are facing upward or downward in relation to the Earth does not affect a device's satisfaction of this limitation.[5]

Accordingly, the undersigned finds that the terms "over" and "above" have their plain and ordinary meaning and do not require a vertical arrangement of features in a particular orientation.

2. "openings"/"through holes"

Several of the asserted claims (or claims from which the asserted claims depend) contain limitations describing "openings" that extend "through the protrusion." *See* '501 patent claim 1 ("a plurality of openings extending through the protrusion"); '502 patent claim 19 ("separate openings extending through the protrusion"), claim 28 ("a plurality of openings in the convex surface, extending through the protrusion"); '648 patent claim 8 ("a plurality of openings provided through the protrusion and the convex surface"). Claim 20 of the '648 patent describes "a plurality of through holes, each through hole including a window."

Apple argues that the claimed "openings" or "through holes" must not contain any material, such as glass or plastic. RIB at 34-39; RRB at 30-34; *id.* at 30 n.16 ("openings—like holes—require an absence of material"). Complainants submit that the claimed "openings" or "through holes" can contain a window of transparent material. CIB at 49-53; CRB at 17-18. Both parties purport to rely on the ordinary meaning of these terms, without proposing any explicit construction. CIB at 53; RRB at 30-31.

Complainants cite evidence in the claims and specification of the Poeze patents that the claimed "openings" and "through holes" can contain a window of transparent material. CIB at

[5] Apple's arguments regarding the "configured to" language of the claim preambles are thus irrelevant to the construction of this limitation.

MASIMO 2043
Apple v. Masimo
IPR2024-00242

49-51. Complainants submit that the purpose of these openings is to allow light to pass through, citing claim 1 of the '501 patent, which describes "the plurality of openings configured to allow light to reach the photodiodes." JX-0001 at claim 1. Complainants cite examples in the claims and specification of the Poeze patents describing transparent windows in the relevant openings and through holes. CIB at 49-51. Complainants further identify Apple patents that refer to "openings" and "windows." *Id.* at 52-53. In reply, Apple cites testimony of its engineers describing [redacted]. RRB at 33-34. Apple argues that an opening or a hole is "an absence of material, into which something can be placed." *Id.* at 32.

In consideration of the parties' arguments and the evidence of record, the undersigned agrees with Complainants that the ordinary meaning of "openings" and "through holes" in the context of the Poeze patents does not preclude transparent material placed in the claimed "openings" or "through holes." An "opening" or "hole" can refer to an absence of material, but this is not necessarily a requirement. For example, a skylight would still be an "opening" in a roof after a glass window is installed, and a swimming hole is still a "hole" when it is filled with water. The undersigned agrees with Complainants that the ordinary meaning of the terms "opening" and "hole" can include openings and holes that include material.

The claims and specification of the Poeze patents use the terms "openings" and "holes" in a way that is consistent with this ordinary meaning by referring to "openings" and "through holes" that may contain transparent material. *See, e.g.,* '502 patent claim 19 ("optically transparent material within each of the openings"), claim 28 ("a plurality of transmissive windows, each of the transmissive windows extending across a different one of the openings"); '648 patent claim 8 ("a separate optically transparent window extending across each of the

MASIMO 2043
Apple v. Masimo
IPR2024-00242

openings"), claim 20 ("each through hole including a window"). The specification explicitly provides that "[t]he openings can be made from glass to allow attenuated light from a measurement site, such as a finger, to pass through to one or more detectors." JX-0001 at 8:26-30; *see also* JX-0001 at 19:38-48 (describing "openings or windows," which "allow light to pass from the measurement site to the photodetectors"), 27:20-27 ("One or more components of conductive glass 730b can be provided in the openings 703."). Figure 7B depicts conductive glass provided in the identified opening:

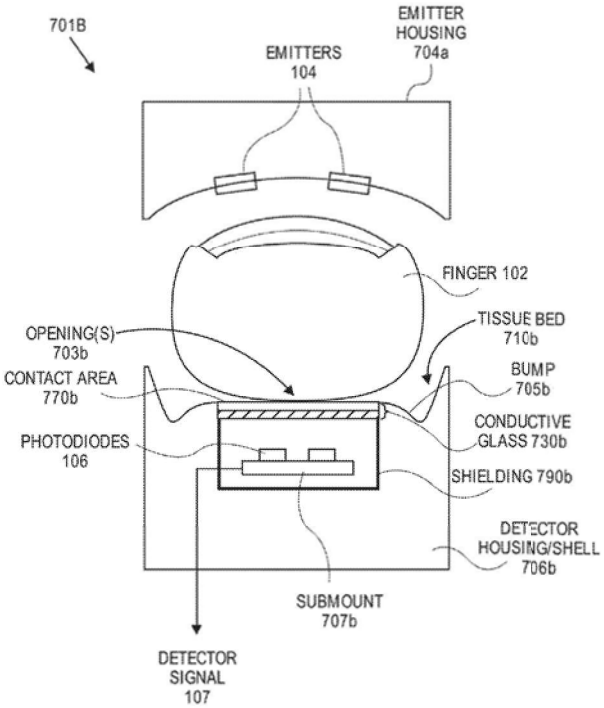


FIG. 7B

JX-0001 at Fig. 7B; *see id.* at 27:13-32. In view of these disclosures, the undersigned agrees with the testimony of Dr. Madisetti that the claimed "openings" and "through holes" in the Poeze patents can be made of glass or transparent material that allows light to pass through to the detectors. *See* Tr. (Madisetti) at 702:8-703:10.

MASIMO 2043
Apple v. Masimo
IPR2024-00242

Apple argues that a "window" is something different from an "opening" or "hole," RIB at 37-38, but none of the statements in the specification cited by Apple suggest that an "opening" can no longer be referred to as an "opening" when filled with glass or covered by a window. To the contrary, the specification describes conductive glass that "can be provided in the openings." JX-0001 at 27:20-22. The claims of the Poeze patents repeatedly describe "windows extending across . . . the openings." '502 patent claim 28; *see also* '648 patent claim 8 (same); '648 patent, claim 20 ("each through hole including a window"). Claim 19 of the '502 patent describes "optically transparent material within each of the openings." The intrinsic evidence supports Complainants' interpretation of these terms to include "openings" and "through holes" that contain transparent material allowing for the transmission of light to the photodiodes.

Accordingly, the undersigned finds that the claimed "openings" and "through holes" can contain transparent material.

E. Infringement

Complainants allege that the Accused Products infringe claim 12 of the '501 patent, claims 22 and 28 of the '502 patent, and claims 12, 24, and 30 of the '648 patent. CIB at 53-83. There is no dispute with respect to the structure and operation of the Accused Products, and Apple only disputes infringement with respect to the "over"/"above" and "openings"/"through holes" limitations addressed above in the context of claim construction. RIB at 26-39; RRB at 20-34. Based on the evidence of record, and because Apple's proposed claim constructions have been rejected, the undersigned finds that these limitations are met, and that the Accused Products thus infringe each of the asserted claims, as discussed below.[6]

[6] Apple's opening brief argues, in addition, that there is no indirect infringement of claim 28 of the '502 patent. *See* RIB at 39-40. Complainants do not provide any argument regarding indirect infringement.

MASIMO 2043
Apple v. Masimo
IPR2024-00242

1. '501 Patent Claim 12[7]

a. Element [1 preamble]: "A user-worn device configured to noninvasively measure a physiological parameter of a user, the user-worn device comprising:"[8]

There is no dispute that the Accused Products meet the limitations of the preamble of claim 1, which requires "[a] user-worn device configured to non-invasively measure a physiological parameter of a user." *See* CIB at 59-60. Dr. Madisetti determined that the Accused Products are watches configured to measure blood oxygen saturation, relying on Apple's marketing materials and technical documentation. Tr. (Madisetti) at 679:12-680:5; CX-0281C (Block Dep. Tr.) at 71:21-72:5, 87:10-14, 177:10-178:7, 251:4-7; CX-1451 (Apple Watch advertisement) at 1:49; CX-1406 (Apple Watch User Guide); CX-1726 (Apple Watch Series 7 Technical Specifications). The evidence of record shows that this limitation is met.

b. Element [1A]: "at least three light emitting diodes (LEDs)"

There is no dispute that each of the Accused Products contains a sensor module with at least three LEDs. *See* CIB at 60-61. Dr. Madisetti identified four clusters of LEDs in each Accused Product, with each cluster containing three LEDs of different wavelengths. Tr. (Madisetti) at 680:6-22; CX-1548C (Apple Watch teardown photographs); CX-0281C (Block Dep. Tr.) at 65:5-67:20; CX-0026C (Apple Engineering Requirement Specification) at 7-8, 30-

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Apple does not explain why an indirect infringement finding is needed to find a violation as to claim 28 of the '502 patent, or as to any other asserted claim (which are all apparatus claims).

[7] Because claim 12 of the '501 patent depends from claim 1, the infringement, technical prong and invalidity analyses address the limitations of both claims 1 and 12. *See* CIB at xxvi.

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

MASIMO 2043
Apple v. Masimo
IPR2024-00242

32; CX-0059C (Apple Watch Series 7 Engineering Drawings) at 1-3. The evidence of record shows that this limitation is met.

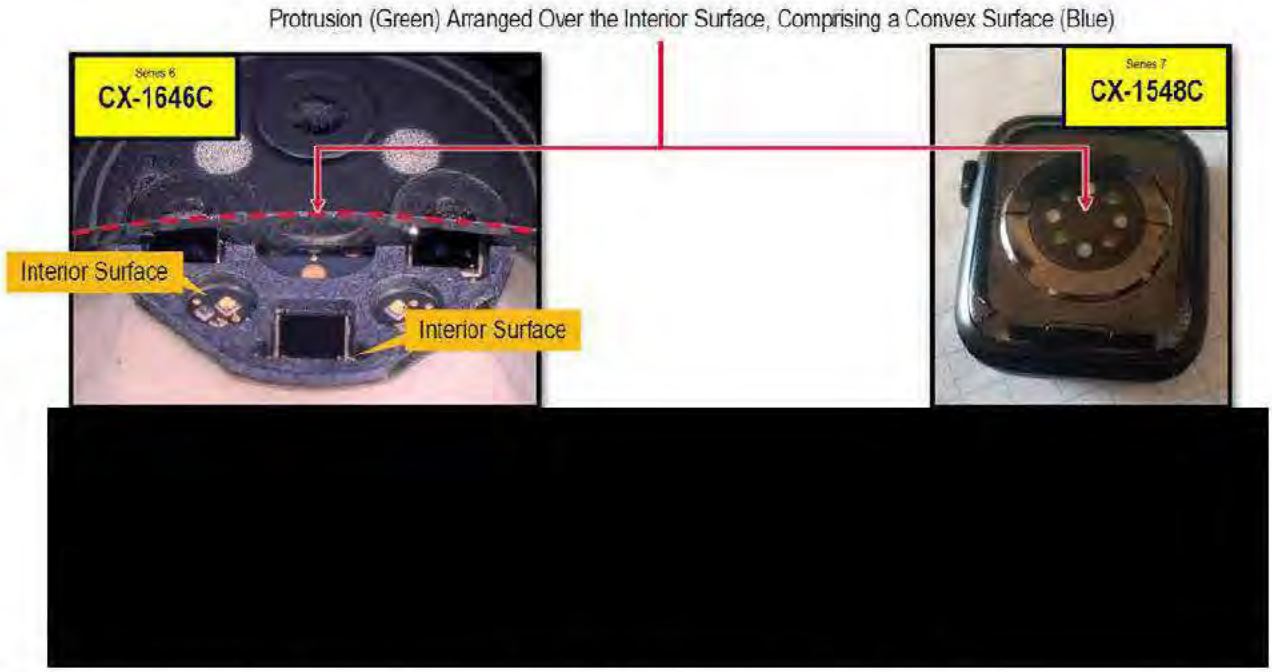
c. Element [1B]: "at least three photodiodes arranged on an interior surface of the user-worn device and configured to receive light attenuated by tissue of the user"

There is no dispute that each of the Accused Products contains at least three photodiodes on an interior surface that are configured receive light that has passed through the user's tissue. *See* CIB at 61-62. Dr. Madisetti identified four photodiodes arranged on Apple Watch sensor boards that are configured to receive light emitted from the LEDs after it has passed through the user's tissue. Tr. (Madisetti) at 680:23-681:11; CX-0281C (Block Dep. Tr.) at 70:13-16, 86:2-87:18; CX-0026C (Apple Engineering Requirement Specification) at 7-8, 30-32; CX-0059C (Apple Watch Series 7 Engineering Drawings) at 1-3. The evidence of record shows that this limitation is met.

d. Element [1C]: "a protrusion arranged over the interior surface, the protrusion comprising a convex surface"

Complainants identify a domed surface in the Accused Products as the claimed protrusion with a convex surface. CIB at 54-57. Dr. Madisetti identified this domed surface arranged over the interior surface of the Accused Products where the photodiodes are located. Tr. (Madisetti) at 681:12-682:11.

MASIMO 2043
Apple v. Masimo
IPR2024-00242



CDX-0011C.016 (citing CX-1646C at 4; CX-1548C at 3; CX-0063C at 1).

Apple argues that the identified protrusion is not "over" the interior surface when the Accused Products are being used for blood oxygen monitoring (with the photodiodes pointed down toward the user's wrist). RIB at 26-34; RRB at 21-29. There is no dispute regarding the orientation of the Accused Products, but as discussed above in the context of claim construction, the claim term "over" does not require a particular vertical arrangement—the protrusion is "over" the interior surface because it is covering the interior surface.

