a light block configured to prevent at least a portion of light from the plurality of light-emitting diodes from reaching the plurality of photodiodes without first reaching the tissue; and

a processor configured to receive and process the outputted at least one signal and determine a physiological parameter of the user responsive to the outputted at least one signal; and

a processing device configured to wirelessly receive physiological parameter data from the physiological monitoring device, wherein the processing device comprises a user interface, a storage device, and a network interface configured to wirelessly communicate with the physiological monitoring device, and wherein the user interface includes a touch-screen display configured to present visual feedback responsive to the physiological parameter data.

Id. at 17:20-18:18.

27. The system of claim 20, wherein at least one of the plurality of light-emitting diodes is configured to emit light of a first wavelength and at least one of the plurality of light-emitting diodes is configured to emit light of a second wavelength, the second wavelength being different than the first wavelength.

Id. at 16:21-23.

C. Level of Ordinary Skill in the Art

The parties have stipulated to the same level of ordinary skill in the art for the '745 patent as the Poeze patents:

> [A] person with a working knowledge of physiological monitoring technologies. The person would have had a Bachelor of Science degree in an academic discipline emphasizing the design of electrical, computer, or software technologies, in combination with training or at least one to two years of related work experience with capture and processing of data or information, including but not limited to physiological monitoring technologies. Alternatively, the person could have also had a Master of Science degree in a relevant academic discipline with less than a year of related work experience in the same discipline.

Joint Stipulation of Facts ¶ 10, EDIS Doc. ID 770692 (May 13, 2022).

D. Claim Construction

The parties dispute the construction of the term "second shape" in claims 1 and 20, but they agree that the differences between their proposed constructions do not affect any disputed

issue. *See* CIB at 185-86; RIB at 163-64. Accordingly, this term shall be construed to have its plain and ordinary meaning, which the parties agree is "a shape different from the first shape." *See Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (Claims must be construed "only to the extent necessary to resolve the controversy.").

E. Infringement

Complainants allege that the Accused Products infringe claims 9 and 27 of the '745 patent, relying on a theory of induced infringement with respect to claim 27. CIB at 188-202. Apple only disputes infringement with respect to the "first shape" and "second shape" limitations. RIB at 164-73; RRB at 81-88. For the reasons discussed below, the undersigned finds that Complainants have not shown, by a preponderance of the evidence, that the Accused Products infringe claims 9 or 27 of the '745 patent.

1. '745 Patent Claim 9

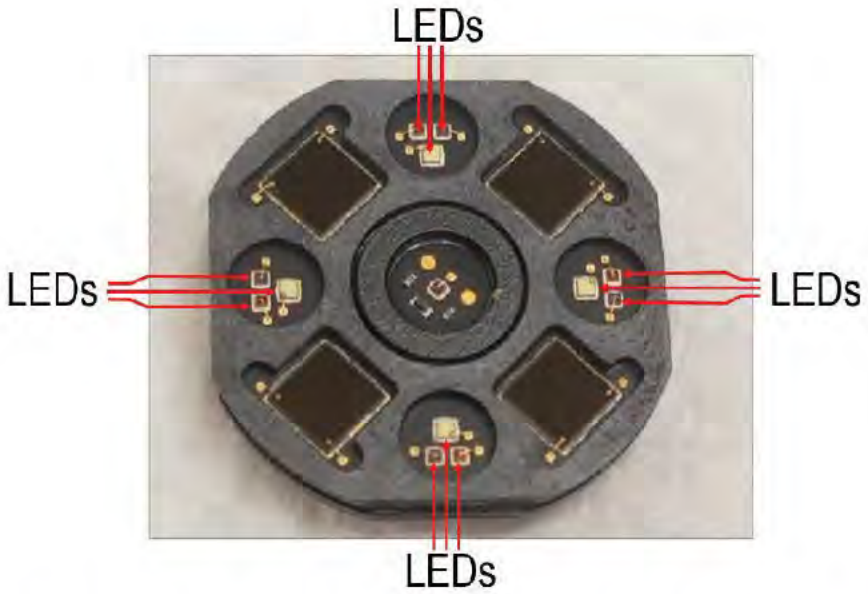
a. Element [1 preamble]: "A physiological monitoring device comprising"

There is no dispute that each of the Accused Products is a "physiological monitoring device" as required by the preamble of claim 1. *See* CIB at 188.[66] Dr. Madisetti identified evidence that the Accused Products are devices that can measure blood oxygen. Tr. (Madisetti) at 729:24-730:6; CDX-0011C.073; CX-0241C (Apple Watch Series First Look); CX-1532 at 4-5 (Apple Watch Series 6 Press Release); CX-1447 at 7 (Apple Watch Series 7 website); CX-1449 at 2 (Apple Watch Series 7 website). Accordingly, the evidence of record shows that the preamble limitations are met by the Accused Products.

[66] The parties have stipulated that the preambles of the asserted patent claims are limiting. *See* Joint Stipulation of Facts ¶ 9, EDIS Doc. ID 770692 (May 13, 2022).

b. Element [1A] "a plurality of light-emitting diodes configured to emit light in a first shape"

There is no dispute that each of the Accused Products has a plurality of light-emitting diodes emitting light in a shape. *See* CIB at 188-90. Dr. Madisetti identified four sets of red, infrared, and green LEDs on the sensor board of the Accused Products. Tr. (Madisetti) at 730:7-731:1.

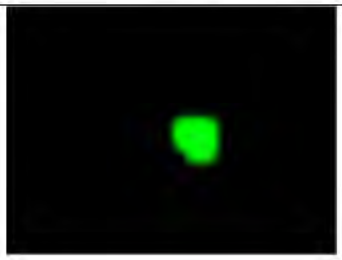


CDX-0011C.074 (labeling LEDs on CX-1548C at 37); *see also* CX-0281C (Block Dep. Tr.) at 83:11-85:16 (identifying LEDs in the Accused Products); Tr. (Mehra) at 855:4-856:14 (describing LEDs in the Accused Products); CX-0057C at 2 (Series 6 schematic); CX-0059C at 2 (Series 7 schematic).

Dr. Madisetti also used a camera to capture images of the light emitted by the LEDs in the Accused Products. Tr. (Madisetti) at 724:14-729:23, 730:7-731:1.

Green (Surface)	Red (Surface)	IR (Surface)
		

CDX-0011C.074 (citing CX-1546C at 5, 15, 1); CIB at 189-90. Dr. Madisetti also captured images of the light 2mm from the LEDs—before passing through a [redacted] Tr. (Madisetti) at 745:5-25.

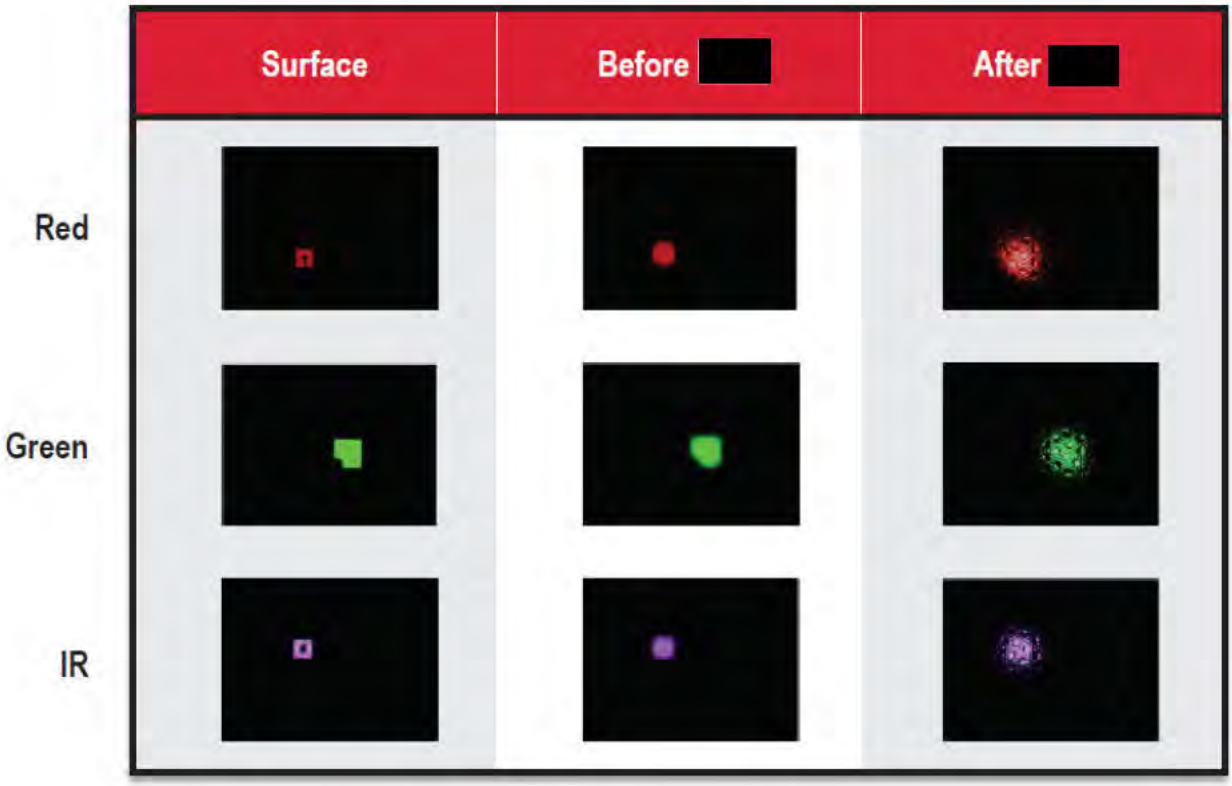
Green [redacted]	Red [redacted]	IR [redacted]
		

CX-1546C at 5, 15, 1; *see* CDX-0011C.091; CIB at 189-90.[67] There is no dispute that this light is emitted in a shape, and accordingly, the evidence of record shows that this limitation is met.

[67] As discussed *infra* in the context of the "material" limitation, the relevant "first shape" is the shape of the light before passing through the lens.

c. Element [1B]: "a material configured to be positioned between the plurality of light-emitting diodes and tissue on a wrist of a user when the physiological monitoring device is in use, the material configured to change the first shape into a second shape by which the light emitted from one or more of the plurality of light-emitting diodes is projected towards the tissue"

With respect to the "material configured to be positioned between the plurality of light-emitting diodes and tissue on a wrist of a user," Dr. Madisetti identified a [redacted] that is positioned between the LEDs and the wrist of the user. Tr. (Madisetti) at 731:25-732:24; CDX-0011C.076. Dr. Madisetti used a camera to capture images of the light 2mm from the LEDs—before passing through [redacted]. Tr. (Madisetti) at 745:5-25; CDX-0011C.091 (citing CX-1546C at 5, 15, 1). He also captured images of the light after passing through [redacted] and compared the shape of the light at three locations—at the LEDs, before [redacted] and after [redacted]. Tr. (Madisetti) at 732:25-733:18, 747:3-12.



CDX-0011C.091 (citing CX-154C at 1, 5, 15). He offered his opinion that the "first shape" at the surface of the LEDs and before [redacted] is different from the "second shape" after [redacted]. Tr. (Madisetti) at 732:25-733:18, 747:3-12. He testified at the hearing: "So you can see clearly with our naked eye that the shapes before [redacted], which is the first shape, and the second shape, which is after [redacted], are different." *Id.* at 733:15-17.

Apple argues that this limitation is not infringed for two reasons: (1) the "first shape" emitted by the LEDs is not the same "first shape" entering [redacted]; and (2) [redacted] is not configured to change the "first shape" into a "second shape." RIB at 164-73; RRB at 81-88. These two issues are addressed separately below:

(i) "first shape"

Apple argues that the plain language of the claim requires the "first shape" of the light emitted at the LEDs to be the same "first shape" of the light received by [redacted]. RIB at 164-65. Apple points to Figure 7A, where there is no gap between the emission of light at LED 702 and the light diffuser 704 where the light is received. JX-009 at 10:65-11:2, Fig. 7B; *see* Tr. (Sarrafzadeh) at 1112:22-1113:10. Apple engineer Dr. Venugopal testified that the LEDs in the Accused Products "have a square shape" and emit light that "is square in shape." Tr. (Venugopal) at 830:4-5, 830:19-22. He further explained that the light emitted from the LEDs "spreads significantly in all direction[s] based on the physics of the LED surface and spreads towards the microlens array and assumes a generally circular shape." *Id.* at 830:25-831:3. Apple's expert Dr. Sarrafzadeh offered opinions that are consistent with Dr. Venugopal's testimony, identifying the square shape of light emitted from the LEDs, which "changes to more of a circular shape, as expected by Lambertian emission." Tr. (Sarrafzadeh) at 1115:2-15. He described the shape of the light at the LEDs as "more of a square shape-ish" and "a concave

polygon." *Id.* at 1115:25-1116:11. He described the shape of the light received by [redacted] as "more of a closer to a circle shape" and a "convex polygon." *Id.* Relying on "fundamentals of geometry," he testified that "concave polygons are fundamentally different from convex polygons." *Id.* He offered his opinion that "the shape that is emitted at the surface of LED is fundamentally different from the shape that is received by [redacted], as we saw in the three examples, and we know that because of physics." *Id.* at 1116:23-1117:8.

Complainants disagree with Apple's interpretation of this claim language, arguing that the designation of the "first shape" in the claims does not require that the shape be unchanged between the LEDs and [redacted]. CIB at 186. Complainants submit that the specification only discusses changes in shape caused by the "beam shaper" that receives light from the LEDs before reaching the user's skin. *See* JX-009 at 7:42-56. Complainants identify a gap between the light emitter and the beam shaper depicted in Figure 3 of the specification, arguing that Apple's interpretation of the claim language would exclude this embodiment. CIB at 187; *see* JX-009 at Fig. 3. Dr. Madisetti reviewed the disclosures in the specification and offered his opinion that the claims "do not require the material to receive light in the same shape that was emitted by the LEDs." Tr. (Madisetti) at 746:13-747:2. Complainants argue that the "first shape" is any shape emitted from the LEDs in between the LEDs and the material. *See* CRB at 110 ("In the claims, the 'first shape' refers to any shape of light emitted by the LEDs before the claimed 'material' changes it into a second shape.").

In consideration of the parties' arguments, the undersigned finds that the language of claim 1 does not require that the emitted light has the same "first shape" at the surface of the LEDs as it has at the surface of the "material configured to change the first shape into a second shape." The first limitation of the claim provides that the LEDs are "configured to emit light in a

first shape," but the term "emit" is not necessarily limited to the surface of the LEDs. There is light "emitted" from the LEDs described in several other limitations of the claim—light that has been changed into a second shape is described as "light emitted from one or more of the plurality of light-emitting diodes," and certain light that is affected by the light block is also described as "light emitted from the plurality of light-emitting diodes." *See* JX-009 at 15:38-41, 15:54-57. Accordingly, while Apple has offered a plausible interpretation of the claim language to refer to the shape of light at the surface of the LEDs, it is clear from other limitations of the claim that the term "emit" is not limited to this meaning.[68]

The specification of the '745 patent supports this interpretation of the "first shape" limitation. When describing the Figure 3 embodiment that is shown with a gap between the emitter and the light diffuser, the specification provides that "[t]he light diffuser 304 receives the optical radiation emitted from the emitter 302 and spreads the optical radiation over an area." JX-009 at 7:42-44, Fig. 3. The same language is used in the context of Figure 7A, which does not show a gap between the emitter and the light diffuser: "The light diffuser 704 receives the optical radiation emitted from the emitter 702 and homogenously spreads the optical radiation over a wide, donut-shaped area." *Id.* at 10:65-11:2, Fig. 7A. In both embodiments the light "emitted from" the LEDs is the light received at the light diffuser, which takes this light and spreads it into a wide shape. The spreading and/or shaping of light by the light diffuser is

[68] Claim 15 also refers to light that has passed through a light diffusing material as "light emitted from one or more of the plurality of light-emitting diodes," and certain light that is affected by the light block is also described as "light emitted from the plurality of light-emitting diodes." *See* JX-009 at 16:44-63.

emphasized in the specification,[69] and there is no discussion in the specification of the shape of the light at the surface of the LEDs.

The undersigned thus finds that the reading of the "first shape" limitation that most naturally aligns with the patent's description of the invention is that the light emitted by the LEDs in a "first shape" refers to the shape of the light that is received by the light diffuser, *i.e.* the claimed "material," which is "configured to change the first shape into a second shape."[70] The undersigned thus finds that both Complainants' and Apple's proposed constructions are incorrect. The "first shape" does not refer to "any" shape of the light between the LEDs and the light diffuser, as proposed by Complainants (*see* CRB at 110), and there is no separate requirement that the shape of the light at the surface of the LEDs be the same as the shape of the light that is received by the light diffuser, as proposed by Apple. Accordingly, there is no basis for Apple's non-infringement argument regarding the "first shape."

(ii) "second shape"

With respect to the "second shape," Apple submits that [redacted] is not configured to change the shape of the light passing through it. RIB at 170-73; RRB at 86-87. Dr. Venugopal testified that "[redacted]." Tr. (Venugopal) at 831:4-9. With respect to the shape of the light passing through [redacted], he testified that "[redacted]." *Id.* Reviewing Dr. Madisetti's images of the light before and after [redacted]

[69] The specification describes "the disclosed systems, devices and methods to implement three-dimensional (3D) pulse oximetry in which the emitted light irradiates a larger volume of tissue at the measurement site 102 as compared to the 2D point optical source approach," which is described as "conventional pulse oximetry." JX-009 at 6:21-25, 5:41-43, Fig. 1, Fig. 2.

