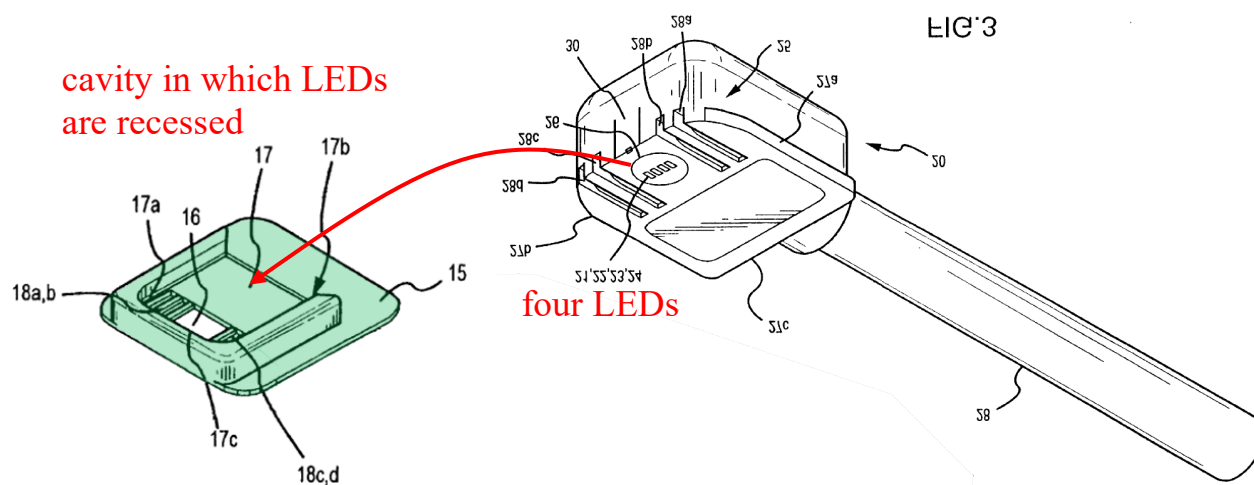
Apple also argues that the LEDs of cable segment (20) (shown above) are recessed into “another cavity” in Raley’s connector (17):



Pet. 29, 31 (excerpted); EX1005, FIG. 4. However, the LEDs would be recessed into this alleged cavity only when Raley’s connector (17) was connected to the cable segment (20). EX1005, FIGS. 1, 3, 5:15-62, 6:6-12; EX2079 ¶65. But even then, the LEDs would not be recessed into a cavity “within *a solid body*” because the alleged cavity is formed of two components—the connector (17) and the cable segment (20). EX1005, FIGS. 1, 3, 5:15-47, 5:57-62, 6:6-12; EX2079 ¶65. Each of those components is a separate solid body, not a single solid body. *Id.*

POR, 18. However, that the cable segment 20 and connector 17 are formed of two separable components is irrelevant to this argument about this cavity which is clearly shown in connector portion 15. The connector 17, including the lip portions 17a-c, together with the connector portion 15 is a solid body (highlighted green below) with a hollowed-out space (cavity surrounded by connector 17 and lip portions 17a-c) for inserting the connector-end 25, and thus the LEDs 21-24 that are located in the connector-end 25, of the interconnect cable segment 20. Upon the connector-end 25

being inserted into the cavity, the LEDs 21-24 occupy a position that is recessed in the cavity surrounded by connector 17 and lip portions 17a-c. In the Institution Decision, the Board agreed that “interconnect cable segment 20 and probe-end 10 being separable components is irrelevant because each of connector-end 25 and connector 17 is a solid body having a pre-existing hollowed-out space that receives emitters 21, 22, 23, 24 when interconnect cable segment 20 and connector 17 are combined.” ID, 36. Therefore, the LEDs are positioned within the pre-existing hollowed out cavity in the interconnect cable segment 20 prior to assembly, as well as within the pre-existing hollowed out cavity of connector portion 15 after assembly, and both of these cavities meet the limitations of the claim, which only requires “...at least three LEDs recessed into a cavity...”



APPLE-1005, FIGS. 1 (partial, colored), 3 (annotated).

11. Lastly, Patent Owner argues that:

Apple further argues in Delaware that (a) “the plain and ordinary meaning of ‘recessed into’ requires setting the LEDs back into a pre-existing cavity,” and (b) “LEDs [that] are mounted on a flat substrate” do not satisfy the claim language. EX2081 ¶476. But here, Apple does not argue, much less show, that Raley meets either of these requirements. Indeed, Raley satisfies neither requirement because it does not disclose whether its LEDs are placed into a “pre-existing” cavity or mounted on a flat substrate. EX1005; EX2079 ¶66. Instead, as Apple’s expert admits, “the exact structure at that location is not explicitly described” and “Raley doesn’t provide a detailed engineering diagram or explicit specifications of the individual components.” EX2080, 100:21-101:18; EX2079 ¶66.

POR, 19. As explained above and during my deposition, a POSITA would have interpreted Raley’s disclosure to describe LEDs that are recessed into a cavity defined by the circular opening 26 in order to not be destroyed during the assembly of the interconnect cable segment 20 into the connector 17 and to protect the patient from excess heat:

Other aspects of what's shown in detail in Raley would be used by a person of ordinary skill in the art when considering the positioning of the LEDs in Abdul-Hafiz. You know, for example, it would be reasonable to position them in a recess so as to avoid heating of the patient due to direct contact. Also, to avoid damage to the LEDs during the assembly and installation process.

EX2080, 74:12-20.

But the important point is that the LEDs are recessed relative to the surrounding surfaces so that the structure isn't destroyed during the assembly process of Raley.

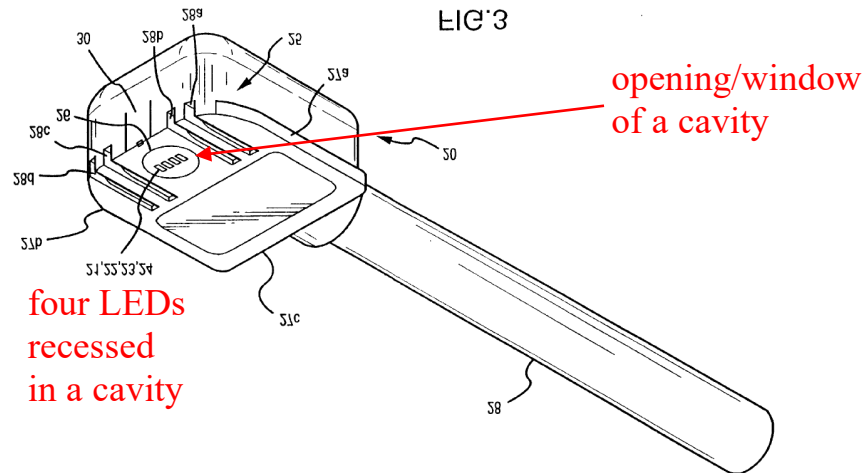
EX2080, 101:8-11

A. I wouldn't want the surface of those LEDs flush with the surrounding surface if I'm going to be extracting and inserting this element over and over again. I think you want them recessed relative to the surrounding surface in order to protect the LEDs.

I think it's obvious to one of ordinary skill in the art that, as Raley's describing a structure 20 that's inserted and extracted from the structure in Figure 1, that the LEDs can't be sliding along the surfaces of the structure in Figure 1 during the assembly and disassembly process.

So it would be obvious -- or it would have been understood or at least obvious to recess the -- all elements -- all surfaces of the LEDs relative to that surrounding surface.

EX2080, 102:13-103:7. Raley's FIG. 3 shows that a circular window or opening 26 accommodates the LED assembly. Window or opening 26 has a vertical depth and is a cavity in the interconnect cable segment within which the LED assembly is recessed and set back into.

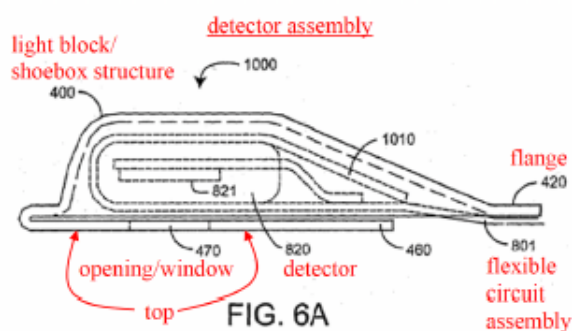


APPLE-1005, FIG. 3 (flipped, annotated). Thus, Raley’s LEDs are “recessed into” a pre-existing cavity. The disclosure of Raley therefore includes a cavity based on the drawings and specification of Raley, and based on how a POSITA would have understood the physical and geometric relationships between the elements must be in order to perform the assembly, disassembly and operation disclosed by Raley. A POSITA would understand that the absence of a detailed, three-dimensional engineering drawing specifying the dimensions of the cavity does not change the disclosure of an opening or window for the emitters which would require a recess of depth that is at least equal to the finite thickness of the emitters, and for the embodiment with a window, a recess of depth at least equal to the sum of the thickness of the emitters and the window. A POSITA would further understand the disclosure of Raley to include the cavity in connector portion 15 that the emitters are positioned within after assembly and during operation.

B. Abdul-Hafiz teaches “a top.”

12. I understand that Patent Owner argues that:

Here, Apple relies only on Abdul-Hafiz for the “top.” Apple argues that Abdul-Hafiz’s bottommost “base 460” discloses the claimed “top”:

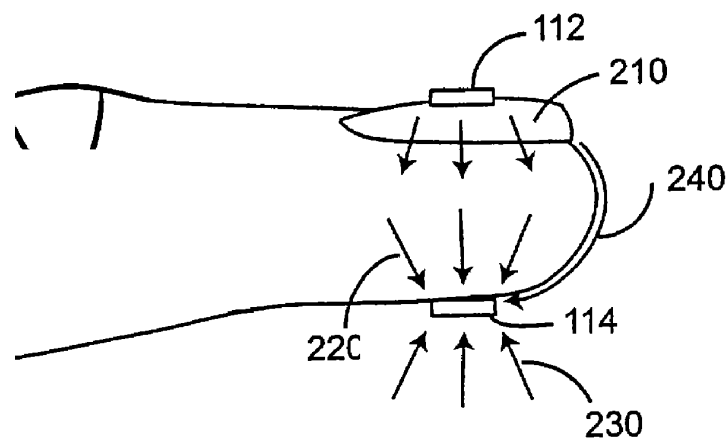


APPLE-1004, FIG. 6A

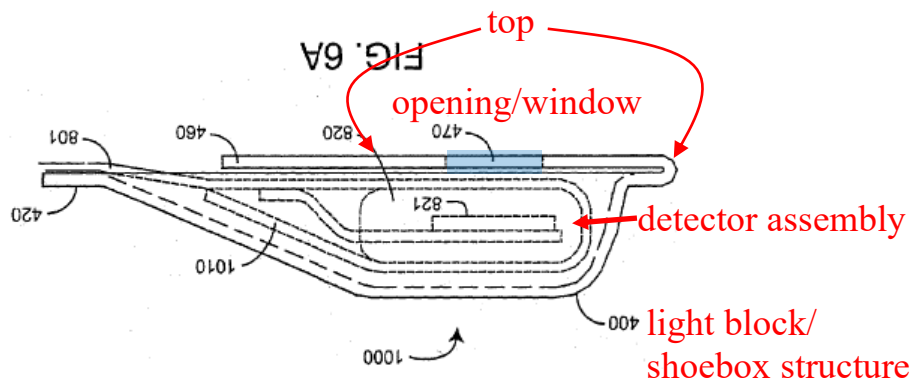
Pet. 43, 67-69, 73. But the alleged light block’s “base” is (1) not the uppermost structure and (2) cannot also be its “top” under Apple’s Delaware construction. Thus, the only reference Apple relies on for this element does not disclose a “top” under Apple’s Delaware construction. EX2079 ¶69.