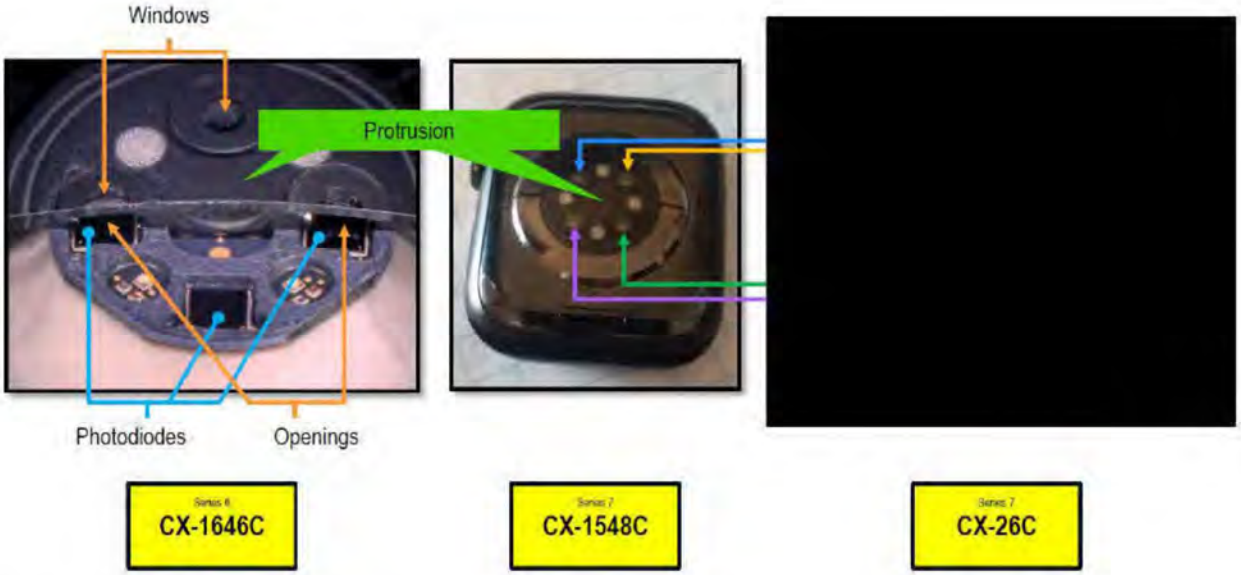
Accordingly, the undersigned finds that the Accused Products meet the limitation requiring "a protrusion arranged over the interior surface."

e. Element [1D]: "a plurality of openings extending through the protrusion and positioned over the three photodiodes"

Complainants identify openings in the Accused Products that are positioned over the four photodiodes. CIB at 57-59. Dr. Madisetti identified evidence [redacted]

MASIMO 2043
Apple v. Masimo
IPR2024-00242

[redacted] that allow light to pass through to the photodiodes. Tr. (Madisetti) at 682:12-683:17.



CDX-0011C.017 (citing CX-1646C at 4; CX-1548C at 3; CX-0026C at 8, 31).

Apple argues that the alleged "openings" do not infringe this limitation because they are [redacted] RIB at 34-39; RRB at 29-34. Apple engineer Ueyn Block explained: [redacted] Tr. (Block) at 901:16-902:3. Apple also argues that the openings are not positioned "over" the photodiodes when the Accused Products are being used for blood oxygen monitoring (with the photodiodes pointed down toward the user's wrist). RIB at 26-39; RRB at 21-29.

As discussed above in the context of claim construction, the undersigned finds that the claimed "openings" can contain transparent material. The fact that the openings in the Accused

MASIMO 2043
Apple v. Masimo
IPR2024-00242

Products [redacted] does not mean that these are not "openings" in accordance with the claim language. There is no dispute that the [redacted] within the openings is transparent and allows for light to reach the photodiodes. *See* CX-0281C (Block) at 272:2-9. There is also no dispute that each opening has an opaque lateral surface separating the opening from the surrounding material. *See* CIB at 62-64; Part IV.E.1.f (Element 1E) *infra*.

The undersigned also finds that the openings are positioned "over" the four photodiodes. As discussed above in the context of claim construction, the claim term "over" does not require a particular vertical arrangement—the openings are positioned "over" the photodiodes because they are aligned with the photodiodes and covering them.

Accordingly, the Accused Products meet the plurality of openings" limitation of '501 patent claim 1.

f. Element [1E]: "the openings each comprising an opaque lateral surface, the plurality of openings configured to allow light to reach the photodiodes, the opaque lateral surface configured to avoid light piping through the protrusion"

There is no dispute that the Accused Products have opaque lateral surfaces in their alleged openings that are configured to avoid light piping. *See* CIB at 62-64. Apple engineers described a [redacted] *see also* CX-0070C at 1; CX-0189C at 2; CX-1548C at 3; CX-0072C at 26, 29-30. Dr. Madisetti considered this evidence to identify [redacted]

MASIMO 2043
Apple v. Masimo
IPR2024-00242

[redacted] as opaque lateral surfaces meeting this limitation. Tr. (Madisetti) at 683:18-685:3. The evidence of record shows that this limitation is met.

g. Element 1[F]: "one or more processors configured to receive one or more signals from the photodiodes and calculate a measurement of the physiological parameter of the user"

There is no dispute that the Accused Products have processors that receive signals from the photodiodes and calculate measurements of physiological parameters. *See* CIB at 64-65. Dr. Madisetti identifies an [redacted] application processor running Apple's [redacted] algorithm to calculate oxygen saturation and pulse rate. Tr. (Madisetti) at 685:4-25; *see* CX-0013C (Apple Engineering Requirements Specification) at 12; CX-0100C (Apple Engineering Requirements Specification) at 6-31; CX-0072C at 3 (Apple Watch Series 6 BOM); CX-1726 (Apple Watch Series 7 Technical Specifications) at 2; CX-0299C (Waydo Dep. Tr.) at 38:10-40:6, 50:11-52:4. The evidence of record shows that this limitation is met.

h. Element [12]: "wherein the convex surface of the protrusion is an outermost surface configured to contact the tissue of the user and conform the tissue into a concave shape"

Claim 12 of the '501 patent depends from claim 1, further requiring that "the convex surface of the protrusion is an outermost surface configured to contact the tissue of the user and conform the tissue into a concave shape." There is no dispute that the Accused Products meet this limitation. *See* CIB at 65-66. As discussed above, Dr. Madisetti identified a convex protrusion in the Accused Products, and Apple documents and testimony confirm that the protrusion is designed [redacted]. *See* Tr. (Madisetti) at 686:1-18; CX-0281 (Block Dep. Tr.) at 200:6-14; CX-0063C (Apple Watch Series 7 Engineering Drawings) at 1; CX-1548C (photographs of Apple Watch Series 7) at 3;

MASIMO 2043
Apple v. Masimo
IPR2024-00242

CX-0070C (Apple Watch Series 7 Engineering Drawings) at 1; CX-0010 (Apple website) at 3. The evidence of record shows that this limitation is met.

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Accordingly, because each limitation of claims 1 and 12 are satisfied, the Accused Products infringe claim 12 of the '501 patent.

2. '502 Patent Claim 22[9]

a. Element [19 preamble]: "A user-worn device configured to non-invasively measure an oxygen saturation of a user, the user worn device comprising:"

There is no dispute that the Accused Products meet the limitations of the preamble of '502 patent claim 19, which requires "[a] user-worn device configured to non-invasively measure an oxygen saturation of a user." *See* CIB at 67. The relevant evidence was discussed above in the context of the preamble of '501 patent claim 1. The evidence of record shows that this limitation is met.

b. Element [19A]: "a plurality of emitters configured to emit light, each of the emitters comprising at least two light emitting diodes (LEDs)"

There is no dispute that each of the Accused Products contains clusters of LEDs, with each cluster containing three LEDs. *See* CIB at 68. The relevant evidence was discussed above in the context of the "LEDs" limitation of '501 patent claim 1. The evidence of record shows that this limitation is met.

[9] Because claim 22 of the '502 patent depends from claims 19, 20, and 21, the infringement, technical prong and invalidity analyses address the limitations of claims 19, 20, 21, and 22. *See* CIB at xxvii.

MASIMO 2043
Apple v. Masimo
IPR2024-00242

c. Element [19B]: "four photodiodes arranged within the user-worn device and configured to receive light after at least a portion of the light has been attenuated by tissue of the user"

There is no dispute that each of the Accused Products contains four photodiodes configured to receive light that has been attenuated by tissue of the user. *See* CIB at 68. The relevant evidence was discussed above in the context of the "photodiodes" limitation of '501 patent claim 1. The evidence of record shows that this limitation is met.

d. Element [19C]: "a protrusion comprising a convex surface including separate openings extending through the protrusion and lined with opaque material, each opening positioned over a different one associated with each of the four photodiodes, the opaque material configured to reduce an amount of light reaching the photodiodes without being attenuated by the tissue"

There is no dispute that each of the Accused Products contains a protrusion comprising a convex surface, as discussed above in the context of the "protrusion" limitation of '501 patent claim 1. *See* CIB at 66. With respect to the '502 patent claim 19 limitation requiring "openings extending through the protrusion," Complainants identify the same "openings" that are discussed above in the context of the "plurality of openings" limitation of '501 patent claim 1. *See* CIB at 66-67. Complainants further identify the same [redacted] discussed above in the context of the "opaque lateral surfaces" limitation of '501 patent claim 1. *Id.*

Apple disputes infringement of this limitation based on its erroneous proposed constructions of the claim terms "over" and "openings." *See* RIB at 26-39; RRB at 21-34. These arguments have been rejected, however, as discussed above in the context of the "plurality of openings" limitation of '501 patent claim 1 and in the claim construction analysis above. *See* Part IV.D, *supra*. Accordingly, the undersigned finds that the Accused Products meet the limitation in '502 patent claim 19 requiring a "protrusion" including "openings extending

MASIMO 2043
Apple v. Masimo
IPR2024-00242

through the protrusion" that are "lined with opaque material," and "each opening positioned over" the photodiodes.

e. Element [19D]: "optically transparent material within each of the openings"

There is no dispute that each of the Accused Products contains optically transparent material within each of the identified openings. *See* CIB at 68. The evidence for the presence of [redacted] in these openings was discussed above in the context of the "plurality of openings" limitation of '501 patent claim 1. The evidence of record shows that this limitation is met.

f. Element [19E]: "one or more processors configured to receive one or more signals from at least one of the four photodiodes and output measurements responsive to the one or more signals, the measurements indicative of the oxygen saturation of the user"

There is no dispute that each of the Accused Products contain processors that receive signals from the photodiodes and output measurements of oxygen saturation. *See* CIB at 68. The relevant evidence was discussed above in the context of the "processors" limitation of '501 patent claim 1. The evidence of record shows that this limitation is met.

g. Element [20]: "further comprising a thermistor"

Claim 20 of the '502 patent depends from claim 19, further requiring a thermistor. There is no dispute that the Accused Products include a thermistor. *See* CIB at 68-69. Dr. Madisetti identified a [redacted] of the Accused Products. Tr. (Madisetti) at 688:18-689:8; *see* CX-0026C (Apple Engineering Requirement Specification) at 31; CX-1548C (Apple Watch teardown photographs) at 37; CX-0059C (Apple Watch Series 7 Engineering Drawings) at 1-5. The evidence of record shows that this limitation is met.

MASIMO 2043
Apple v. Masimo
IPR2024-00242

h. Element [21]: "wherein the one or more processors are further configured to receive a temperature signal from the thermistor and adjust operation of the user-worn device responsive to the temperature signal"

Claim 21 of the '502 patent depends from claim 20, further requiring that "the one or more processors are further configured to receive a temperature signal from the thermistor and adjust operation of the user device responsive to the temperature signal." There is no dispute that the Accused Products [redacted]. *See* CIB at 69-70. Dr. Madisetti identified Apple documents and testimony showing that a processor in the Accused Products [redacted] Tr. (Madisetti) at 689:17-690:16 (citing CX-0100C (Apple Engineering Requirement Specification) at 8; *see also* CX-0281C (Block Dep. Tr.) at 62:3-64:17; CX-0283C (Charonneau-LeFort Dep. Tr.) at 78:4-79:18, 123:6-12; CX-0299C (Waydo Dep. Tr.) at 84:2-85:22; CX-0285C (Dua Dep. Tr.) at 139:1-15. The evidence of record shows that this limitation is met.

i. Element [22]: "wherein the plurality of emitters comprise at least four emitters, and wherein each of the plurality of emitters comprises a respective set of at least three LEDs"

Claim 22 of the '502 patent depends from claim 21, further requiring that "the plurality of emitters comprise at least four emitters, and wherein each of the plurality of emitters comprises a respective set of at least three LEDs." There is no dispute that the plurality of emitters in the Accused Products comprise four sets of three LEDs. *See* CIB at 70-71. The relevant evidence was discussed above in the context of the "LEDs" limitation of '501 patent claim 1. The evidence of record shows that this limitation is met.

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MASIMO 2043
Apple v. Masimo
IPR2024-00242

Accordingly, because each limitation of claims 19, 20, 21, and 22 are satisfied, the undersigned finds that the Accused Products infringe claim 22 of the '502 patent.

3. '502 Patent Claim 28

a. Element [28 preamble]: "A user-worn device configured to non-invasively measure an oxygen saturation of a user, the user worn device comprising:"

There is no dispute that the Accused Products meet the limitations of the preamble of '502 patent claim 28, which requires "[a] user-worn device configured to non-invasively measure an oxygen saturation of a user." *See* CIB at 72. The relevant evidence was discussed above in the context of the preamble of '501 patent claim 1. The evidence of record shows that this limitation is met.

b. Element [28A]: "a first set of light emitting diodes (LEDs), the first set of LEDs comprising at least an LED configured to emit light at a first wavelength and an LED configured to emit light at a second wavelength"

There is no dispute that each of the Accused Products contains four sets of LEDs, with each set containing three LEDs emitting light at different wavelengths. *See* CIB at 72. The relevant evidence was discussed above in the context of the "LEDs" limitation of '501 patent claim 1. The evidence of record shows that this limitation is met.

c. Element [28B]: "a second set of LEDs spaced apart from the first set of LEDs, the second set of LEDs comprising at least an LED configured to emit light at the first wavelength and an LED configured to emit light at the second wavelength"

There is no dispute that each of the Accused Products contains four sets of LEDs, with each set containing three LEDs emitting light at different wavelengths. *See* CIB at 72. The relevant evidence was discussed above in the context of the "LEDs" limitation of '501 patent claim 1, and Dr. Block confirmed that the wavelengths in each of the LED groups is the same--

MASIMO 2043
Apple v. Masimo
IPR2024-00242

containing one infrared LED, one red LED, and one green LED. *See* CX-0281C (Block Dep. Tr.) at 65:5-67:20. The evidence of record shows that this limitation is met.

d. Element [28C]: "four photodiodes arranged in a quadrant configuration on an interior surface of the user-worn device and configured to receive light after at least a portion of the light has been attenuated by tissue of the user"

There is no dispute that each of the Accused Products contains four photodiodes arranged in a quadrant configuration receiving light that has been attenuated by tissue of the user. *See* CIB at 72-73. The relevant evidence was discussed above in the context of the "photodiodes" limitation of '501 patent claim 1, and Dr. Madisetti identified photographs of the sensor board of the Accused Products showing the quadrant configuration of the photodiodes. Tr. (Madisetti) at 692:3-16; CX-1548C. The evidence of record shows that this limitation is met.

e. Element [28D]: "a thermistor configured to provide a temperature signal"

There is no dispute that each of the Accused Products contains a thermistor that provides a temperature signal. *See* CIB at 73. The relevant evidence was discussed above in the context of '502 patent claim 20. The evidence of record shows that this limitation is met.

f. Element [28E]: "a protrusion arranged above the interior surface, the protrusion comprising: a convex surface"

There is no dispute that each of the Accused Products contains a protrusion comprising a convex surface, as discussed above in the context of the "protrusion" limitation of '501 patent claim 1. *See* CIB at 71. Apple disputes infringement of this limitation based on its erroneous proposed construction of the term "above." *See* RIB at 26-34; RRB at 21-29. These arguments have been rejected, however, as discussed above in the context of the "protrusion" limitation of '501 patent claim 1 and in the claim construction analysis above. *See* Part IV.D.1, *supra*.