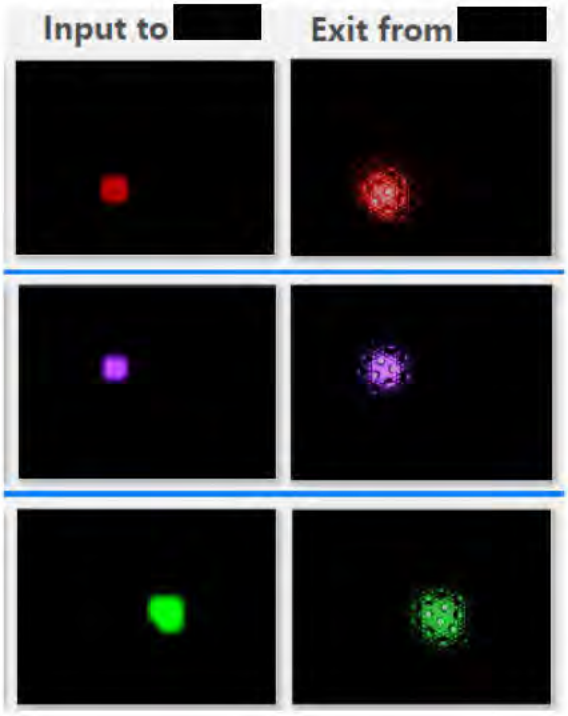
[70] The cases that Apple cites regarding antecedent basis are consistent with this construction, *see* RIB at 164, because the two limitations of the claim refer to the same "first shape."

Dr. Sarrafzadeh offered his opinion that these were the same shape: "the input to [redacted] shapes are more or less a circular form, and as they exit [redacted] they are also more or less a circular form." Tr. (Sarrafzadeh) at 1118:1-11. Dr. Sarrafzadeh acknowledges that there are "dark spots" in the [redacted] images, but he explains that these are variations in intensity rather than shape. *Id.* at 1119:24-1120:4. Apple further argues that Dr. Madisetti failed to explicitly analyze the difference between the "first shape" before [redacted] and the "second shape" after [redacted]. RIB at 172-73.

In reply, Complainants cite Dr. Madisetti's testimony that there is a change in shape between the images before [redacted] and after [redacted]. *See* Tr. (Madisetti) at 747:3-12; CDX-0011C.091. Complainants dispute Dr. Sarrafzadeh's analysis of the dark spots in Dr. Madisetti's images and argue that there is no support for his testimony that intensity variations are not a change in shape. CRB at 115. Complainants cite the '745 patent specification's discussion of a circle and donut as distinct shapes, arguing that a shape is not solely defined by its perimeter. JX-009 at 10:65-11:2. Complainants argue that the difference in shape before and after [redacted] is "self-evident," and "readily apparent." CIB at 194; CRB at 118.

In consideration of the parties' arguments, the undersigned finds that Complainants have failed to carry their burden to prove infringement with respect to the "second shape" limitation. The undersigned agrees with Apple that Dr. Madisetti's analysis with respect to this limitation was unreliable and conclusory. *See* RIB at 160-62. His primary infringement analysis compared the images of the light at the LEDs with images of light after [redacted], *see* Tr. (Madisetti) at 733:5-18; CDX-0011C.077, but as discussed above, the relevant "first shape" is immediately before [redacted], because it is [redacted] that must be configured to change the light from the "first shape" to the "second shape." When Dr. Madisetti compared images of light immediately

before and after [redacted], he only offered conclusory testimony that "you can clearly see that the shape changes." Tr. (Madisetti) at 747:3-12; CDX-0011C.091. Complainants rely on this testimony and argue that the difference between the shapes is "self-evident" or "readily apparent." CIB at 194; CRB at 118. Apple disputes Complainants' contentions, however, and Dr. Sarrafzadeh describes the shapes of the two sets of images as "more or less circular," with shapes that are "relatively the same." *Id.* at 1118:1-24.



RDX-0007.144C (citing CX-0307iC).

The undersigned finds that neither Dr. Madisetti nor Dr. Sarrafzadeh have disclosed a reliable methodology for identifying shapes or determining whether one shape is different from another. Their testimony at hearing comparing the "first shape" images to the "second shape" images was conclusory and unreliable, with Dr. Madisetti failing to even identify the allegedly different shapes that he observed. Indeed, on cross-examination, Dr. Madisetti was presented with several shape outlines and was asked for his opinion on whether the shapes were the same

or different. Tr. (Madisetti) at 782:6-783:12. Despite Complainants' argument that changes in shape are "self-evident," Dr. Madisetti could not offer an opinion as to whether certain at least somewhat different images represented a change in "shape." *Id.* (stating that he could not say whether RDX-12.3 and RDX-12.5 showed a change in shape); *see also id.* at 1384:23-1385:10 (indicating that images in RDX-12.5 were known to him from his own testing). Dr. Madisetti's inability to compare such shapes underscores the lack of any reliable methodology in his infringement analysis. *See* RIB at 168-69.[71]

Moreover, the '745 patent specification describes shapes that are "substantially rectangular, square, circular, oval, or annular, among others." JX-009 at 3:12-14; *see also id.* at 8:9-12 ("a predefined geometry (e.g., a rectangle, square, or circle)"). Another part of the specification describes "a wide, donut-shaped area." *Id.* at 10:65-11:2.[72] Dr. Madisetti did not use any such descriptors to identify shapes in his images of the emitted light in Accused Products—he only offered conclusory opinions that certain shapes were "different" or observing

[71] The specification indicates that that a diffuser may provide a "defined area shape" only in some embodiments of the invention. *See* JX-009 at 3:5-14 ("In certain embodiments of the present disclosure, the diffuser comprises glass, ground glass, glass beads, opal glass, or a microlens-based, band-limited, engineered diffuser that can deliver efficient and uniform illumination. ***In some embodiments, the diffuser is further configured to define a surface area shape*** by which the emitted spread light is distributed onto a surface of the tissue measurement site. The defined surface area shape can include, by way of non-limiting example, a shape that is substantially rectangular, square, circular, oval, or annular, among others."). This language also indicates that light diffusion, in itself, does not necessarily provide changes in "shape." This is reflected in claim 15 of the '745 patent, which is asserted for domestic industry (as part of dependent claim 18) but not for infringement, requiring a "light diffusing material" without any limitations regarding the shape of the light. *Id.* at 16:36-17:3.

[72] All of these references to shapes in the specification refer to the "second shape" after the light diffuser, which is projected on to the skin. There is no discussion of the "first shape" of light before the light diffuser, except in the context of prior art "point optical sources," wherein the measurement site is an "irradiated circular area of the point optical source." JX-009 at 5:54-0, Fig. 1.

"changes" between images. *See* Tr. (Madisetti) at 733:5-18, 747:3-12.[73] The undersigned agrees with Complainants that there are differences in the emitted light before and after [redacted],[74] but Complainants have failed to present sufficient credible evidence that these differences represent two different "shapes." A preponderance of the evidence does not support a finding that the Accused Products meet this limitation.

In addition, there is no evidence in the record that Apple configured [redacted] to change the shape of the light. Dr. Venugopal testified that [redacted] for the Apple Watch Series 6 was designed "[redacted]." Tr. (Venugopal) at 826:13-829:14. Apple engineering documents corroborate Dr. Venugopal's testimony—showing that Apple considered [redacted]. RX-0895C at 317. Complainants are not required to prove intent with respect to an apparatus claim, but the Apple engineering documents in the record are consistent with Dr. Venugopal's testimony that light passing through [redacted]" Tr. (Venugopal) at 831:4-9. It is Complainants' burden to prove that [redacted] is configured to change the emitted light from a first shape to a second shape, and a preponderance of the evidence does not support a finding that the Accused Products meet this limitation.

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[73] Although it is not clear that he applied any reliable methodology, Dr. Sarrafzadeh was more willing to describe specific shapes in the images of the Accused Products, such as "a square shape," "square shape-ish," "closer to a circle shape," or "more or less a circular form." Tr. (Sarrafzadeh) at 1115:17-1118:11.

[74] One visible difference between the images is the pattern of light and dark spots in the "second shape" images. *See* CX-0307iC at 10-21. Dr. Sarrafzadeh stated that the images have "light there, but the cameras don't show them" due to camera "deficiencies." Tr. (Sarrafzadeh) at 1118:4-8, 1119:24-1120:4. Dr. Madisetti's testing shows that there is light in the dark spots when viewed with a lower intensity threshold. CX-0307iC at 11 (images showing no dark spots with "intensity threshold at 0.05"); *see* RRB at 86-87. In any case, it is unclear whether such spots indicate a change in "shape."

d. Element [1C]: "a plurality of photodiodes configured to detect at least a portion of the light after the at least the portion of the light passes through the tissue, the plurality of photodiodes further configured to output at least one signal responsive to the detected light"

There is no dispute that each of the Accused Products has four photodiodes configured to detect light after it passes through a user's tissue, outputting signals responsive to the detected light. *See* CIB at 196-77; *see* Tr. (Madisetti) at 733:19-734:15; CDX-0011C.078 (citing CX-1548C (Apple Watch Series 7 photograph) at 37; CX-1646C (Apple Watch Series 6 photograph); CX-0059C (Apple Watch Series 7 CAD drawings) at 2; CX-0057C (Apple Watch Series 6 CAD drawings); CX-0281C (Block Dep. Tr.) at 7:21-72:5; CX-0297C (Venugopal Dep. Tr.) at 95:5-96:11; CX-0299C (Waydo Dep. Tr.) at 28:22-29:8). The evidence of record shows that this limitation is met.

e. Element [1D]: "a surface comprising a dark-colored coating, the surface configured to be positioned between the plurality of photodiodes and the tissue when the physiological monitoring device is in use, wherein an opening defined in the dark-colored coating is configured to allow at least a portion of light reflected from the tissue to pass through the surface"

There is no dispute that each of the Accused Products has a surface with a dark-colored coating positioned between the photodiodes and the user's skin, with openings above each photodiode allowing light to pass through. *See* CIB at 197; Tr. (Madisetti) at 734:16-735:18; CDX-0011C.079 (citing CX-0070C (Apple Watch Series 7 Specification) at 5; CX-0068C (Apple Watch Series 6 Specification) at 5; CX-0297C (Venugopal Dep. Tr.) at 188:16-189:1, 192:14-194:15; CX-0291C (Mehra Dep. Tr.) at 105:20-106:14, 111:19-112:8); *see also* Tr. (Block) at 901:13-902:3. The evidence of record shows that this limitation is met.

f. Element [1E]: "a light block configured to prevent at least a portion of the light emitted from the plurality of light-emitting diodes from reaching the plurality of photodiodes without first reaching the tissue"

There is no dispute that each of the Accused Products has an optical barrier that blocks light from the LEDs from reaching the photodiodes without first reaching the user's tissue. *See* CIB at 198; Tr. (Madisetti) at 735:19-736:19; CDX-0011C.080 (citing CX-0059C (Apple Watch Series 7 CAD drawings) at 1; CX-0057C (Apple Watch Series 6 CAD drawings) at 1; CX-0297C (Venugopal Dep. Tr.) at 92:6-93:3; CX-0281C (Block Dep. Tr.) at 59:5-20, 61:3-6, 81:5-22). The evidence of record shows that this limitation is met.

g. Element [1F]: "a processor configured to receive and process the outputted at least one signal and determine a physiological parameter of the user responsive to the outputted at least one signal"

There is no dispute that each of the Accused Products has a processor that receives and processes signals from the photodiodes and determines an oxygen saturation measurement. *See* CIB at 199; Tr. (Madisetti) at 736:20-737:12; CDX-0011C.081 (citing CX-0013C (ASIC schematic) at 12; CX-0100C ([redacted] ERS) at 7; CX-0299C (Waydo Dep. Tr. at 38:19-2, 39:2-6, 50:11-14, 68:12-21, 72:10-22, 73:16-19). The evidence of record shows that this limitation is met.

h. Element [9]: "wherein the physiological parameter comprises oxygen saturation"

Claim 9 of the '745 patent depends from claim 1, "wherein the physiological parameter comprises oxygen saturation." There is no dispute that each of the Accused Products measures oxygen saturation. *See* CIB at 199; Tr. (Madisetti) at 737:13-23; CDX-0011C.082 (citing CX-1447 (Apple Watch Series 7 website) at 7; CX-1532 (Apple Watch Series 6 website) at 4). The evidence of record shows that this limitation is met.

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Accordingly, the evidence does not show infringement of claim 9 because Complainants have not proven, by a preponderance, that the Accused Products have a material that is configured to change emitted light from a "first shape" into a "second shape," as required by claim 1.

2. '745 Patent Claim 27

a. Element [20 preamble]: "A system configured to measure one or more physiological parameters of a user, the system comprising: a physiological monitoring device comprising:"

The preamble of claim 20 of the '745 patent requires "[a] system configured to measure one or more physiological parameters of a user," including "a physiological monitoring device." The alleged "system" is an Accused Product in communication with an Apple iPhone. *See* CIB at 199-200. As discussed above in the context of the preamble of '745 patent claim 1, there is no dispute that the Accused Products are devices that can measure blood oxygen. *See* CIB at 201. Moreover, there is no dispute that the Accused Products can be used with an Apple iPhone. *Id*; *see* Tr. (Madisetti) at 738:25-740; CDX-0011C.085 (citing CX-1271 (Apple website) at 1; CX-0010 (Apple website) at 2-3; CX-0299C (Waydo Dep. Tr.) at 74:6-75:17). The evidence of record shows that this limitation is met.

b. Element [20A]: "a plurality of light-emitting diodes configured to emit light in a first shape"

Claim 20 has a "plurality of light-emitting diodes" limitation that is identical to the limitation of claim 1. As discussed above in the context of claim 1, there is no dispute that each of the Accused Products has a plurality of light-emitting diodes emitting light in a shape. *See* CIB at 201. The evidence of record shows that this limitation is met.

c. Element [20B]: "a material configured to be positioned between the plurality of light-emitting diodes and tissue of the user when the physiological monitoring device is in use, the material configured to change the first shape into a second shape by which the light emitted from one or more of the plurality of light-emitting diodes is projected towards the tissue"

Claim 20 has a "material configured to change the first shape into a second shape" limitation that is identical to the limitation of claim 1. For the reasons discussed above in the context of claim 1, the undersigned finds that Complainants have not shown that the Accused Products have a material that is configured to change emitted light from a "first shape" into a "second shape."

d. Element [20C]: "a plurality of photodiodes configured to detect at least a portion of the light after the at least the portion of the light passes through the tissue, the plurality of photodiodes further configured to output at least one signal responsive to the detected light"

Claim 20 has a "plurality of photodiodes" limitation that is identical to the limitation of claim 1. As discussed above in the context of claim 1, there is no dispute that each of the Accused Products has four photodiodes configured to detect light after it passes through a user's tissue, outputting signals responsive to the detected light. *See* CIB at 201. The evidence of record shows that this limitation is met.

e. Element [20D]: "a surface comprising a dark-colored coating, the surface configured to be positioned between the plurality of photodiodes and the tissue when the physiological monitoring device is in use, wherein an opening defined in the dark-colored coating is configured to allow at least a portion of light reflected from the tissue to pass through the surface"

Claim 20 has a "surface comprising a dark-colored coating" limitation that is identical to the limitation of claim 1. As discussed above in the context of claim 1, there is no dispute that each of the Accused Products has a surface with a dark-colored coating positioned between the

photodiodes and the user's skin, with openings above each photodiode allowing light to pass through. *See* CIB at 201. The evidence of record shows that this limitation is met.

f. Element [20E]: "a light block configured to prevent at least a portion of the light emitted from the plurality of light-emitting diodes from reaching the plurality of photodiodes without first reaching the tissue"

Claim 20 has a "light block" limitation that is identical to the limitation of claim 1. As discussed above in the context of claim 1, there is no dispute that each of the Accused Products has an optical barrier that blocks light from the LEDs from reaching the photodiodes without first reaching the user's tissue. *See* CIB at 201. The evidence of record shows that this limitation is met.

g. Element [20F]: "a processor configured to receive and process the outputted at least one signal and determine a physiological parameter of the user responsive to the outputted at least one signal"

Claim 20 has a "processor" limitation that is identical to the limitation of claim 1. As discussed above in the context of claim 1, there is no dispute that each of the Accused Products has a processor that receives and processes signals from the photodiodes and determines an oxygen saturation measurement. *See* CIB at 201. The evidence of record shows that this limitation is met.

h. Element [20G]: "a processing device configured to wirelessly receive physiological parameter data from the physiological monitoring device, wherein the processing device comprises a user interface, a storage device, and a network interface configured to wirelessly communicate with the physiological monitoring device, and wherein the user interface includes a touch-screen display configured to present visual feedback responsive to the physiological parameter data"

There is no dispute that an Apple iPhone is a processing device with a user interface, storage device, and wireless interface that can wirelessly communicate with the Accused

Products, receive oxygen saturation data and present an oxygen saturation measurement on a touch-screen display. *See* CIB at 201; Tr. (Madisetti) at 740:6-24; CDX-0011C.086 (citing CX-0010C (Apple website) at 5; CX-1492 (Apple website) at 4; CX-0299C (Waydo Dep. Tr.) at 74:11-75:17). The evidence of record shows that this limitation is met.

i. Element [27]: "wherein at least one of the plurality of light-emitting diodes is configured to emit light of a first wavelength and at least one of the plurality of light-emitting diodes is configured to emit light of a second wavelength, the second wavelength being different than the first wavelength"

Claim 27 of the '745 patent depends from claim 20, further requiring that "at least one of the plurality of light-emitting diodes is configured to emit light of a first wavelength and at least one of the plurality of light-emitting diodes is configured to emit light of a second wavelength, the second wavelength being different than the first wavelength." There is no dispute that the Accused Products contain green (525 nm), red (660 nm), and infrared (850 nm) LEDs. *See* CIB at 202; Tr. (Madisetti) at 740:25-741:14; CDX-0011C.087 (citing CX-0059C (Apple Watch Series 7 drawing) at 2; CX-0057C (Apple Watch Series drawing) at 2; CX-0297C (Venugopal Dep. Tr.) at 53:1-55:14). The evidence of record shows that this limitation is met.

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Accordingly, the evidence does not show direct infringement of claim 27 because Complainants have not proven, by a preponderance, that the Accused Products have a material that is configured to change emitted light from a "first shape" into a "second shape," as required by claim 20 (from which claim 27 depends).

3. Induced Infringement

Complainants contend that Apple induces infringement of '745 patent claim 27 by importing the Accused Products to be used in connection with Apple iPhones. CIB at 199-200.