POR, 20. It is irrelevant that the ’911 patent and Abdul-Hafiz use different terms for the uppermost portion. Patent Owner ignores that uppermost and bottommost are relative to the orientation of the device, and that the only reasonably relevant situation that should be considered for this determination would be during use of the product (not when in storage in a cabinet, for example). While in operation, Abdul-Hafiz shows that pulse oximetry systems are conventionally applied as shown in figures 1 and 2a, with the emitter above the fingernail, and the detectors positioned below the pad of the finger. In this arrangement, which is consistent with the

description in the '911 and in the other prior art references, a POSITA would have understood that the photosensor positioned below the finger requires an aperture/opening on the top of the housing/light block containing the photosensor to capture light propagating from the emitter and through the tissue. Therefore, a POSITA would have understood that the detector assembly is oriented as shown



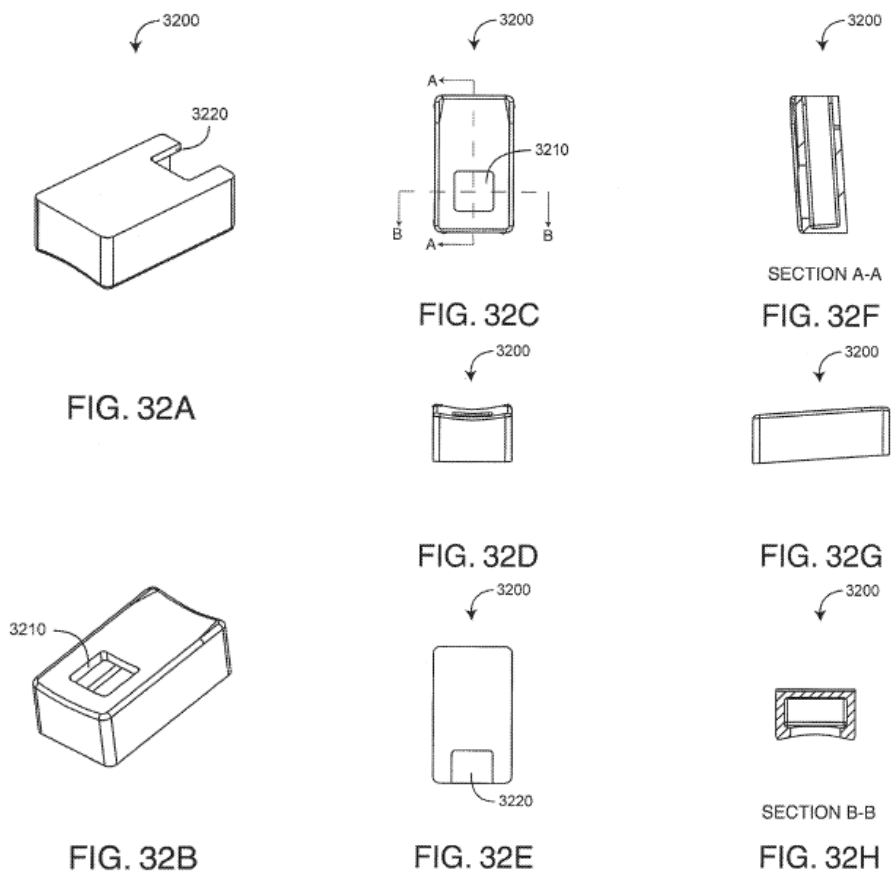
below (element 114 in figure 2 of Abdul-Hafiz), and in that orientation, the base 460 is the uppermost structure that covers the shoebox structure/light block.



APPLE-1004, FIG. 6A (rotated, annotated). In the Institution Decision, the Board agreed that “in use, Abdul-Hafiz’s low noise optical housing 400 is positioned below

a tissue site, e.g., a patient's finger, to allow light passing through the tissue site to pass through aperture 470 in base 460 to detector 820 enclosed within low noise optical housing 400, making the portion of base 460 with aperture 470 the uppermost portion of low noise optical housing 400 enclosing detector 820.” ID, 37. Further, the disclosure of the '911 patent provides little guidance on the identification of the “top” of the light block. As with Abdul-Hafiz, '911 patent's FIG. 1 appears to be the same as Abdul Hafiz's FIG. 1, and taken together with the '911 patent's FIG. 2A, indicates that the aperture/opening of the housing/light block would face upwards. The eight illustrations in the '911 patent's FIGS. 32A-32H (see below) show the light block of the '911 patent in a variety of orientations with the opening on the top, bottom, or sides of the illustrations, with no indication in the figures or in the description that there is a specific portion of this object that would be the “top”. As with the Abdul-Hafiz disclosure, the absence of any specific labelling or description of a “top”, a POSITA is left with little guidance, and would naturally fall to thinking of the orientation in the one situation that is well-described in both references – the use scenario, where the emitter is positioned on top of the finger, and the detector is below the finger, and any useful aperture/opening would be facing up, and therefore positioned on the top of the housing/light block. To the extent a POSITA would identify the opening on the top of the light block in the claims of the '911 patent, a POSITA would rely on exactly the same reasoning to identify the

aperture of Abdul-Hafiz as being on top of the housing. Therefore, exactly to the extent that the '911 patent discloses a “top”, Abdul-Hafiz discloses a “top”.



APPLE-1001, FIGS. 32A-H.

C. Abdul-Hafiz teaches a light block with “only one opening.”

13. I understand that Patent Owner argues that:

The EMI shield of Abdul-Hafiz's detector assembly cannot be ignored. Apple's expert repeatedly admitted at his deposition that the EMI shield (1005, 1010) in the detector assembly (1000) would block at least some light from reaching the detector (820/821). EX2080, 109:13-20, 110:22-111:5, 111:18-112:2, 112:22-113:15, 115:8-17, 160:9-161:2. Indeed, a POSITA would have understood that the EMI shield (1005, 1010) in Abdul-Hafiz's detector assembly (1000) blocked at least some stray light because such EMI shielding is normally made of optically opaque material like copper. EX2080, 105:8-106:21, 112:9-21; EX1004 ¶¶46-47, FIGS. 10-11; EX2079 ¶77.

POR, 24. As I explained during my deposition, a POSITA would not have understood that Abdul-Hafiz's EMI shield is a light block. Abdul-Hafiz never describes that the EMI shield blocks light nor describes that the EMI shield is made of optically opaque material like copper.

Q. And what is the purpose of the EMI shield 1010 in Abdul-Hafiz?

A. I think it's there to reduce the influence of electromagnetic interference from the surroundings on the operation of the detector.

Q. Does Abdul-Hafiz describe that the EMI shield 1010 provides ambient and piped light reduction?

A. I don't believe so.

EX2080, 158:15-159:1.

Q. And because Abdul-Hafiz provides optical housing 400, is it reasonable for a POSITA to assume that the EMI shield 1010 didn't provide adequate ambient and piped light reduction?

A. Yeah, I would say so.

EX2080, 159:18-22.

The objective of the EMI shield is to block EMI inside of a housing that's already blocked the light. So it might be pretty bad at blocking the light on its own.

EX2080, 160:18-21. I also explained during my deposition that there are examples of EMI shields that would still allow some light transmission and may not provide adequate ambient and piped light reduction.

opaque. There's some counter examples. I'm not sure they're relevant, but a very thin metallic film could provide EMI shielding while still allowing some light transmission. But I don't think that's a

EX2080, 106:13-20.

Q. You agree that a common material for EMI shields is optically opaque materials, like copper, metal; correct?

A. They could be. You could make a useful EMI shield out of a copper mesh that wouldn't necessarily be opaque. And you could make a useful EMI shield out of thinner films of copper that might not be opaque.

There are some EMI shields that are constructed of conductive plastic in certain products, and those might or might not be opaque optically.

EX2080, 161:3-14. Indeed, transparent EMI shields were known at the time of the '911 patent. For example, International Patent Application Publication No. WO2000002294A2 describes EMI shields that "permit high visible light transmissivity." APPLE-1084. As another example, U.S. Patent No. 4,412,255 to Kuhlman et al. describes a "transparent electromagnetic shield." APPLE-1085. Therefore, a POSITA would appreciate that the EMI shield discussed in Abdul-Hafiz is not necessarily capable of blocking light. In contrast, the housing 400 of Abdul Hafiz is clearly described as consisting of "...a laminate of two materials including an outer white layer 407 and an inner black layer 408. By utilizing a laminate of both white and black material, the low noise optical housing 400 advantageously functions both as a light absorber and as a light reflector. The white layer 407 acts

as a reflector, reflecting unwanted ambient light outward from a detector enclosed in the housing, as described below, as well as reflecting emitter source light back into a patient tissue site. The reflected ambient light reduces noise and the reflected source light increases the sensor current transfer ratio. The black layer 408 absorbs unwanted ambient light, preventing it from reaching the enclosed detector 820 (FIGS. 6A-B).” APPLE-1004, [0034]. In this description, the optical properties of the housing are clearly described as reflecting and absorbing unwanted ambient light, whereas the EMI shield of Abdul Hafiz is only described with respect to its effect as a shield of electromagnetic interference. *See, e.g.*, APPLE-1004, [0041]-[0043], [0046]. A POSITA would have known that light and EMI are different. For example, Abdul-Hafiz describes “FIGS. 8–12 illustrate assembly of a neonate sensor 700 (FIGS. 7A-B) and an adult sensor 750 (FIG. 7C) including component attachment (FIGS. 8A-B), detector EMI shielding and optical shielding”, indicating that “detector EMI shielding and optical shielding” are two distinct things, provided by two distinct structural elements. Abdul-Hafiz refers to a separate patent (U.S. Patent Application No. 10/137,942, filed May 2, 2002, and published November 2002 as U.S. Patent Application Publication No. 2002/0165440, and issued as U.S. Patent No. 6,985,764 January 2006) that describes EMI shields made from layers of “...Dupont CB028 silver-filled thermoplastic screenable ink.” APPLE-1004, [0041]; APPLE-1086, [0036]. Such screenable inks consist of conductive metal

particles in a thermoplastic suspension. APPLE-1087 (describing a “Screen Types” of “Stainless steel, polyester” and “Substrate” of “Epoxy glass, Mylar and DuPont™ Kapton® polyimide film”). Therefore, a POSITA would have understood that an EMI shield can be made from a number of materials, not exclusively “...optically-opaque materials like copper...” (as Patent Owner alleges). Further, a POSITA would have understood that thin layers of metallic materials and especially thin layers of screenable metallic ink can be semi-transparent. This example of a thin screenable metallic ink, which can be a semi-transparent EMI shield, are consistent with my deposition testimony quoted above, and with the understanding of a POSITA about the distinction between the housing 400 and the EMI shield 1010. These are two distinct objects with two distinct roles – the housing 400 provides a light block with an aperture, and the EMI shield 1010 blocks electromagnetic interference.

14. Additionally, the possibility that the EMI shield may also block some light is irrelevant. The Board in its Institution Decision agreed:

Patent Owner's argument is unavailing because Petitioner relies on Abdul-Hafiz's low noise optical housing 400, not fixed shield 1005, for disclosing the recited light block. Pet. 35 (citing Ex. 1003 ¶¶ 85–87). Petitioner correctly asserts that light passes through the single aperture 470 in low noise optical housing 400 to detector 820. *Id.* at 42 (citing Ex. 1003 ¶ 96; Ex. 1004, Abstract, ¶¶ 5–7). For purposes of institution, we are persuaded that Abdul-Hafiz discloses the recited only one opening in the light block.