MASIMO 2043
Apple v. Masimo
IPR2024-00242

Accordingly, the undersigned finds that the Accused Products meet the limitation in '502 patent claim 28 requiring a "protrusion arranged over the interior surface."

g. Element [28F]: "a plurality of openings in the convex surface, extending through the protrusion, and aligned with the four photodiodes, each opening defined by an opaque surface configured to reduce light piping"

With respect to the "plurality of openings" limitation of '502 patent claim 28, Complainants identify the same "openings" that are discussed above in the context of the "plurality of openings" limitation of '501 patent claim 1. *See* CIB at 71. There is no dispute that these openings are aligned with the four photodiodes. *See id.* Apple disputes infringement of this limitation based on its erroneous proposed construction of the term "openings." *See* RIB at 34-39; RRB at 29-34. These arguments have been rejected, however, as discussed above in the context of the "plurality of openings" limitation of '501 patent claim 1. Accordingly, the undersigned finds that the Accused Products meet the limitation in '502 patent claim 28 requiring a "plurality of openings in the convex surface, extending through the protrusion, and aligned with the four photodiodes." Further, there is no dispute that the Accused Products have opaque surfaces surrounding the openings that are configured to reduce light piping, as discussed above in the context of the "opaque lateral surface" limitation of '501 patent claim 1. *See* CIB at 71. Accordingly, the evidence shows that this limitation is met by the Accused Products.

h. Element [28G]: "a plurality of transmissive windows, each of the transmissive windows extending across a different one of the openings"

There is no dispute that each of the Accused Products contains transmissive windows extending across each of the identified openings. *See* CIB at 73. The evidence for the presence of transparent windows in these openings was discussed above in the context of the "plurality of

MASIMO 2043
Apple v. Masimo
IPR2024-00242

openings" limitation of '501 patent claim 1. The evidence of record shows that this limitation is met.

i. Element [28H]: "at least one opaque wall extending between the interior surface and the protrusion, wherein at least the interior surface, the opaque wall and the protrusion form cavities, wherein the photodiodes are arranged on the interior surface within the cavities"

There is no dispute that each of the Accused Products contains an opaque wall between the interior surface and the protrusion that forms a cavity for the photodiodes. *See* CIB at 74. Dr. Madisetti identified the opaque wall in photographs of the Accused Products. Tr. (Madisetti) at 692:17-693:13; *see* CX-1646C (Complaint Exhibit 18) at 4; CX-0026C (Apple Engineering Requirement Specification) at 7-8, 30-32; CX-0059C (Apple Watch Series 7 Engineering Drawings) at 1-3; *see also* CX-0283C (Charbonneau-Lefort Dep. Tr.) at 87:5-8, 105:22-106:7. The evidence of record shows that this limitation is met.

j. Element [28I]: "one or more processors configured to receive one or more signals from at least one of the photodiodes and calculate an oxygen saturation measurement of the user, the one or more processors further configured to receive the temperature signal"

There is no dispute that each of the Accused Products contains processors that receive signals from the photodiodes and output measurements of oxygen saturation, and there is no dispute that the processors receive a temperature signal. *See* CIB at 74. The relevant evidence was discussed above in the context of the "processors" limitations of '501 patent claim 1 and '502 patent claim 21. The evidence of record shows that this limitation is met.

MASIMO 2043
Apple v. Masimo
IPR2024-00242

k. Element [28J]: "a network interface configured to wirelessly communicate the oxygen saturation measurement to at least one of a mobile phone or an electronic network"

There is no dispute that the Accused Products have a network interface that can wirelessly communicate oxygen saturation measurements to a mobile phone or electronic network. *See* CIB at 74-75. Dr. Madisetti identifies Bluetooth and Wi-Fi interfaces that communicate SpO2 measurements to an Apple iPhone. Tr. (Madisetti) at 693:14-694:11; *see* CX-0010 (Apple website) at 5; CX-1726 (Apple Watch Series 7 Technical Specifications) at 21. This operation of the Accused Products was confirmed by the testimony of Apple engineers. *See* CX-0299C (Waydo Dep. Tr.) at 74:20-75:17 (SpO2 measurements "stored in the HealthKit database on the Watch will also eventually make its way to the phone" via "Wi-Fi or Bluetooth"); CX-0285C (Dua) at 144:9-14 ("the heart rate along with the SpO_2 that's measured at the same time are both communicated to the iPhone"). The evidence of record shows that this limitation is met.

l. Element [28K]: "a user interface comprising a touch-screen display, wherein the user interface is configured to display indicia responsive to the oxygen saturation measurement of the user"

There is no dispute that the Accused Products have a touch-screen display that shows oxygen saturation measurements. *See* CIB at 75-76. Dr. Madisetti identified Apple documents showing that Apple Watches have touch-screen displays that can show an SpO2 measurement. Tr. (Madisetti) at 694:12-22 (citing CX-1407 at 3); *see also* CX-0281C (Block Dep. Tr. at 237:11-238:8); CX-0010 (Apple webpage). The evidence of record shows that this limitation is met.

MASIMO 2043
Apple v. Masimo
IPR2024-00242

m. Element [28L]: "a storage device configured to at least temporarily store at least the measurement"

There is no dispute that the Accused Products store the blood oxygen measurement in memory. *See* CIB at 76. Apple engineers confirmed that the SpO2 values are stored in the memory of the Accused Products. *See* CX-0299C (Waydo Dep. Tr.) at 74:17-19; CX-0285C (Dua Dep. Tr.) at 131:8-15; *see also* CX-1726 at 1-2 (identifying memory in Apple Watch Series 7). The evidence of record shows that this limitation is met.

n. Element [28M]: "a strap configured to position the user-worn device on the user"

There is no dispute that the Accused Products have a strap. *See* CIB at 76. Dr. Madisetti identified a strap configured to hold the Accused Products in place on a user's wrist. Tr. (Madisetti) at 695:11-20; *see* CX-0010 (Apple website) at 4; CX-1726 (Apple Watch Series 7 Technical Specifications) at 3. The evidence of record shows that this limitation is met.

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Accordingly, because each limitation of the claim is satisfied, the undersigned finds that the Accused Products infringe claim 28 of the '502 patent.

4. '648 Patent Claim 12[10]

a. Element [8 preamble]: "A user-worn device configured to non-invasively determine measurements of a physiological parameter of a user, the user-worn device comprising:"

There is no dispute that the Accused Products meet the limitations of the preamble of '648 patent claim 8, which requires "[a] user-worn device configured to non-invasively determine measurements of a physiological parameter of a user." *See* CIB at 77. The relevant

[10] Because claim 12 of the '648 patent depends from claim 8, the infringement, technical prong and invalidity analyses address the limitations of claims 8 and 12. *See* CIB at xxix.

MASIMO 2043
Apple v. Masimo
IPR2024-00242

evidence was discussed above in the context of the preamble of '501 patent claim 1. The evidence of record shows that this limitation is met.

b. Element [8A]: "a first set of light emitting diodes (LEDs), the first set comprising at least an LED configured to emit light at a first wavelength and at least an LED configured to emit light at a second wavelength"

There is no dispute that each of the Accused Products contains four sets of LEDs, with each set containing three LEDs emitting light at different wavelengths. *See* CIB at 78. The relevant evidence was discussed above in the context of the "LEDs" limitation of '501 patent claim 1. The evidence of record shows that this limitation is met.

c. Element [8B]: "a second set of LEDs spaced apart from the first set of LEDs, the second set of LEDs comprising an LED configured to emit light at the first wavelength and an LED configured to emit light at the second wavelength"

There is no dispute that each of the Accused Products contains four sets of LEDs, with each set containing three LEDs emitting light at different wavelengths. *See* CIB at 78. The relevant evidence was discussed above in the context of the "LEDs" limitation of '501 patent claim 1 and the "second set of LEDs" limitation of '502 patent claim 28. The evidence of record shows that this limitation is met.

d. Element [8C]: "four photodiodes"

There is no dispute that each of the Accused Products contains four photodiodes. *See* CIB at 78. The relevant evidence was discussed above in the context of the "photodiodes" limitation of '501 patent claim 1. The evidence of record shows that this limitation is met.

e. Element [8D]: "a protrusion comprising a convex surface, at least a portion of the protrusion comprising an opaque material"

There is no dispute that each of the Accused Products contains a protrusion comprising a convex surface, which includes a portion with opaque material. *See* CIB at 78. The relevant

MASIMO 2043
Apple v. Masimo
IPR2024-00242

evidence was discussed above in the context of the "protrusion" and "openings" limitations of '501 patent claim 1. The evidence of record shows that this limitation is met.

f. Element [8E]: "a plurality of openings provided through the protrusion and the convex surface, the openings aligned with the photodiodes"

With respect to the "plurality of openings" limitation of '648 patent claim 8, Complainants identify the same "openings" that are discussed above in the context of the "plurality of openings" limitation of '501 patent claim 1. *See* CIB at 77. There is no dispute that these openings are aligned with the four photodiodes. *See id.* Apple disputes infringement of this limitation based on its erroneous proposed construction of the term "openings." *See* RIB at 34-39; RRB at 29-34. These arguments have been rejected, however, as discussed above in the context of the "plurality of openings" limitation of '501 patent claim 1 and in the claim construction analysis above. *See* Part IV.D.2, *supra*. Accordingly, the undersigned finds that the Accused Products meet the limitation in '648 patent claim 8 requiring a "a plurality of openings provided through the protrusion and the convex surface, the openings aligned with the photodiodes."

g. Element [8F]: "a separate optically transparent window extending across each of the openings"

There is no dispute that each of the Accused Products contains optically transparent windows extending across each of the identified openings. *See* CIB at 78. The evidence for the presence of transparent windows in these openings was discussed above in the context of the "plurality of openings" limitation of '501 patent claim 1. The evidence of record shows that this limitation is met.

MASIMO 2043
Apple v. Masimo
IPR2024-00242

h. Element [8G]: "one or more processors configured to receive one or more signals from at least one of the photodiodes and output measurements of a physiological parameter of a user"

There is no dispute that each of the Accused Products contains processors that receive signals from the photodiodes and output measurements of oxygen saturation. *See* CIB at 79. The relevant evidence was discussed above in the context of the "processors" limitation of '501 patent claim 1. The evidence of record shows that this limitation is met.

i. Element [8H]: "a housing"

There is no dispute that the Accused Products have a housing. *See* CIB at 79. Dr. Madisetti identified a photograph of the housing for the Accused Products. Tr. (Madisetti) at 697:17-24 (citing CX-1548C at 3). The evidence of record shows that this limitation is met.

j. Element [8I]: "a strap configured to position the housing proximate tissue of the user when the device is worn"

There is no dispute that the Accused Products have a strap. *See* CIB at 80. The relevant evidence was discussed above in the context of the "strap" limitation of '502 patent claim 28. The evidence of record shows that this limitation is met.

k. Element [12]: "the physiological parameter comprises oxygen or oxygen saturation"

There is no dispute that the Accused Products meet the limitations of '648 patent claim 12, which depends from claim 8 and requires that "the physiological parameter comprises oxygen or oxygen saturation." *See* CIB at 80. The relevant evidence was discussed above in the context of the preamble and the "physiological parameter" limitation of '501 patent claim 1. The evidence of record shows that this limitation is met.

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Accordingly, because each of the limitations of claims 8 and 12 are satisfied, the undersigned finds that the Accused Products infringe claim 12 of the '648 patent.

MASIMO 2043
Apple v. Masimo
IPR2024-00242

5. '648 Patent Claim 24[11]

a. Element [20 preamble]: "A user-worn device configured to non-invasively determine measurements of a user's tissue, the user-worn device comprising:"

There is no dispute that the Accused Products meet the limitations of the preamble of '648 patent claim 20, which requires "[a] user-worn device configured to non-invasively determine measurements of a user's tissue." *See* CIB at 81. The relevant evidence was discussed above in the context of the preamble of '501 patent claim 1. The evidence of record shows that this limitation is met.

b. Element [20A]: "a plurality of light emitting diodes (LEDs)"

There is no dispute that each of the Accused Products has LEDs. *See* CIB at 82. The relevant evidence was discussed above in the context of the "LEDs" limitation of '501 patent claim 1. The evidence of record shows that this limitation is met.

c. Element [20B]: "at least four photodiodes configured to receive light emitted by the LEDs, the four photodiodes being arranged to capture light at different quadrants of tissue of a user"

There is no dispute that each of the Accused Products contains four photodiodes arranged in quadrants. *See* CIB at 82. The relevant evidence was discussed above in the context of the "photodiodes" limitation of '501 patent claim 1 and the "photodiodes" limitation of '502 patent claim 28. The evidence of record shows that this limitation is met.

d. Element [20C]: "a protrusion comprising a convex surface"

There is no dispute that each of the Accused Products contains a protrusion comprising a convex surface. *See* CIB at 80-81. The relevant evidence was discussed above in the context of

[11] Because claim 24 of the '648 patent depends from claim 20, the infringement, technical prong and invalidity analyses address the limitations of claims 20 and 24. *See* CIB at xxix.

MASIMO 2043
Apple v. Masimo
IPR2024-00242

the "protrusion" limitation of '501 patent claim 1. The evidence of record shows that this limitation is met.

e. Element [20D]: "a plurality of through holes, each through hole including a window and arranged over a different one of the at least four photodiodes"

With respect to the '648 patent claim 20 limitation requiring "a plurality of through holes," Complainants identify the holes in the protrusion that are discussed above in the context of the "plurality of openings" limitation of '501 patent claim 1. *See* CIB at 81. Apple disputes infringement of this limitation based on its erroneous proposed constructions of the claim terms "over" and "through holes." *See* RIB at 26-39; RRB at 21-34. These arguments have been rejected, however, as discussed above in the context of the "plurality of openings" limitation of '501 patent claim 1 and in the claim construction analysis above. *See* Part IV.D, *supra*. Accordingly, the undersigned finds that the Accused Products meet the limitation in '648 patent claim 20 requiring a "a plurality of through holes, each through hole including a window and arranged over a different one of the at least four photodiodes."

f. Element [20E]: "one or more processors configured to receive one or more signals from at least one of the photodiodes and determine measurements of oxygen saturation of the user"

There is no dispute that each of the Accused Products contains processors that receive signals from the photodiodes and output measurements of oxygen saturation. *See* CIB at 82. The relevant evidence was discussed above in the context of the "processors" limitation of '501 patent claim 1. The evidence of record shows that this limitation is met.

g. Element [24]: "wherein the protrusion comprises opaque material configured to substantially prevent light piping"

Claim 24 of the '648 patent depends from claim 20, further requiring that "the protrusion comprises opaque material configured to substantially prevent light piping." There is no dispute

MASIMO 2043
Apple v. Masimo
IPR2024-00242

that the identified protrusion in the Accused Products has a coating and ink that is configured to prevent light piping, as discussed above in the context of the "opaque lateral surface" limitation of '501 patent claim 1. *See* CIB at 82. The evidence of record shows that this limitation is met.