Complainants submit that Apple had knowledge of the '745 patent as of the filing of the original complaint on June 30, 2021. *See* CX-1254C (Apple interrogatory responses) at 35. Complainants identify documentation from Apple instructing users how to connect the Accused Products with Apple iPhones. *See* CX-1727 (Apple Watch User Guide) at 1. Dr. Madisetti identified documentation from Apple instructing users how to pair an Apple Watch with an iPhone and use the Health app to monitor blood oxygen on the iPhone. Tr. (Madisetti) at 738:25-740:5; CDX-0011C.085 (citing CX-1727 (Apple Watch User Guide) at 1; CX-0010 (Apple website) at 2-3; CX-0299C (Waydo Dep. Tr.) at 74:11-75:17).

Apple argues that Complainants failed to carry their burden to show that Apple had the necessary specific intent for induced infringement. RRB at 88. Apple argues that that there is no testimonial evidence that Apple actively induced its users to infringe or that Apple knew that its users' actions would constitute infringement. *Id.*

In consideration of the parties' arguments, the undersigned finds that a preponderance of the evidence supports a finding that Apple knew of the alleged infringement of claim 27 as of the filing of the Complaint, which contained allegations of infringement (including a claim chart for claim 27) similar to the evidence presented at the hearing. *See* Complaint Exhibit 18 (June 30, 2021). In addition, there is no dispute that Apple has provided instructions to its users for pairing the Accused Products with Apple iPhones to monitor blood oxygen through Apple's Health app. *See* CX-1727 (Apple Watch User Guide) at 1; CX-0010 (Apple website) at 2-3; CX-0299C (Waydo Dep. Tr.) at 74:11-75:17. The Commission has found induced infringement based on similar evidence when there has been an underlying finding of direct infringement. *See, e.g., Certain Beverage Brewing Capsules*, Inv. No. 337-TA-929, Comm'n Op. at 17-21, EDIS Doc. ID 577827 (Apr. 5, 2016).

The undersigned finds that Apple has not induced infringement of claim 27, however, because Complainants have not shown underlying direct infringement of this claim.

F. Domestic Industry—Technical Prong

The domestic industry products that Complainants rely on for the '745 patent are the Circle sensor (CPX-0021C) and the Wings sensor (CPX-0029C),[75] the RevA sensor (CPX-0052C), the RevD sensor (CPX-0058C), and the RevE sensors (CPX-0019C, CPX-0020C, CPX-0065C)(collectively, "the '745 DI Products"). CIB at 203.[76] Complainants allege that each of the '745 DI Products practices '745 patent claim 18, which depends from claim 15. *Id.* at 203-11.

1. '745 Patent Claim 18

a. Element [15 preamble]: "A physiological monitoring device comprising:"

There is no specific dispute that each of the '745 DI Products is a "physiological monitoring device" as required by the preamble of claim 15. *See* CIB at 204; RIB at 175-77.[77] Mr. Scruggs testified that each of the '745 DI Products "supported the ability to measure oxygen saturation and pulse rate." Tr. (Suggs) at 393:17-20. Dr. Madisetti also observed a demonstration by Dr. Scruggs of the RevA, RevD, and RevE devices measuring oxygen saturation. Tr. (Madisetti) at 749:23-750:11. Dr. Madisetti also relied on a demonstration by Mr. Scruggs of the Circle and Wings sensors connected to a Rad-97 monitor. *Id.* at 754:24-

[75] Complainants assert that the Circle sensor and Wings sensor practice the '745 patent when connected to a Rad-97 monitor (CPX-0014a). CIB at 203, 209-10.

[76] Complainants also rely on the Masimo W1 as a domestic industry product, but for the reasons discussed *supra* in the context of the Poeze patents, evidence regarding this product will not be considered.

[77] Apple disputes whether certain of the '745 DI Products were operable before the filing of the Complaint, *see* RIB at 174-75, and this issue is addressed *infra*, Section VII.

755:3. For these reasons and those discussed below with regard to Element [15H], the evidence of record shows that this limitation is met.

b. Element [15A]: "a plurality of light-emitting diodes configured to emit light proximate a wrist of a user"

There is no dispute that each of the '745 DI Products has a plurality of light-emitting diodes. *See* CIB at 204. Dr. Madisetti identified the LEDs in each of the '745 DI Products. Tr. (Madisetti) at 750:22-751:11; CDX-0011C.098. Mr. Scruggs testified that the '745 DI Products each contain LEDs. Tr. (Scruggs) at 393:12-394:3. The evidence of record shows that this limitation is met.

c. Element [15B]: "a light diffusing material configured to be positioned between the plurality of light-emitting diodes and a tissue measurement site on the wrist of the user when the physiological monitoring device is in use"

Mr. Scruggs identified "a diffusing media above the LEDs" in the '745 DI Products, which is [redacted] for the Circle, Wings, RevA, RevD, and RevE sensors. Tr. (Scruggs) at 401:2-13. Dr. Madisetti observed the [redacted] "diffusing the light" in a demonstration by Mr. Scruggs. Tr. (Madisetti) at 760:18-22; *see also* RX-0266C (demonstration of RevA sensor); RX-0267C (demonstration of RevD sensor); RX-0268C (demonstration of RevE sensor). Dr. Madisetti identified the location of the diffusing material in each of the '745 DI Products. Tr. (Madisetti) at 751:12-752:2; CDX-011C.099 (citing CX-1132C (Circle CAD) at 2; CX-0656C (Circle photo); CX-1137C (Wings CAD) at 6; CX-0658C (Wings photo); CX-111C (RevA CAD); CX-0661C (RevA photo); CX-1058C (RevD photo) at 442; CX-0666C (RevD photo); CX-1125C (RevE CAD) at 2; CX-0653C (RevE photo); CX-0655C (RevE photo); CX-0676C (RevE photo); CX-1058C (RevE photo) at 593). Complainants

further submit that this material is located on the side of the product that contacts the user's wrist in each of the '745 DI Products, thus meeting this limitation. CIB at 205-07.

Apple argues that Dr. Madisetti's analysis of photos and images is insufficient to prove that the material above the LEDs in the '745 DI Products is a "light diffusing material." RIB at 175-76. Dr. Sarrafzadeh called this analysis "unscientific" and "unreliable given that the components are actually quite small." Tr. (Sarrafzadeh) at 1127:1-1128:4; RDX-7C.0162. Dr. Sarrafzadeh further testified that [redacted] is not always a diffusing material." Tr. (Sarrafzadeh) at 1127:15-1128:8. Apple further argues that the documentation for the '745 DI Products is unreliable because of certain discrepancies between the physical exhibits and Masimo's schematics. RIB at 175.

In consideration of the parties' arguments, the undersigned finds that Complainants have shown, by a preponderance of the evidence, that the '745 DI Products have a "light diffusing material" meeting this limitation. Mr. Scruggs described the diffusing material in each of the '745 DI Products, noting the "milky color" above the LEDs. Tr. (Scruggs) at 401:2-13. He specifically identified the [redacted] material in the Circle, Wings, RevA, RevD, and RevE sensors. *Id.*Dr. Madisetti confirmed the location of the material identified by Mr. Scruggs in photos and schematics of each of the '745 DI Products. Tr. (Madisetti) at 751:12-752:2. Dr. Sarrafzadeh raises some questions regarding the reliability of Dr. Madisetti's analysis, but the appearance of the '745 DI Products in videos and photographs is consistent with Mr. Scruggs's testimony. *See* CDX-011C.099. On this record, a preponderance of the evidence supports a finding that each of the '745 DI Products meets this claim limitation with a light diffusing material positioned between the LEDs and the user's wrist.

d. Element [15C]: "a light block having a circular shape"

There is no dispute that each of the '745 DI Products has a light block that forms a circular shape around the LEDs. *See* CIB at 207. Dr. Madisetti identified the circular light block photographs and schematics of each of the '745 DI Products. Tr. (Madisetti) at 752:3-10; CDX-0011C.100. Mr. Scruggs described a "light barrier . . . that surrounds the emitters so it separates the LEDs from the photodiodes." Tr. (Scruggs) at 400:9-12. The evidence of record shows that this limitation is met.

e. Element [15D]: "a plurality of photodiodes configured to detect at least a portion of the light emitted from the plurality of light-emitting diodes after the light passes through the light diffusing material and a portion of the tissue measurement site encircled by the light block, wherein the plurality of photodiodes are arranged in an array having a spatial configuration corresponding to a shape of the portion of the tissue measurement site encircled by the light block"

There is no dispute that each of the '745 DI Products has photodiodes that are arranged in a circular array around the light block that are configured to detect light that is reflected from the user's skin. *See* CIB at 207-08. Dr. Madisetti identified the arrangement of photodiodes in photographs and schematics of each of the '745 DI Products. Tr. (Madisetti) at 752:22-754:8; CDX-0011C.101. The evidence of record shows that this limitation is met.

f. Element [15E]: "wherein the plurality of photodiodes are further configured to output at least one signal responsive to the detected light"

There is no specific dispute that the photodiodes in each of the '745 DI Products are configured to output a signal responsive to detected light. *See* CIB at 208; RIB at 175-77. Dr. Madisetti identified circuit diagrams showing the output of the photodiodes in the RevA, RevD, and RevE devices. Tr. (Madisetti) at 754:9-755:6; CDX-0011C.102 (citing CX-0701C (RevA diagram) at 2, 6; CX-0710C (Rev D diagram) at 3, 7; CX-0705C (RevE diagram). With

respect to the Circle and Wings sensors, Dr. Madisetti relied on a demonstration by Mr. Scruggs showing these sensors outputting oxygen saturation information to a separate Rad-97 monitor. Tr. (Madisetti) at 754:24-755:3. Mr. Scruggs explained that "the signal from the photodiodes was transmitted through a cable to the Rad-97 instrument." Tr. (Scruggs) at 403:18-404:2 (describing Circle sensor), 404:14-19 (describing Wings sensor). For these reasons, and those discussed in relation to Element [15H], the evidence of record shows that this limitation is met.

g. Element [15F]: "wherein the plurality of light-emitting diodes and the plurality of photodiodes are arranged in a reflectance measurement configuration"

There is no dispute that the photodiodes in each of the '745 DI Products are located on the same side as the LEDs and are thus arranged to detect light that is reflected from the user's wrist. *See* CIB at 209; Tr. (Madisetti) at 755:7-25; CDX-0011C.103. The evidence of record shows that this limitation is met.

h. Element [15G]: "wherein the light block is configured to optically isolate the plurality of light-emitting diodes from the plurality of photodiodes by preventing at least a portion of light emitted from the plurality of light-emitting diodes from reaching the plurality of photodiodes without first reaching the portion of the tissue measurement site"

There is no dispute that the light block in each of the '745 DI Products separates the LEDs from the photodiodes, blocking at least a portion of light from reaching the photodiodes without first reaching the user's skin. *See* CIB at 209; Tr. (Madisetti) at 756:1-15; CDX-0011C.104. The evidence of record shows that this limitation is met.

i. Element [15H]: "a processor configured to receive and process the outputted at least one signal and determine a physiological parameter of the user responsive to the outputted at least one signal"

Dr. Madisetti identified processors for each of the '745 DI Products that receive and process signals from the photodiodes. Tr. (Madisetti) at 756:16-757:13; CDX-0011C.105. For the Circle sensor and Wings sensor, Mr. Scruggs explained that the relevant processor is in the Rad-97 instrument, which is connected to the sensors via a cable. Tr. (Scruggs) at 403:11-404:2 ("So the Circle sensor gathered the raw physiological data from the wrist using the LEDs and detectors, and the signal from the photodiodes was transmitted through a cable to the Rad-97 instrument. And then the Rad-97 instrument uses its processors, and the Masimo SET pulse oximetry algorithm to calculate oxygen saturation and pulse rate."), 405:1-7 (same for Wings sensor). Dr. Madisetti also relied on a demonstration by Mr. Scruggs of the Circle and Wings sensors connected to a Rad-97 monitor. *Id.* at 754:24-755:3. Dr. Madisetti also observed a separate demonstration by Dr. Scruggs of the RevA, RevD, and RevE devices measuring oxygen saturation. Tr. (Madisetti) at 749:23-750:11. Mr. Al-Ali described internal testing of the oxygen saturation measurements of Masimo sensors at the time of the RevA sensors. Tr. (Al-Ali) at 271:16-277:13; CX-0378C at 32. He also described testing relevant to the RevD sensors and the RevE sensors. Tr. (Al-Ali) at 276:12-278:3, 316:2-317:20; CX-0494C. Complainants submit that this evidence shows that each of the '745 DI Products has a processor that receives and processes signals from the photodiodes to calculate oxygen saturation. CIB at 209-11; CRB at 121.

Apple argues that the evidence in the record is insufficient to show that any of the '745 DI Products calculates oxygen saturation. RIB at 176-77. As discussed above in the context of the Poeze patents, Apple submits that Complainants failed to identify the source code in the

domestic industry products that calculates any physiological parameter. *Id.* at 47-48; *see* Tr. (Sarrafzadeh) at 1124:24-1125:11. Dr. Sarrafzadeh offered his opinion that the evidence presented by Complainants was insufficient to determine whether the '745 DI Products calculated oxygen saturation. Tr. (Sarrafzadeh) at 1122:20-1126:20. He specifically highlights an erroneous oxygen saturation reading of "81" during a demonstration of the Wings sensor. *Id.* at 1124:12-23. With respect to the Circle sensor and Wings sensor, Apple argues that the claim limitation is not satisfied because the identified "processor" is not in the sensor but in the separate Rad-97 instrument. RIB at 177; RRB at 91.

In consideration of the parties' arguments, the undersigned finds that Complainants have shown by a preponderance of the evidence that each of the '745 DI Products has a processor that receives signals from the photodiodes and determines an oxygen saturation measurement. With respect to the Circle sensor and Wings sensor, claim 15 does not preclude the "physiological-monitoring device" from comprising a sensor that is connected to a separate instrument via a cable. As discussed above in the context of the Poeze patents, the testimony of Mr. Scruggs and Mr. Al-Ali regarding the design, testing, and operation of Masimo's products is sufficient to show that the'745 DI Products measure oxygen saturation. The demonstrations of the '745 DI Products during discovery further confirm the operation of these products, and the minor inconsistencies identified by Dr. Sarrafzadeh do not refute Complainants' affirmative evidence that these products measure oxygen saturation.

Accordingly, the evidence shows by a preponderance that each of the '745 DI Products has a processor that receives signals from the photodiodes and determines an oxygen saturation measurement.

j. Element [15I]: "wherein the physiological monitoring device is configured to transmit physiological parameter data to a separate processor"

There is no specific dispute that the '745 DI Products are configured to transmit oxygen saturation data to an additional processor. *See* CIB at 211; RIB at 175-77. For the Circle and Wings sensors, Dr. Madisetti identified Wi-Fi and Bluetooth functionality in the Rad-97 instrument that would facilitate transmission of oxygen saturation data. Tr. (Madisetti) at 758:8-11; CDX-0011C.107 (citing CX-0679 at 96, 99). For the RevA sensor, Dr. Madisetti identified a laptop that received oxygen saturation data during a demonstration by Mr. Scruggs. Tr. (Madisetti) at 757:16-23; CDX-0011C.106 (citing CX-0836C (demonstration photos) at 4). Dr. Madisetti identified two separate processors in the RevD and RevE sensors, explaining that oxygen saturation data is sent from the [redacted] processor to the [redacted] processor. Tr. (Madisetti) at 757:14-758:6; CDX-0011C.106 (citing CX-0709C (RevD schematic) at 3). For the RevE sensor, Dr. Madisetti further identifies a phone that received oxygen saturation during a demonstration by Mr. Scruggs. Tr. (Madisetti) at 757:24-758:4; CDX-0011C.106 (citing CX-0836C (demonstration photos) at 8-13). For these reasons, and those discussed in relation to Element [15H], the evidence of record shows that this limitation is met by the '745 DI Products.

k. Element [18]: "wherein the physiological parameter comprises oxygen saturation"

Claim 18 of the '745 patent depends from claim 15, "wherein the physiological parameter comprises oxygen saturation." As discussed above in the context of the "processor" limitation, the undersigned finds that the '745 DI Products measure oxygen saturation.

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Accordingly, because each limitation of claims 15 and 18 are satisfied, the evidence shows, by a preponderance, that each of the '745 DI Products practice claim 18 of the '745 patent.

2. Status of DI Products at the Time of the Complaint

Apple argues that no patent-practicing domestic industry article existed at the time of the complaint. RIB at 174-75; RRB at 12-14. Complainants dispute Apple's contention. CRB at 119-20. Specifically, Apple disputes whether the Circle and Wings sensors were operable with the Rad-97 monitor before the complaint was filed. RIB at 174-75. Apple further disputes whether the RevA sensor was operable with a laptop before the complaint was filed. *Id.* Complainants rely on Mr. Scruggs's testimony that the Circle sensor, Wings sensor, RevA sensor, and RevD sensor were built before the complaint was filed. Tr. (Scruggs) at 394:12-397:24. Complainants further rely on Mr. Al-Ali's testimony regarding clinical testing of Masimo Watch devices. Tr. (Al-Ali) at 262:7-264:13, 268:22-278:13, 313:14-318:22. Mr. Scruggs also testified that the Circle sensor was used in clinical studies at Masimo in October 2019. Tr. (Scruggs) at 475:8-15.

In consideration of the parties' arguments, the undersigned finds that at least the RevA, RevD, and RevE sensors were articles protected by the '745 patent that existed before the filing of the complaint. As discussed above in the context of the Poeze patents, the record evidence is sufficient to show that the RevA, RevD, and RevE devices existed prior to the filing of the complaint. Apple argues that the laptop Mr. Scruggs used to display the oxygen saturation measurement from the RevA sensor was not used with the RevA sensor before the filing of the complaint, RIB at 174, but this laptop is not part of the domestic industry article protected by claim 18 of the '745 patent. Mr. Scruggs's laptop was only used to demonstrate the final

limitation of claim 15 [15I], which requires that the RevA sensor is "configured to transmit physiological parameter data to a separate processor." *See* Tr. (Madisetti) at 757:16-23; CX-0836C (demonstration photos) at 4. Mr. Scruggs's laptop was part of the demonstration showing that the RevA sensor was configured as required by the claims, but the laptop is not part of the domestic industry article—the RevA had the required configuration even in the absence of the laptop.[78] With respect to the RevD and RevE sensors, Apple argues that software was loaded on these devices after the complaint was filed, RIB at 42-43, but as discussed above in the context of the Poeze patents, *supra* Section IV.F.7, the evidence shows that these devices were tested before the filing of the complaint. *See* Tr. (Al-Ali) at 276:17-278:13, 316:2-317:20 (citing CX-0494C). Moreover, at least one of the RevE devices produced in discovery (CPX-0019C) can be considered to represent devices that existed at the time of the complaint, based on software that is dated July 9, 2021.