ID, 39. As I explained in my First Declaration, Abdul-Hafiz's optical housing 400, not the EMI shield, discloses the claimed light block with only one opening. APPLE-1003, ¶96. As shown in FIGS. 4A-4C, the optical housing 400 has only one opening and does not include an EMI shield. Notably, claims 1 and 19 of the '911 patent require a light block "...with only one opening configured for light to pass...". The optical housing 400 of Abdul Hafiz clearly has only one opening through which light can pass. The presence of other structures in the optical path after the opening, such as an EMI shield, does not change the fact that the opening in optical housing 400 of Abdul Hafiz is configured to allow light to pass. A POSITA would have understood that this single opening in optical housing 400 is configured to allow light to pass.

light block/shoebox structure

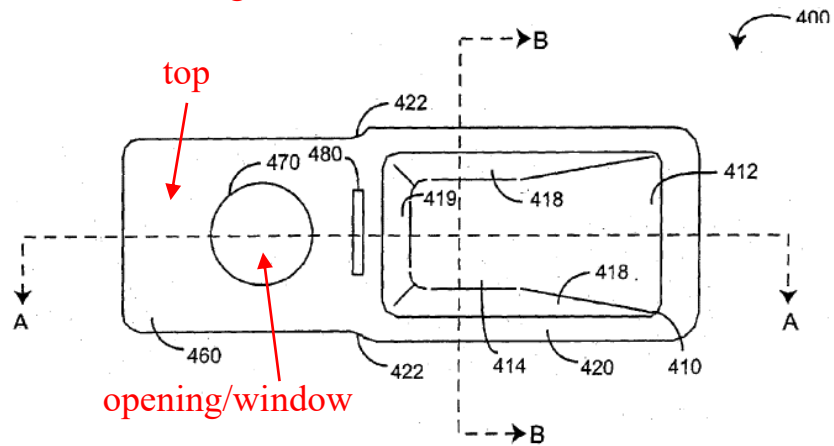


FIG. 4A

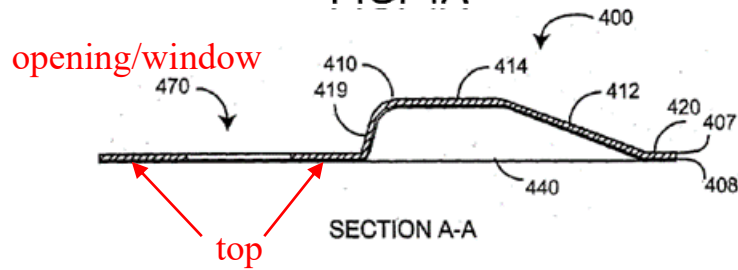


FIG. 4B

Id.; APPLE-1004, FIGS. 4A-4C (annotated). Similarly, the '911 patent discloses a shoe box 3200 (light block) that has only one opening 3210 and does not include an EMI shield.

light block/shoebox structure

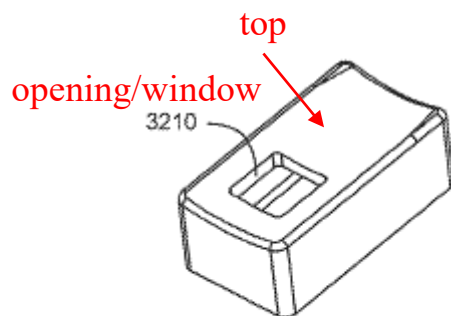


FIG. 32B

APPLE-1001, FIGS. 32A-32B; APPLE-1003, ¶98. Indeed, Dr. Madisetti in his rebuttal expert report submitted in the related litigation agreed that “the ’911 Patent’s detector window 3210 in the shoebox 3200 provides written description for the claimed ‘opening.’” APPLE-1082, ¶907.

15. Additionally, similar to Abdul-Hafiz, the ’911 patent discloses an EMI shield. Specifically, the ’911 patent discloses “...The foil 2450 is wrapped around the shielded detector with the foil side in and the aperture 2452 is aligned with the EMI shield grid 2444).” APPLE-1001, 13:31-33. This is describing an aperture through which light can pass “aligned with the EMI shield grid”. This configuration of an EMI shield underneath an opening in an enclosure is consistent with the disclosure of an aperture in the housing followed by an EMI shield in Abdul Hafiz. With this in view, if the ’911 patent’s EMI shield were considered a light block (as Masimo and their expert insist must be the case with Abdul Hafiz), on the basis of a

description of an opening and an EMI shield in '911 patent that is equivalent to the description in Abdul Hafiz, then the '911 patent provides no support for this claimed element because the '911 patent's EMI shield has the same grid with multiple openings that is identified by Masimo in Abdul-Hafiz. Further, the '911 patent provides additional details in its disclosure with respect to FIG. 24. Here, the detector assembly 2400 includes an EMI shield 2440 with an EMI shield grid 2444. APPLE-1001, 13:38-54. The '911 patent's FIG. 24 shows the EMI shield grid 2444 has multiple openings.

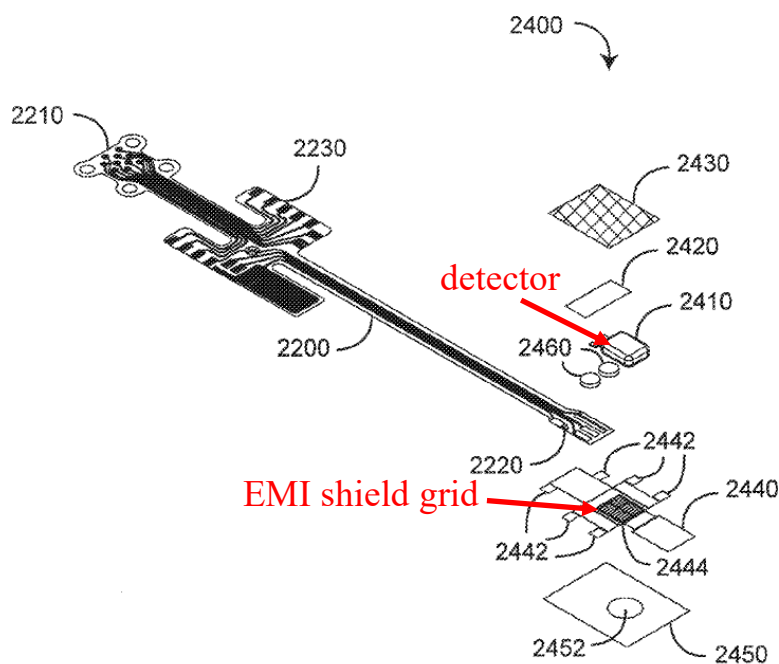


FIG. 24

APPLE-1001, FIGS. 24 (annotated). The '911 patent further explains that “a shoe box 3200... accommodates the detector assembly 2400 (FIG. 24)” and “the detector

assembly 2400 inserts into a shoe [box] 3200.” APPLE-1001, 15:14-23, 19:15-16. As shown in the '911 patent FIG. 46, the detector assembly 2400 including EMI shield 2440 with EMI shield grid 2444 inserts into shoe box 3200. The shoe box 3200 is the light block and does not itself include an EMI shield. As also shown in the '911 patent's FIG. 24, the EMI shield grid 2444 has multiple openings that are positioned beneath the opening in the shoebox.

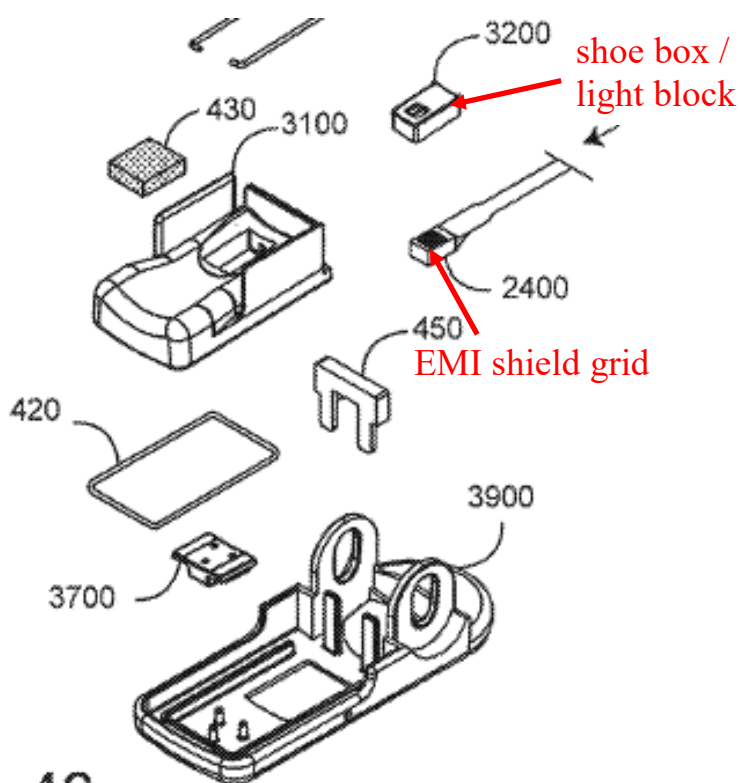


FIG. 46

APPLE-1001, FIG. 46 (annotated). To the extent '911 patent discloses a light block with only one opening, Abdul-Hafiz discloses this same feature to the same level of detail.

D. Abdul-Hafiz discloses an opening/window with an area smaller than the detector's detection surface area at least as well as the '911 patent itself discloses this element.

16. Patent Owner argues that:

App'x 930, 934 (Fed. Cir. 2016) (same). Abdul-Hafiz's figures do not disclose an opening or window with an area smaller than a detection surface area of the detector because its specification is silent on the precise dimensions and sizes that Apple relies on, as explained below.

Abdul-Hafiz does not explicitly disclose that its figures are drawn to scale.

POR, 28.

Additionally, Abdul-Hafiz's specification never describes the dimensions of the features Apple relies on: the diameter of the aperture (470) and the length and width of the detector (820)/photodiode chip (821). EX1004 ¶¶5, 7, 33-34, 37, 39, 46; EX2079 ¶85. It also never describes the precise sizes of those components or how those component sizes compare to one another. EX1004 ¶¶5-7, 33-34, 37-39, 46; EX2079 ¶85. Therefore, Abdul-Hafiz's figures "*do not define the precise proportions of the elements and may not be relied on to show particular sizes*" of its aperture (470) or detector (820)/photodiode chip (821) because its specification is silent on this issue. *Hockerson-Halberstadt*, 222 F.3d at 956. Accordingly, Apple

POR, 29. As with other claim terms discussed elsewhere in this declaration, Patent Owner appears to hold the prior art to a higher standard of disclosure than the '911 patent. The '911 patent's "Detailed Description," while lengthy, provides no description of this feature. It never mentions the terms "opening" or "detection

surface area,” uses the term “window” only once, and never describes the opening/window as having an area smaller than a detection surface area of the detector. While the ’911 patent describes a detector pad and enclosure to block ambient light and reduce light piping, the ’911 patent never mentions an opening/window with an area smaller than the detector’s detection surface area to block ambient light and reduce light piping:

As shown in FIG. 4, the detector pad **3100** is structured to properly position a fingertip in relationship to the detector assembly **2400**. The pads have flaps that block ambient light. The detector assembly **2400** is housed in an enclosure so as to reduce light piping from the emitter assembly to the detector assembly without passing through fingertip tissue.

APPLE-1001, 6:42-47.

FIGS. **31A-H** illustrate a detector pad **3100** having detector pad flaps **3110**, a shoe box cavity **3120** and isolation notches **3150**. The detector pad flaps **3110** overlap with emitter pad flaps **3010** (FIGS. **30A-H**), interleaving to block ambient light. The shoe box cavity **3120** accommodates a shoe box **3200** (FIG. **32A-H**) described below. Isolation

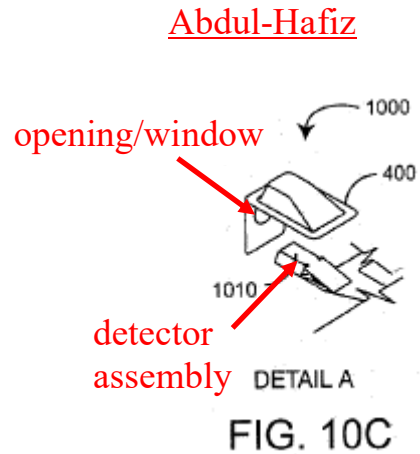
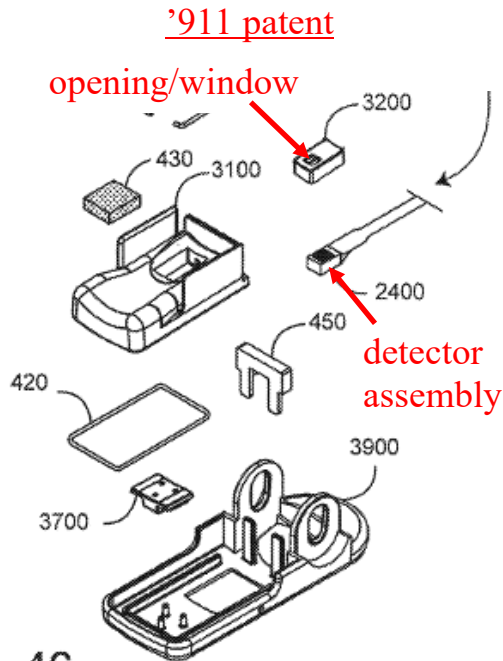
APPLE-1001, 15:4-9.