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Accordingly, because each of the limitations of claims 20 and 24 are satisfied, the undersigned finds that the Accused Products infringe claim 24 of the '648 patent.

6. '648 Patent Claim 30

Claim 30 of the '648 patent depends from claim 20, further requiring that "the protrusion further comprises one or more chamfered edges." There is no dispute that the identified protrusion in the Accused Products has chamfered edges. *See* CIB at 82-83. Dr. Madisetti identified chamfered edges on engineering drawings for the Accused Products. Tr. (Madisetti) at 699:4-19; CX-0063C (Apple Watch Series 7 Engineering Drawings) at 2; *see also* CX-1548C (Apple Watch Series 7 Photographs) at 3; CX-0070C (Apple Watch Series 7 Engineering Drawings) at 1. The evidence of record shows that this limitation is met.

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Accordingly, because each of the limitations of claims 20 and 30 are satisfied, the undersigned finds that the Accused Products infringe claim 30 of the '648 patent.

F. Domestic Industry—Technical prong

The domestic industry products that Complainants rely on for the Poeze patents are the RevA sensor (CPX-0052C), the RevD sensor (CPX-0058C), the RevE sensors (CPX-0019C, CPX-0020C, CPX-0065C), and the Masimo W1 (CPX-0146C). CIB at 26-35. Complainants allege that the RevA, RevD, RevE, and Masimo W1 devices practice claim 12 of the '501 patent and claims 12, 24, and 30 of the '648 patent; and that the RevD, RevE, and Masimo W1 devices

MASIMO 2043
Apple v. Masimo
IPR2024-00242

practice claim 28 of the '502 patent. CIB at 85-117. For the reasons discussed below, the evidence shows, by a preponderance, that Complainants have satisfied the technical prong with respect to certain claims of the Poeze patents.

1. Consideration of Post-Complaint Evidence

As an initial matter, the parties dispute whether evidence of post-complaint activities can be considered in the context of the domestic industry requirement. *See* RIB at 18-21; RRB at 17-18, 154; CRB at 11-13.

Apple argues that the only evidence that should be considered with respect to the alleged domestic industry is evidence of activities that pre-date the filing of the complaint, citing Commission precedent requiring that satisfaction of the domestic industry requirement be assessed at the time of the complaint. RIB at 18-21. Apple relies on *Certain Thermoplastic-Encapsulated Electric Motors, Components Thereof, and Products and Vehicles Containing the Same* ("*Thermoplastic-Encapsulated Electric Motors*"), where the Commission stated that "[o]rdinarily, the relevant date at which to determine if the domestic industry requirement of section 337 is satisfied is the filing date of the complaint." Inv. No. 337-TA-1073, Comm'n Op. at 6-7, EDIS Doc. ID 684974 (Aug. 12, 2019). Apple argues that the date of the complaint is the relevant timeframe for evaluating the domestic industry, and that the Commission has held that it "will consider post-complaint evidence regarding domestic industry only in very specific circumstances, *i.e.*, 'when a significant and unusual development has occurred after the complaint has been filed.'" *Certain Collapsible Sockets for Mobile Electronic Devices and Components Thereof*, Inv. No. 337-TA-1056, Comm'n Op. at 15 n.10, EDIS Doc. ID 649819 (July 9, 2018) (quoting *Certain Television Sets, Television Receivers, Television Tuners, and*

MASIMO 2043
Apple v. Masimo
IPR2024-00242

Components Thereof, Inv. No. 337-TA-910, Comm'n Op. at 72, EDIS Doc. ID 568157 (Oct. 30, 2015)).

With respect to the technical prong, Complainants contend that post-complaint evidence can be considered in this investigation because the Masimo W1 (a post-complaint product) has been shown to practice claims of the asserted patents, in contrast to the post-complaint products in *Thermoplastic-Encapsulated Electric Motors*. CRB at 12. With respect to the economic prong, Complainants also distinguish the facts in *Thermoplastic-Encapsulated Electric Motors* because [redacted]. *Id.* Complainants further argue that Masimo has made certain investments that represent significant and unusual developments, including investments in [redacted], [redacted] and the acquisition of Sound United. *See* Tr. (Scruggs) at 433:13-15; Tr. (McGavock) at 543:16-544:14, 545:3-17; Tr. (Al-Ali) at 323:18-324:25; Tr. (Muhsin) at 344:14-345:1; CX-1637 (Masimo 2021 Earnings Presentation) at 19-20; Tr. (Young) at 482:14-25.

Consistent with Commission precedent, evidence regarding Complainants' post-complaint activities will not be considered with respect to the domestic industry in this investigation.

The Commission has held that, "as a general matter, the only activities that are relevant to the determination of whether a domestic industry exists or is in the process of being established are those that occurred before the complaint was filed." *Certain Video Game Systems and Controllers*, Inv. No. 337-TA-743, Comm'n Op., 2012 WL 13171643, at *3 (Jan. 20, 2012). However, "in appropriate situations, based on the specific facts and circumstances of an investigation, the Commission may consider activities and investments beyond the filing of the

MASIMO 2043
Apple v. Masimo
IPR2024-00242

complaint." *Id.*[12] The Commission has held that such "facts and circumstances" may be shown by "a significant and unusual development" such as circumstances pertaining to "bankruptcy, a change in patent ownership, manufacturing, or licensing activity." *Certain Television Sets, Television Receivers, Television Tuners, and Components Thereof*, Inv. No. 337-TA-910, Comm'n Op., 2015 WL 6755093 (Oct. 30, 2015). Where there has been no showing of significant and unusual developments, the Commission has held that it would be error to "consider[] evidence as of the close of discovery, rather than as of the complaint filing date." *Certain Televisions, Remote Controls, and Components Thereof*, Inv. No. 337-TA-1263, Comm'n Op., 2022 WL 17486245, at *13 (Nov. 30, 2022) ("*Certain Televisions*").

Complainants have not made a showing of significant and unusual developments in the present investigation.[13] Complainants rely on developments with respect to the manufacturing of "Masimo Watch" products, CIB at 289-90, but to the extent that the Commission has considered post-complaint evidence due to unusual developments regarding manufacturing, this has been in circumstances involving the cessation of domestic manufacturing. *See, e.g., Certain Video Graphics Display Controllers, and Products Containing Same,* Inv. No. 337-TA-412, Initial Determination at 12-13, EDIS Doc. ID 172529 (May 17, 1999) (unreviewed in relevant part); *Certain Variable Speed Wind Turbines and Components Thereof*, Inv. No. 337-TA-376,

[12] The Federal Circuit has similarly affirmed the Commission's use of the complaint's filing date for assessing domestic industry under the facts and circumstances of the cases at issue. *See Bally/Midway Mfg. v. U.S. Int'l Trade Comm'n*, 714 F.2d 1117, 1120 (Fed Cir. 1983) (holding that, "under the circumstances of this case," the proper date for assessing the domestic "industry" was the filing date of the complaint, where a different position would undercut the purposes of Section 337); *Motiva, LLC v. Int'l Trade Comm'n*, 716 F.3d 596, 601 n.6 (Fed. Cir. 2013) (affirming Commission's use of the complaint's filing date as the relevant date for the domestic industry determination).

[13] Apple argues that Complainants have waived any contention regarding "significant and unusual developments" because this argument was not raised in Complainants' pre-hearing brief. *See* RRB at 154. Complainants did not waive this argument. *See* CPHB at 229-231.

MASIMO 2043
Apple v. Masimo
IPR2024-00242

Comm'n Op. 4, 10-13, EDIS Doc. ID 44138 (Aug. 21, 1997). Masimo's post-complaint progress towards the manufacture of "Masimo Watch" products appears to be consistent with Masimo's pre-complaint plans and projections for these products—there is nothing significant or unusual about these developments. *See* RIB at 19. Accordingly, post-complaint evidence regarding the alleged domestic industry will not be considered. *Cf. Certain Televisions*, 2022 WL 17486245, Comm'n Op. at *13 (holding that, in the context of considering whether the technical prong of the domestic industry had been shown, the ID erred to the extent post-complaint evidence was considered).[14]

Masimo's asserted pre-complaint domestic industry products are the RevA (CPX-0052C), RevD (CPX-0058C), and RevE prototypes (CPX-0019C, CPX-0020C, CPX-0065C). There is no dispute that the RevA and RevD sensors were made before the filing of the complaint—Mr. Scruggs explained that Masimo built the RevA sensor in November 2020, and the RevD sensor in April 2021. Tr. (Scruggs) at 396:2-13, 397:7-24. Masimo contends that two of the RevE prototypes were created pre-complaint. *See* CRB at 31-32.[15]

The undersigned will not consider any evidence regarding the Masimo W1 product, because this product made in December 2021, several months after the complaint was filed. *See* Tr. (Kiani) at 124:5-24; Tr. (Scruggs) at 398:24-399:400:2.

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[14] The underlying Initial Determination reviewed by the Commission, like the investigation here, included a claim for a domestic industry in the process of being established. *See Certain Televisions, Remote Controls, and Components Thereof*, Inv. No. 337-TA-1263, Initial Determination, at 89-92, 144-145 (June 28, 2022) (EDIS Doc. ID 775506).

[15] Apple contends that the software installed on the RevD sensor has a most recent date of July 30, 2021, and that the software installed on the RevE sensors was not loaded until September and October 2021, with an earliest "known date" of July 9, 2021—after the filing of the complaint. *See* RIB at 42-43. This issue is discussed *infra* in the context of whether a domestic industry existed at the time of the complaint.

MASIMO 2043
Apple v. Masimo
IPR2024-00242

A limitation-by-limitation analysis for the RevA, RevD, and RevE devices is set forth below.

2. '501 Patent Claim 12

a. Element [1 preamble]: "A user-worn device configured to noninvasively measure a physiological parameter of a user, the user-worn device comprising:"

The preamble of '501 patent claim 1 requires "[a] user-worn device configured to non-invasively measure a physiological parameter of a user." Complainants submit that the RevA, RevD, and RevE devices meet this limitation because they are configured to measure the oxygen saturation and pulse rate of a user. CIB at 86-87; *see also* CIB at 30-35. Complainants rely on testimony from Mr. Scruggs and Mr. Muhsin describing the functionality of each of the Masimo devices. Tr. (Scruggs) at 407:22-408:4, 410:1-4, 405:8-406:11; Tr. (Muhsin) at 346:6-15. Dr. Madisetti observed a demonstration of the RevA, RevD, and RevE by Mr. Scruggs and determined that these devices each calculate oxygen saturation. Tr. (Madisetti) at 715:20-716:21; CDX-0011C.054. Mr. Al-Ali described internal testing of the oxygen saturation measurements of Masimo's prototype sensors that was presented in October 2020. Tr. (Al-Ali) at 272:16-277:13; CX-0378C at 32. He described this presentation as relating to a sensor with a design consistent with the RevA device (CPX-0052C). *See* Tr. (Al-Ali) at 270:17-22 (referencing *id.* at 260:11-25:14 (discussing CX-0375C; CPX-0052C)). He also described testing of other prototype Masimo Watch devices in early 2021. Tr. (Al-Ali) at 265:15-268:21, 276:12-278:3; CX-0433C. Mr. Al-Ali further described testing of RevE devices in June 2021. Tr. (Al-Ali) at 316:2-317:20; CX-0494C. Masimo submits that the test results for the domestic industry products show a degree of accuracy that is consistent with FDA guidance. CIB at 85 (citing CX-0269).

MASIMO 2043
Apple v. Masimo
IPR2024-00242

Apple argues that Complainants have not met their burden to show that any of the domestic industry products measure oxygen saturation. RIB at 46-52. 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. Apple's experts testified that their observations of demonstrations of the domestic industry products were insufficient to determine whether oxygen saturation or pulse rate were being measured. Tr. (Warren) at 1254:8-1256:25; Tr. (Sarrafzadeh) at 1122:20-1126:20. They further testified that certain measurements of blood oxygen relied upon by Complainants were "inconsistent" with reference measurements from another Masimo device. Tr. (Sarrafzadeh) at 1126:7-20; Tr. (Warren) at 1256:2-25; RDX-0008.149C.

With respect to the RevA and RevD sensors, Apple disputes whether these are "user-worn" devices, because the devices were produced without a strap or any other means for being worn by a user. RIB at 45-46. Complainants submit that each of these sensors includes mechanisms for attaching a strap, and Mr. Scruggs testified that they each had straps "at one point in time." Tr. (Scruggs) at 405:8-406:3, 406:23-407:18; CIB at 89.