With respect to the Circle sensor and the Wings sensor, the associated Rad-97 monitor is necessary to the practice of the "determine a physiological parameter" limitation [15H], and the protected domestic industry article thus comprises the sensors together with the Rad-97 monitor. Although Complainants have identified some evidence that the Circle and Wings sensors were used in testing in 2019 and 2020, there is no evidence that these sensors were used together with the identified Rad-97 monitor in those tests. *See* Tr. (Scruggs) at 475:8-15; Tr. (Al-Ali) at 262:7-263:10. Mr. Scruggs explained how the Circle and Wings sensor could have worked with the Rad-97, but he never confirmed that these sensors were used with a Rad-97 monitor at any time

[78] As described by Mr. Al-Ali, an October 2020 presentation describes internal testing of the oxygen saturation measurements of prototype sensors consistent with the RevA design. Tr. (Al-Ali) at 272:16-277:13; CX-0378C at 32.

before the filing of the complaint. *See* Tr. (Scruggs) at 403:11-404:2 ("It could work with many of the Masimo instruments. One example of that would be the Rad-97."). Complainants have not shown that the asserted domestic industry articles—the Circle sensor connected to the Rad-97 monitor and the Wings sensor connected to the Rad-97 monitor—existed as articles protected by claim 18 of the '745 patent before the filing of the complaint.

Accordingly, Complainants have shown that at least with respect to the RevA, RevD, and RevE sensors, domestic industry articles protected by the '745 patent existed before the filing of the complaint, and Complainants have thus satisfied the technical prong for the '745 patent with respect to a domestic industry existing at the time of the complaint.

Moreover, for the same reasons discussed above in the context of the Poeze patents, *supra* Part IV.F.7-8, the evidence shows satisfaction of the technical prong for a domestic industry in the process of being established. In particular, the evidence shows, by a preponderance, that Masimo has taken the necessary tangible steps to develop a product that will practice claim 18 of the '745 patent and shows a significant likelihood that this product development will lead to a device that practices the claim.

G. Invalidity – Obviousness

Apple contends that claims 9 and 27 of the '745 patent are obvious in view of the Apple Watch Series 0 and that claims 9, 18, and 27 of the '745 patent are obvious in view of U.S. Patent No. 8,670,819 to Iwamiya *et al.* (RX-0130, "Iwamiya") in combination with U.S. Patent No. 9,392,946 to Sarantos *et al.* (RX-0366, "Sarantos") and U.S. Patent No. 8,998,815 to Venkatraman *et al.*, (RX-0368, "Venkatraman"). RIB at 178-201; RRB at 94-110. Complainants dispute Apple's allegations of obviousness, identifying certain objective indicia of non-obviousness in support of their arguments. CIB at 212-34; CRB at 121-33.

1. Apple Watch Series 0

The Apple Watch Series 0 was the first commercial Apple Watch, and Apple submits that it went on sale to the public on April 24, 2015, citing an Apple press release and the testimony of Apple and Masimo witnesses. RX-0023 (Apple Press Release); Tr. (Block) at 910:22-911:2; Tr. (Kiani) at 138:1-4. Complainants dispute whether Apple has shown that the Apple Watch Series 0 was publicly available before the priority date of the '745 patent in July 2015. CIB at 212-13. Complainants argue that the press release only describes an expected release date and that Apple's witness testimony is uncorroborated. *Id.*; CRB at 123.

The record shows clear and convincing evidence that the Apple Watch Series 0 was publicly on sale by April 24, 2015. Apple's press release represents that the Apple Watch will be "Available for Purchase Online April 24." RX-0023. Complainants argue that the statement in this press release was made in advance of the release date, but the April 2015 release date for the Apple Watch Series 0 was further corroborated by the testimony of Dr. Block and Dr. Venugopal. Tr. (Block) at 910:22-24 ("It was released in the spring of 2015."); Tr. (Venugopal) at 818:10-15 ("The first customer ship for Series 0 was in April of 2015."). Complainants have identified no evidence that the announced release date for the Apple Watch Series 0 was delayed and no reason to doubt the testimony of Apple's witnesses—when Mr. Kiani was asked about his knowledge of the release of the first Apple Watch, he testified that "I don't remember the exact timing, but I'm sure those dates are correct." Tr. (Kiani) at 138:1-4. The evidence thus shows that the Apple Watch Series 0 was publicly available in April 2015, which qualifies it as prior art under 35 U.S.C. § 102(a)(1).

Complainants further argue that Apple has failed to introduce reliable evidence for the structure and operation of the Apple Watch Series 0, identifying several discrepancies between

the product photos relied upon by Dr. Sarrafzadeh and the features described in Apple schematics. CIB at 213-18. The undersigned agrees with Apple, however, that the discrepancies identified by Complainants are irrelevant to the asserted claims of the '745 patent. *See* RRB at 95-97. The parties' disputes regarding the structure and operation of the Apple Watch Series 0 that are relevant to the limitations of the asserted claims are addressed below.

a. '745 patent, claim 9

(i) Element [1 preamble]: "A physiological monitoring device comprising"

Apple contends that the Apple Watch Series 0 is a "physiological monitoring device" because it contains a heart rate sensor. RIB at 179; *see* Tr. (Sarrafzadeh) at 1092:7-13; Tr. (Waydo) at 937:2-8; Tr. (Land) at 957:5-15; RX-0396.0011C (Apple specification). Complainants do not specifically dispute this preamble limitation. *See* CIB at 212-24; CRB at 122-27.

(ii) Element [1A]: "a plurality of light-emitting diodes configured to emit light in a first shape"

Apple contends that the Apple Watch Series 0 has four LEDs that emit light in a shape. RIB at 179; *see* Tr. (Sarrafzadeh) at 1092:15-21; Tr. (Land) at 959:3-13; Tr. (Block) at 897:15-898:1. Dr. Venugopal testified that the Apple Watch Series 0 contained green and infrared LEDs, and the shape of the LEDs was square. Tr. (Venugopal) at 819:1-7, 820:16-821:11; RX-0392C.006 (Apple specification) at Fig. 2. Complainants do not specifically dispute this limitation. *See* CIB at 212-24; CRB at 122-27.

(iii) Element [1B]: "a material configured to be positioned between the plurality of light-emitting diodes and tissue on a wrist of a user when the physiological monitoring device is in use, the material configured to change the first shape into a second shape by which the light emitted from one or more of the plurality of light-emitting diodes is projected towards the tissue"

Apple submits that the Apple Watch Series 0 has a "Fresnel lens" positioned between the LEDs and the user's wrist, which changes the shape of the light from the LEDs. RIB at 108-81. Dr. Venugopal identified the Fresnel lens as part of the Apple Watch Series 0. Tr. (Venugopal) at 819:1-7. Apple relies on an engineering requirement specification document for Apple's "Generation 1" optical sensing module, which was identified by Dr. Venugopal as applying to the Apple Watch Series 0 through 3. *Id.* at 820:10-15 (citing RX-0392C). Dr. Venugopal explained that "[t]he Fresnel lens had two purposes," which were "cosmetic obscuration" and "to have light emitted from the green LED to be collimated." *Id.* at 821:12-21. The green light is "positioned under the optical center," and "gets restricted to a certain angle so that most of it gets out of the window." *Id.* at 821:22-4, 822:22-25; RX-0392C.007 at Fig. 3. With respect to the infrared LED in the optical sensing module, Dr. Venugopal explained that "because it is not passing through an optical center, gets thrown off in a different direction, and it exits the watch and hits the skin a little bit further away." Tr. (Venugopal) at 823:4-9. He testified that the infrared light "has a crescent shape." *Id.* Dr. Sarrafzadeh relied on the Apple specification document and offered his opinion that the "Fresnel lens has these grooves as highlighted here, and these grooves take the shape of the LED and transform that into a crescent type of a shape." Tr. (Sarrafzadeh) at 1092:23-1093:8 (citing RX-0392C); *see* RDX-7.86C, RDX-7.87C.

Complainants argue that the testimony of Dr. Venugopal and Dr. Sarrafzadeh are insufficient to show that the Apple Watch Series 0 meets this limitation by clear and convincing

evidence. CIB at 220-22. Complainants contend that there are no documents or testing to corroborate Apple's contention that the Fresnel lens changes the shape of the infrared light in the Apple Watch Series 0. *Id.* Complainants further cite an Apple patent (naming Dr. Venugopal among the inventors) describing a Fresnel lens whose effect is for a "light emitter to retain its optical power, collection efficiency, beam shape, and collection area such that the light undergoes minimal change." CX-1806 at ¶ 53.

Apple argues in reply that Dr. Sarrafzadeh's opinions are corroborated by the placement of the infrared LED in relation to the Fresnel lens shown in Apple's engineering documents, highlighting a close-up of the lens and the placement of the LEDs. RRB at 99-100.

RX-0392C.00 at Fig. 2. Apple submits that Dr. Sarrafzadeh and Dr. Venugopal explained how the offset placement of the infrared LED causes a change in shape as the light passes through a crescent-shaped portion of the Fresnel lens. *See* Tr. (Sarrafzadeh) at 1093:4-8; Tr. (Venugopal) at 823:4-9.

In consideration of the parties' arguments, the undersigned finds that Apple has failed to offer clear and convincing evidence that the Fresnel lens changes the shape of the light emitted by the infrared LED in the Apple Watch Series 0. Dr. Sarrafzadeh's testimony is conclusory—

he asserts that the grooves on the Fresnel lens transforms the light "into a crescent type of a shape," but he merely showed a demonstrative with a drawing of a crescent that was not shown to be the result of any testing or observation of the Apple Watch Series 0. Tr. (Sarrafzadeh) at 1093:4-8; RDX-7.87C; Tr. (Madisetti) at 1358:3-5. Dr. Venugopal explained how the Fresnel lens collimates the green light at the optical center while throwing off the infrared light in a different direction because it is off-center, but he only offers a short conclusory statement about the shape of the infrared light: "It has a crescent shape." Tr. (Venugopal) at 821:22-823:9. Changing the shape of the infrared light is not one of the two purposes that Dr. Venugopal described for the Fresnel lens. *See id.* at 821:12-21.[79] The record contains no images of the light passing through the Fresnel lens or any explanation for why Apple would have designed the Fresnel lens to change the shape of the infrared light, and the conclusory testimony of Dr. Sarrafzadeh and Dr. Venugopal falls short of the clear and convincing standard necessary to prove invalidity. *See Motorola Mobility, LLC v. Int'l Trade Comm'n*, 737 F.3d 1345, 1349 (Fed. Cir. 2013) (where expert's testimony was "a single sentence, without explanation," finding that the ALJ and Commission did not "act unreasonably in finding this conclusory sentence did not rise to the level of clear and convincing evidence").

(iv) Element [1C]: "a plurality of photodiodes configured to detect at least a portion of the light after the at least the portion of the light passes through the tissue, the plurality of photodiodes further configured to output at least one signal responsive to the detected light"

Apple contends that the Apple Watch Series 0 has two photodiodes that detect light after it interacts with the user's tissue. RIB at 181; *see* Tr. (Sarrafzadeh) at 1093:9-12; Tr. (Land) at

[79] The Apple patent application cited by Complainants is consistent with Dr. Venugopal's testimony that the purpose of the Fresnel lens is to obscure internal components and to retain optical power. *See* CX-1806 at ¶ 53.

959:3-13; Tr. (Venugopal) at 819:1-7; RX-0392C.006 at Fig. 2. Complainants do not specifically dispute this limitation. *See* CIB at 212-24; CRB at 122-27.

(v) Element [1D]: "a surface comprising a dark-colored coating, the surface configured to be positioned between the plurality of photodiodes and the tissue when the physiological monitoring device is in use, wherein an opening defined in the dark-colored coating is configured to allow at least a portion of light reflected from the tissue to pass through the surface"

Apple submits that the Apple Watch Series 0 has a [redacted] back crystal, which is positioned between the photodiodes and the user's wrist and has openings to allow light reflected from the tissue to reach the photodiodes. RIB at 181-82; RRB at 101; *see* Tr. (Sarrafzadeh) at 1093:13-21; Tr. (Land) at 959:3-13. Dr. Sarrafzadeh testified that "the first layer of the [redacted] is a dark-colored coating." Tr. (Sarrafzadeh) at 1093:13-21; RDX-7.89C.[80] In the alternative, he offered his opinion that "one of ordinary skill knows that you can easily and low-tech add dark-colored coating to it." *Id.* Apple argues that dark-colored coatings were well-known in the prior art and would have been obvious to a person of ordinary skill in the art. RRB at 101 (citing RX-0366 (Sarantos) at 17:12-16; RX-0035.0202 (Webster)). Complainants dispute Apple's contentions, arguing that there is no evidence that the [redacted] surface of the Apple Watch Series 0 has layers and that Dr. Sarrafzadeh's testimony is insufficient to establish that adding a dark-colored coating would have been obvious. CIB at 222-23.

In consideration of the parties' arguments, the undersigned agrees with Complainants that Apple has failed to show, clearly and convincingly, that the [redacted] back crystal of the Apple Watch Series 0 is a "coating." There is no evidence that the [redacted] back crystal

[80] Complainants note that the image on RDX-7.89C is an Apple Watch Series 1, not an Apple Watch Series 0. *See* CIB at 215.

comprises layers that can be described as a "coating," and Apple has failed to offer clear and convincing evidence that one of ordinary skill in the art would have added a dark-colored coating to the surface of the back crystal in the Apple Watch Series 0. *See, e.g.*, JX-0009 at 9:32-34 (referring to a "top surface coated with a light-absorbing material"). Dr. Sarrafzadeh offers conclusory testimony that a person of ordinary skill in the art would have been able to add a "low-tech" coating to the Apple Watch Series 0, but even if this opinion were reliable, Dr. Sarrafzadeh fails to identify any reason to add such a coating. Such testimony is insufficient to carry Apple's burden to prove obviousness by clear and convincing evidence. *See InTouch Techs., Inc. v. VGO Commc'ns, Inc.*, 751 F.3d 1327, 1352 (Fed. Cir. 2014) (reversing obviousness finding where expert's "testimony primarily consisted of conclusory references to her belief that one of ordinary skill in the art could combine these references, not that they would have been motivated to do so.").

(vi) Element [1E]: "a light block configured to prevent at least a portion of the light emitted from the plurality of light-emitting diodes from reaching the plurality of photodiodes without first reaching the tissue"

With respect to the "light block" limitation, Apple relies on an Apple specification that depicts blocks labeled "[redacted]" between the emitters and detectors.

RX-0396C.0017 at Fig. 6. [redacted]." Tr. (Land) at 961:22-962:13; *see also* Tr. (Sarrafzadeh) at 1093:22-1094:3. Complainants argue that the Apple specification cited by Mr. Land is unreliable, because it is dated July 2013—two years before the release of the Apple Watch Series 0—and it does not show the convex back surface that is in the final product. CIB at 216-17; CRB at 127; *see* Tr. (Madisetti) at 1356:10-22.

In consideration of the parties' arguments, the undersigned finds that Apple has shown by clear and convincing evidence that the Apple Watch Series 0 meets the "light block" limitation of the '745 patent claim 1. Mr. Land identified the Apple engineering requirement specification document as one that corresponds to the Apple Watch Series 0. Tr. (Land) at 961:7-21 (identifying RX-0396C). He described the optical path diagram in that document as "a schematic for some of the major elements in the Apple Watch." *Id.* at 961:22-962:13. The fact

that the diagram does not show other features of the Apple Watch, such as the curved back crystal, is irrelevant to this limitation. Mr. Land's testimony and the diagram from Apple's specification clearly show that the Apple Watch Series 0 had the claimed "light block."

(vii) Element [1F]: "a processor configured to receive and process the outputted at least one signal and determine a physiological parameter of the user responsive to the outputted at least one signal"

Apple contends that the Apple Watch Series 0 has a processor that receives signals from the photodiodes and calculates a pulse rate. RIB at 183; *see* Tr. (Sarrafzadeh) at 1094:4-9; Tr. (Land) at 959:3-13; RX-0392C.011. Complainants do not specifically dispute this limitation. *See* CIB at 212-24; CRB at 122-27.

(viii) Element [9]: "wherein the physiological parameter comprises oxygen saturation"

Claim 9 of the '745 patent depends from claim 1, "wherein the physiological parameter comprises oxygen saturation." The Apple Watch Series 0 does not measure oxygen saturation, but Dr. Sarrafzadeh offered his opinion that pulse oximetry would have been obvious to a person of ordinary skill in the art because such devices have been known since the 1970s. Tr. (Sarrafzadeh) at 1094:10-17. Apple cites testimony from Dr. Mehra that "pulse oximetry as a feature is essentially heart rate sensing, but comparing the amplitude of the signal at two different colors of light or wavelengths of light." Tr. (Mehra) at 852:7-17. Dr. Waydo testified that Apple's later development of a blood oxygen sensor built on its work on heart rate detection, because "the blood oxygen sensor is a PPG of photoplethysmography sensor, much like the heart rate sensors." Tr. (Waydo) at 923:12-23. Dr. Mannheimer testified that "putting a couple of LEDs in a Series 0 watch form factor" would produce a blood oxygen measurement, "but not to the level that we were looking for." Tr. (Mannheimer) at 1015:9-19.

Complainants argue that Apple failed to identify what modifications to the Apple Watch Series 0 would be necessary to measure oxygen saturation. CIB at 218-20. Complainants further identify evidence that Apple engineers expressed skepticism regarding Apple's likelihood of success in implementing an oxygen saturation measurement in the Apple Watch. *See* Tr. (Mannheimer) at 1012:12-16; CX-0299C (Waydo Dep. Tr.) at 166:4-167:5; CX-0295C (Shui Dep. Tr.) at 108:15-21. Complainants argue that it is unlikely that one of ordinary skill in the art would have been successful in modifying the Apple Watch Series 0 to measure oxygen saturation when the record shows that Apple's team of engineers worked for several years after the Apple Watch's release to implement this feature. CIB at 220.