FIGS. **32A-H** illustrate a shoe box **3200** that accommodates the detector assembly **2400** (FIG. **24**). A detector window **3210** provides an optical path from a tissue site to the detector **2410** (FIG. **24**). A flex circuit notch **3220** accommodates the flex circuit tail **2206** (FIG. **22**) routed from the emitter pad **3000** (FIGS. **30A-H**). In one embodiment, the shoe box **3200** is colored black or other substantially light absorbing color and the emitter pad **3000** and detector pad **3100** are each colored white or other substantially light reflecting color.

APPLE-1001, 15:14-23.

17. As such, I relied on the figures of the '911 patent to interpret this claim limitation. The only plausible support for this element appears to be FIG. 46 which shows the detector assembly 2400 and the shoe box 3200 with the window 3210 in the same figure. The '911 patent FIG. 46 appears to show that the opening/window has an area smaller than the entire surface area of one side of the detector. Thus, FIG. 46 indicates to a POSITA that the “detection surface area” recited in the claims would be the surface area of the light-detecting side of the detector. Indeed, Dr. Madisetti in his rebuttal expert report submitted in the related litigation stated that a “POSITA would have known that the detection surface area of a given detector is essentially the entire surface area of the detector.” APPLE-1082, ¶911.

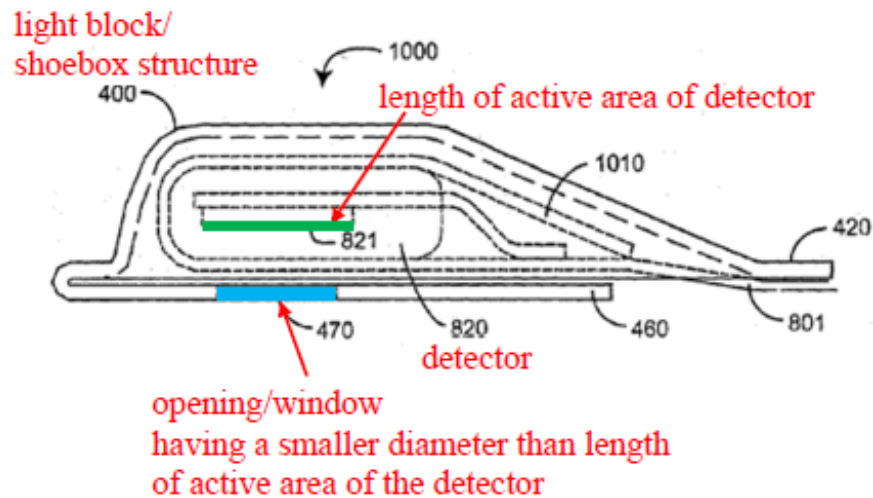
18. Abdul-Hafiz’s specification and figures are at least as, if not more, detailed than the '911 patent’s specification and figures supporting this element. As such, Abdul-Hafiz satisfies this element in at least the same way as and beyond the '911 patent, i.e., from its figures. A visual inspection of the '911 patent’s FIG. 46 and Abdul-Hafiz’s FIG. 10C shows the same relationship between the detector and the opening/window with respect to this element.



APPLE-1001, FIG. 46 (left, annotated); APPLE-1004, FIG. 10C (right, annotated).

19. In addition to Abdul-Hafiz's FIG. 10C, Abdul-Hafiz's FIGS. 6A, 3, and 11B consistently show the opening/window smaller than the detector's detection surface area. Abdul-Hafiz's FIG. 6A shows that the length of the side of the light-detecting area of Abdul-Hafiz's detector 820 is longer than the diameter of Abdul-Hafiz's aperture 470:

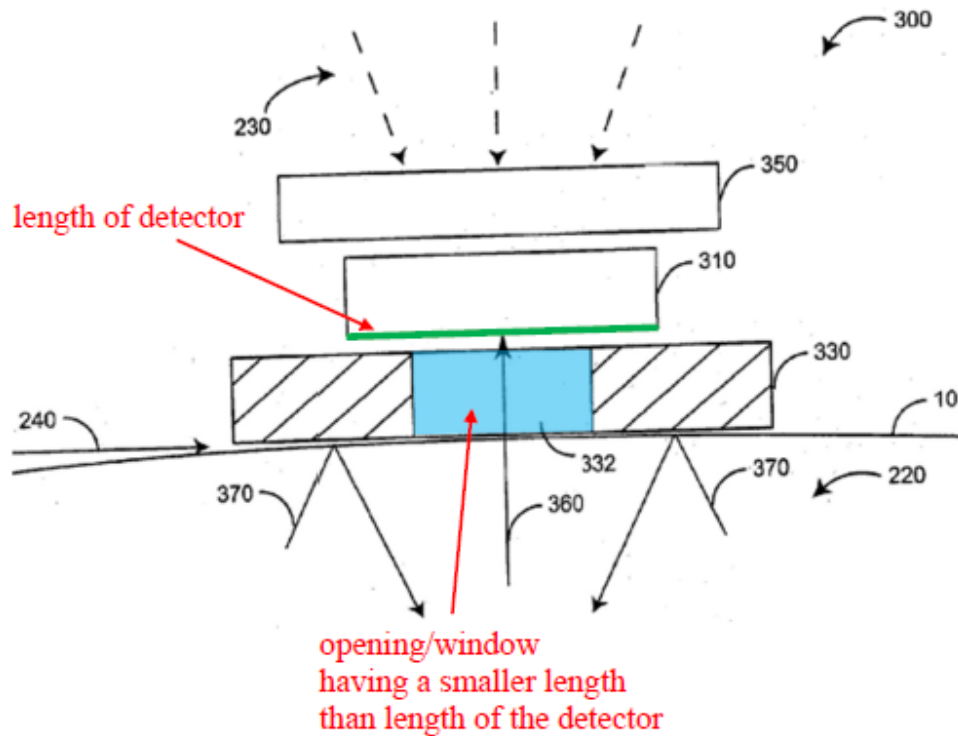
Abdul-Hafiz+Raley's shielded detector assembly



APPLE-1004, FIG. 6A

APPLE-1004, FIG. 6A (as annotated in APPLE-1003, ¶101). Abdul-Hafiz explains that the “housing 400 is configured to accept a detector 820 (FIGS. 6A-B) and *provide ambient light and piped light reduction*” and the “base 460 also provides a spacer and aperture *to reduce light piping.*” APPLE-1004, [0033], [0037].

20. Additionally, Abdul-Hafiz’s FIG. 3 shows that the length of the side of the light-detecting area of Abdul-Hafiz’s detector 310 is longer than the diameter of Abdul-Hafiz’s aperture 332, and provides explanation of the importance of the relative size of these elements for success in reducing light piping:



APPLE-1004, FIG. 3

APPLE-1004, FIG. 3 (as annotated in APPLE-1003, ¶102). A POSITA would have recognized that Abdul-Hafiz's FIG. 3 in conjunction with its accompanying description teaches that piped light 240 and some off axis portions 370 of propagated light 220 are blocked because of the relation between the size of the aperture 332 and the size of the detector 310:

[0004] FIG. 3 illustrates a prior art low noise sensor 300. The sensor 300 has a detector 310, a spacer 330 and an optical shield 350. The detector 310 is configured to receive light 220 that has propagated through a tissue site 10, as described with respect to FIGS. 1-2, above. The spacer 330 is positioned between the tissue site 10 and the detector 310, providing an optical barrier so as to reduce the intensity of piped light 240 that reaches the detector 310. The spacer 330 defines an aperture 332 that allows a transmitted portion 360 of propagated light 220 to reach the detector 310. A blocked portion 370 of propagated light 220 is reflected back into the tissue and/or absorbed by the spacer 330, depending upon the spacer material. The optical shield 350 may be a metal foil or other opaque material that prevents ambient light 230 from reaching the detector 310. Further, the detector 310, spacer 330 and optical shield 350 may be enclosed in a housing (not shown) of opaque material that further prevents ambient light 230 from reaching the detector 310. A low noise sensor is described in U.S. Pat. No. 5,782,757, cited above.

APPLE-1004, [0004]. Abdul-Hafiz clearly indicates that the optical housing 400 shown in FIGS. 4A-C, and also shown in FIGS. 6A and 10C, incorporates the functions, and thus the benefits, of FIG. 3:

[0033] FIGS. 4A-C illustrate a low noise optical housing 400 having a protruding cover 410, a generally flat flange 420 disposed around the periphery of the cover 410, and a generally flat base 460 adjoining the flange 420. The housing 400 is configured to accept a detector 820 (FIGS. 6A-B) and provide ambient light and piped light reduction. In particular, the low noise optical housing 400 advantageously incorporates the functions of a light barrier, opaque cover, spacer and aperture, as described with respect to FIG. 3, above, in a relatively small, easy to manufacture, one-piece design.

APPLE-1004, [0033]. Neither Patent Owner nor Dr. Madisetti dispute that FIG. 3 “more clearly shows that the aperture 322 has a smaller length than the length of the

detector 310,” as I discussed in my First Declaration. APPLE-1003, ¶102; POR, 29; EX2079, ¶86. I understand that when Dr. Madisetti was asked whether he disputed that FIG. 3 of Abdul-Hafiz “more clearly shows that the aperture 322 has a smaller length than the length of the detector 310” (EX2079, ¶86 (citing Pet. 47-48)), he stated that he merely disputed “its relevance with respect to [Apple’s] petition” but never indicated that he disputed Abdul-Hafiz’s showing in FIG. 3 of the aperture 322 having a smaller length than the length of the detector 310. APPLE-1083, 50:8-52:3. Based on the explicit statement in Abdul-Hafiz that the “...low noise optical housing 400 advantageously incorporates the functions of light barrier, opaque cover, spacer, and aperture, as described with respect to FIG. 3, above...”, a POSITA would certainly have understood that the “light barrier” and “aperture” and their functions as described with respect to Figure 3 are more than relevant – in fact, these descriptions provide far more support for an opening/window with an area smaller than the detector’s detection surface area than anything provided in the ’911 patent, and certainly provides sufficient support for this element being disclosed in Abdul-Hafiz.

21. With respect to the width of the detector, Abdul-Hafiz’s FIG. 11B reveals that the width of the light-detecting side of Abdul-Hafiz’s detector is at least as wide as the diameter of Abdul-Hafiz’s aperture. As Patent Owner acknowledges, FIG. 11B shows that Abdul-Hafiz’s aperture (470) includes a fixed EMI shield (1005, red).

POR, 30. The EMI shield (1010), which includes fixed shield 1005, is directly folded over the detector (820) such that it becomes a “shielded detector assembly” (1000).

Id. As shown in Abdul-Hafiz FIG. 11B below as annotated by Patent Owner, the EMI shield (1005, red) spans at least the entire area of the aperture (470).

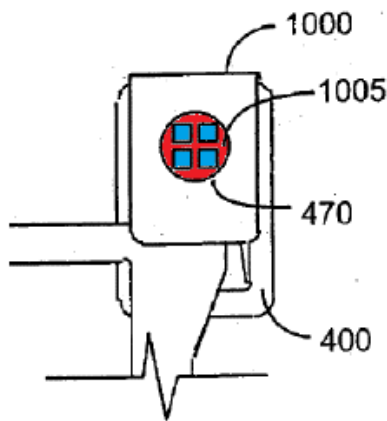


FIG. 11B

APPLE-1004, FIG. 11B (as annotated in POR, 31). In FIG. 11B, the boundary of the EMI shield (1005, red) is under the optical housing (400) and not seen within the aperture (470). Because the EMI shield (1005, red) is part of the EMI shield (1010) that is directly folded over the detector (820), the surface area of the EMI shield (1005, red) is representative of the surface area of the light-detecting side of Abdul-Hafiz’s detector, just like the ’911 patent FIG. 46. Because the EMI shield (1005, red) is rectangular and spans at least the entire area of the aperture (470), the circular aperture (470) has an area smaller than the surface area of the EMI shield (1005, red), and thus the aperture (470) has an area smaller than the light-detecting side of Abdul-Hafiz’s detector, just like the ’911 patent FIG. 46. From Abdul-Hafiz’s FIG.