In consideration of this evidence, the undersigned finds that Complainants have shown by a preponderance of the evidence that the RevA, RevD, and RevE devices measure blood oxygen saturation. The testimony of Masimo's witnesses is credible regarding the design and testing of these products with respect to measuring blood oxygen, and is supported by the results of the testing described in Masimo's documents. In particular, Mr. Al-Ali explicitly identified testing of blood oxygen functionality conducted in 2020 using prototype designs consistent with the RevA sensor, additional testing in the timeframe of the RevD devices in early 2021, and further testing of RevE devices in June 2021. Tr. (Al-Ali) at 260:11-25:14, 265:15-268:21, 270:17-22,

MASIMO 2043
Apple v. Masimo
IPR2024-00242

276:12-278:3, 315:16-316:18; CX-0375C; CX-0378C; CX-0433C; CX-0494C.[16] Dr. Madisetti observed a demonstration of the RevA, RevD, and RevE by Mr. Scruggs and determined that these devices each calculate oxygen saturation. Tr. (Madisetti) at 715:20-716:21; CDX-0011C.054.[17] Apple's experts also attended a demonstration of the RevA, RevD, and RevE by Mr. Scruggs, although their observations were inconclusive. Tr. (Warren) at 1254:4-1256:25; Tr. (Sarrafzadeh) at 1122:20-1126:20; RDX-0007C.154; RX-1470; *see* Tr. (Warren) at 1258:9-17 ("My opinion is that these DI articles do not implement the functionality in that's in the claims, because I was not able to establish that they were producing physiological parameters.").[18] The testimony of Mr. Ali-Ali regarding Masimo's internal testing, together with Dr. Madisetti's testimony, credibly indicate that Masimo's sensors are configured to make oxygen saturation measurements. *See* Tr. (Ali-Ali) at 272:16-275:12, 276:12-278:3, 318:15-22;

[16] This testing included a [redacted] that, Mr. Ali-Ali explained, provided measurements "well within acceptable numbers for a hospital product." *See* Tr. (Ali-Ali) at 274:11-275:3. Apple argues that this testing is not clearly linked to the specific domestic industry prototypes produced, CRB at 41-42, but the timing of these testing results matches with the development of the RevA, RevD, and RevE devices, and the fact that Masimo was able to test the blood oxygen functionality of multiple prototypes during this time is strong circumstantial evidence that the RevA, RevD, and RevE devices were capable of measuring blood oxygen, particularly given the evidence that these devices were not separate products, but part of an iterative design process. *See, e.g.*, Tr. (Scruggs) at 394:13-398:23. Moreover, as discussed *infra*, a domestic industry in the process of being established does not require the current existence of a physical article. Thus, this testing also strongly supports a finding that Masimo had, at the time of filing the complaint, taken necessary tangible steps to develop a product that will practice this limitation of the patent and a significant likelihood of success in doing so.

[17] Apple cites the fact that Dr. Madisetti was unable to identify the correct Masimo source code at hearing. *See* CRB at 33-34. This does not undercut the demonstrated evidence that Masimo tested its devices to measure blood oxygen saturation.

[18] Apple's experts identified differences in the oxygen saturation measurements of a commercially available pulse oximeter in comparison to the Masimo W1, but this post-complaint device is not being considered as part of the asserted domestic industry. *See* RDX-0008.149C. Moreover, the variation in the measurements appears to be consistent with FDA guidance regarding pulse oximetry—an FDA document identified by Complainants states: "For example, if an FDA-cleared pulse oximeter reads 90%, then the true oxygen saturation in the blood is generally between 86%-94%." CX-0269 (FDA Safety Communication) at 4.

MASIMO 2043
Apple v. Masimo
IPR2024-00242

CX-0378C at 32; CX-0494C; Tr. (Madisetti) at 715:20-716:20; CDX-0011C.054. The evidence of record is sufficient to show, by a preponderance, that the RevA, RevD, and RevE sensors measure blood oxygen.

With respect to the "user-worn" limitation, there is no dispute that the RevE sensors have straps that allow these devices to be worn. *See* Tr. (Scruggs) at 408:20-409:14; CPX-0019C; CPX-0020C; CPX-0065C. The RevA and RevD sensors produced in discovery do not have straps, but these devices have attachment mechanisms for a strap, and Mr. Scruggs testified that these devices had straps "at one point in time." Tr. (Scruggs) at 405:8-406:3, 406:23-407:18, 460:13-17. Moreover, as discussed above, Mr. Al-Ali described testing relating to the Masimo's RevA and RevD sensors in the fall of 2020 and early 2021. Tr. (Al-Ali) at 260:11-25:14, 265:15-268:21, 270:17-22, 276:12-278:3. His description of this testing suggests that the devices were "user-worn." *See Id.* at 278:5-13 (describing placement of devices on user's wrist).[19] The evidence is sufficient to show, by a preponderance, that the RevA, RevD, and RevE sensors meet the "user-worn" limitation.

Accordingly, a preponderance of the evidence of record shows that the RevA, RevD, and RevE sensors meet the limitations of the preamble of '501 patent claim 1.

b. Element [1A]: "at least three light emitting diodes (LEDs)"

There is no dispute that the RevA, RevD, and RevE devices each contain a sensor module with at least three LEDs. *See* CIB at 89-91; RIB at 45-54. Dr. Madisetti identified two clusters of LEDs in each of these devices, with each cluster containing four or five LEDs. Tr. (Madisetti) at 711:14-712:4, 712:20-713:15; CDX-0011C.09 (citing CX-1111C (RevA CAD); CX-1124C

[19] The testing data for the sensor consistent with the RevA device includes "Motion Analysis," including "Walking/Running." CX-0378C at 27.

MASIMO 2043
Apple v. Masimo
IPR2024-00242

(RevD CAD); CX-1125C (RevE CAD); *see* CPX-0052C (RevA); CPX-0058C (Rev D); CPX-0019C, CPX-0020C, CPX-0065C (RevE). The evidence of record shows that this limitation is met by the RevA, RevD, and RevE devices.

c. Element [1B]: "at least three photodiodes arranged on an interior surface of the user-worn device and configured to receive light attenuated by tissue of the user"

Dr. Madisetti identified at least three photodiodes on an interior surface in each of the RevA, RevD, and RevE devices. Tr. (Madisetti) at 712:5-19. He relied on photographs and schematics of the devices to identify the photodiodes. *Id.*; CDX-0011C.050 (for RevA citing CPX-0052C; CX-0661C (photo)); CX-0473C (schematic) at 1, 3; CX-1111C (CAD) at 3, 5, 6; for RevD citing CPX-0058C; CX-0389C (schematic) at 1, 3; CX-1124C (CAD) at 3-4, 8; for RevE citing CPX-0019C, CPX-0020C, CPX-0065C; CX-0653C, CX-0655C, CX-0676C (photos); CX-0390C (schematic) at 1, 3; CX-1125C (CAD) at 2, 6, 7); *see generally* CIB at 91-92.

Apple argues that the evidence produced by Complainants is insufficient to show that these devices each have at least three photodiodes, because these elements are not visible from the outside of the devices and the schematics and technical drawings are allegedly unreliable. RIB at 52-54. Mr. Scruggs admitted that there were certain discrepancies between Masimo's CAD files and the actual RevA, RevD, and RevE sensors, recognizing that the devices represented "what we were able to manufacture at the time." RX-1209C (Scruggs Dep. Tr.) at 91:18-92:24; *see also* Tr. (Scruggs) at 465:2-467:18 (confirming "there are some differences" between the CAD files and the prototype products). Dr. Warren was unable to confirm whether the devices had photodiodes through a visual inspection. Tr. (Warren) at 1259:12-23.

MASIMO 2043
Apple v. Masimo
IPR2024-00242

In consideration of the parties' arguments, the undersigned finds that Complainants have shown by a preponderance of the evidence that the RevA, RevD, and RevE devices each have at least three photodiodes meeting this claim limitation. Although there are some discrepancies between the physical prototypes and Masimo's schematics and technical drawings, there is no evidence that the layout of the photodiodes is inaccurate. Mr. Scruggs testified that "the essential meat and potatoes stuff, like the sensor, it's very accurately reflected" by the CAD drawings, because "that's very important for the devices." Tr. (Scruggs) at 467:2-7, 477:9-478:8; *see also* Tr. (Al-Ali) at 313:144-314:7 (confirming the accuracy of the CAD drawings for the RevE sensors).

Accordingly, the evidence shows, by a preponderance, that each of the RevA, RevD, and RevE devices meet the "at least three photodiodes" limitation of '501 patent claim 1.

d. Element [1C]: "a protrusion arranged over the interior surface, the protrusion comprising a convex surface"

There is no dispute that the RevA, RevD, and RevE devices each contain a convex protrusion. *See* CIB at 92-93. Dr. Madisetti identified convex protrusions in each of these devices, relying on photographs and the physical devices. Tr. (Madisetti) at 713:16-714:7; CDX-0011C.051 (citing CX-0813C (RevA); CX-0815C (RevD); CX-0812C (RevE); *see* CPX-0052C (RevA); CPX-0058C (Rev D); CPX-0019C, CPX-0020C, CPX-0065C (RevE). The evidence of record shows that this limitation is met by the RevA, RevD, and RevE devices.

e. Element [1D]: "a plurality of openings extending through the protrusion and positioned over the three photodiodes"

In the convex protrusion of the RevA, RevD, and RevE devices, Dr. Madisetti identified openings with transparent windows, relying on technical drawings and the physical devices. Tr. (Madisetti) at 714:8-24; CDX-0011C.052 (citing CX-1111C (RevA); CX-1124C (RevD); CX-

MASIMO 2043
Apple v. Masimo
IPR2024-00242

1125C (RevE)); *see* CPX-0052C (RevA); CPX-0058C (Rev D); CPX-0019C, CPX-0020C, CPX-0065C (RevE); CIB at 93-95. Apple argues that these features are not "openings," referencing its non-infringement arguments for this limitation. RRB at 43. This argument is inconsistent with the claim construction for "openings" adopted above, and accordingly, the evidence shows that the RevA, RevD, and RevE devices meet the plurality of openings" limitation of '501 patent claim 1.

f. Element [1E]: "the openings each comprising an opaque lateral surface, the plurality of openings configured to allow light to reach the photodiodes, the opaque lateral surface configured to avoid light piping through the protrusion"

Mr. Scruggs described a "light barrier" present in the RevA, RevD, and RevE devices that is a "black feature that surrounds the emitters so it separates the LEDs from the photodiodes." Tr. (Scruggs) at 400:3-24; CDX-005C.002. He explained that the light barrier was configured "so that light would travel only into the skin and . . . to minimize light traveling within the sensor." *Id.* Dr. Madisetti identified these features in technical drawings for the RevA, RevD, and RevE devices and testified that these were opaque lateral surfaces configured to allow light to reach the photodiodes and to avoid light piping through the protrusion. Tr. (Madisetti) at 714:25-19; CDX-0011C.053 (citing CX-1111C (RevA); CX-1124C (RevD); CX-1125C (RevE)).

Apple argues that the evidence produced by Complainants is insufficient to show that these devices have the claimed opaque lateral surfaces, because these features are not visible from the outside of the devices, and the schematics and technical drawings are allegedly unreliable. RIB at 52-54; RRB at 43-44. For the same reasons discussed above in the context of the "at least three photodiodes" limitation, Complainants have shown by a preponderance of the evidence that the RevA, RevD, and RevE devices each have opaque lateral surfaces meeting this

MASIMO 2043
Apple v. Masimo
IPR2024-00242

claim limitation. The undersigned finds Mr. Scruggs's testimony regarding these features to be credible and Masimo's CAD drawings to be reliable with respect to these features.

Accordingly, the evidence shows by a preponderance that each of the RevA, RevD, and RevE devices meet the "opaque lateral surface" limitation of '501 patent claim 1.

g. Element [1F]: "one or more processors configured to receive one or more signals from the photodiodes and calculate a measurement of the physiological parameter of the user"

Dr. Madisetti identifies processors in the RevA, RevD, and RevE devices that receive signals from photodiodes and calculate oxygen saturation. Tr. (Madisetti) at 715:20-716:21. Dr. Madisetti relies on documentation for each of these products. *Id.*; CDX-0011C.054 (for RevA: CX-0701C at 2, CPX-012C, and CX-0836C at 4; for RevD: CX-0710C at 2-3, CX-1062C at 48, and CX-1074C; for RevE: CX-0705C at 2-3, CX-1062C at 30, 35). Mr. Scruggs described the measurement of oxygen saturation and pulse rate in each iteration of the Masimo Watch. Tr. (Scruggs) at 393:17-394:3. He described the sensor board of the RevA device including two processors on the sensor board responsible for calculating the pulse oximetry measurement. *Id.* at 406:4-11. He also identified two processors on the sensor board of the RevD device. *Id.* at 408:11-19.

As discussed above in the context of the preamble, Apple argues that Complainants have not met their burden to show that any of the domestic industry products measure oxygen saturation. RIB at 46-52. For the reasons discussed above, however, the undersigned finds that Complainants have met their burden to show, by a preponderance, that the RevA, RevD, and RevE devices calculate oxygen saturation. The record evidence further shows, by a preponderance, that the RevA, RevD, and RevE each contain processors for receiving signals from the photodiodes and calculating oxygen saturation.

MASIMO 2043
Apple v. Masimo
IPR2024-00242

Accordingly, the evidence shows that each of the RevA, RevD, and RevE devices meet the "one or more processors" limitation of '501 patent claim 1.

h. Element [12]: "wherein the convex surface of the protrusion is an outermost surface configured to contact the tissue of the user and conform the tissue into a concave shape"

Claim 12 of the '501 patent depends from claim 1, further requiring that "the convex surface of the protrusion is an outermost surface configured to contact the tissue of the user and conform the tissue into a concave shape." There is no dispute that this limitation is practiced by the RevA, RevD, and RevE devices. *See* CIB at 102. As discussed above, Dr. Madisetti identified a convex protrusion in these products, and his analysis confirms that the protrusion is designed to contact a user's wrist and conform the skin into a concave shape. *See* Tr. (Madisetti) at 716:24-717:13; CDX-0011C.055 (citing CX-0813C (RevA); CX-0815C (RevD); CX-0812C (RevE)).

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Accordingly, because each limitation of claims 1 and 12 are satisfied by a preponderance of the evidence, the undersigned finds that the RevA, RevD, and RevE devices practice claim 12 of the '501 patent.

3. '502 Patent Claim 28

a. Element [28 preamble]: "A user-worn device configured to non-invasively measure an oxygen saturation of a user, the user worn device comprising:"

The preamble of '502 patent claim 28 requires "[a] user-worn device configured to non-invasively measure an oxygen saturation of a user." The parties' disputes with respect to this preamble are the same as those addressed above in the context of the preamble of '501 patent claim 1. *See* CIB at 102; RIB at 54. As discussed above in the context of the preamble of '501

MASIMO 2043
Apple v. Masimo
IPR2024-00242

patent claim 1, Complainants have shown by a preponderance of the evidence that the RevD and RevE devices are user-worn devices that measure blood oxygen saturation, meeting the limitations of the preamble of '502 patent claim 28.[20]

b. Element [28A]: "a first set of light emitting diodes (LEDs), the first set of LEDs comprising at least an LED configured to emit light at a first wavelength and an LED configured to emit light at a second wavelength"

There is no dispute that the RevD and RevE devices contain LEDs, as discussed above in the context of the "LEDs" limitation of '501 patent claim 1. *See* CIB at 103. Dr. Madisetti identified two clusters of LEDs in each of these devices, with each cluster containing four or five LEDs. Tr. (Madisetti) at 711:14-712:4, 712:20-713:15; CDX-0011C.09 (citing CX-1111C (RevA CAD); CX-1124C (RevD CAD); CX-1125C (RevE CAD); CX-1128C (Masimo W1 CAD); *see* CPX-0052C (RevA); CPX-0058C (Rev D); CPX-0019C, CPX-0020C, CPX-0065C (RevE)). Complainants rely on the testimony of Mr. Scruggs with respect to the wavelengths of light in these LEDs, identifying clusters of four LEDs in the RevD and RevE devices with wavelengths of [redacted] Tr. (Scruggs) at 406:23-407:18, 408:20-409:14. Apple argues that Dr. Madisetti did not identify any evidence of these wavelengths and that the arrangement of the LEDs could not be confirmed by a visual inspection, RIB at 55, but Mr. Scruggs's testimony and Masimo's schematics are sufficient to show, by a preponderance, that the RevD and RevE devices meet this limitation of '502 patent claim 28.