In consideration of the parties' arguments, the undersigned finds that Apple has failed to offer clear and convincing evidence that one of ordinary skill in the art would have modified the Apple Watch Series 0 to measure oxygen saturation with a reasonable expectation of success. Apple cites the testimony of its engineers that adding some LEDs would make it possible to measure oxygen saturation, but there is no clear explanation of the modifications that would be necessary. *See* Tr. (Mannheimer) at 1015:9-19. The Federal Circuit has found such generalized arguments for combining prior art features to be insufficient, holding that it may be necessary to provide "a clear, evidence-supported account of the contemplated workings of the combination" as "a prerequisite to adequately explaining and supporting a conclusion that a relevant skilled artisan would have been motivated to make the combination and reasonably expect success in doing so." *Personal Web Techs., LLC v. Apple, Inc.*, 848 F.3d 987, 994 (Fed. Cir. 2017). Here, Apple has failed to explain how the addition of LEDs for measuring blood oxygen would have been implemented, and whether these modifications would affect other limitations of the '745

patent—such as the Fresnel lens that Apple relies on for the "second shape" limitation.[81] In addition, the record contains testimony from multiple Apple engineers expressing skepticism regarding the implementation of pulse oximetry in the Apple Watch. *See* Tr. (Mannheimer) at 1012:12-16; CX-0299C (Waydo Dep. Tr.) at 166:4-167:5; CX-0295C (Shui Dep. Tr.) at 108:15-21. Apple has thus failed to show how one of ordinary skill in the art would have modified the Apple Watch Series 0 to measure blood oxygen and has failed to show, clearly and convincingly, that that there would have been a reasonable expectation of success in making any such modifications.

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Accordingly, the evidence fails to show that claim 9 of the '745 patent is obvious in view of the Apple Watch Series 0, because Apple has not clearly and convincingly shown that the Apple Watch Series 0 has a material that changes emitted light from a "first shape" to a "second shape," or that it would have been obvious for one of ordinary skill in the art to modify the Apple Watch Series 0 to have a "dark-colored coating" or to measure oxygen saturation.

b. '745 Patent Claim 27

(i) Element [20 preamble]: "A system configured to measure one or more physiological parameters of a user"

The preamble of claim 20 of the '745 patent requires "[a] system configured to measure one or more physiological parameters of a user," including "a physiological monitoring device." As discussed above in the context of the preamble of '745 patent claim 1, there is no dispute that the Apple Watch Series 0 is a "physiological monitoring device" because it contains a heart rate sensor. *See* RIB at 184.

[81] When Apple implemented a blood oxygen feature in the Apple Watch Series 6, the Fresnel lens was removed in favor of a microlens array. *See* Tr. (Venugopal) at 836:3-838:25.

(ii) Element [20A]: "a plurality of light-emitting diodes configured to emit light in a first shape"

Claim 20 has a "plurality of light-emitting diodes" limitation that is identical to the limitation of claim 1. As discussed above in the context of claim 1, there is no dispute that the Apple Watch Series 0 has four LEDs that emit light in a shape. *See* RIB at 179, 185.

(iii) Element [20B]: "a material configured to be positioned between the plurality of light-emitting diodes and tissue of the user when the physiological monitoring device is in use, the material configured to change the first shape into a second shape by which the light emitted from one or more of the plurality of light-emitting diodes is projected towards the tissue"

Claim 20 has a "material configured to change the first shape into a second shape" limitation that is identical to the limitation of claim 1. For the reasons discussed above in the context of claim 1, the undersigned finds that Apple has not shown that the Apple Watch Series 0 has a material that changes a "first shape" into a "second shape."

(iv) Element [20C]: "a plurality of photodiodes configured to detect at least a portion of the light after the at least the portion of the light passes through the tissue, the plurality of photodiodes further configured to output at least one signal responsive to the detected light"

Claim 20 has a "plurality of photodiodes" limitation that is identical to the limitation of claim 1. As discussed above in the context of claim 1, there is no dispute that the Apple Watch Series 0 has two photodiodes that detect light after it interacts with the user's tissue. *See* RIB at 181, 185.

(v) Element [20D]: "a surface comprising a dark-colored coating, the surface configured to be positioned between the plurality of photodiodes and the tissue when the physiological monitoring device is in use, wherein an opening defined in the dark-colored coating is configured to allow at least a portion of light reflected from the tissue to pass through the surface"

Claim 20 has a "surface comprising a dark-colored coating" limitation that is identical to the limitation of claim 1. For the reasons discussed above in the context of claim 1, Apple has not shown that the Apple Watch Series 0 has a surface comprising a dark-colored coating or that one of ordinary skill in the art would have added such a coating.

(vi) Element [20E]: "a light block configured to prevent at least a portion of the light emitted from the plurality of light-emitting diodes from reaching the plurality of photodiodes without first reaching the tissue"

Claim 20 has a "light block" limitation that is identical to the limitation of claim 1. For the reasons discussed above in the context of claim 1, the evidence shows that the Apple Watch Series 0 has a light block that prevents at least a portion of light from the LEDs from reaching the photodiodes.

(vii) Element [20F]: "a processor configured to receive and process the outputted at least one signal and determine a physiological parameter of the user responsive to the outputted at least one signal"

Claim 20 has a "processor" limitation that is identical to the limitation of claim 1. As discussed above in the context of claim 1, there is no dispute that the Apple Watch Series 0 has a processor that receives signals from the photodiodes and calculates a pulse rate. *See* RIB at 183, 185.

(viii) Element [20G]: "a processing device configured to wirelessly receive physiological parameter data from the physiological monitoring device, wherein the processing device comprises a user interface, a storage device, and a network interface configured to wirelessly communicate with the physiological monitoring device, and wherein the user interface includes a touch-screen display configured to present visual feedback responsive to the physiological parameter data"

Apple contends and provided testimony that the Apple Watch Series 0 wirelessly communicates with an Apple iPhone comprising a user interface including a touch-screen display, a storage device, and a wireless interface. RIB at 185; *see* Tr. (Sarrafzadeh) at 1095:17-1096:5. Complainants dispute whether Apple has shown that an iPhone could display the pulse rate measurement of an Apple Watch Series 0, however, arguing that Apple failed to identify any application on the iPhone for presenting any visual feedback responsive to any physiological parameter data. CIB at 223.[82] In his testimony, Dr. Sarrafzadeh stated that the Apple Watch could wirelessly communicate with a cell phone such as an iPhone, and that "the app can provide a visual feedback to show the physiological parameters," thus showing that this limitation is met. *See* Tr. (Sarrafzadeh) at 1095:17-1096:5; RDX-7.94C. While Dr. Sarrafzadeh did not identify a particular app for these application, his testimony is unrebutted, and Apple's public statements at the time of the release of the Apple Watch Series 0 described "Apple Watch's health and fitness features" and offered customers assistance "to pair their Apple Watch with their iPhone." RX-0023.

[82] Apple argues that this argument has been waived, RRB at 102, but Complainants' pre-hearing brief includes a contention that "Apple provides no evidence to show how an iPhone meets the elements within [20G]." CPHB at 164.

(ix) Element [27]: "wherein at least one of the plurality of light-emitting diodes is configured to emit light of a first wavelength and at least one of the plurality of light-emitting diodes is configured to emit light of a second wavelength, the second wavelength being different than the first wavelength"

Claim 27 of the '745 patent depends from claim 20, further requiring that "at least one of the plurality of light-emitting diodes is configured to emit light of a first wavelength and at least one of the plurality of light-emitting diodes is configured to emit light of a second wavelength, the second wavelength being different than the first wavelength." Apple submits that the Apple Watch Series 0 has green and infrared LEDs. RIB at 185; *see* Tr. (Sarrafzadeh) at 1096:6-10; Tr. (Land) at 959:3-13; Tr. (Venugopal) at 819:1-7, 820:16-821:11; RX-0392C.006 (Apple specification) at Fig. 2. Complainants do not specifically dispute this limitation. *See* CIB at 212-24; CRB at 122-27.

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For the reasons discussed above, the evidence of record fails to show that claim 27 of the '745 patent is obvious in view of the Apple Watch Series 0. Apple has not shown, clearly and convincingly, that the Apple Watch Series 0 has a material that changes emitted light from a "first shape" to a "second shape," and Apple has not shown, clearly and convincingly, that it would have been obvious to modify the Apple Watch Series 0 to have a "dark-colored coating" as required by the limitations of claim 20.

2. Iwamiya

U.S. Patent No. 8,670,819 is entitled "Optical Biological Information Detecting Apparatus and Optical Biological Information Detecting Method," naming inventors Hiroshi Iwamiya and Shuji Nakajima, and assignee Casio Computer Co. Ltd. RX-0130 ("Iwamiya"). Iwamiya issued on March 11, 2014, from an application filed on June 29, 2010, *id.*, and

accordingly it is prior art to the '745 patent pursuant to 35 U.S.C. § 102(a)(1). Apple contends that claims 9, 18, and 27 of the '745 patent are obvious in view of Iwamiya in combination with other prior art patents. RIB at 186-99; RRB at 102-09.

a. '745 Patent Claim 9

(i) Element [1 preamble]: "A physiological monitoring device comprising"

There is no dispute that Iwamiya discloses a "physiological monitoring device" because it discloses an "optical biological information detecting apparatus." RX-0130; *see* RIB at 186; Tr. (Sarrafzadeh) at 1098:8-12; Tr. (Madisetti) at 1359:8-1365:6.

(ii) Element [1A]: "a plurality of light-emitting diodes configured to emit light in a first shape"

There is no dispute that Iwamiya discloses light-emitting diodes emitting light in a shape. RX-0130 at 6:7-11, Fig. 4; *see* RIB at 186; Tr. (Sarrafzadeh) at 1098:13-18; RDX-7.100C; Tr. (Madisetti) at 1359:8-1365:6.

(iii) Element [1B]: "a material configured to be positioned between the plurality of light-emitting diodes and tissue on a wrist of a user when the physiological monitoring device is in use, the material configured to change the first shape into a second shape by which the light emitted from one or more of the plurality of light-emitting diodes is projected towards the tissue"

There is no dispute that Iwamiya discloses an "annular light guide unit" that is positioned between the light-emitting diodes and a user's wrist and changes the shape of the light into an annular shape. RX-0130 at 6:11:14 ("an annular guide unit 7 that guides the observation light emitted from the light emitting units 6 and annularly diffuses and irradiates the observation light with respect to a skin H"), 6:22-31 (describing location of light guide unit 7), *see* RIB at 186-87; Tr. (Sarrafzadeh) at 1098:19-1099:2; RDX-7.101C; Tr. (Madisetti) at 1359:8-1365:6.

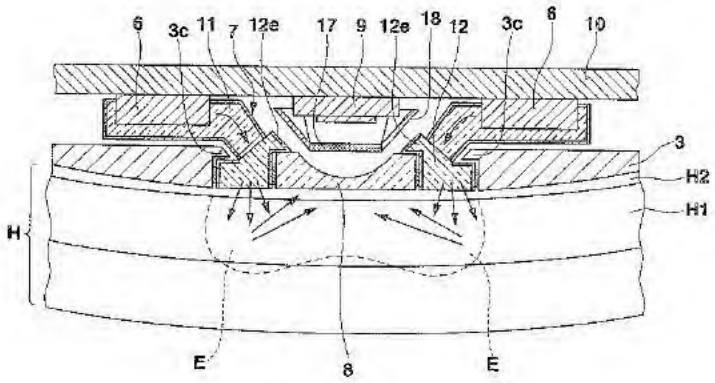

FIG.4

RX-0130 at Fig. 4.

(iv) Element [1C]: "a plurality of photodiodes configured to detect at least a portion of the light after the at least the portion of the light passes through the tissue, the plurality of photodiodes further configured to output at least one signal responsive to the detected light"

There is no dispute that Iwamiya discloses a plurality of photodiodes that output a signal responsive to light that is reflected from a user's tissue. RX-0130 at 8:20-23, Fig. 4; *see* RIB at 187-88; Tr. (Sarrafzadeh) at 1099:3-6, 1105:12-16; RDX-7.102C; Tr. (Madisetti) at 1359:8-1365:6.

(v) Element [1D]: "a surface comprising a dark-colored coating, the surface configured to be positioned between the plurality of photodiodes and the tissue when the physiological monitoring device is in use, wherein an opening defined in the dark-colored coating is configured to allow at least a portion of light reflected from the tissue to pass through the surface"

Apple identifies a "light shielding frame" that surrounds the photodiodes in Iwamiya, RX-0130 at 8:38-42, and Dr. Sarrafzadeh testifies that it would have been obvious to add a dark-colored coating to this surface, and one example of such a coating is disclosed in Sarantos. Tr.

(Sarrafzadeh) at 1099:7-15; RDX-7.103C (citing RX-0366 at 17:6-16, Fig. 22).[83]

Dr. Sarrafzadeh submits that both Iwamiya and Sarantos are wrist-worn physiological monitoring devices, and one of ordinary skill in the art would have been motivated to add a dark-colored coating to Iwamiya to enhance the light shielding. Tr. (Sarrafzadeh) at 1100:15-1101:4. Dr. Sarrafzadeh testified that one of ordinary skill in the art would have expected success in implementing the "low-tech" and "low cost" addition of a dark-colored coating. *Id.* at 1101:5-10. Dr. Sarrafzadeh further cites Webster's disclosure that "black opaque material" can be an effective light shield. *Id.* at 1100:22-1101:4; RDX-7.109C; RX-0035 at 202.

Complainants argue that one of ordinary skill in the art would not have been motivated to add a dark-colored coating to Iwamiya because Iwamiya discloses "light shielding" that uses a reflective material. *See* Tr. (Madisetti) at 1361:9-12 (citing RX-0130 at 18:61-65). In reply, Apple argues that the reflective light shielding is disclosed in a separate embodiment of Iwamiya that is not relevant to the Figure 4 embodiment identified by Dr. Sarrafzadeh. RRB at 106-07.

In consideration of the parties' arguments, the undersigned finds that the evidence clearly and convincingly shows a reason to use a dark-colored coating for the "light shielding frame" in Figure 4. Dr. Sarrafzadeh convincingly explains that one of ordinary skill in the art would have reason to use a dark-colored coating, such as that disclosed in Sarantos, to improve the light-shielding properties of the Figure 4 embodiment, and that one of ordinary skill in the art would have expected success in implementing this change. While Iwamiya discloses a reflective light shielding component with respect to another embodiment (RX-0130 at 18:61-65), this does not

[83] Sarantos is U.S. Patent No. 9,392,946, which names inventors Chris W. Sarantos and Peter W. Richards, and issued from an application filed on May 28, 2015. RX-0366. Accordingly, Sarantos is prior art to the '745 patent pursuant to 35 U.S.C. § 102(a)(2).

teach away from the use of other light shielding options or enhancements known in the art, particularly with respect to the Figure 4 embodiment, which does not mention "reflective" shielding. *See, e.g., Syntex (U.S.A.) LLC v. Apotex*, 407 F.3d 1371, 1379 (Fed. Cir. 2005) ("What a reference teaches a person of ordinary skill is not . . . limited to what a reference specifically 'talks about' . . . a reference will teach way when it suggests that the developments flowing from its disclosures are unlikely to produce the objective of the applicant's invention . . .").

(vi) Element [1E]: "a light block configured to prevent at least a portion of the light emitted from the plurality of light-emitting diodes from reaching the plurality of photodiodes without first reaching the tissue"

There is no dispute that Iwamiya discloses reflection layers 13 and 15 that are light blocks configured to prevent light from the light-emitting diodes from reaching the photodiodes without first reaching the tissue. RX-0130 at 6:67-7:3, 7:45-49, Fig. 3; *see* RIB at 189-90; Tr. (Sarrafzadeh) at 1099:16-21; RDX-7.104C; Tr. (Madisetti) at 1359:8-1365:6.

(vii) Element [1F]: "a processor configured to receive and process the outputted at least one signal and determine a physiological parameter of the user responsive to the outputted at least one signal"

There is no dispute that Iwamiya discloses a CPU that receives and processes signals from the photodiodes and "outputs the data as biological information" that represents a physiological parameter. RX-0130 at 9:40-43, Fig. 10; *see* RIB at 190-91; Tr. (Sarrafzadeh) at 1099:22-1100:1; RDX-7.105C; Tr. (Madisetti) at 1359:8-1365:6.

(viii) Element [9]: "wherein the physiological parameter comprises oxygen saturation"

Claim 9 of the '745 patent depends from claim 1, "wherein the physiological parameter comprises oxygen saturation." Dr. Sarrafzadeh testified that this limitation is obvious in view of

Iwamiya's disclosure of a measurement of "biological information," because oxygen saturation is a type of biological information. Tr. (Sarrafzadeh) at 1100:2-8; RDX-7.106C; *see* RX-0130 at 9:1-7. Apple further submits that the prior art Sarantos reference explicitly discloses a measurement of oxygen saturation, explaining that "[i]f multiple light-emitting devices are used . . . photoplethysmographic techniques may also be used to measure other physiological parameters besides heart rate, such as blood oxygenation levels." RX-0366 at 13:44-47; *see* Tr. (Sarrafzadeh) at 1100:9-14. Dr. Sarrafzadeh offered his opinion that one of ordinary skill in the art would have been motivated to use the teaching in Sarantos to measure oxygen saturation in Iwamiya because both references describe wrist-worn physiological monitoring devices, and measuring oxygen saturation would enhance Iwamiya's device. Tr. (Sarrafzadeh) at 1100:15-20, 1101:12-19. Dr. Sarrafzadeh also offered his opinion that such a combination would be successful based on Sarantos's suggestion and the existence of oxygen saturation measurement devices in the prior art. *Id.* at 1101:20-1102:1.