11B, the surface area of the light-detecting side of Abdul-Hafiz's detector must be bigger than the circle otherwise the boundary of the detector would be visible in the circle. As I explained during my deposition, "the outer boundaries of the detector are not shown in that illustration." EX2080, 114:8-14. Because no detector edges are shown, the diameter of the circle is at most as wide as the smallest dimension of the detector. A POSITA would have understood from Abdul-Hafiz's FIG. 11B that the width of the detector is at least as wide as the diameter of the circular aperture and, given that the length of the detector is known from FIGS. 6A and 3 to be longer than the diameter of the circular aperture, the detection surface area is larger than the surface area of the aperture, as illustrated by the red boundary outline of the detection surface area in FIG. 11B below.

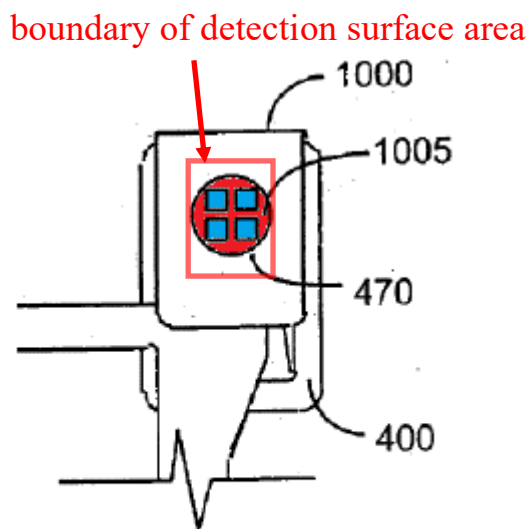


FIG. 11B

APPLE-1004, FIG. 11B (annotated according to Abdul-Hafiz's teachings). As such,

given the longer length and at least equal width and rectangular shape of the light-detecting side relative to the circular diameter of Abdul-Hafiz's aperture, a POSITA would have recognized that Abdul-Hafiz satisfies this element at least as well as the '911 patent itself discloses this element.

22. Patent Owner takes issue with Apple's and my reliance on Abdul-Hafiz's figures as teaching this element. POR, 3, 25-26, 28-29. Patent Owner contends that "patent drawings do not define the precise proportions of the elements and may not be relied on to show particular sizes if the specification is completely silent on the issue." POR, 28. But in the related litigation, I understand that Dr. Madisetti states that "the '911 Patent, including the text of its specification, indicates that FIG. 46 is drawn relative to scale and therefore informs a POSITA about the relative sizing of components in the sensor," and that Apple's expert in the litigation, Dr. Warren, "did not consider all the relevant text and figures." APPLE-1082, ¶¶924-941. In this IPR, Dr. Madisetti is committing the same error that he accuses Dr. Warren of committing by ignoring important disclosures of Abdul-Hafiz that I refer to above.

23. In his rebuttal expert report, Dr. Madisetti disputed that there is nothing in the '911 patent "indicating that the figures are drawn to scale or otherwise define the proportions of the elements." APPLE-1082, ¶929. In doing so, Dr. Madisetti reasoned that "FIG. 46 is described in the specification as 'a detailed exploded perspective view' of how each component in the overall 'sensor' 400 goes together,

and thus a POSITA would have readily understood that FIG. 46 is drawn relative to scale.” APPLE-1082, ¶930. With respect to Abdul-Hafiz’s figures with similar descriptive text and views, however, Dr. Madisetti stated that they are not drawn to scale:

[0020] FIGS. 6A-B are detailed side views of alternative embodiments of a low noise optical housing enclosing a detector;

APPLE-1004, [0020].

Q So paragraph 20 says that "FIGS. 6A-B are detailed side views of alternative embodiments of a low noise optical housing enclosing a detector."

Is that language sufficient for a POSITA to interpret Figures 6A-B as precise and drawn to scale?

A No, I don't believe so because it just shows that it is identifying the various components.

It does not state that the figure is drawn to scale.

APPLE-1083, 33:18-34:6.

[0026] FIGS. 10A-C are detailed perspective views of an unassembled, a partially assembled and a fully assembled EMI shield, respectively, prior to low noise optical housing installation;

APPLE-1004, [0026].

Q So paragraph 26 says, "FIGS. 10A-C are detailed perspective views of an unassembled, a partially assembled, and a fully assembled EMI shield, respectively, prior to low noise optical housing installation."

Is that language in Abdul-Hafiz sufficient for a POSITA to interpret Figures 10A-C as precise and drawn to scale?

A No. As I mentioned, from a technical point of view, these just show the different components of the assembly.

This does not tell me or state that the figures are drawn to scale.

APPLE-1083, 34:9-21. Therefore, Dr. Madisetti is inconsistent in his opinions regarding whether each of the '911 patent and Abdul-Hafiz discloses this claim element.

24. Patent Owner further argues that:

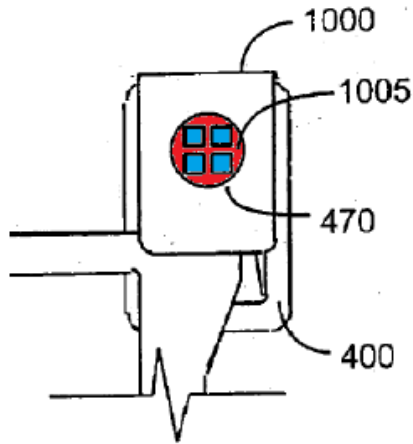


FIG. 11B

EX1004, FIG. 11B. A POSITA would have understood that the four blue areas shown above are the detection surface area of the detector/photodiode (820/821) because the shield (1005) only permits light to reach those four areas of the detector/photodiode (820/821). EX2079 ¶¶87-88. And as shown below, the area of POR, 31-32. Patent Owner relies on Dr. Madisetti's declaration testimony to support this argument, but neither Patent Owner nor Dr. Madisetti points to any support in the '911 patent for its construction of detection surface area being "the four blue areas" where light reaches the detector.

Q Can you point to anything in the '911 Patent to support your interpretation of the detection surface area?

...

A I don't have an opinion with respect to the '911 in my declaration. So I don't -- I don't want to comment on that.

APPLE-1083, 27:4-29:20.

25. As I explained during my deposition, the light can come in at oblique angles and reach portions of the detector/photodiode (820/821) that are under the fixed shield (1005):

Q. And that's because the EMI shield blocks light in those other areas except for the four square openings; right?

A. So whether the shield blocks light in portions of the active area of the detector depends on the angles of those light rays. So there are portions of the active area that I can't see as line of sight in Figure 11 that would still be detecting light rays that come in at oblique angles, slightly oblique angles.

EX2080, 114:15-115:2. Further, as discussed earlier, Abdul Hafiz does not require the EMI shield to be constructed of optically-opaque material, and therefore there is

nothing in Abdul Hafiz to support Patent Owner’s statement that the light incident on the red areas in their annotated version of Figure 11B would be unable to reach the detection surface area. As discussed earlier, a POSITA would have appreciated that there can be optically-transparent EMI shield materials and that nothing in the disclosure of Abdul Hafiz excludes such an EMI shield material, especially since Abdul-Hafiz explicitly refers to a prior art reference which discloses EMI shields made from layers of “...DuPont CB028 silver-filled thermoplastic screenable ink.” APPLE-1086, [0036]. Based on all of this and on the ’911 patent’s FIG. 46, as I explained above, a POSITA would have understood the “detection surface area” recited in the claims to be the surface area of the light-detecting side of the detector.

26. I understand that Patent Owner takes issue with Apple’s and my explanation that Abdul-Hafiz’s detector is “square or rectangular”:

its length. EX1004, FIGS. 3, 6; EX2079 ¶94. Because Abdul-Hafiz does not show the width of the detector (820), Apple misleadingly argues the detector is “*square or rectangular*” so that Apple can assume that its length and width are the same. Pet. 48-50. But Apple is wrong. Even if Abdul-Hafiz’s drawings disclosed precise dimensions or sizes (which is incorrect), FIGS. 10A-10B shows that the detector has a *non-square rectangular shape*—not the “square” shape that Apple asserts.

POR, 33-36. Regardless of whether the detector is square or rectangular, as I explained above, Abdul-Hafiz’s FIG. 11B would have been understood to reveal that the width is at least as wide as or wider than the diameter of the circular aperture

and, given that the length is known from FIGS. 6A and 3 to be longer than the diameter of the circular aperture, the detection surface area is larger than the surface area of the aperture, as illustrated by two possible examples of the red boundary outline of the detection surface area in FIG. 11B below.

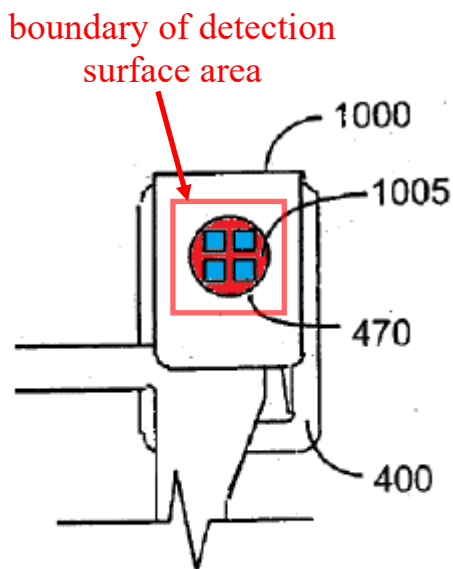


FIG. 11B

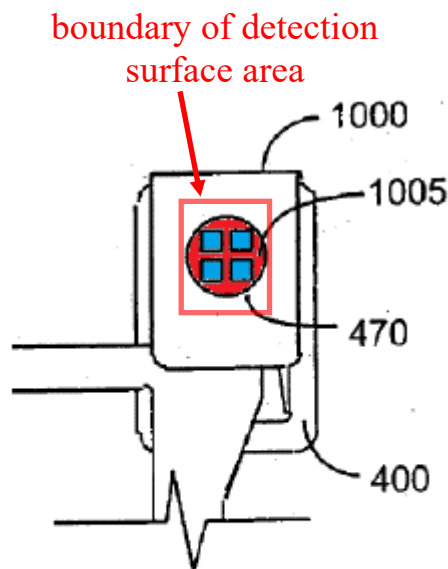


FIG. 11B

APPLE-1004, FIG. 11B (annotated according to Abdul-Hafiz's teachings).

27. I understand that Patent Owner further argues that:

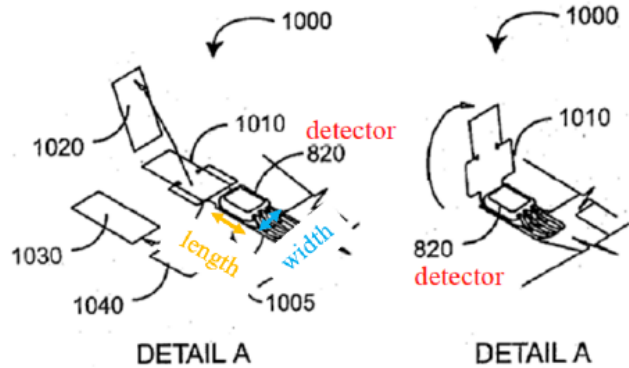
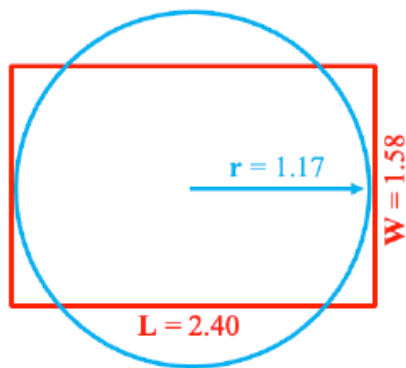


FIG. 10A

FIG. 10B

Further, if Abdul-Hafiz's drawings disclosed precise dimensions or sizes (which is incorrect), FIGS. 10A-10B (above) show that the width of Abdul-Hafiz's rectangular detector is smaller than the diameter of the aperture (470). EX1004, FIGS. 10A-10B; EX2079 ¶95. Thus, a POSITA would have understood that Abdul-Hafiz's aperture area (blue) is not necessarily smaller—and may be larger—than its detection surface area (red), as shown below. EX2079 ¶95.