[20] Complainants do not assert that the RevA device practices claim 28 of the '502 patent. *See* CIB at 102-112.

MASIMO 2043
Apple v. Masimo
IPR2024-00242

c. Element [28B]: "a second set of LEDs spaced apart from the first set of LEDs, the second set of LEDs comprising at least an LED configured to emit light at the first wavelength and an LED configured to emit light at the second wavelength"

As discussed above in the context of the "LEDs" limitation of '501 patent claim 1 and the "first set of LEDs" limitation of '502 patent claim 28, the evidence shows that the RevD and RevE devices each have two separate clusters of LEDs, and Mr. Scruggs described these clusters as having the same sets of wavelengths. *See* Tr. (Scruggs) at 406:23-407:18, 408:20-409:14, 410:5-24. Accordingly, the evidence shows, by a preponderance, that the RevD and RevE devices meet the "second set of LEDs" limitation of '502 patent claim 28.

d. Element [28C]: "four photodiodes arranged in a quadrant configuration on an interior surface of the user-worn device and configured to receive light after at least a portion of the light has been attenuated by tissue of the user"

With respect to the "four photodiodes" limitation of '502 patent claim 28, Complainants rely on the same evidence discussed above in the context of the "at least three photodiodes" limitation of '501 patent claim 1. *See* CIB at 103-04. Complainants identify a "quadrant configuration" in schematics of these products that were reviewed by Dr. Madisetti. *Id.* (citing CDX-0011C.050; CX-1111C; CX-1124C; CX-1125C; CX-1128C). Apple argues that Complainants' evidence with respect to this limitation is unreliable, *see* RIB at 54-55, but for the same reasons discussed above in the context of the "at least three photodiodes" limitation of '501 patent claim 1, the undersigned finds that Complainants have shown by a preponderance of the evidence that the RevD and RevE devices each have four photodiodes arranged in a quadrant configuration that meet this claim limitation.

MASIMO 2043
Apple v. Masimo
IPR2024-00242

e. Element [28D]: "a thermistor configured to provide a temperature signal"

Dr. Madisetti identified thermistors in the RevD and RevE devices, relying on schematics and technical drawings. Tr. (Madisetti) at 720:21-721:5; CDX-0011C.059 (for RevD citing CX-1124C (CAD) at 3, 8; CX-0536C (schematic) at 1, 3; CX-0710C (schematic) at 3, 7; for RevE citing CX-1125C (CAD) at 2, 7; CX-0705C (schematic) at 3, 7; CX-0390C (schematic) at 3). Mr. Scruggs identified two thermistors in the RevD and RevE devices. Tr. (Scruggs) at 406:23-407:18 (RevD), 408:20-409:14 (RevE); *see generally* CIB at 104-106.

Apple argues that the evidence produced by Complainants is insufficient to show that these devices have the claimed thermistors, because these features are not visible from the outside of the devices, and the schematics and technical drawings are allegedly unreliable. RIB at 54-55. For the same reasons discussed above in the context of the photodiode limitations of '501 patent claim 1, the undersigned finds Mr. Scruggs's testimony regarding these features to be credible and Masimo's CAD drawings to be reliable with respect to these features.

Accordingly, the undersigned finds that each of the RevD and RevE devices meet the "thermistor" limitation of '502 patent claim 28.

f. Element [28E]: "a protrusion arranged above the interior surface, the protrusion comprising: a convex surface"

There is no dispute that each of the RevD and RevE devices contain a protrusion comprising a convex surface that is arranged above the interior surface, as discussed above in the context of the "protrusion" limitation of '501 patent claim 1. *See* CIB at 106. The evidence shows, by a preponderance, that this limitation is met by the RevD and RevE devices.

MASIMO 2043
Apple v. Masimo
IPR2024-00242

g. Element [28F]: "a plurality of openings in the convex surface, extending through the protrusion, and aligned with the four photodiodes, each opening defined by an opaque surface configured to reduce light piping"

There is no dispute that each of the RevD and RevE devices have a "plurality of openings" extending through the protrusion and aligned with the photodiodes, as discussed above in the context of the "plurality of openings" limitation of '501 patent claim 1, and these openings are defined by opaque surfaces, as discussed above in the context of the "opaque lateral surface" limitation of '501 patent claim 1. *See* CIB at 106. The evidence shows, by a preponderance, that this limitation is met by the RevD and RevE devices.

h. Element [28G]: "a plurality of transmissive windows, each of the transmissive windows extending across a different one of the openings"

There is no dispute that each of the RevD and RevE devices have a "plurality of transmissive windows," as discussed above in the context of the "plurality of openings" limitation of '501 patent claim 1. *See* CIB at 106-07. The evidence shows, by a preponderance, that this limitation is met by the RevD and RevE devices.

i. Element [28H]: "at least one opaque wall extending between the interior surface and the protrusion, wherein at least the interior surface, the opaque wall and the protrusion form cavities, wherein the photodiodes are arranged on the interior surface within the cavities"

There is no dispute that each of the RevD and RevE devices contain an opaque wall between the interior surface and the protrusion, as discussed above in the context of the "opaque lateral surface" limitation of '501 patent claim 1. *See* CIB at 107-08. Dr. Madisetti further identifies cavities formed by the opaque wall and the protrusion, relying on schematics and technical drawings. Tr. (Madisetti) at 721:6-25; CDX-0011C.060 (for RevD citing CX-1124C (CAD); CX-0666C (schematic); for RevE citing CX-1125C (CAD); CX-1038C (schematic)).

MASIMO 2043
Apple v. Masimo
IPR2024-00242

The evidence shows, by a preponderance, that this limitation is met by the RevD and RevE devices.

j. Element [28I]: "one or more processors configured to receive one or more signals from at least one of the photodiodes and calculate an oxygen saturation measurement of the user, the one or more processors further configured to receive the temperature signal"

There is no dispute that each of the RevD and RevE devices contain processors that receive signals from the photodiodes, as discussed above in the context of the "processors" limitation of '501 patent claim 1. *See* CIB at 108. Apple disputes whether these processors calculate oxygen saturation, RIB at 54, but as discussed above in the context of the preamble of the '501 patent claim 1, a preponderance of the evidence shows that the RevD and RevE devices measure and calculate oxygen saturation. Moreover, there is no dispute that the processors receive a temperature signal, as discussed above in the context of the "thermistor" limitation. *See id.* at 104-108. The evidence shows, by a preponderance, that this limitation is met by the RevD and RevE devices.

k. Element [28J]: "a network interface configured to wirelessly communicate the oxygen saturation measurement to at least one of a mobile phone or an electronic network"

There is no dispute that the RevD and RevE devices contain network interfaces that can communicate with a mobile device via Bluetooth. *See* CIB at 108-110. Dr. Madisetti identified evidence that these devices have a network interface. Tr. (Madisetti) at 722:1-24; CDX-0011C.061 (citing CX-0709C (RevD and RevE sensor board schematic); CX-0836C (RevE demonstration photographs) at 9, 12, 13). Mr. Scruggs described the wireless communication capability of the RevD and RevE devices. Tr. (Scruggs) at 406:23-407:18, 408:20-409:14. The evidence shows, by a preponderance, that this limitation is met by the RevD and RevE devices.

MASIMO 2043
Apple v. Masimo
IPR2024-00242

l. Element [28K]: "a user interface comprising a touch-screen display, wherein the user interface is configured to display indicia responsive to the oxygen saturation measurement of the user"

There is no dispute that the RevD and RevE devices have a touch-screen display that shows oxygen saturation measurements. *See* CIB at 111. Dr. Madisetti identified evidence that these devices have touch-screen displays that can show an SpO2 measurement. Tr. (Madisetti) at 722:1-24; CDX-0011C.061 (citing CPX-058C (RevD device); CX-1062C (photographs); CPX-019C, CPX-020C, CPX-065C (RevE devices); CX-1068C, CX-1069C, CX-1072C (RevE device videos)). The evidence shows, by a preponderance, that this limitation is met by the RevD and RevE devices.

m. Element [28L]: "a storage device configured to at least temporarily store at least the measurement"

There is no dispute that the RevD and RevE devices store the blood oxygen measurement in memory. *See* CIB at 111. Dr. Madisetti identified evidence that these devices have memory to store the SpO2 measurement. Tr. (Madisetti) at 722:1-24; CDX-001C.061 (citing CX-0709C (RevD and RevE sensor board schematic)). The evidence shows, by a preponderance, that this limitation is met by the RevD and RevE devices.

n. Element [28M]: "a strap configured to position the user-worn device on the user"

There is no dispute that the RevE have straps for a user's wrist. *See* CIB at 112; CPX-019C, CPX-020C, CPX-065C. With respect to the RevD device. Complainants identify a mechanism for attaching a strap and rely on Mr. Scruggs's testimony that it had a strap "at some point." *See* Tr. (Scruggs) at 406:23-407:18. As discussed above in the context of the preamble of '501 patent claim 1, the undersigned finds that a preponderance of the evidence shows that the RevD device also had a strap.

MASIMO 2043
Apple v. Masimo
IPR2024-00242

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Accordingly, because each limitation of the claim is satisfied, the undersigned finds that the RevD and RevE products practice claim 28 of the '502 patent.

4. '648 Patent Claim 12

a. Element [8 preamble]: "A user-worn device configured to non-invasively determine measurements of a physiological parameter of a user, the user-worn device comprising:"

The preamble of '648 patent claim 8 requires "[a] user-worn device configured to non-invasively determine measurements of a physiological parameter of a user." The parties' disputes with respect to this preamble are the same as those addressed above in the context of the preamble of '501 patent claim 1. *See* CIB at 112; RIB at 55-56. As discussed above in the context of the preamble of '501 patent claim 1, the undersigned finds that Complainants have shown by a preponderance of the evidence that the RevA, RevD, and RevE devices are user-worn devices that measure blood oxygen saturation, meeting the limitations of the preamble of '502 patent claim 28.

b. Element [8A]: "a first set of light emitting diodes (LEDs), the first set comprising at least an LED configured to emit light at a first wavelength and at least an LED configured to emit light at a second wavelength"

There is no dispute that the RevA, RevD, and RevE devices each contain LEDs, as discussed above in the context of the "LEDs" limitation of '501 patent claim 1. *See* CIB at 112-13. Apple disputes whether the LEDs meet each of these limitations, *see* RIB at 56, but as discussed in the context of the "first set of LEDs" limitation of '502 patent claim 28, the evidence shows that the LEDs are arranged in clusters in the RevD and RevE devices and have a first and second wavelength. In addition, the evidence shows that the LEDs in the RevA device

MASIMO 2043
Apple v. Masimo
IPR2024-00242

have wavelengths that are the same as the RevD and RevE devices, as discussed by Mr. Scruggs. *See* Tr. (Scruggs) at 405:8-406:3.

c. Element [8B]: "a second set of LEDs spaced apart from the first set of LEDs, the second set of LEDs comprising an LED configured to emit light at the first wavelength and an LED configured to emit light at the second wavelength"

There is no dispute that the RevA, RevD, and RevE devices each contain clusters of LEDs, as discussed above in the context of the "LEDs" limitation of '501 patent claim 1. *See* CIB at 112-13. Moreover, the undersigned finds that there is a second set of LEDs in the RevD and RevE devices meeting his limitation, as discussed in the context of the "second set of LEDs" limitation of '502 patent claim 28. *See* CIB at 113. In addition, the evidence shows that there is a second set of LEDs in the RevA device with the same wavelengths as the first set, as discussed by Mr. Scruggs. *See* Tr. (Scruggs) at 405:8-406:3.

d. Element [8C]: "four photodiodes"

Complainants identify four photodiodes in each of the RevA, RevD, and RevE devices, citing the same evidence discussed above in the context of the "photodiodes" limitation of '501 patent claim 1. *See* CIB at 113. Apple disputes whether the evidence is sufficient to show the presence of these photodiodes, *see* RIB at 56, but the evidence shows, by a preponderance, that the RevA, RevD, and RevE devices each contain four photodiodes, for the reasons discussed above in the context of the "photodiodes" limitation of '501 patent claim 1.

e. Element [8D]: "a protrusion comprising a convex surface, at least a portion of the protrusion comprising an opaque material"

There is no dispute that the RevA, RevD, and RevE devices each contain a protrusion comprising a convex surface, which includes a portion with opaque material, as discussed above in the context of the "protrusion" and "openings" limitations of '501 patent claim 1. *See* CIB at

MASIMO 2043
Apple v. Masimo
IPR2024-00242

113. The evidence shows, by a preponderance, that this limitation is met by the RevA, RevD, and RevE devices.

f. Element [8E]: "a plurality of openings provided through the protrusion and the convex surface, the openings aligned with the photodiodes"

Complainants identify a "plurality of openings" in the RevA, RevD, and RevE devices, citing the same evidence discussed above in the context of the "plurality of openings" limitation of '501 patent claim 1. *See* CIB at 113. Apple disputes this limitation based on its erroneous construction for the term "openings." *See* RRB at 46. As discussed above in the context of the "plurality of openings" limitation of '501 patent claim 1, the evidence shows, by a preponderance, that this limitation is met by the RevA, RevD, and RevE devices.

g. Element [8F]: "a separate optically transparent window extending across each of the openings"

There is no dispute that the RevA, RevD, and RevE devices each contain optically transparent windows extending across each of the identified openings, as discussed above in the context of the "plurality of openings" limitation of '501 patent claim 1. *See* CIB at 113-14. The evidence shows, by a preponderance, that this limitation is met by the RevA, RevD, and RevE devices.

h. Element [8G]: "one or more processors configured to receive one or more signals from at least one of the photodiodes and output measurements of a physiological parameter of a user"

There is no dispute that the RevA, RevD, and RevE devices each contain processors that receive signals from the photodiodes, as discussed above in the context of the "processors" limitation of '501 patent claim 1. *See* CIB at 114. Apple disputes whether these processors calculate oxygen saturation, RIB at 56, but as discussed above in the context of the preamble of the '501 patent claim 1, a preponderance of the evidence shows that the RevA, RevD, and RevE

MASIMO 2043
Apple v. Masimo
IPR2024-00242

devices measure and calculate oxygen saturation. The evidence shows, by a preponderance, that this limitation is met by the RevA, RevD, and RevE devices.

i. Element [8H]: "a housing"

There is no dispute that the RevA, RevD, and RevE devices each have a housing. *See* CIB at 114-15. Dr. Madisetti identified photographs of the housing for the RevA, RevD, and RevE devices. Tr. (Madisetti) at 725:19-726:1; CDX-0011C.066 (citing CX-0661C; CX-1058C; CX-1415C; CX-0784C); *see also* CPX-052C; CPX-058C; CPX-019C; CPX-020C; CPX-065C. Mr. Scruggs also testified that the RevA, RevD, and RevE devices each have a housing. Tr. (Scruggs) at 405:8-06:3, 406:23-407:18, 408:20-409:14. The evidence shows, by a preponderance, that this limitation is met by the RevA, RevD, and RevE devices.

j. Element [8I]: "a strap configured to position the housing proximate tissue of the user when the device is worn"

There is no dispute that the RevE devices have straps for a user's wrist. *See* CIB at 115; CPX-019C, CPX-020C, CPX-065C. In addition, as discussed above in the context of the preamble of '501 patent claim 1, the undersigned finds that the record evidence is sufficient to find that the RevA and RevD devices had straps.

k. Element [12]: "the physiological parameter comprises oxygen or oxygen saturation"

Claim 12 of the '648 patent depends from claim 8 and requires that "the physiological parameter comprises oxygen or oxygen saturation." There is no dispute with respect to this limitation, except to the extent that Apple disputes the satisfaction of the preamble limitation regarding the measurement of a physiological parameter. *See* CIB at 115; RIB at 56. The undersigned finds that the RevA, RevD, and RevE devices are configured to determine

MASIMO 2043
Apple v. Masimo
IPR2024-00242

measurements of blood oxygen for the same reasons discussed above in the context of the preamble and the "physiological parameter" limitation of '501 patent claim 1.