Complainants argue that Iwamiya's disclosure of a measurement of "biological information" is insufficient to show a measurement of oxygen saturation. CIB at 225-26. Dr. Madisetti explained that Iwamiya only disclosed the use of one wavelength of light, which would be insufficient for measuring oxygen saturation. Tr. (Madisetti) at 1359:22-1361:1; CDX-0012C.065. Moreover, the only "biological information" disclosed in Iwamiya is heart rate. RX-0130 at 9:1-7 ("pulse wave"); *see* Tr. (Madisetti) at 1360:2-4. Complainants further identify an optical filter disclosed in Iwamiya that would block light below 900nm, which would preclude the wavelengths necessary for pulse oximetry. CIB at 227 (citing RX-0130 at 8:42-47, 18:55-60). Sarantos is also not primarily designed for the wavelengths necessary for pulse oximetry, noting that "[t]he aspect ratios and dimensional values discussed herein are tailored

based on the green/yellow light spectrum and are not tailored for use in other spectrums, such as the red or infrared spectra." RX-0336 at 18:48-51. Complainants further argue that Apple has failed to identify a reason for combining Iwamiya and Sarantos or to show that such a combination would have a reasonable expectation of success. CIB at 228-30; CRB at 128-29.

In consideration of the parties' arguments, the undersigned finds that Apple has failed to show by clear and convincing evidence that it would have obvious for one of ordinary skill to combine Iwamiya and Sarantos to measure oxygen saturation. Because Iwamiya only discloses the use of one wavelength of light, the evidence indicates that one of ordinary skill in the art would not have been able to use the device in Iwamiya to measure oxygen saturation. Tr. (Madisetti) at 1359:22-1361:1. Moreover, Iwamiya operates at wavelengths that are not appropriate for pulse oximetry. *See* RX-0130 at 8:42-47; CIB at 227 (Iwamiya blocks light below 900 nm). Sarantos includes a suggestion to use multiple emitters with PPG sensors to measure blood oxygenation levels, but the only reason that Dr. Sarrafzadeh identifies for adding such a feature is that it "would enhance, by way of example, what the biological information of Iwamiya is." Tr. (Sarrafzadeh) at 1101:12-19. The Federal Circuit has held that such generic expert testimony is insufficient for obviousness. *See ActiveVideo Networks, Inc. v. Verizon Commc'ns, Inc.*, 694 F.3d 1312, 1328 (Fed. Cir. 2012) (where expert testified that a motivation would have been "to build something better," the court found that "[t]his testimony is generic and bears no relation to any specific combination of prior art elements.").[84]

[84] Moreover, Apple fails to explain how the multiple emitters described in Sarantos would have been implemented in Iwamiya in a way that is compatible with the annular light guide that is necessary to meet the "second shape" limitation. *See Personal Web Techs., LLC v. Apple, Inc.*, 848 F.3d 987, 994 (Fed. Cir. 2017) (reversing a finding of obviousness where the record lacked "a clear, evidence-supported account of the contemplated workings of the combination").

Apple also has not clearly and convincingly shown that one of ordinary skill in the art would have had a reasonable expectation of success in modifying Iwamiya to measure oxygen saturation—the record contains testimony from multiple Apple engineers expressing skepticism regarding the implementation of pulse oximetry in a wrist-worn device. *See* Tr. (Mannheimer) at 1012:12-16; CX-0299C (Waydo Dep. Tr.) at 166:4-167:5; CX-0295C (Shui Dep. Tr.) at 108:15-21.

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Accordingly, Apple has failed to show that claim 9 of the '745 patent is obvious in view of Iwamiya in combination with Sarantos, because Apple has not shown, clearly and convincingly, that it would have been obvious to one of ordinary skill in the art to modify the device disclosed in Iwamiya with the teachings in Sarantos regarding a measurement of oxygen saturation with a reasonable expectation of success.

b. '745 Patent Claim 18

(i) Element [15 preamble]: "A physiological monitoring device comprising:"

There is no dispute that Iwamiya discloses a "physiological monitoring device" as required by the preamble of claim 15, as discussed above in the context of the preamble of claim 1. *See* RIB at 193.

(ii) Element [15A]: "a plurality of light-emitting diodes configured to emit light proximate a wrist of a user"

There is no dispute that Iwamiya discloses light emitting diodes, as discussed above in the context of claim 1. *See* RIB at 193. Moreover, there is no dispute that Iwamiya discloses a device that is worn on the wrist. *See* RX-0130 at 4:54-5, Fig. 4.

(iii) Element [15B]: "a light diffusing material configured to be positioned between the plurality of light-emitting diodes and a

tissue measurement site on the wrist of the user when the physiological monitoring device is in use"

There is no dispute that Iwamiya discloses an "annular light guide" that "annularly diffuses and irradiates the observation light." RX-0130 at 6:10-14, Fig. 4; *see* Tr. (Sarrafzadeh) at 1103:10-15; RDX-7.116C. Moreover, there is no dispute that this annular light guide is positioned between the light-emitting diodes and the user's wrist, as discussed above in the context of claim 1. *See* RIB at 193.

(iv) Element [15C]: "a light block having a circular shape"

There is no dispute that Iwamiya discloses reflection layers 13 and 15 that are light blocks, as discussed above in the context of claim 1. *See* RIB at 193-94. Figures 2 and 3 of Iwamiya show that these light blocks are arranged around the annular light guide in a circular shape. RX-0130 at 6:67-7:3, 7:45-49, Fig. 2, Fig. 3; *see* Tr. (Sarrafzadeh) at 1103:16-21; RDX-7.117C.

(v) Element [15D]: "a plurality of photodiodes configured to detect at least a portion of the light emitted from the plurality of light-emitting diodes after the light passes through the light diffusing material and a portion of the tissue measurement site encircled by the light block, wherein the plurality of photodiodes are arranged in an array having a spatial configuration corresponding to a shape of the portion of the tissue measurement site encircled by the light block"

There is no dispute that Iwamiya discloses a plurality of photodiodes configured to detect light that is reflected from a user's tissue, as discussed above in the context of claim 1. *See* RIB at 194-95. Iwamiya further describes "the plural light receiving units **9** preferably disposed on the same circumference centered on an optical axis of the scattered light taking unit **8**." RX-0130 at 14:39-41, Fig. 4; *see* Tr. (Sarrafzadeh) at 1103:22-1104:5; RDX-7.118C. Dr. Sarrafzadeh testified that he believes this limitation is indefinite but that "using Masimo's

interpretation," this limitation is disclosed by Iwamiya. See Tr. (Sarrafzadeh) at 1103:23-5; RDX-7.118C.

Complainants argue that the disclosure in Iwamiya identified by Apple is insufficient to teach a plurality of photodiodes "arranged in an array having a spatial configuration corresponding to a shape of the portion of the tissue measurement site encircled by the light block." CIB at 232; CRB at 130-31. Complainants submit that Iwamiya only depicts a single light receiving unit. *See* Tr. (Madisetti) at 1364:7-8. Complainants further cite a statement in the prosecution history of a parent application to the '745 patent explaining that the plurality of detectors "must include sufficient detectors to represent such shapes." CX-1760 at 322; *see* Tr. (Madisetti) at 1366:13-1367:19.

In consideration of the parties' arguments, the undersigned finds that Iwamiya clearly discloses "plural light receiving units." *See* RX-0130 at 14:36-41; Tr. (Sarrafzadeh) at 1103:23-1104:5; RDX-7.118C (citing RX-0130 at 14:39-41). These plural light receiving units are further described as "disposed on the same circumference centered on an optical axis of the scattered light taking unit." *Id.* at 14:39-41; Tr. (Sarrafzadeh) at 1103:23-1104:5; RDX-7.118C. This disclosure of "plural" photodiodes that are "on the same circumference" at least renders the limitation requiring "a spatial configuration corresponding to a shape . . . encircled by the light block" to be *prima facie* obvious. *See* CRB at 131 (to meet [15D], "a plurality of photodiodes would need to be arranged in a circular-shaped array"). Iwamiya's "plural light receiving units" is a plurality,[85] and the "same circumference" corresponds to a shape encircled by the light block. *See* RX-0130 at 14:36-41.

[85] Complainants cite statements in the prosecution history of a parent application to the '745 patent where the applicant suggested that up to six detectors may be needed to represent a circular shape. *See* CX-1760

(vi) Element [15E]: "wherein the plurality of photodiodes are further configured to output at least one signal responsive to the detected light"

There is no dispute that the photodiodes in Iwamiya are configured to output a signal responsive to the detected light, as discussed above in the context of claim 1. *See* RIB at 195.

(vii) Element [15F]: "wherein the plurality of light-emitting diodes and the plurality of photodiodes are arranged in a reflectance measurement configuration"

There is no dispute that the light-emitting diodes in Iwamiya are arranged in a reflectance measurement configuration with the photodiodes on the same side of the tissue. *See* RIB at 195; Tr. (Sarrafzadeh) at 1104:11-15; RDX-7.119C; Tr. (Madisetti) at 1359:8-1365:6.

(viii) Element [15G]: "wherein the light block is configured to optically isolate the plurality of light-emitting diodes from the plurality of photodiodes by preventing at least a portion of light emitted from the plurality of light-emitting diodes from reaching the plurality of photodiodes without first reaching the portion of the tissue measurement site"

There is no dispute that the light blocks in Iwamiya are configured to prevent light from the light-emitting diodes from reaching the photodiodes without first reaching the tissue, as discussed above in the context of claim 1. *See* RIB at 195-96.

(ix) Element [15H]: "a processor configured to receive and process the outputted at least one signal and determine a physiological parameter of the user responsive to the outputted at least one signal"

There is no dispute that Iwamiya discloses a CPU that receives and processes signals from the photodiodes and determines a physiological parameter, as discussed above in the context of claim 1. *See* RIB at 196.

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at 322. Both a "plural" and a "plurality" could include six photodiodes. *See In re Peterson*, 315 F.3d 1325, 1329 (Fed. Cir. 2003) ("In cases involving overlapping ranges, we and our predecessor courts have consistently held that even a slight overlap in range establishes a prima facie case of obviousness.").

(x) Element [15I]: "wherein the physiological monitoring device is configured to transmit physiological parameter data to a separate processor"

Apple relies on Venkatraman in combination with Iwamiya for the limitation requiring that the physiological parameter can be transmitted to a separate processor. RIB at 196-97.[86] Venkatraman discloses a biometric device that can communicate with a secondary device (e.g., a smartphone) through a wired or wireless connection. RX-0368 at 30:66-31:35. "The biometric monitoring device may send biometric and other data to the smartphone in real-time or with some delay." *Id.* at 57:44-46. Venkatraman describes numerous benefits to using a biometric device with a smartphone app. *See id.* at 57:20-59:13. Dr. Sarrafzadeh testified that it would have been obvious to one of ordinary skill in the art to combine Iwamiya's device with the secondary device of Venkatraman because such connections were well known to enhance such devices. Tr. (Sarrafzadeh) at 1105:24-1106:7, 1108:9-18. Dr. Sarrafzadeh also testified that a person of ordinary skill in the art would have had a reasonable expectation of success, "because adding these external devices was known for quite a bit of time." *Id.* at 1106:8-11, 1108:19-23. Complainants do not dispute that the evidence shows a reason to combine Iwamiya with Venkatraman, and a reasonable expectation of success, with regard to this limitation. *See* Tr. (Madisetti) at 1359:8-1365:6.

(xi) Element [18]: "wherein the physiological parameter comprises oxygen saturation"

Claim 18 of the '745 patent depends from claim 15, "wherein the physiological parameter comprises oxygen saturation." Apple submits that the measurement of oxygen saturation is

[86] Venkatraman is U.S. Patent No. 8,998,815, which names inventors Subramaniam Venkatraman and Shelten Gee Jao Yuen, and issued on April 7, 2015. RX-0368. Accordingly, Venkatraman is prior art to the '745 patent pursuant to 35 U.S.C. § 102(a)(1).

obvious in view of Iwamiya in combination with Sarantos. *See* RIB at 197. For the reasons discussed above in the context of claim 9, Apple not shown, clearly and convincingly, that it would have been obvious to one of ordinary skill in the art to modify the device disclosed in Iwamiya with the teachings in Sarantos to implement a measurement of oxygen saturation with a reasonable expectation of success.

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Accordingly, the evidence fails to clearly and convincingly show that claim 18 of the '745 patent is obvious in view of Iwamiya in combination with Sarantos and Venkatraman.

c. '745 Patent Claim 27

(i) Element [20 preamble]: "A system configured to measure one or more physiological parameters of a user, comprising:"

The preamble of claim 20 of the '745 patent requires "[a] system configured to measure one or more physiological parameters of a user," including "a physiological monitoring device." As discussed above in the context of the preamble of '745 patent claim 1, the evidence shows that Iwamiya discloses a "physiological monitoring device" because it contains a heart rate sensor. *See* RIB at 186, 197.

(ii) Element [20A]: "a plurality of light-emitting diodes configured to emit light in a first shape"

Claim 20 has a "plurality of light-emitting diodes" limitation that is identical to the limitation of claim 1. As discussed above in the context of claim 1, there is no dispute that Iwamiya discloses light-emitting diodes emitting light in a shape. *See* RIB at 186, 197.

(iii) Element [20B]: "a material configured to be positioned between the plurality of light-emitting diodes and tissue of the user when the physiological monitoring device is in use, the material configured to change the first shape into a second shape by which the light emitted from one or more of the

plurality of light-emitting diodes is projected towards the tissue"

Claim 20 has a "material configured to change the first shape into a second shape" limitation that is identical to the limitation of claim 1. As discussed above in the context of claim 1, there is no dispute that Iwamiya discloses an "annular light guide unit" that is positioned between the light-emitting diodes and a user's wrist and changes the shape of the light from a first shape to a second shape. *See* RIB at 186-87, 197

(iv) Element [20C]: "a plurality of photodiodes configured to detect at least a portion of the light after the at least the portion of the light passes through the tissue, the plurality of photodiodes further configured to output at least one signal responsive to the detected light"

Claim 20 has a "plurality of photodiodes" limitation that is identical to the limitation of claim 1. As discussed above in the context of claim 1, there is no dispute that Iwamiya discloses a plurality of photodiodes that output a signal responsive to light that is reflected from a user's tissue. *See* RIB at 187-88, 197.

(v) Element [20D]: "a surface comprising a dark-colored coating, the surface configured to be positioned between the plurality of photodiodes and the tissue when the physiological monitoring device is in use, wherein an opening defined in the dark-colored coating is configured to allow at least a portion of light reflected from the tissue to pass through the surface"

Claim 20 has a "surface comprising a dark-colored coating" limitation that is identical to the limitation of claim 1. For the reasons discussed above in the context of claim 1, the undersigned finds that one of ordinary skill in the art would have had a reason to use a dark-colored coating in the device disclosed in Iwamiya and would have had a reasonable expectation of success.

(vi) Element [20E]: "a light block configured to prevent at least a portion of the light emitted from the plurality of light-emitting

diodes from reaching the plurality of photodiodes without first reaching the tissue"

Claim 20 has a "light block" limitation that is identical to the limitation of claim 1. As discussed above in the context of claim 1, there is no dispute that Iwamiya discloses light blocks configured to prevent light from the light-emitting diodes from reaching the photodiodes without first reaching the tissue. *See* RIB at 189-90, 197.

(vii) Element [20F]: "a processor configured to receive and process the outputted at least one signal and determine a physiological parameter of the user responsive to the outputted at least one signal"

Claim 20 has a "processor" limitation that is identical to the limitation of claim 1. As discussed above in the context of claim 1, there is no dispute that Iwamiya discloses a CPU that receives and processes signals from the photodiodes to determine a physiological parameter. *See* RIB at 190-91, 197.

(viii) Element [20G]: "a processing device configured to wirelessly receive physiological parameter data from the physiological monitoring device, wherein the processing device comprises a user interface, a storage device, and a network interface configured to wirelessly communicate with the physiological monitoring device, and wherein the user interface includes a touch-screen display configured to present visual feedback responsive to the physiological parameter data"

Apple relies on Venkatraman in combination with Iwamiya for the limitation that the physiological parameter can be transmitted to a separate processing device. RIB at 197-98; Tr. (Sarrafzadeh) at 1108:1-23; RDX-7.129C. Apple identifies disclosures in Venkatraman describing a connection between a biometric monitoring device and a smartphone. *See* RX-0368 at 30:66-31:35, 57:20-59:13. Complainants argue that Apple has failed to show that Venkatraman discloses a "touch-screen display configured to present visual feedback responsive to the physiological parameter data." CRB at 132.

In consideration of the parties' arguments, and for the reasons discussed above in the context of claim 15, the undersigned finds that one of skill in the art would have reason to connect the biometric device in Iwamiya with a smartphone as taught in Venkatraman with a reasonable expectation of success. *See* Tr. (Sarrafzadeh) at 1105:24-1106:11. The undersigned finds that one of ordinary skill in the art would have understood that a smartphone is a processing device comprising a user interface, a storage device, and a network interface. *See id.* at 1108:1-8. Moreover, Venkatraman explicitly discloses a smartphone app that displays biometric information on a touchscreen. *See* RX-0368 at 57:54-58:6 ("The user may be able to see these and other metrics on the dashboard . . . They may be able to access previous days by pressing a button or icon on a touchscreen."). Accordingly, each of the elements of the "processing device" limitation are clearly disclosed in Venkatraman, and one of ordinary skill would have reason to connect the biometric device in Iwamiya with a smartphone as taught in Venkatraman with a reasonable expectation of success.

(ix) Element [27]: "at least one of the plurality of light-emitting diodes is configured to emit light of a first wavelength and at least one of the plurality of light-emitting diodes is configured to emit light of a second wavelength, the second wavelength being different than the first wavelength"

Claim 27 of the '745 patent depends from claim 20, further requiring that "at least one of the plurality of light-emitting diodes is configured to emit light of a first wavelength and at least one of the plurality of light-emitting diodes is configured to emit light of a second wavelength, the second wavelength being different than the first wavelength." There is no dispute that Iwamiya only discloses the use of one wavelength of light. *See* Tr. (Madisettti) at 1359:22-1366:1; RX-0130 at 10:34-38. Apple contends that this limitation would have been obvious to one of ordinary skill in the art in view of Iwamiya in combination with Sarantos, which provides

that "it may be desirable to include separate light-emitting devices that are each able to emit different wavelengths of light" to measure other physiological parameters, such as blood oxygenation levels. RX-0366 at 13:44-58. Complainants argue that Apple has failed to show that one of ordinary skill in the art would have combined Iwamiya with Sarantos with a reasonable expectation of success. CIB at 228-30; CRB at 128-30.