Area of Aperture
 $\pi \times r^2 = \pi \times 1.17^2 = 4.30 \text{ units}^2$

is greater than

Detection Surface Area
 $L \times W = 2.40 \times 1.58 = 3.79 \text{ units}^2$

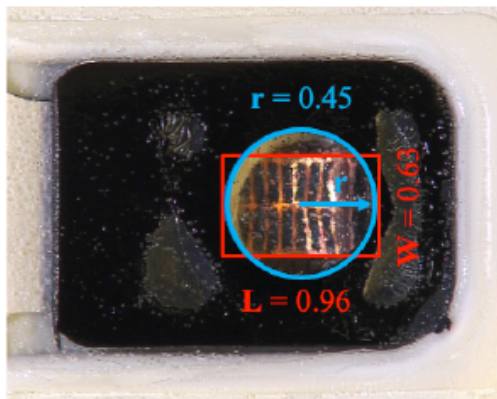
Id. The above illustration of Abdul-Hafiz's aperture (blue) relative to its detection surface area (red) accurately represents the proportions/sizes from its figures.

POR, 34-35. However, FIGS. 10A-10B do not show the aperture, and Patent Owner and Dr. Madisetti do not explain how they arrived at these specific dimensions from the disclosure of Abdul-Hafiz, or even how they have found any basis for the

dimensions shown in this drawing. Because there is no support at all for these specific dimensions of the detector and aperture area in the disclosure of Abdul-Hafiz, a POSITA would not arrive at the same interpretation. Further, there appears to be no reason to select these particular dimensions for the detector area and the aperture area, except that they lead to a detector area that is perhaps 10% smaller relative to the aperture area - by selecting a length that is only 1% larger than the diameter of the aperture (thereby ignoring all of the disclosure related to Figures 3 and 6), and selecting a width that is significantly smaller than the diameter of the aperture (despite the lack of support for this assertion of the relative sizes). There is simply no support for these Patent Owner-selected specific dimensions in Abdul-Hafiz, and meanwhile there is explicit support for a POSITA to find that the length and width of the detector are much larger than these dimensions. Therefore FIGS. 10A-10B do not support Patent Owner's arguments regarding the size of the aperture.

28. Patent Owner then introduces a product from Masimo, the Masimo LNOP sensor, and makes arguments about dimensions of features in this product as support for its arguments about the dimensions of features in Abdul-Hafiz:

EX2079 ¶¶95-96. Indeed, the Abdul-Hafiz patent covers the Masimo LNOP sensor, which also has an aperture with an area *larger than* the detection surface area:



Area of Aperture
 $\pi \times r^2 = \pi \times 0.45^2 = 0.64 \text{ units}^2$

is greater than

Detection Surface Area
 $L \times W = 0.96 \times 0.63 = 0.60 \text{ units}^2$

EX2045; EX2079 ¶96.

POR, 35. But Patent Owner's reliance on the Masimo LNOP sensor is misplaced. Masimo's LNOP sensor may be one particular product embodiment that is possibly related to the Abdul-Hafiz reference. Even if this product happens to be associated with the Abdul-Hafiz reference, the specific details presented by Patent Owner are not within the disclosure of Abdul-Hafiz, which is the disclosure I relied upon in my analysis and the disclosure that a POSITA would have considered in the analysis of the '911 patent's claims. Further, it is clear that the Masimo LNOP sensor is not representative of Abdul-Hafiz because there are differences between the LNOP sensor and Abdul-Hafiz. For example, a visual comparison of the picture of the LNOP sensor with Abdul-Hafiz FIG. 11B shows that the EMI shield grids and the optical housings are different. The differences between the LNOP sensor and Abdul-Hafiz establish that they are not identical, and the LNOP sensor at least embodies a different species of Abdul-Hafiz. Even if the LNOP sensor had an

aperture with an area larger than the detection surface area, that does not establish that this feature of the LNOP sensor necessarily follows from the Abdul-Hafiz's disclosures. Additionally, the dimensions chosen for the length and width of the detection area in the annotated image of the LNOP suffer from the same selection problems that I described above with respect to the dimensions Masimo produces based on FIGS. 10A-B of Abdul-Hafiz. Specifically, there is no reason based on these illustrations for Masimo to select a detector length that is only slightly larger than the diameter of the aperture and a width that is no larger than the openings in the EMI shield layer. Interestingly, this EMI shield in the LNOP product appears to be formed from the Dupont screen-printed ink on a flex material described in the earlier Masimo reference, and therefore is possibly semi-transparent.

E. Abdul-Hafiz also renders obvious an opening/window with an area smaller than the detector's detection surface area.

29. Patent Owner argues that:

the at least one detector.” *Supra* §§VII.A.2-3. And Apple does not propose modifying Abdul-Hafiz or combining it with another reference to have a smaller aperture (470). Pet. 50-51. Thus, Apple fails to even argue, much less show, that a POSITA would have been motivated to modify Abdul-Hafiz to have a smaller “opening”/“window,” or reasonably expected any such modification to succeed. Therefore, the Petition fails to establish that Claims 1 and 10 would have been obvious to a POSITA. EX2079 ¶¶100-101.

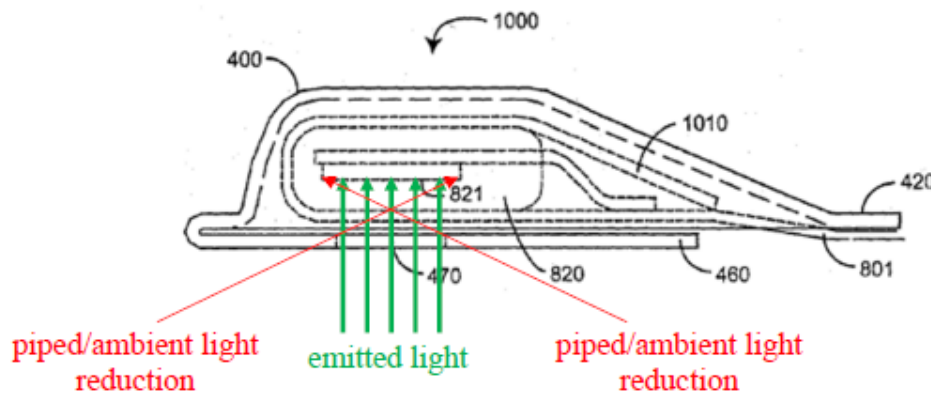
POR, 37. However, my understanding is that Apple did indeed propose that a

POSITA would have found it obvious to modify Abdul-Hafiz to have a smaller aperture, to the extent that Abdul-Hafiz does not explicitly disclose this element:

Abdul-Hafiz shows figures where the aperture has a smaller diameter than the length of the active area of the detector, and thus a POSITA would have understood or found it obvious that Abdul-Hafiz's aperture (opening/window) has an area smaller than the active area of the photodiode chip 821 (detection surface area). APPLE-1003, ¶105.

Pet., 50. The Petition further explained that a POSITA would have been motivated to modify Abdul-Hafiz to have a smaller “opening”/“window” to “desirably reduce the extraneous light entering through the opening of the housing and the finger as a light guide” and to prevent “rays from optical noise sources such as ambient light 230 and piped light 240, which are typically incident on the detector 114 at a large angle of incidence, from reaching the active area of the detector”:

A POSITA also would have understood that such a dimensional relationship between Abdul-Hafiz's aperture and the active area of the photodiode chip 821 is consistent with Abdul-Hafiz's expressly disclosed purpose of the "low noise optical housing 400" to "provide ambient light and piped light reduction." APPLE-1004, [0033]; APPLE-1003, ¶106. That is, based on Abdul-Hafiz's disclosure, a POSITA would have understood or **found it obvious** that Abdul-Hafiz limiting the aperture diameter of its optical housing would desirably reduce the extraneous light entering through the opening of the housing and the finger as a light guide. *Id.*; APPLE-1004, [0003]. Indeed, as shown in the following annotated figure, limiting the aperture diameter relative to the active area of the photodiode chip 821 prevents rays from optical noise sources such as ambient light 230 and piped light 240, which are typically incident on the detector 114 at a large angle of incidence, from reaching the active area of the detector. *Id.*



APPLE-1004, FIG. 6A

Pet., 50-51.

30. To that end, Webster corroborates what a POSITA would have known, that “it is important to minimize the effects from light other than the optical signals of

interest” and for “the pulse oximeter to work effectively, most of the light being transmitted from the LEDs must not reach the photodiode unless it has passed through tissue containing arterial blood.” APPLE-1011, 96¹. According to Webster, to “minimize errors, the pulse oximeter designer must attempt to limit the light reaching the photodiode to that which has traveled through tissue containing arterial blood.” *Id.* One measure that “can be taken to ensure this” involves “decreas[ing] the angle of incidence to the photodiode”, which a POSITA would have understood is achieved by reducing the size of the aperture to reduce the available area for piped light to reach the detector, as shown in the annotated Figure 6A of Abdul-Hafiz above. APPLE-1011, 96-97, FIG. 6.6.

31. Further, U.S. Patent Application Publication No. 2004/0054291 to Schulz et al. also corroborates what a POSITA would have known, describing another example of a transmission probe with opaque material that blocks light and where a “window in the opaque material can be sized as needed to block the proper amount of light from entering the aperture to, for example, avoid saturation of the light detector.” APPLE-1080, [0073].

32. U.S. Patent No. 6,608,562 to Kimura et al. also corroborates a POSITA’s understanding that “sunlight or light from a fluorescent light (extraneous light)

¹ Citations to APPLE-1011 refer to page numbers of the PDF document.

enters the light-receiving device 404” “by being guided by the skin of the finger F” and that “extraneous light having a large angle of incidence θ such as that guided through the skin of the finger F can be blocked” to reduce “erroneous detection caused by the influence of extraneous light” and to increase “the detection capability.” APPLE-1081, 12:51-54, 12:59-63. Kimura describes “a window 412 for limiting the angle of incidence at which light can enter the light-receiving device 404 is provided above the light-receiving device 404.” APPLE-1081, 14:19-23. “The window 412 above the light-receiving device 404 is formed by providing a blocking film 413 capable of blocking light” and “making a hole of a predetermined size in the center of this blocking film 413.” APPLE-1081, 14:23-27. Kimura explains that that “the window width d ” is made “to cut out light having an angle of incidence θ of over $\pm 30^\circ$ ” because “extraneous light guided in through the skin of the finger F can be considered to be incident on the light-receiving device 404 at a large angle of incidence ($\theta \geq 30^\circ$).” APPLE-1081, 14:28-44. “Consequently, since extraneous light can be effectively cut out by limiting the window width d , it is possible to reduce erroneous detection caused by the influence of extraneous light.” APPLE-1081, 14:44-47.

33. Based on a POSITA’s knowledge and understanding as supported by the explicit disclosure of Abdul-Hafiz and corroborated by these references, a POSITA would have readily understood that in transmission probes such as Abdul-Hafiz’s, it

would be desirable to have the opening configured to have a smaller area than the detection surface area of the detector to decrease the angles of incidence to the detector. The modification to Abdul-Hafiz is merely configuring the aperture to have an area smaller than the detection surface area of the detector, and therefore a POSITA would have had a reasonable expectation of success of making such modification.

F. Raley enables measuring four blood analyte levels using four LEDs, and a POSITA would have reasonably expected success in modifying Abdul-Hafiz in view of Raley.

34. Patent Owner argues that Raley did not enable a POSITA to measure four blood analyte levels using four wavelengths of light, and thus a POSITA would not have reasonably expected success in the proposed modification of Abdul-Hafiz and Raley. POR, 21, 39-48. Patent Owner's only technical argument alleges that a POSITA would not have known how to measure four blood analytes with only four wavelengths of light because of other unknown variables such as path length:

Moreover, Apple's algebra argument is technically incorrect. A POSITA would have understood that measuring the "at least four" parameters Apple relies on with four wavelengths depends on more than four unknowns. EX1007, 5:38-40; EX2051, 8:53-60; EX2052, 3:37-55; EX2079 ¶114. Apple's algebra argument is an over-simplification, which can be shown by considering that while oxygen saturation is one parameter, measuring that parameter requires more than one wavelength of light. And Raley does not address other potential problems such as path length, and Jarman merely assumes path length (ΔL) is constant and ignores it. *See generally* EX1005; EX1007, 5:38-40; *id.*, 5:21-6:28; EX2079 ¶114. But a POSITA would have understood that path length readily changes for many reasons (e.g., variations in tissue structure, motion, etc.) and is another unknown variable in the analyte measurements Apple relies on. EX2051, 8:53-60; EX2052, 3:37-55; EX1006, 2:64-3:4; EX2079 ¶114. Apple fails to show that the number of unknown analytes matches the number of wavelengths because that is an oversimplification.