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Accordingly, because each limitation of the claim is satisfied, the undersigned finds that the RevA, RevD, and RevE devices practice claim 12 of the '648 patent.

5. '648 Patent Claim 24

a. Element [20 preamble]: "A user-worn device configured to non-invasively determine measurements of a user's tissue, the user-worn device comprising:"

The preamble of '648 patent claim 20 requires "[a] user-worn device configured to non-invasively determine measurements of a user's tissue." The parties' disputes with respect to this preamble are the same as those addressed above in the context of the preamble of '501 patent claim 1. *See* CIB at 115; RIB at 55-56. As discussed above in the context of the preamble of '501 patent claim 1, Complainants have shown by a preponderance of the evidence that the RevA, RevD, and RevE devices are user-worn devices that measure blood oxygen saturation, meeting the limitations of the preamble of '648 patent claim 20.

b. Element [20A]: "a plurality of light emitting diodes (LEDs)"

There is no dispute that the RevA, RevD, and RevE devices each contain LEDs, as discussed above in the context of the "LEDs" limitation of '501 patent claim 1. *See* CIB at 115.

c. Element [20B]: "at least four photodiodes configured to receive light emitted by the LEDs, the four photodiodes being arranged to capture light at different quadrants of tissue of a user"

With respect to the "four photodiodes" limitation of '648 patent claim 20, Complainants rely on the same evidence discussed above in the context of the "four photodiodes" limitation of '502 patent claim 28 for the RevD and RevE devices. *See* CIB at 115-16. Complainants further

MASIMO 2043
Apple v. Masimo
IPR2024-00242

submit that the RevA has four photodiodes arranged in a quadrant configuration, citing a photograph and technical drawings. *See* CX-0661C (photo); CX-0473C (schematic) at 1, 3; CX-1111C (CAD). Apple argues that Complainants' evidence with respect to this limitation is unreliable, *see* CIB at 56, but for the same reasons discussed above in the context of the "at least three photodiodes" limitation of '501 patent claim 1, Complainants have shown by a preponderance of the evidence that the RevA, RevD, and RevE devices each have four photodiodes arranged in a quadrant configuration that meet this claim limitation.

d. Element [20C]: "a protrusion comprising a convex surface"

There is no dispute that the RevA, RevD, and RevE devices each contain a protrusion comprising a convex surface, which includes a portion with opaque material, as discussed above in the context of the "protrusion" limitation of '501 patent claim 1. *See* CIB at 116. The evidence shows, by a preponderance, that this limitation is met by the RevA, RevD, and RevE devices.

e. Element [20D]: "a plurality of through holes, each through hole including a window and arranged over a different one of the at least four photodiodes"

Complainants identify "through holes" in the RevA, RevD, and RevE devices, citing the same evidence discussed above in the context of the "plurality of openings" limitation of '501 patent claim 1. *See* CIB at 116. Apple disputes this limitation based on its erroneous construction for the term "openings." *See* RRB at 46. As discussed above in the context of the "plurality of openings" limitation of '501 patent claim 1, the evidence shows, by a preponderance, that this limitation is met by the RevA, RevD, and RevE devices.

MASIMO 2043
Apple v. Masimo
IPR2024-00242

f. Element [20E]: "one or more processors configured to receive one or more signals from at least one of the photodiodes and determine measurements of oxygen saturation of the user"

There is no dispute that the RevA, RevD, and RevE devices each contain processors that receive signals from the photodiodes, as discussed above in the context of the "processors" limitation of '501 patent claim 1. *See* CIB at 116-17. Apple disputes whether these processors calculate oxygen saturation, RIB at 56, but as discussed above in the context of the preamble of the '501 patent claim 1, a preponderance of the evidence shows that the RevA, RevD, and RevE devices measure and calculate oxygen saturation. The evidence shows, by a preponderance, that this limitation is met by the RevA, RevD, and RevE devices.

g. Element [24]: "wherein the protrusion comprises opaque material configured to substantially prevent light piping"

Claim 24 of the '648 patent depends from claim 20, further requiring that "the protrusion comprises opaque material configured to substantially prevent light piping." There is no dispute that the identified protrusion in the RevA, RevD, and RevE devices meets this limitation, as discussed above in the context of the "opaque lateral surface" limitation of '501 patent claim 1. *See* CIB at 117.

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Accordingly, because each of the limitations of claims 20 and 24 are satisfied, the undersigned finds that the RevA, RevD, and RevE devices practice claim 24 of the '648 patent.

6. '648 Patent Claim 30

Claim 30 of the '648 patent depends from claim 20, further requiring that "the protrusion further comprises one or more chamfered edges." There is no dispute that the identified protrusions in the RevA, RevD, and RevE devices have chamfered edges. *See* CIB at 117. Dr. Madisetti identified chamfered edges on engineering drawings for the RevA, RevD, and

MASIMO 2043
Apple v. Masimo
IPR2024-00242

RevE. Tr. (Madisetti) at 726:2-14; CDX-0011C.067 (citing CX-1111C (RevA); CX-1124C (RevD); CX-1125C (RevE)).

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Accordingly, because each of the limitations of claims 20 and 30 are satisfied, the undersigned finds that the RevA, RevD, and RevE devices practice claim 30 of the '648 patent.

7. Domestic Industry Existing at the Time of the Complaint

Apple argues that no patent-practicing domestic industry article existed at the time of the complaint. RIB at 42-45; RRB at 12-14. Complainants dispute Apple's contentions. CRB at 30-32. As discussed above, Complainants have shown by a preponderance of the evidence that the RevA, RevD, and RevE devices practice claim 12 of the '501 patent and claims 12, 24, and 30 of the '648 patent, and that the RevD and RevE devices also practice claim 28 of the '502 patent.

With respect to a domestic industry that is alleged to exist at the time of the complaint, the Commission has held that a domestic industry article must exist at that time. *See Thermoplastic-Encapsulated Electric Motors*, Comm'n Op. at 9, EDIS Doc. ID 684974 ("Both Federal Circuit law and Commission precedent require the existence of actual 'articles protected by the patent' in order to find that a domestic industry exists.") (citing *Microsoft Corp. v. Int'l Trade Comm'n*, 731 F.3d 1354 (Fed. Cir. 2013) ("[a] company seeking section 337 protection must . . . provide evidence that . . . relates to an actual article that practices the patent")); *id.* at 10 (finding that no domestic industry "exists" relating to the articles protected by the patent where evidence failed to show "the presence of an article protected by the patent at the time of the complaint").

MASIMO 2043
Apple v. Masimo
IPR2024-00242

In consideration of the parties' arguments, the undersigned finds that the RevA, RevD, and RevE devices have been shown to be articles protected by claims of the Poeze patents existing at the time of the complaint. As discussed *supra*, although the RevA and RevD devices were produced in discovery without a strap, a preponderance of the evidence shows that these devices were user-worn devices before the filing of the complaint. *See* Tr. (Scruggs) at 405:8-406:3, 406:23-407:18, 460:13-17; Tr. (Al-Ali) at 260:11-25:14, 265:15-268:21, 270:17-22, 276:12-278:3; CX-0378C at 27.

Apple further argues that the laptop Mr. Scruggs used to display the oxygen saturation measurement from the RevA sensor during discovery was not used with this sensor before the filing of the complaint, RIB at 43-44, but this laptop is not part of the domestic industry article protected by the identified claims of the Poeze patents (Complainants do not assert that the RevA practices claim 22 of the '502 patent, which requires a display). *See* CRB at 30-31. Mr. Scruggs's laptop was part of the demonstration showing that the RevA sensor was configured as required by the claims, *see* Tr. (Madisetti) at 757:16-23; CX-0836C (demonstration photos) at 4, but the laptop is not part of the domestic industry article—the RevA had the required configuration even in the absence of the laptop.[21]

With respect to the RevD sensor, Apple argues that software was loaded on this device on July 30, 2021, after the complaint was filed. RIB at 42-43; *see* Tr. (Scruggs) at 459:4-460:7; Tr. (Sarrafzadeh) at 1121:9-24; RX-1183C.0035-39. As discussed above, however, Mr. Al-Ali described testing of RevD sensors in early 2021—before the filing of the complaint. Tr. (Al-Ali)

[21] 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.

MASIMO 2043
Apple v. Masimo
IPR2024-00242

at 276:17-278:13. A preponderance of the evidence thus shows that the RevD existed prior to the complaint.[22]

With respect to the RevE devices, Apple argues that the software installed on these devices has a "known date" of July 9, 2021, and this software was loaded on these devices in September and October 2021. *See* RIB at 42-43; Tr. (Scruggs) at 457:12-25, 458:1-459:2, 460:23-461:16; Tr. (Sarrafzadeh) at 1121:9-24; RX-1183C.0035-39. At the hearing, Mr. Scruggs could not specifically identify a date when the RevE devices were made, stating that they were "built between May and September 2021," a range of dates that includes the date the complaint was filed. Tr. (Scruggs) at 398:20-23; *see id.* at 458:1-459:3 (admitting that CPX-0020C was created in September 2021). The evidence shows that at least one of the RevE devices produced (CPX-0019C) existed at the time of the complaint—the evidence shows that software was loaded on this device on July 9, 2021,[23] which pre-dates the filing date of the amended complaint, July 12, 2021, as recognized in the Commission's Notice of Institution. 86 Fed. Reg. 46275.[24] Moreover, Mr. Al-Ali described testing of RevE devices (though not the

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[22] Apple's arguments focus on the physical devices produced in discovery, *e.g.*, CPX-0058C, which were loaded with specific software, but the circumstantial evidence regarding testing shows, by a preponderance of the evidence, that prototype devices with designs that are consistent with the asserted domestic industry products were operational before the filing of the complaint and subject to testing. *See* Tr. (Ali-Ali) at 272:16-275:12, 276:12-278:3, 318:15-22; CX-0378C at 32; CX-0494C; n.16 *supra*.

[23] Complainants acknowledge that these devices were altered after the filing of the complaint with "different firmware versions prior to and subsequent to that version for development," but have represented that the July 9 version of the software was restored in October 2021. *See* RX-1183C.0037-.0039; Tr. (Scruggs) at 457:9-21 (software was installed on physical 19 on July 9, 2021).

[24] The original complaint was filed on June 30, 2021, with a redacted public version of an amended complaint filed July 7, 2021, a full confidential version of the amended complaint filed on July 12, 2021, and a supplement to the complaint filed on July 19, 2021. *See* EDIS Doc. ID 745713, 746186, 746514, 747244. *See In re Samsung Electronics Co., Ltd.*, 2 F.4th 1371, 1376 (Fed. Cir. 2021) (amended complaints supersede the original complaint); *Nolen v. Lufkin Indus., Inc.*, 466 Fed. Appx. 895, 898 (Fed. Cir. 2012) ("Generally, an amended pleading supersedes the original for all purposes").

MASIMO 2043
Apple v. Masimo
IPR2024-00242

specific devices produced) in June 2021. Tr. (Al-Ali) at 316:2-317:20 (citing CX-0494C and explaining "that data was collected on June 29th). This record is sufficient to show, by a preponderance of the evidence, that RevE devices existed and practiced asserted claims of Poeze patents at the time the complaint was filed.

* * *

Accordingly, Complainants have shown that the technical prong of the domestic industry requirement is satisfied with respect to a domestic industry existing at the time of the complaint for the Poeze patents.

8. Domestic Industry in the Process of Being Established

Complainants have separately alleged that there is a domestic industry in the process of being established. CIB at 305-09; *see* Amended Complaint ¶ 86. In *Certain Stringed Musical Instruments & Components Thereof* ("*Stringed Instruments*"), the Commission held that a domestic industry is in the process of being established when (1) a complainant takes "the necessary tangible steps to establish such an industry in the United States," and (2) there is a "significant likelihood that the industry requirement will be satisfied in the future." Inv. No. 337-TA-586, Comm'n Op. at 14-17, EDIS Doc. ID 300615 (May 16, 2008). The Commission recently declined to adopt an ID's finding that a currently existing article must exist at the time of the complaint to show a domestic industry in the process of being established. *Certain Televisions, Remote Controls, and Components Thereof*, Comm'n Op., Inv. No. 337-TA-1263, 2022 WL 17486245, at *15 (Nov. 30, 2022) ("The Commission, however, does not adopt the ID's finding that a currently existing physical article must exist at the time of the complaint filing to show a domestic industry in the process of being established."). The Commission further found that a domestic industry in the process of being established had not been shown because

MASIMO 2043
Apple v. Masimo
IPR2024-00242

the record lacked sufficient evidence of a future physical article that would practice the patent. *See id.* (Roku failed to produce "sufficient evidence of how . . . [the] domestic industry device . . . ***will operate*** so as to allow the parties to probe in discovery, and the Commission to make a determination, as to whether Gazelle ***will practice*** the '875 patent") (emphasis added).[25] The Commission's discussion indicates that a physical article practicing the patent need not yet exist to prove a "process of being established claim."[26]

Following this guidance, the evidence of record shows, by a preponderance, that the technical prong of the domestic industry requirement is satisfied based on an industry in the process of being established. As discussed *supra*, the evidence shows that the RevA device practices claim 12 of the '501 patent and claims 12, 24, and 30 of the '648 patent. Similarly, the RevD and RevE devices meet all of the limitations of claim 12 of the '501 patent, claim 28 of the '502 patent, and claims 12, 24, and 30 of the '648 patent.