For the same reasons discussed above in the context of '745 patent claim 9, the undersigned finds that Apple has not shown by clear and convincing evidence that one of ordinary skill would have been able to combine Iwamiya and Sarantos to use two wavelengths of light with a reasonable expectation of success. The only specific motivation for using multiple emitters disclosed in Sarantos is for measuring oxygen saturation, *see* RX-0366 at 13:44-47, and as discussed *supra*, the evidence does not clearly and convincingly show that one of ordinary skill in the art would have had a reasonable expectation of success in modifying Iwamiya to measure oxygen saturation.

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Accordingly, the evidence fails to show that claim 27 of the '745 patent is obvious in view of Iwamiya in combination with Sarantos, because Apple has not shown, clearly and convincingly, that one of ordinary skill in the art would have had a reason to modify the device disclosed in Iwamiya with the teachings in Sarantos regarding the use of two wavelengths with a reasonable expectation of success.

3. Objective Considerations of Non-Obviousness

Complainants contend that certain objective indicia discussed above in the context of the Poeze patents support a finding of non-obviousness for the claims of '745 patent, including Apple's skepticism and failures in implementing wrist-based pulse oximetry and the commercial

success of the Apple Watch Series 6. CIB at 233-34; CRB at 132-33. Apple disputes whether this evidence is relevant to the obviousness of the '745 patent claims. RIB at 199-201; RRB at 109-110.

For the reasons discussed above in the context of the Poeze patents, this evidence does not weigh significantly against a finding of obviousness.[87] For the reasons discussed above, however, the evidence does not provide a clear and convincing showing of obviousness for the claims of '745 patent.

H. Invalidity – Written Description and Enablement

Apple contends that the asserted claims of the '745 patent are invalid for lack of written description and/or indefiniteness pursuant to 35 U.S.C. § 112. RIB at 201-04; RRB at 110-11.

1. Written Description (Claims 1, 9, 20, 27)

Apple argues that claims 1 and 20 of the '745 patent, from which asserted claims 9 and 27 depend, are invalid for lack of written description with respect to a "surface comprising a dark-colored coating . . . wherein an opening defined in the dark-colored coating is configured to allow at least a portion of light reflected from the tissue to pass through the surface" in an embodiment where the sensors are in a reflectance configuration. RIB at 201-02. In the context of the fingertip sensor 300 depicted in Figures 3 and 4, the specification describes a "light-absorbing detector filter 306 "having a top surface coated with a "light-absorbing material" that "can be a black opaque material or coating or any other dark color or coating configured to absorb light." JX-009 at 9:31-36, Fig. 3, Fig. 4A. The specification describes a separate embodiment depicted in Figures 7A and 7B that is "a 3D reflective pulse oximetry sensor 700"

[87] The evidence of commercial success is not relevant because the Accused Products have not been shown to practice claims of the '745 patent.

with an annular "light block 706." *Id.* at 10:40-51, Fig. 7A, Fig. 7B. Dr. Sarrafzadeh testified that "there is no description on how to combine these embodiments in the description of the patent." Tr. (Sarrafzadeh) at 1110:24-1111:2. Apple argues that the specification thus fails to describe the claimed invention "as an integrated whole" with a dark-colored coating used with a reflectance sensor. RIB at 202; RRB at 110 (citing *Novozymes A/S v. DuPont Nutrition Biosciences APS*, 723 F.3d 1336, 1349 (Fed. Cir. 2013).

Complainants submit that the specification explicitly links the two embodiments together: "In other embodiments, for example, as describe [sic] below with respect to FIGS. 7A and 7B, the 3D sensor 300 can be arranged to detect light that is reflected by the tissue measurement site 102." JX-009 at 7:4-14. Dr. Madisetti identified a light concentrator (labeled 308 and 708 in the specification) that is common to both the Figure 3 and Figure 7 embodiments and "links all these embodiments together." Tr. (Madisetti) at 1365:7-1366:8 (citing JX-009 at 9:30-40). Complainants argue that these disclosures show that the two embodiments are not distinct but are linked together. CIB at 235-36; CRB at 133-34.

The evidence fails to show, clearly and convincingly, a lack of adequate written description support for the "dark-colored coating" limitations of claims 1 and 20. The undersigned agrees with Complainants that the specification describes common elements in the Figure 3 fingertip sensor and the Figure 7 reflectance sensor, explicitly suggesting that "the 3D sensor 300 can be arranged to detect light that is reflected by the tissue measurement site," thus supporting Dr. Madisetti's opinion that one of ordinary skill would link these embodiments. JX-009 at 7:4-14; Tr. (Madisetti) at 13:65:7-1366:8. Moreover, with respect to the light blocker 706 in the Figure 7 embodiment, the specification explicitly provides that "[t]he light blocker 706 and the cover 707 can be made of any material that optically isolates the light concentrator 708

and the detector 710." *Id.* at 11:14-16, Fig. 7B.[88] This disclosure of "any material" for light blocking further supports Dr. Madisetti's opinion that the "light-absorbing material" described earlier in the specification in reference to Figure 4A, including "a black opaque material or coating or any other dark color or coating configured to absorb light," is linked to the Figure 7 embodiment. JX-009 at 9:31-36; Tr. (Madisetti) at 1365:7-1366:8; CDX-0012C.081. The Federal Circuit has held that "the description requirement does not demand any particular form of disclosure, or that the specification recite the claimed invention *in haec verba*." *Ariad*, 598 F.3d at 1352 (citations removed). Apple's argument that the dark-colored coating is distinct from the reflectance sensor embodiment is unconvincing in view of these disclosures in the specification.

Accordingly, based on the evidence of record, Apple has not shown clearly and convincingly that claims 1 or 20 of the '745 patent are invalid for lack of written description.

2. Indefiniteness (Claims 15, 18)

Apple argues that claim 15 of the '745 patent, from which asserted claim 18 depends, is invalid for indefiniteness with respect to the limitation requiring a plurality of photodiodes "arranged in an array having a spatial configuration corresponding to a shape of the portion of the tissue measurement site encircled by the light block." RIB at 202-04; RRB at 110-11. Dr. Sarrafzadeh testified that one of ordinary skill in the art would not have been able to determine which shape corresponds to an arrangement of photodiodes, providing an example of four photodiodes that could correspond to many different shapes. Tr. (Sarrafzadeh) at 1111:3-18; RDX-7.134C. Apple argues that this ambiguity regarding how a spatial configuration

[88] Figure 7 also appears to show shows a positioning of a surface of the light blocker 706 between the tissue and photodiode, similar to the positioning of element 306 in Fig. 3.

corresponds to a shape renders this limitation indefinite, because one of skill in the art would not be able to determine the scope of the invention with reasonable certainty. RIB at 202-04 (citing *Nautilus, Inc. v. Biosig Instruments, Inc.*, 57 U.S. 898, 910 (2014)).

Complainants argue that Apple has not met its clear and convincing burden to prove indefiniteness. CIB at 236-38. Complainants submit that Dr. Sarrafzadeh failed to consider the surrounding claim language and other evidence in the intrinsic record defining the scope of this limitation. *Id.* at 237-38. Complainants submit that the "shape" of the configuration of photodiodes is defined by the light block, which has "a circular shape." *See* JX-009 at 16:43-52. Complainants further rely on statements in the prosecution history of the '745 patent that discuss "sufficient detectors to represent such shapes," with an example that "six or more detectors could be arranged in an annular shape and meet the recited limitation." CX-1760 at 322; *see also id.* (indicating that two or three detectors would be insufficient). Dr. Madisetti relied on these disclosures and offered his opinion that this limitation "would be understood by a person having ordinary skill in the art as requiring a sufficient number of detectors, such that when arranged together in an array can match -- have a close similarity or present the at least partially circular shape of the irradiated portion of the tissue measurement site." Tr. (Madisetti) at 1366:13-1367:19.

In consideration of the parties' arguments, the undersigned agrees with Complainants that Apple has not shown, clearly and convincingly, that the claimed arranged of photodiodes in a "spatial configuration corresponding to a shape" is indefinite. In particular, Dr. Sarrafzadeh's testimony relying on hypothetical shapes drawn through an arrangement of photodiodes fails to read this term within the context of claim 15's surrounding language. *See* CIB at 236-37. The "shape" referenced in this limitation is "a shape of the portion of the tissue measurement site

encircled by the light block." To determine whether a device meets this limitation, one of ordinary skill in the art would not draw arbitrary shapes around the photodiodes, as Dr. Sarrafzadeh appears to suggest, but would rather assess this limitation in relation to the "tissue measurement site encircled by the light block." *See* Tr. (Madisetti) at 1366:13-1367:10. Apple has failed to show that one of ordinary skill in the art would be unable to determine whether the limitation is met by comparing the arrangement of photodiodes to the shape of the encircled tissue.[89]

Accordingly, Apple has not shown by clear and convincing evidence that claim 15 of the '745 patent is invalid for indefiniteness.

I. Prosecution Laches

Apple contends that the asserted claims of the '745 patent are unenforceable due to prosecution laches. RIB at 204-05. Apple identifies the filing dates for provisional applications and continuation applications in the family of the '745 patent and ties them to the release dates for Apple Watch products. *Id.* Apple argues that the '745 patent should be held unenforceable due to prosecution laches because the application for the '745 patent was filed nearly five years after the first provisional patent application in the family, and during this timeframe Apple invested heavily in the development of Apple Watch products and growing the market for wearable technology. *Id.*; RRB at 112.

Complainants argue that Apple has failed to show any unreasonable or unexplained delay in the prosecution of the '745 patent. CIB at 238-39. Mr. Stoll described a "continuous

[89] As discussed above in the context of the domestic industry requirement, this limitation is met by photodiodes arranged in a circular array around the light block in the '745 DI Products. As discussed above in the context of obviousness, this limitation is, at least, *prima facie* obvious in view of Iwamiya's description of "plural light receiving units" that are "disposed on the same circumference" as the light block.

unbroken chain of patent prosecution." Tr. (Stoll) at 1415:2-10; *see* CX-1760 ('745 patent prosecution history). Complainants submit that the filing dates for applications in the '745 patent family in 2015, 2016, 2018, 2019, and 2020 demonstrate active prosecution of patents in this family. CRB at 134.

In consideration of the parties' arguments, the undersigned finds that Apple has failed to show that the '745 patent should be found unenforceable due to prosecution laches. As discussed above in the context of the Poeze patents, prosecution laches requires a showing of unreasonable and inexcusable delay, and evidence sufficient to make that showing is lacking here. The record shows continuous prosecution activity from the filing of the original provisional application in 2015 to the issuance of the '745 patent in 2020. *See* JX-009; CX-1760. Apple's arguments tying certain patent application filings to release dates for the Apple Watch is unpersuasive, and the timeline is not consistent with Apple's allegations that Masimo drafted claims to cover the Apple Watch. *See* CIB at 204-05.[90] Apple has not identified delay in the prosecution of the '745 patent that would warrant a finding of prosecution laches.

VI. U.S. PATENT NO. 7,761,127

The '127 patent is entitled "Multiple Wavelength Sensor Substrate," naming inventors Ammar Al-Ali, Mohamed Diab, Marcelo Lamego, James P. Coffin, and Yassir Abdul-Hafiz and claiming priority to a provisional application filed on March 1, 2005, and a non-provisional application filed on March 1, 2006. JX-007.

[90] As discussed above, the Apple Watch Series 0 is prior art to the '745 patent, so any claims drafted to cover this product would have been invalid as anticipated. In addition, the '745 patent issued before the release of the Apple Watch Series 6 and the other Accused Products in this investigation, so the claims of the '745 patent could not have been drafted based on any released Apple Watch with a blood oxygen feature.

A. Specification

The specification of the '127 patent describes a physiological sensor with emitters transmitting radiation at multiple wavelengths and a thermal mass that stabilizes a bulk temperature for the emitters. JX-007 at Abstract, 10:22-26, Fig. 12. "A temperature sensor 1230 is thermally coupled to the thermal mass 1220" to measure the bulk temperature. *Id.* at 10:26-31. The specification explains that the wavelengths of the light emitters "are determinable as a function of the drive currents 1210 and the bulk temperature 1202." *Id.*

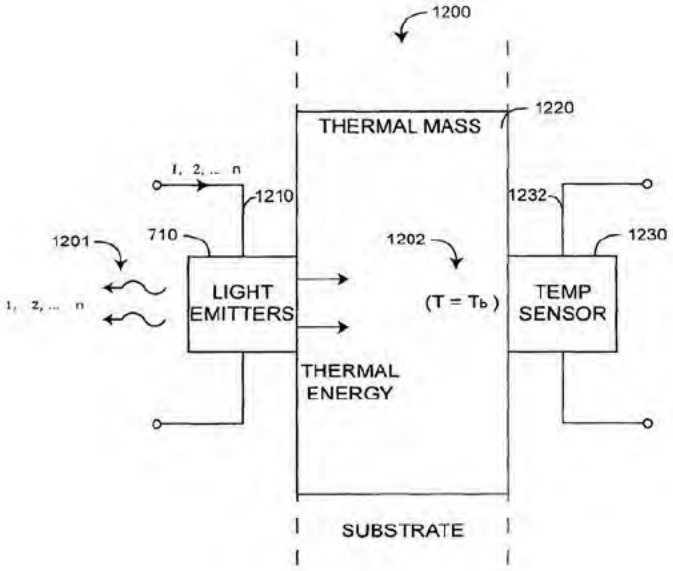

FIG. 12

Id. at Fig. 12. In particular, the operating wavelength λ_a of each light emitter is determined according to a function of the bulk temperature T_b, the drive current for the light emitter I_{drive}, and the total drive current for all light emitters ΣI_{drive}. *Id.* at 10:32-39.

The specification describes one embodiment where LEDs are mounted on a substrate, which is "configured with a relatively significant thermal mass, which stabilizes and normalizes the bulk temperature so that the thermistor measurement of bulk temperature is meaningful." *Id.*

at 10:67-11:4. A substrate depicted in Figure 14 has "a component layer 1401, inner layers 1402-1405, and a solder layer 1406." *Id.* at 11:5-10.

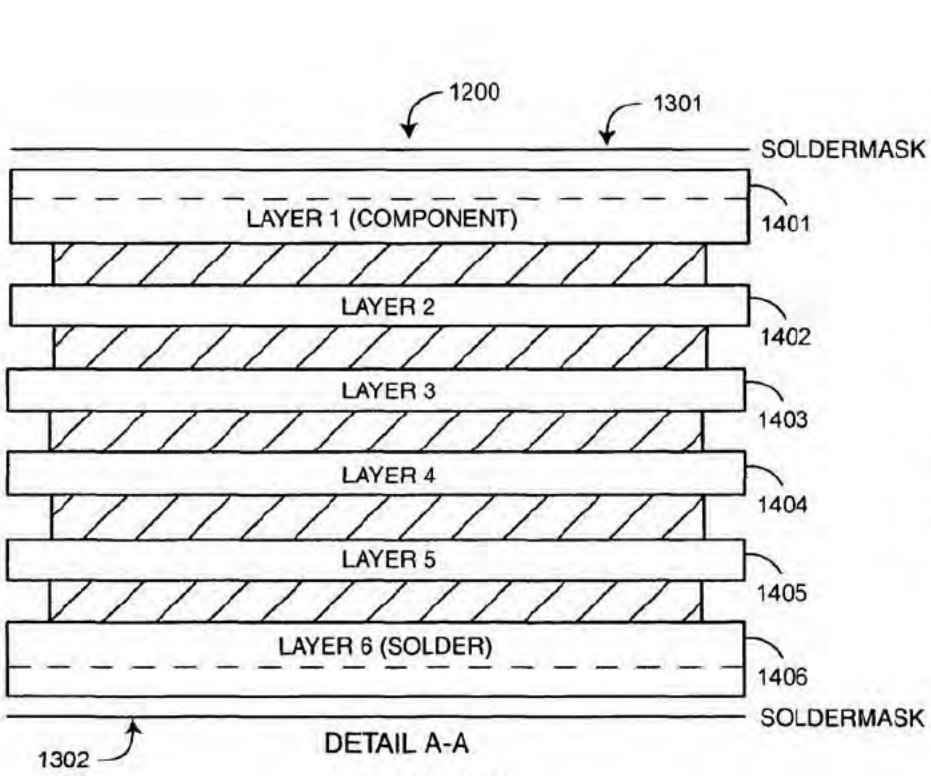

FIG. 14

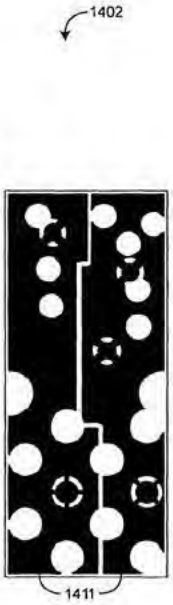

FIG. 18

Id. at Fig. 14, Fig. 18. Figure 18 depicts inner layer 1402 having "substantial metallized areas 1411 that provide a thermal mass 1220 (FIG. 12) to stabilize a bulk temperature for the emitter array 700 (FIG. 12)." *Id.* at 11:10-13.

B. Claims

Complainants assert claim 9 of the '127 patent, which depends from claim 7. The limitations of these claims are recited below:

> 7. A physiological sensor capable of emitting light into tissue and producing an output signal usable to determine one or more physiological parameters of a patient, the physiological sensor comprising:
>
> a thermal mass;

a plurality of light emitting sources, including a substrate of the plurality of light emitting sources, thermally coupled to the thermal mass, the sources having a corresponding plurality of operating wavelengths, the thermal mass disposed within the substrate;

a temperature sensor thermally coupled to the thermal mass and capable of determining a bulk temperature for the thermal mass, the operating wavelengths dependent on the bulk temperature; and

a detector capable of detecting light emitted by the light emitting sources after tissue attenuation, wherein the detector is capable of outputting a signal usable to determine one or more physiological parameters of a patient based upon the operating wavelengths.

JX-007 at 19:35-53.

9. The physiological sensor of claim 7 wherein the temperature sensor comprises a thermistor.

Id. at 19:58-59.