POR, 45, *see also* 42. In this statement, Patent Owner asserts that there are more than four unknowns requiring more than four measurements, and that path length is one such unknown in the case of oximeters as described by Raley and Jarman. But Patent Owner fails to show that any of these alleged additional "unknowns" could not be estimated, canceled out, or calculated to make them "knowns." The one example Patent Owner gives of path length can be estimated away so that it is no longer an additional "unknown." However, as Patent Owner admits (POR, 64; EX2079, ¶145), "Secker explains that this problem of 'differing depth of penetration

at various wavelengths' is limited to reflectance sensors and 'does *not* apply' to transmission sensors":

By such construction, the assumptions of the theory are perfectly met. Particularly, the assumption that the length of a light path through tissue cancels out because the lengths of the light paths at both (or more) wavelengths are equal, is fulfilled. Therefore, the invention allows a considerably more precise measurement of oxygen saturation with a reflection sensor. It has to be particularly emphasized that, in transmission oximetry, the systematic error encountered by different light paths is limited as there are usually two transmitters located very close to each other and a receiver located on the opposite side of the human limb so that the light paths, although not identical, are very close to each other. This does *not* apply in case of reflection oximetry due to the differing depth of penetration at various wavelengths. Therefore, the basic idea of the present invention is more important for application in reflection oximetry, than it is for transmission oximetry.

APPLE-1006, 3:28-45. Dr. Madisetti confirmed this during his deposition:

A Secker says this in the context of -- in the context that is limited to reflectance sensors and does not apply to transmission sensors, which it calls transmission sensors.

So Secker says that this differing depth of penetration at various wavelengths is limited to reflectance sensors.

APPLE-1083, 91:18-92:2, 95:7-16. For transmittance sensors arranged in a fingertip probe such as those described in Raley and Abdul-Hafiz and the '911 patent, the emitters are located very close together, and thus the light paths are very close

together and the path lengths are approximately the same for light emitted by each emitter, as explained in Webster:

wavelength λ_{IR} . If the two sources are positioned at approximately the same location on the finger, the length of the light path through the finger is approximately the same for light emitted by each LED. Thus, the change in the light path resulting from arterial blood flow Δd is approximately the same for both the red and infrared wavelength sources. For this reason, the Δd term in the numerator and the denominator of the right side of equation (9.11) cancel,

APPLE-1011, 144-145, 104. Because the path lengths are approximately the same, the path lengths in the equations cancel out, and this “unknown variable”, which receives considerable attention from the Patent Owner and Dr. Madisetti, is well-accounted for. A POSITA would have understood from the prior art that it is not necessary to independently determine and correct for path length differences in a transmission pulse oximeter, such as described in the '911 patent, Abdul-Hafiz, Raley, and other references. Therefore a POSITA's motivation to modify Abdul-Hafiz to include the four detectors of Raley is not at all reduced by the arguments about “unknown variables” presented by Masimo.

G. A POSITA would have been motivated to modify Abdul-Hafiz to measure more blood analytes.

35. Patent Owner argues that:

Further, a POSITA would not have modified Abdul-Hafiz as Apple proposes because doing so would frustrate Abdul-Hafiz's intended purpose. Abdul-Hafiz, like the Masimo LNOP sensor it covers, was intended to be a low-cost disposable sensor made of a fabric "tape stock," as shown below. EX1004, FIGS. 7A-7C, ¶11, claim 20; EX2038.

POR, 49. Upon considering Patent Owner's argument, the Board stated in its Institution Decision:

Furthermore, even if we agree with Patent Owner that measuring additional blood analytes would increase the cost and inconvenience of Abdul-Hafiz's pulse oximetry system, Patent Owner does not contend that the increased cost and inconvenience would outweigh the benefit of having more functionalities. *See Winner Int'l Royalty Corp. v. Wang*, 202 F.3d 1340,

ID, 32-33. Patent Owner's POR fails to provide any evidence on this point. Patent Owner never asserts that a POSITA would definitively NOT incur the additional costs for the benefit of having more blood analytes being measured.

36. In addition, the '911 patent's claims do not require the sensor be low cost and disposable. Although Abdul-Hafiz describes certain goals, there is no disclosure in either Abdul-Hafiz or Raley that criticizes, discredits, or otherwise discourages their combination. The existence of alternatives, even if better than the proposed combination of Abdul-Hafiz and Raley, does not obviate the motivation to make the combination. Patent Owner's argument, even if correct, does not undermine the obviousness of the Abdul-Hafiz+Raley combination. After performing the

comparison that purportedly indicates the undesirability of the proposed combination, that combination would not vanish from a POSITA's mind and suddenly become non-obvious. A POSITA would have been led to the combination when the additional benefit of measuring more analytes would outweigh the alleged added costs and inconvenience. Additionally, a POSITA would have considered the teaching of Abdul-Hafiz and Raley and the benefits that would arise from the combination, and also considered the cost of modifications, as well as additional choices that would impact cost. As discussed in the Petition and my First Declaration, measuring additional blood analytes is useful and desirable in some realistic situations which would be a benefit that offsets a more complex and more expensive device:

A POSITA would have found it obvious and would have been motivated to incorporate Raley's teachings into Abdul-Hafiz's pulse oximetry system to expand the use of photoplethysmography into the monitoring of additional blood analytes. APPLE-1005, 1:39-45, 3:52-4:9, 5:63-6:2; APPLE-1003, ¶67. A POSITA understood that blood oxygenation can be adversely affected by the generation of additional hemoglobin species, called dyshemoglobins. APPLE-1007, 1:19-36. For example, carboxyhemoglobin is generated when carbon monoxide molecules bind to the hemoglobin in blood. *Id.* An accurate measurement of carboxy hemoglobin concentration in the patient's blood may be needed when the patient is a smoker or if carbon monoxide poisoning is suspected. *Id.*; APPLE-1011, 54. Additionally, elevated methemoglobin levels in the blood can be caused by various medications, illegal drugs, and certain pathological conditions such as sickle cell anemia. APPLE-1007, 1:19-36. Therefore, measurement of the methemoglobin concentration is also useful during patient evaluation. *Id.*

Pet., 18, *see also* 15.

37. Patent Owner additionally argues that:

thus was more expensive to make. A POSITA also would have understood that including the sensor's LEDs in a separate reusable component (e.g., Raley's connector-end (25)) as Apple proposes would have further increased cost because of the need to inspect and clean that component between patients. *Id.* ¶123. Apple's

POR, 50. But the proposed combination was not a bodily incorporation of Raley into Abdul-Hafiz. A POSITA is not compelled to blindly follow the teaching of one prior art reference over the other without the exercise of independent judgment. Rather, a

POSITA, as a person of ordinary creativity, would have been able to implement a low-cost and disposable sensor based on Abdul-Hafiz and Raley's teachings by, for example, including the sensor's LEDs in a disposable component. In this way, Abdul-Hafiz's techniques would still yield its desired cost benefits when applied to a multiple blood analyte device because of the various low cost attributes of Abdul-Hafiz's device that would still be preserved in the modified and enhanced multi-blood analyte device of the Abdul-Hafiz+Raley combination.

H. A POSITA would have been motivated to modify Abdul-Hafiz to compensate for errors in the measurement of oxygen saturation due to the presence of carboxyhemoglobin and methemoglobin.

38. Patent Owner attempts to show no need to improve the accuracy of Abdul-Hafiz's oxygen saturation measurements by relying on the Masimo LNOP sensor:

Third, Apple assumes there was an accuracy problem with Abdul-Hafiz's oxygen saturation measurements. Pet. 18-20. But that is incorrect. Abdul-Hafiz covers the Masimo LNOP sensor, as explained above. *Supra* §III. And the accuracy of the Abdul-Hafiz design (i.e., Masimo's LNOP sensors) was known among POSITAs and highly regarded in the industry. *See, e.g.*, EX2061, 3 ("Over 40

POR, 53-54. As discussed previously, Masimo's LNOP sensor is not the prior art reference cited in the Petition or my First Declaration representing Apple's positions and are not relevant to this topic. Additionally, the LNOP sensor is not a limiting embodiment or even representative of Abdul-Hafiz because there are differences

between the LNOP sensor and Abdul-Hafiz. For example, a visual comparison of the picture of the LNOP sensor with Abdul-Hafiz FIG. 11B shows that the EMI shield grids and the optical housings are different. Further, Abdul-Hafiz does not describe any “advanced signal processing” comparable to that included in the Masimo LNOP sensors. EX2038, 1-2. The differences between the LNOP sensor and Abdul-Hafiz establish that they are not identical, and the LNOP sensor at least embodies a different species of Abdul-Hafiz. Therefore, the accuracy of Masimo LNOP sensors does not necessarily follow from Abdul-Hafiz’s disclosures and does not necessarily reflect the accuracy of Abdul-Hafiz’s measurement.

39. A POSITA would have found it obvious to take a different approach to improve Abdul-Hafiz’s measurements based on prior art references such as Jarman, Barthelemy, and other prior art showing that there was a known need in the art to compensate for errors in oxygen saturation measurements resulting from carboxyhemoglobin and methemoglobin. Pet. 18; APPLE-1003, ¶68; APPLE-1007, 1:63-2:14; APPLE-1008, 3:25-37. Raley expressly teaches that its probe with four emitters would be useful for measuring three or four blood analytes such as oxyhemoglobin, deoxyhemoglobin, carboxyhemoglobin, and methemoglobin. APPLE-1005, 5:65–6:2. Given the established need in the art to compensate for errors in oxygen saturation measurements resulting from carboxyhemoglobin and methemoglobin and Raley’s express teaching of a probe that measures blood

analytes such carboxyhemoglobin and methemoglobin, a POSITA would have been motivated to combine the teachings of Abdul-Hafiz's pulse oximetry system and Raley's probe to compensate for errors in the measurement of oxygen saturation due to the presence of carboxyhemoglobin and methemoglobin. Pet., 15, 18-19. In its Institution Decision, the Board agreed with my analysis:

5:65–6:2. Given the need in the art to compensate for errors in oxygen saturation measurements resulting from carboxyhemoglobin and methemoglobin and Raley's express teaching of a probe that measures blood analytes such carboxyhemoglobin and methemoglobin, we are persuaded, at this stage of the proceeding, that a POSITA would have been motivated to combine the teachings of Abdul-Hafiz's pulse oximetry system and Raley's probe to compensate for errors in the measurement of oxygen saturation due to the presence of carboxyhemoglobin and methemoglobin.

ID, 34.

40. Patent Owner argues that:

Additionally, Apple's insistence on solving an oxygen saturation accuracy problem in Abdul-Hafiz that did not exist with some type of unexplained "compensation" reveals its hindsight-based analysis. EX2079 ¶130. Apple's generic "improve-the-accuracy" motivation is merely a theoretical benefit or possibility of achieving a beneficial result, which fails to show that a POSITA would have been motivated to make the specific combination that Apple relies upon. *Id.*;

POR, 54-55.

Similarly, Apple's expert merely explained that carboxyhemoglobin and methemoglobin "*might*" have motivated the proposed modifications of Abdul-Hafiz.