C. Level of Ordinary Skill in the Art

There is no dispute regarding the appropriate level of ordinary skill in the art for the '127 patent in this investigation. *See* CIB at 239; RIB at 209. Dr. Sarrafzadeh testified that a person of ordinary skill in the art would be a person with "working knowledge of physiological monitoring and thermal management technology, … a Bachelor of Science in an academic discipline emphasizing design of electrical and thermal technologies in combination with training or at least one or two years of related work experience with processing of data information, including but not limited to physiological monitoring technology" and "if somebody had a Master of Science in relevant academic discipline with less than a year of related work experience, that would qualify." Tr. (Sarrafzadeh) 1047:17-1048:4. Mr. Goldberg used this same level of ordinary skill for his analysis. *See* Tr. (Goldberg) at 1391:22-24.

D. Claim Construction

The parties have agreed that a "plurality of wavelengths" is "two or more operating wavelengths." *See* CIB at 239; RIB at 209; Updated Joint Proposed Claim Construction Chart at 1, EDIS Doc. ID 763856 (Feb. 23, 2022).

In their post-hearing briefs, the parties dispute the construction of two terms in claim 7 of the '127 patent: "thermal mass" and "bulk temperature for the thermal mass." CIB at 239-47; RIB at 213-15; CRB at 135-41; RRB at 114-23.[91]

1. "thermal mass"

"[A] thermal mass" is the first limitation in the body of claim 7, and the term "thermal mass" also appears in the "plurality of light emitting sources" limitation, requiring a substrate of the light emitting sources to be "thermally coupled to the thermal mass," and in the "temperature sensor" limitation of claim 7, which requires "a temperature sensor thermally coupled to the thermal mass and capable of determining a bulk temperature for the thermal mass, the operating wavelengths dependent on the bulk temperature." JX-007 at 19:39-48.[92]

Apple contends that a "thermal mass" is a component that stabilizes a bulk temperature. RIB at 213-14; RRB at 116-19. Apple states that the claimed thermal mass "stabilizes a bulk

[91] Complainants argue that Apple never identified the terms "thermal mass" and "bulk temperature" during claim construction but relied on certain constructions to argue non-infringement. CIB at 239. Apple argues that Complainants' proposed claim constructions are untimely and that, "[p]rior to Complainants' initial post-hearing brief, no party requested constructions of 'thermal mass' or 'bulk temperature for the thermal mass.'" RRB at 114. Given that, *inter alia*, both parties addressed claim construction in their initial post-hearing briefs, and testimony regarding this issue was presented at the hearing without objection, the parties' claim construction arguments will be considered. *See, e.g.*, Tr. (Goldberg) at 618:9-21, 624:10-25; Tr. (Sarrafzadeh) at 1069:2-14, 1081:20-1082:8.

[92] These limitations mirror disclosures in the specification, wherein "[a] temperature sensor 130 is thermally coupled to the thermal mass 1220, wherein the temperature sensor 1232 provides a temperature sensor output 1232 responsive to the bulk temperature 1202 so that the wavelengths are determinable as a function of the drive currents 1210 and the bulk temperature 1202." JX-007 at 10:26-31.

temperature," such that "the thermistor is then able to meaningfully measure that 'bulk temperature.'" RIB at 213. Apple argues that the term "thermal mass" does not refer simply to "the physical property of 'thermal mass' that is possessed by all objects with mass." *Id.* Apple further contends that the existence of a thermal mass cannot simply be assumed "if the sensor estimates wavelength using a temperature measurement." RRB at 117. In the context of invalidity, Apple argues that Complainants' interpretation of the "thermal mass" limitation would cover any circuit board with multiple layers. RIB at 234-35. Apple submits that the consistent disclosures in the specification of the '127 patent requires that the "thermal mass" is a component that stabilizes a bulk temperature. *Id.* at 213-14; RRB at 116-19.

Complainants propose to construe "thermal mass" to mean a "mass that provides a bulk temperature that can be used to reliably estimate the operating wavelengths of the LEDs." CIB at 240-44; CRB at 136-38. Complainants argue that the term "thermal mass" is "described in terms of the ability to estimate wavelength from the temperature measurement of the thermal mass." CIB at 243. Complainants do not specifically dispute that the "thermal mass" stabilizes a bulk temperature but argue that the temperature is not required to be constant—only sufficient to be used to reliably estimate the operating wavelengths of the LEDs. *Id.* at 234-44; CRB at 136-37. Complainants also argue that there is no basis for any requirement that the "thermal mass" have a minimum thickness. CIB at 234; CRB at 136.

Upon review of the parties' submissions, the undersigned finds that the term "thermal mass" refers to a mass that stabilizes a bulk temperature. This is consistent with the use of the term within the specification, which provides that "[a] thermal mass 1220 is disposed proximate

to the emitters 710 so as to stabilize a bulk temperature 1202 for the emitters." *Id.* at 10:24-26.[93] The specification further describes a substrate that is "configured with a relatively significant thermal mass, which stabilizes and normalizes the bulk temperature so that the thermistor measurement of bulk temperature is meaningful." *Id.* at 10:67-11:4. In a specific embodiment, a layer of a substrate is described as having "substantial metallized areas 1411 that provide a thermal mass 1220 (FIG. 12) to stabilize a bulk temperature for the emitter array 700 (FIG. 12)." *Id.* at 11:10-13.

The specification thus clearly describes a "thermal mass" that stabilizes a bulk temperature, and the parties do not appear to dispute this fact, although only Apple's construction explicitly incorporates temperature stabilization. *See* RRB at 116-17; CIB at 240 (citing the specification's disclosures that the "thermal mass" as "disposed proximate the emitters so as to stabilize a bulk temperature for the emitters" and "relatively significant so as to stabilize and normalize the bulk temperature.").[94] Both Dr. Sarrafzadeh and Mr. Goldberg agreed that the '127 patent describes the claimed thermal mass as stabilizing a bulk temperature. *See* Tr. (Sarrafzadeh) at 1069:7-22; Tr. (Goldberg) at 643:4-12.[95]

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[93] Claims 1 and 26 include "thermal mass" limitations that mirror these specification disclosures, describing "a thermal mass disposed proximate to the emitters and within the substrate so as to stabilize a bulk temperature for the emitters." JX-007 at 19:9-11 (claim 1), 21:5-7 (claim 26).

[94] In the context of invalidity, Complainants argue that prior art references lack a "thermal mass" that "would stabilize a bulk temperature of the substrate," or a component "that functions as a thermal mass by stabilizing a bulk temperature." CIB at 279, 281.

[95] The parties also agree that the term "thermal mass," as used in the patent, does not correspond simply to a physical property possessed by any mass. *See* Tr. (Goldberg) at 639:24-640:3 (noting distinction between "thermal mass in the context of the patent or the thermal mass . . . as a scientific principle of physics"); Tr. (Sarrafzadeh) at 1071:17-21 (distinguishing between "thermal mass of the patent" and the physical property of thermal mass of "any material"); RRB at 124-25.

While Complainants do not explicitly dispute that the claimed thermal mass stabilizes a bulk temperature, they argue that Apple's interpretation of stabilization is too narrow, requiring a minimum thickness for the thermal mass or stabilization at a constant temperature. CIB at 243; CRB at 136. Apple's proposed construction does not require a minimum thickness or a constant temperature, however. *See* RRB at 118-19. Dr. Sarrafzadeh merely offered his opinion that certain metal layers could not be a "thermal mass" where "[t]hey are not really thick enough to provide any . . . thermal stability." Tr. (Sarrafzadeh) at 1066:4-9.[96] The undersigned thus agrees with Apple that the claimed "thermal mass" is a mass that stabilizes a bulk temperature.[97]

Complainants fail to explain why their proposed construction omits any requirement for temperature stabilization, arguing only that the "thermal mass" is a "mass that provides a bulk temperature that can be used to reliably estimate the operating wavelengths of the LEDs." CIB at 240; *see* CRB at 136-38. Complainants further define "bulk temperature" to be "a single temperature used to estimate the operating wavelengths of all the LEDs." CIB at 244. Substituting this definition into Complainants' construction of "thermal mass," Complainants' proposed definition of "thermal mass" becomes "a mass that provides a single temperature used to estimate the operating wavelengths of all the LEDs, that can be used to reliably estimate the

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[96] He also observed temperature variations in a circuit board, finding that it was "not at a uniform temperature through time or spatially" and that the temperature "is not stabilized." *Id.* at 1078:23-1079:9. Dr. Sarrafzadeh's analysis is consistent with Apple's proposed construction and the specification's description of "a relatively significant thermal mass, which stabilizes and normalizes the bulk temperature." JX-007 at 10:67-11:4, 11:10-13.

[97] Apple's proposed construction describes the "thermal mass" as a "component" that stabilizes a bulk temperature, RIB at 213-14, but Apple does not explain why the claim term "mass" has been replaced with the word "component," which does not appear in the claims or the relevant portions of the specification. Complainants have used the word "mass" in their proposed construction, *see* CIB at 240, and there does not appear to be any meaningful dispute regarding the meaning of the word "mass." Accordingly, the undersigned shall construe the term "thermal mass" without substituting another word for "mass."

operating wavelengths of the LEDs" —or, effectively, "a mass that provides a single temperature used to reliably estimate the operating wavelengths of all the LEDs." Complainants also make clear that the "single temperature" required for a bulk temperature need not be a uniform temperature but is simply a "single measurement." *See* CIB at 246 ("bulk temperature" need not be a "uniform or average temperature."); *id.* at 247 (explaining that bulk temperature "is a single measurement for the thermal mass").

The intrinsic evidence fails to indicate that any mass of a non-uniform temperature, from which a single temperature measurement can be provided to estimate the operating wavelengths of all LEDs is, *ipso facto*, a "thermal mass."

First, Complainants' construction merely restates the language in the "temperature sensor" limitation of claim 7 while providing no meaning to the limitation requiring a "thermal mass." *See* JX-007 at 19:45-48 (claim 7 requiring "a temperature sensor thermally coupled to the thermal mass and capable of determining a bulk temperature for the thermal mass, the operating wavelengths dependent on the bulk temperature"). The Federal Circuit has held that "[i]t is highly disfavored to construe terms in a way that renders them void, meaningless, or superfluous." *Wasica Finance GmbH v. Continental Automotive Systems, Inc.*, 853 F.3d 1272, 1288 n.10 (Fed. Cir. 2017).

Further, the prosecution history of the '127 patent weighs against Complainants' approach. Complainants rely on the prosecution history to show that the claims of the '127 patent were distinguished from prior art without a "thermal mass," CIB at 242, CRB at 137-38, but it is clear from this record that the examiner did not understand the term "thermal mass" to only require an estimate of the operating wavelengths of the LEDs based on a single temperature measurement. In the relevant portion of the prosecution history of the '127 patent, the examiner

considered a prior art reference, U.S. Patent No. 5,259,381 to Cheung et al. (RX-0406, "Cheung"), finding that Cheung "discloses all the elements of the current invention . . . except for the sensor comprising a thermal mass disposed proximate the emitters, wherein the thermal mass stabilizes a bulk temperature of the emitters." JX-008 at 363, 433 (MASITC_00077988, 00078058) (rejecting, *inter alia*, prosecution claim 5, which ultimately issued in amended form as claim 7).[98] When discussing the prosecution history at the hearing, Mr. Goldberg agreed that "Cheung does not have a thermal mass." Tr. (Goldberg) at 1395:13-15. Despite the lack of a "thermal mass," the examiner recognized that Cheung discloses a "temperature sensor" and a method for "determining a plurality of operating wavelengths of the light emitting sources so that one or more physiological parameters can be determined based upon the operating wavelengths." JX-008 at 362 (MASITC_00077987); *see* RX-0406 at Abstract ("[A] temperature sensor (50) is included in the sensor (12) to produce a signal indicative of sensor temperature. This signal is interpreted by the oximeter circuitry including, for example, a microcomputer (16), where the effect of temperature on wavelength is compensated for."). In response to this rejection and following an interview with the examiner, Complainants' counsel amended all of the independent claims of the '127 patent. JX-008 at 399-407.[99]

Cheung's temperature sensor measures a single temperature that is used to "accurately determine" the wavelengths of two LEDs for oxygen saturation measurements. *See* RX-0406 at

[98] Prosecution claim 5 at that time required, *inter alia*, "a temperature sensor thermally coupled to the thermal mass and capable of determining a bulk temperature for the thermal mass, the operating wavelengths dependent on the bulk temperature" and the determination of "one or more physiological parameters of a patient based upon the operating wavelengths." JX-008, at 38 (MASITC_00077663).

[99] In response to rejections based on obviousness in view of Cheung in combination with additional prior art references, including U.S. Patent No. 6,360,113 ("Dettling '113") and U.S. Patent Pub. No. 2002/0154665 ("Funabashi et al. '665), the claims were amended to specify that the thermal mass is disposed within a substrate. *See* JX-008 at 363-64, 399-407.

13:20-32 ("[A] temperature sensor 50 . . . is employed to produce a signal that indicates the temperature of sensor assembly 48. . . . [T]his signal, when combined with information about the coding resistor 52 value, allows microcomputer 16 to accurately determine the wavelengths of the light emitted by LEDs 40 and 42 and subsequently produce an accurate determination of oxygen saturation."); RRB at 115 (quoting Cheung). Complainants' proposed construction would thus fail to distinguish claim 7's requirement for a "thermal mass" over a reference that the examiner (and Complainants' expert) recognized does not have a thermal mass. Accordingly, Complainants' proposed construction is unsupported—a "thermal mass" is not merely any mass from which a single temperature measurement can be used to estimate the operating wavelengths of the LEDs.[100]

* * *

Accordingly, "thermal mass" shall be construed to mean a mass that stabilizes a bulk temperature.

2. "bulk temperature for the thermal mass"

The "temperature sensor" limitation of claim 7 describes "a bulk temperature for the thermal mass, the operating wavelengths dependent on the bulk temperature." JX-007 at 19:45-

[100] To the extent Complainants seek to argue that their proposed construction requires, in addition, "reliably" estimating wavelength in a manner that improves over Cheung (*see* CIB at 285), such an addition is not supported by the evidence. As discussed above, the examiner viewed Cheung as meeting the claim requirements except for that of a "thermal mass" stabilizing a bulk temperature. Complainants' proposed claim construction, moreover, does not include any proviso requiring a greater degree of accuracy than Cheung. Complainants' infringement analysis also does not provide any comparison of the Accused Products to the accuracy provided in Cheung. Moreover, even if greater accuracy were shown in the Accused Products, the evidence shows that there are multiple ways to achieve greater accuracy in wavelength estimation apart from inclusion of a thermal mass, and some of these methods can be used in combination with a temperature measurement. *See* RRB at 115-16; RX-0035.0086. The existence of a thermal mass does not simply follow, as a matter of logic, from reliable wavelength estimation using, *inter alia*, a single temperature measurement. *See* RIB at 114-115.

48. As discussed above in the context of "thermal mass," the specification provides that "[a] thermal mass 1220 is disposed proximate to the emitters 710 so as to stabilize a bulk temperature 1202 for the emitters." *Id.* at 10:24-26. The specification further provides that "[a] temperature sensor 130 is thermally coupled to the thermal mass 1220, wherein the temperature sensor 1230 provides a temperature sensor output 1232 responsive to the bulk temperature 1202 so that the wavelengths are determinable as a function of the drive currents 1210 and the bulk temperature 1202." *Id.* at 10:26-31. The specification describes two distinct methods for determining the wavelengths of the emitters, distinguishing between a method using the bulk temperature (T_b) and a method using the temperatures of individual light emitters (T_a). *Id.* at 10:32-48. In a "bulk temperature" embodiment, a thermistor is used "to determine the bulk temperature of LEDs 801 (FIG. 8) mounted on the substrate 1200," and "[t]he substrate 1200 is configured with a relatively significant thermal mass, which stabilizes and normalizes the bulk temperature so that the thermistor measurement of bulk temperature is meaningful." *Id.* at 10:67-11:4.

Apple does not propose an explicit construction for "bulk temperature" but argues that the "bulk temperature for the thermal mass" should follow the 'ordinary usage of the adjective 'bulk,' which is the majority or greater part." RIB at 215. Apple, in support, cites certain deposition testimony of one of the named inventors indicating that it is an "average" or "representative" temperature. *Id.* (citing RX-1195C (Abdul-Hafiz Dep. Tr.) at 99:1-19 ("[T]he bulk temperature means . . . I call it the representative temperature . . . a representative temperature of the whole bulk, and that's what we call bulk temperature.")) Apple also relies on a statement made by Complainants' counsel at the Markman hearing that "people understand bulk is the vast majority." Markman H'rng Tr. at 42:6-9. Apple further distinguishes a "bulk temperature" from "a local temperature" for one part of the mass. RIB at 215 ("the temperature

sensor measures a 'bulk temperature' that is different from a regular temperature measurement by a temperature sensor, which is a local temperature measurement"); *see also* RIB at 214-15; RRB at 116-19.

Complainants argue that a "bulk temperature" is "a single temperature used to estimate the operating wavelength of all the LEDs." CIB at 244. Complainants argue that the claimed bulk temperature does not need to be an average temperature or a uniform temperature for the thermal mass, relying on the claim language describing the "bulk temperature" as a single temperature used to estimate the operating wavelengths of all the LEDs. CIB at 244-47; CRB at 138-41. Complainants argue that the "bulk temperature" is not necessarily an "average" temperature, but rather is a "single, 'representative' measurement." CIB at 244-45. Complainants rely on the testimony of Yassir Abdul-Hafiz, one of the named inventors, who described a "bulk temperature" as the "representative temperature," which is different from a "local temperature" at a "spot that we are measuring." RX-1195C (Abdul-Hafiz Dep. Tr.) at 99:1-15. He further explained that the temperature of a "thermal mass" can be "a representative temperature of the whole bulk, and that's what we call bulk temperature." *Id.* at 99:16-19. His co-inventor Mr. Diab described the "bulk temperature" as a "baseline that is defined by this substrate, and what we found in this invention is that if you measure that baseline and -- with a certain quality for the substrate, . . . you can have a very good correlation to the inside temperature of each LED." RX-1200C (Diab Dep. Tr.) at 137:12-138:8.

In consideration of the parties' arguments, the undersigned construes "bulk temperature of the thermal mass" to mean a representative temperature for the thermal mass. The parties do not appear to dispute that the "bulk temperature" claimed in the '127 patent is a representative temperature for the thermal mass, in accordance with Mr. Abdul-Hafiz's testimony. This