...

might be important."), 85:20-86:9; EX2079 ¶132. But Apple's assertions that these other measurements *might* be useful do not show that a POSITA **would have been motivated** to modify Abdul-Hafiz to measure these parameters. EX2079 ¶132; *see*,

POR, 55-56. But the motivation is not merely to "build something better." Rather, I articulated a specific motivation (to improve oxygen saturation accuracy), based on evidence of record (Jarman, Barthelemy, and other prior art), to support the conclusion of obviousness. APPLE-1003, ¶¶67-68. I explained a number of circumstances that would inspire the motivation:

additional blood analytes. APPLE-1005, 1:39-45, 3:52-4:9, 5:63-6:2. A POSITA would understand that blood oxygenation can be adversely affected by the generation of additional hemoglobin species, called dyshemoglobins. APPLE-1007, 1:19-36. For example, carboxyhemoglobin is generated when carbon monoxide molecules bind to the hemoglobin in blood. *Id.* An accurate measurement of carboxy hemoglobin concentration in the patient's blood may be needed when the patient is a smoker or if carbon monoxide poisoning is suspected. *Id.*; APPLE-1011, 54 ("Increased levels of COHb, for example, will cause an overestimation in S_aO_2 because the pulse oximeter cannot distinguish between HbO_2 and COHb. In cases of carbon-monoxide poisoning, this could have terrible consequences if the clinician is unaware."). Additionally, elevated methemoglobin levels in the blood can be caused by various medications, illegal drugs, and certain pathological conditions such as sickle cell anemia. APPLE-1007, 1:19-36.

68. In this regard, a POSITA would have found it obvious and would have been motivated to incorporate Raley's teachings into Abdul-Hafiz's pulse oximetry system to further compensate for errors in the measurement of oxygen saturation due to the presence of carboxyhemoglobin and methemoglobin in the blood in above normal levels. APPLE-1007, 1:63-2:14; APPLE-1008, 3:25-37. A POSITA understood that if carboxyhemoglobin or methemoglobin is present in the blood in above normal levels, a conventional two-wavelength pulse oximeter will give falsely high readings for the arterial oxygen saturation. *Id.*

Id.; Pet. 18-20, 25-27; POR, 55-56. These circumstances are corroborated by evidence submitted by Patent Owner:

oxygenated. Since carboxyhemoglobin is a toxic form that can cause death at levels greater than 50%, the development of a pulse oximeter that can separately measure carboxyhemoglobin and oxyhemoglobin will be a major advance in healthcare. Such a device would soon become a standard of care in emergency rooms, ambulances, and many other critical care settings."

EX2046, 2.

hemoglobin and reduced hemoglobin. If any other light absorbers are present in the blood, the pulse oximeter's calibration may be invalid. Intravenous injection of dyes

...

The common dyshemoglobins, methemoglobin and carboxyhemoglobin, have been shown to produce serious errors in SpO₂ readings in animal studies.^{2,3} These errors have been confirmed in clinical case reports.^{4,5} No pre-

...

Given the life-threatening dangers of methemoglobin and carboxyhemoglobin toxicity, a pulse oximeter capable of measuring these dyshemoglobins would be an important addition to our monitoring armamentarium.

EX2047, 1.

Dyshemoglobins in higher than normal concentrations in the arteries can cause either false high or false low readings. The presence of carboxyhemoglobin, such as those encountered in smoke inhalation, will cause a misleadingly high pulse oximeter reading, and therefore readings should be highly suspect on fire accident victims. Methemoglobin is normally found in extremely low blood concentrations. However, if present in high concentration may cause false low values or false high values, since it tends to drive the SpO₂ measurement to 80%. In any case where an abnormal mix of hemoglobin

EX2057. A reasonable practitioner would sometimes have these types of patients,

and in those circumstances, it would be desirable to measure these additional blood analytes to improve the accuracy of the oxygen saturation measurement. In context, “might” means that it is possible that a practitioner to have this type of patient and when they do, it would be desirable to be able to measure the additional analytes. “Might” does not indicate doubt that this could be done. Rather, this could be done by a POSITA, not that it might not be possible to do so.

41. Patent Owner argues that:

Fourth, Apple’s proposed modification is based on Raley—a Datex-Ohmeda reference. Pet. 14-31; EX1005. But a POSITA would have recognized that Datex-Ohmeda’s pulse oximeters were calibrated to be “more insensitive to changes of carboxyhemoglobin and methemoglobin concentrations in blood” than other sensors at the time. EX2063, 9; EX2079 ¶131. Because devices like Raley were already “more insensitive” to carboxyhemoglobin and methemoglobin, a POSITA would not have been motivated to modify Abdul-Hafiz based on Raley to “compensate for errors in the measurement of oxygen saturation due to [these analytes].” Pet. 14-31.

POR, 55. Datex-Ohmeda’s pulse oximeters are not the prior art reference cited in the Petition or my First Declaration representing Apple’s positions and are not relevant to this topic, as is the case with the Masimo LNOP product discussed above. Additionally, the Datex-Ohmeda’s pulse oximeter is not a limiting embodiment or even representative of Raley because there are differences between Datex-Ohmeda’s pulse oximeters and Raley’s disclosure. A comparison of Datex-Ohmeda S/5 M-

Modules Technical Reference Manual with Raley's disclosure shows that the Manual provides many details that are absent in Raley and vice versa. For example, the Manual describes a sensor with two emitters:

A pulse oximeter measures the light absorption of blood at two wavelengths, one in the near infrared (about 900 nm) and the other in the red region (about 660 nm) of the light spectrum. These wavelengths are emitted by LEDs in the SpO₂ probe, the light is transmitted through peripheral tissue and is finally detected by a PIN-diode opposite the LEDs in the probe. The pulse oximeter derives the oxygen saturation (SpO₂) using an empirically determined relationship between the relative absorption at the two wavelengths and the arterial oxygen saturation SaO₂.

EX2063, 22². In contrast, Raley discloses a device with four emitters:

FIG. 3 depicts a bottom elevational view of one embodiment of the patient end of interconnect cable segment 20. The embodiments of FIG. 3 includes four emitters 21, 22, 23 and 24. Such an embodiment would be useful in a photoplethysmographic monitor for measuring three or four blood analytes such as oxyhemoglobin, deoxyhemoglobin, carboxyhemoglobin and methemoglobin. Alternatively, the

APPLE-1005, 5:63-6:2. The differences between the Manual and Raley establish that they are not identical, and the pulse oximeter described in the Manual at least embodies a different species of Raley. Therefore, the sensitivity of the pulse oximeter described in the Manual does not necessarily follow from Raley's disclosure and does not necessarily reflect the sensitivity of Raley's measurements.

I. The Abdul-Hafiz+Raley+Secker combination teaches at least eight or twelve LEDs comprising at least three different wavelengths.

42. Patent Owner argues that:

² Citations to EX2063 refer to page numbers of the PDF document.

Accordingly, none of Apple's combination references teach at least eight or twelve LEDs comprising at least three different wavelengths. Because Apple fails

POR, 59-62, 4. Here, Patent Owner is arguing each reference individually, asserting that none discloses the overall claimed subject matter, rather than properly evaluating the references' combined teachings. Neither Patent Owner nor Dr. Madisetti dispute that Raley discloses LEDs of four different wavelengths and Secker discloses four LEDs for each wavelength, but instead focus on Secker's purported deficiencies individually. Here, a POSITA recognizing that Raley provides LEDs of four wavelengths and Secker provides four LEDs for each wavelength would have found it obvious to provide four LEDs for each of the four wavelengths to obtain the benefits of the Abdul-Hafiz+Raley+Secker combination, resulting in sixteen LEDs.

J. A POSITA would have been motivated to add more LEDs to the Abdul-Hafiz+Raley combination.

43. Patent Owner argues that:

Secker describes a particular approach of using more LEDs to solve a problem that was limited to reflectance sensors. But Apple relies on Secker's approach to propose adding LEDs to the Abdul-Hafiz+Raley sensor—a different type of sensor known as a transmittance sensor. Accordingly, Secker's approach would not have motivated a POSITA to add more LEDs to the Abdul-Hafiz+Raley sensor. EX2079 ¶143.

POR, 63-67. However, Secker plainly discloses a sensor including four LEDs for

each wavelength. APPLE-1006, 15:35-46, FIG. 8. Even if Secker allegedly describes a reflectance sensor, this does not preclude a POSITA from utilizing Secker's teachings in combination with prior art transmission sensors.

44. As Webster explains:

In transmission probes, as the photodiode has to detect the light transmitted through the tissue, the detector is placed in line with the LEDs so that the maximum amount of the transmitted light is detected. The photodiode should be

APPLE-1011, 104. If the LEDs are not in line with the photodiode, then the amount of detected light decreases. *Id.* In line with textbook recommendations that the detector should be placed in line with the LEDs, Abdul-Hafiz discloses mounting the emitter at different positions to accommodate different sized patients or different tissue site thicknesses and invites a POSITA to look to other electrical and mechanical structures that allow detector-emitter spacing adjustment:

contact set **1112** (not shown). The choice of mounting the emitter with a narrower or wider spacing accommodates different sensor types for different sized patients or different tissue site thicknesses with fewer unique sensor parts or

APPLE-1004, [0047], [0049], FIGS. 11A-11B, 11D-11E.

elongated aperture **1170** (**FIG. 11C**). One of ordinary skill in the art will recognize other electrical and mechanical structures that allow such detector-emitter spacing adjustment.

APPLE-1004, [0050]. To that end, a POSITA would have recognized that Secker's teachings allow detector-emitter spacing adjustment. Pet., 78-79. Indeed, Patent Owner admits that Secker describes techniques for adding and selecting LEDs to

achieve the optimal light path. POR, 64-67; EX2079 ¶145.

45. Patent Owner further argues that:

Abdul-Hafiz never describes or suggests a single sensor that accommodates different sized patients or tissue thicknesses, much less sets that functionality as its “goal.” EX2079 ¶152. Instead, Abdul-Hafiz describes that each of its sensors is for *one patient size/tissue thickness only*—adult, infant (3-10 kg), or neonate (< 3 kg).

POR, 68-69. But neither I nor the Petition ever stated that Abdul-Hafiz alone describes or suggests “a *single sensor* that accommodates different sized patients or tissue thicknesses.” In this case, a POSITA would have recognized that “different tissue structures between fingers of different patients” (APPLE-1006, 13:35-37) and “variations in the flesh of e.g. a finger even from patient to patient” exists (APPLE-1006, 14:19-22), and also that “thickness of the tissue, the distance between the LED and the photodiode... will vary from patient to patient” (APPLE-1011, 69) based on prior art disclosures such as Secker and Webster. A POSITA would have also understood, based on Webster’s teachings, that the “thickness of the finger” changes “the path length for the light that is transmitted through the finger.” APPLE-1011, 143. In line with these teachings, Abdul-Hafiz discloses mounting the emitter at different positions to accommodate different sized patients or different tissue site thicknesses. APPLE-1004, [0047], [0049]-[0050], FIGS. 11A-11B, 11D-11E; Pet., 78-79. A POSITA would have recognized that these variations in finger tissue and thicknesses exist even in transmittance applications and would have been motivated

to provide a sensor that accommodates different sized patients or tissue thicknesses.

Id. This would obviate the need for the physician or clinician to select the appropriately sized sensor for the patient's finger. Patent Owner does not dispute that it would be beneficial to provide a single sensor that accommodates different sized patients or tissue thicknesses.

46. Patent Owner further argues that:

Secker discusses an approach of automatically selecting LEDs to obtain equal tissue penetration depth by different wavelengths in reflectance sensors, as explained above. But Secker never describes or suggests using that approach to accommodate different sized patients or tissue thicknesses. EX1006; EX2079 ¶156. Instead,

POR, 69-70. Neither I nor the Petition ever stated that Secker describes or suggests using its approach of automatically selecting LEDs to accommodate different sized patients or tissue thicknesses. Rather, the Petition established that the Abdul-Hafiz+Raley+Secker combination would provide such a sensor. Pet., 78-82. As I explained above, Secker recognizes “different tissue structures between fingers of different patients” (APPLE-1006, 13:35-37) and “variations in the flesh of e.g. a finger even from patient to patient” exists (APPLE-1006, 14:19-22), and Webster also states that “thickness of the tissue, the distance between the LED and the photodiode... will vary from patient to patient” (APPLE-1011, 69). A POSITA would have also understood, based on Webster's teachings, that the “thickness of the finger” changes “the path length for the light that is transmitted through the

finger.” APPLE-1011, 143. A POSITA would have recognized that these variations in finger tissue and thicknesses exist even in transmittance applications. Secker discloses that “[s]uch an automatic adaptation system may be used for **all kinds of applications, patients and tissue characteristics**; it always selects the best possible transmitter/receiver combination for a particular kind of measurement.” EX1006, 7:35-40. Secker’s description of reflection sensors does not constitute a teaching away from use of Secker’s teachings in transmittance sensors.

IV. CONCLUSION

47. 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.

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