Even if certain of the Masimo Watch prototypes were missing limitations of the Poeze patents, *e.g.*, the "user-worn" limitation in the claim preambles, the evidence shows that at the

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[25] *See also id.* ("'Respondents have had no opportunity to evaluate . . . whether Roku's future promised product actually would practice the claims of the '875 patent'") (quoting ID with approval); *id.* (finding that Roku failed to meet its burden of showing "that there was a significant likelihood that the Gazelle Remote (or any other physical article) would practice one or more claims of the '875 patent in the future"); *id.* ("Evidence of a complainant's progress towards an article that will practice one or more claims of the asserted patent as of the complaint filing date is relevant to whether the complainant has taken the necessary tangible steps to establish an industry, and whether there is a significant likelihood that the domestic industry requirement will be satisfied in the future").

[26] At the time the parties filed their post-hearing briefs, the Commission had not yet addressed in this manner "the circumstances, if any, in which a complainant can demonstrate a domestic industry in the process of being established absent the existence of a protected article." *Thermoplastic-Encapsulated Motors*, Comm'n Op. at 11-12, 2019 WL 9596564, at *7 (EDIS Doc. ID 684974); *cf. Certain Mobile Devices with Multifunction Emulators*; Inv. No. 337-TA-1170, Initial Determination at 148-52, EDIS Doc. ID 738549 (Mar. 16, 2021) (finding satisfaction of the technical prong in the absence of a physical article based on complainants' "tangible and necessary steps to practice the claim" and a "significant likelihood that the practice will occur."), *reviewed and taking no position on this issue*, Comm'n Notice, EDIS 747056 (July 16, 2021).

MASIMO 2043
Apple v. Masimo
IPR2024-00242

time of the complaint, Masimo had taken necessary "tangible steps" in engineering and research and development towards a product that practiced claims of the Poeze patents. As described above, Masimo's design documents and testing results show that the Masimo Watch prototypes in development meet the limitations of the Poeze patents.[27] Mr. Scruggs described the development process for Masimo Watch prototypes as an iterative process. *See id.* at 393:12-20 ("we've designed, built, and tested many iterations of the Masimo Watch"), 402:2-12 (describing "the progression of the different sensor designs"); *see also* Tr. (Muhsin) at 342:25-343:7 (describing "many iterations of wrist sensors"), 345:2-7 (describing "[m]any iterations on the watch through the design phases"); Tr. (Al-Ali) at 275:13-276:11 (describing ongoing testing of sensor designs, and with each subsequent design, "[i]t gets a little bit better"). Thus, even if the evidence were insufficient to show that the RevA, RevD, and RevE devices existing at the time of the complaint practiced each of the limitations of the asserted claims, the evidence would be sufficient to show a domestic industry in the process of being established.

Accordingly, the undersigned finds that Complainants have satisfied the technical prong with respect to claim 12 of the '501 patent, claim 28 of the '502 patent, and claims 12, 24, and 30 of the '648 patent, for a domestic industry in the process of being established based on the RevA, RevD, and RevE devices.

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[27] Apple argues that its experts were not allowed certain access to the prototypes (*see* RIB at 48-49), but Complainants produced schematics, source code, and the data from Masimo's testing regarding these prototypes in discovery, and provided witnesses for deposition. *See* CRB at 29-30, 33-34. Many of Apple's complaints regarding domestic industry discovery were addressed in the context of Apple's motion for sanctions and Apple's motion to strike domestic industry contentions. *See* Order No. 31 (Apr. 8, 2022); Order No. 32 (May 5, 2022). The record shows that Apple was provided a reasonable opportunity to evaluate whether Masimo's development activities would result in a product practicing the asserted claims. *See Certain Televisions, Remote Controls, and Components Thereof*, Inv. No. 337-TA-1263, Comm'n Op., 2022 WL 17486245, at *15 (Nov. 30, 2022) (noting that respondents should be given an "opportunity to evaluate in fact or expert discovery whether [complainant]'s future promised product actually would practice the claims").

MASIMO 2043
Apple v. Masimo
IPR2024-00242

G. Invalidity – Anticipation/Obviousness

Apple alleges that the asserted claims of the Poeze patents are invalid as anticipated in view of U.S. Patent No. 7,620,212 (RX-0411), entitled "Electro-Optical Sensor," which issued from an application filed on August 12, 2003, identifying assignee Lumidigm, Inc. (RX-0411 is referenced herein as "Lumidigm"). RIB at 67-103. There is no dispute that Lumidigm is prior art to the Poeze patents.

Apple further alleges that the asserted claims of the Poeze patents are invalid as obvious in view of Lumidigm alone or in combination with U.S. Patent No. 5,766,131 (RX-0666, "Seiko '131"), which issued from an application filed on July 30, 1996; U.S. Patent No. 4,224,948 (RX-0670, "Cramer"), which issued from an application filed on November 24, 1987, the textbook *Design of Pulse Oximeters* by J.G. Webster (RX-0035, "Webster"), published in 1997; and/or U.S. Patent No. 9,001,047 (RX-0673, "Apple '047"), which issued from an application filed on January 4, 2008. RIB at 67-103. There is no dispute that these references are prior art to the Poeze patents.

The undersigned finds that Lumidigm does not anticipate any asserted claim of the Poeze patents at least because, as discussed below, it does not include the required "protrusion" with a "convex" surface as set forth in all asserted claims. Accordingly, the relevant analysis for all asserted claims is an obviousness assessment. For the reasons discussed below, the evidence shows, clearly and convincingly, that '501 patent claim 12 is invalid as obvious. Apple has not shown, clearly and convincingly, that any of the asserted claims of the '502 patent or the '648 patent is invalid as obvious.

MASIMO 2043
Apple v. Masimo
IPR2024-00242

1. '501 Patent Claim 12

a. Element [1 preamble]: "A user-worn device configured to noninvasively measure a physiological parameter of a user, the user-worn device comprising:"

Apple submits that Lumidigm discloses a "user-worn device configured to noninvasively measure a physiological parameter of a user" in Figure 8B, a "biometric reader" that "is built into the case of a wristwatch." RX-0411 at 11:60-12:2; *see* Tr. (Warren) at 1207:23-1208:13; RDX-8C.23.

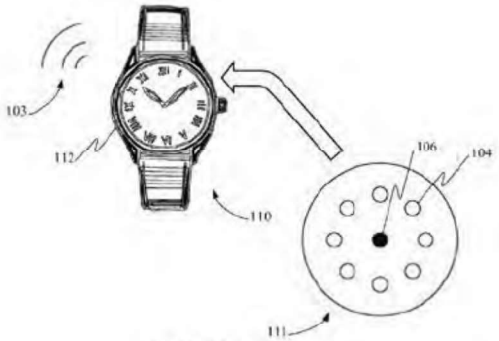


FIG. 8B

This device "operates based upon signals detected from the skin in the area of the wrist." RX-0411 at 11:60-63. Apple submits that Lumidigm discloses embodiments in which the sensor is incorporated into a user-worn wristwatch, and that in certain embodiments, Lumidigm's sensor uses those signals to "measure physiological parameters, based on the 'concentration of a substance in the individual's tissue,' including 'oxygenation and/or hemoglobin levels in the blood.'" RIB at 70 (citing RX-0411 at 19: 16-28, 11:61-64, Tr. (Warren) at 1208:1-13, 1214:12-1215:4); *see also* RIB at 68.

Complainants argue that Lumidigm fails to disclose non-invasively measuring a physiological parameter in the wristwatch embodiment of Figure 8B. CIB at 124-26. Complainants submit that the "biometric reader" of Lumidigm is used to identify a user based on "tissue spectral data" and not to measure a physiological parameter. *Id.* (citing RX-0411 at

MASIMO 2043
Apple v. Masimo
IPR2024-00242

10:42-59, 5:30-44, 11:15-28, 11:60-61); *see* Tr. (Madisetti) at 1340:17-25, 1341:8-12. Complainants argue that the "extended functionality" of Lumidigm is not disclosed in connection with the wristwatch embodiment. *See* Tr. (Madisetti) at 1330:6-8, 1330:20-1331:11, 1340:17-1341:14. Complainants describe these functionalities as part of a "brainstorming session," relying on the testimony of Robert Rowe, one of the named inventors of Lumidigm. *See* Tr. (Rowe) at 1146:18-1147:3.

In consideration of the parties' arguments, the undersigned finds that Lumidigm meets the limitations of the preamble of '501 patent claim 1 by disclosing a user-worn wristwatch embodiment with a biometric sensor configured to measure a physiological parameter. *See* RX-0411 at 3:35-47, 11:60-12:2, 19:18-28; Tr. (Warren) at 1208:1-12; RDX-8.20 (identifying, *inter alia*, incorporation of a "alcohol-monitor function" and a "bilirubin-monitor function"). Lumidigm describes the measurement of such parameters as a non-invasive "spectroscopic function." *Id.* at 3:45-47, 19:18-28. The undersigned agrees with Complainants that the primary focus of Lumidigm is a biometric sensor for identification, but Lumidigm clearly discloses additional "extended functionality" using "the spectral-analysis capabilities of the biometric sensor," including where "the spectral analysis is used to identify a physiological state of an individual." *Id.* at 18:26-28. Lumidigm provides that "identification of such a physiological state may be made by measuring the spectral variation of a measured spectrum for light scattered by the tissue of the individual, and comparing it with a reference spectral variation." *Id.* at 18:29-32. Lumidigm describes, *inter alia*, examples of a bilirubin monitor and a blood-alcohol monitor. *Id.* at 19:29-50.

These disclosures of physiological monitoring are in the "extended functionality" section of the Lumidigm specification, which are clearly applicable to the user-worn wristwatch

MASIMO 2043
Apple v. Masimo
IPR2024-00242

embodiment, with the specification stating that the extended functionalities are "especially suitable when the biometric sensor is comprised by a portable device, such as a portable electronic device." *Id.* at 17:67-18:2. The specification explicitly identifies "a watch" as an example of a "portable electronic device having extended functionality." *Id.* at 3:21-37. These extended functionalities, in combination with biometric functions, are also reflected in the claims of the Lumidigm patent, which claim a device "further configured to operate the biometric sensor to perform a nonbiometric function," and providing a limited set of nonbiometric functions including "an alcohol-monitor function, a bilirubin-monitor function," and "a hemoglobin-monitor function." *Id.* at 25:35-45 (claims 11 and 12).

Complainants cite evidence that the Lumidigm inventors never developed a device with the described extended functionalities, *see* CIB at 126-27, but "the invention in a prior art publication need not have actually been made or performed to satisfy enablement." *In re Antor Media Corp.*, 689 F.3d 1282, 1290 (Fed. Cir. 2012). Moreover, there is a "presumption . . . that both the claimed and unclaimed disclosures in a prior art patent are enabled." *Amgen Inc. v. Hoechst Marison Roussel, Inc.*, 314 F.3d 1313, 1355 (Fed. Cir. 2003).[28]

[28] While this statement in *Amgen* arose in the context of an anticipation analysis, it is relevant to obviousness as well. While a non-enabled prior art reference can be used in an obviousness analysis for what it teaches, "the evidence of record must still establish that a skilled artisan could have made the claimed invention." *Raytheon Techs. Corp. v. GE Co.*, 993 F.3d 1374, 1381 (Fed. Cir. 2021) ("even though a non-enabling reference can play a role in an obviousness analysis, the evidence of record must still establish that a skilled artisan could have made the claimed invention"). The Federal Circuit has held that "[i]n the absence of . . . other supporting evidence to enable a skilled artisan to make the claimed invention, a standalone § 103 reference must enable the portions of its disclosure being relied upon . . . the same standard applied to anticipatory references." *Id.* at 1381. This holding indicates that the same presumption applied to asserted anticipation references can be applied to an embodiment disclosed in a prior art obviousness reference. *See also In re Kumar*, 418 F.3d 1361, 1368 (Fed. Cir. 2005) ("when a *prima facie* case of obviousness is deemed made . . . rebuttal may take the form of evidence that the prior art does not enable the claimed subject matter . . . [t]he applicant has the burden of coming forward with evidence in rebuttal").

MASIMO 2043
Apple v. Masimo
IPR2024-00242

Complainants identify evidence that measuring blood oxygen at the wrist would have been unlikely to be successful at the time of the Poeze patents, *see* CIB at 127-29, but claim 1 of the '501 patent is not limited to blood oxygen—the preamble limitations can be met by a device that measures any "physiological parameter." Lumidigm describes functionality for measuring several different physiological parameters, *e.g.*, hemoglobin levels, bilirubin, and blood alcohol, and Complainants have not offered any evidence to rebut the presumption that these functionalities are enabled by Lumidigm's disclosure.[29] Accordingly, the undersigned finds that Lumidigm clearly and convincingly discloses the preamble limitation of claim 1.

b. Element [1A]: "at least three light emitting diodes (LEDs)"

There is no dispute that Lumidigm discloses at least three LEDs. *See* CIB at 71-72. Lumidigm describes a "sensor assembly" that "comprises a plurality of light sources." RX-0411 at 6:22-24. Lumidigm explicitly states that these light sources "may comprise light emitting diodes ('LEDs')." *Id.* at 6:38-43. There are more than three light sources depicted in the wristwatch embodiment in Figure 8B, and Lumidigm provides that "FIG. 8B again shows the equidistant-sensor geometry of FIG. 4 for illustrative purposes only; more generally, any of the sensor geometries previously disclosed or other equivalent configurations can be used for this application." *Id.* at 11:65-12:2. One such alternative to the sensor geometry of Figure 4 is depicted in Figure 6, which shows 3 light sources:

[29] Complainants' arguments regarding blood oxygen are discussed *infra* in relation to the '502 and '648 patents. As set forth therein, the undersigned agrees with Complainants that there is no prior art enablement of a wristwatch that measures blood oxygen.

MASIMO 2043
Apple v. Masimo
IPR2024-00242

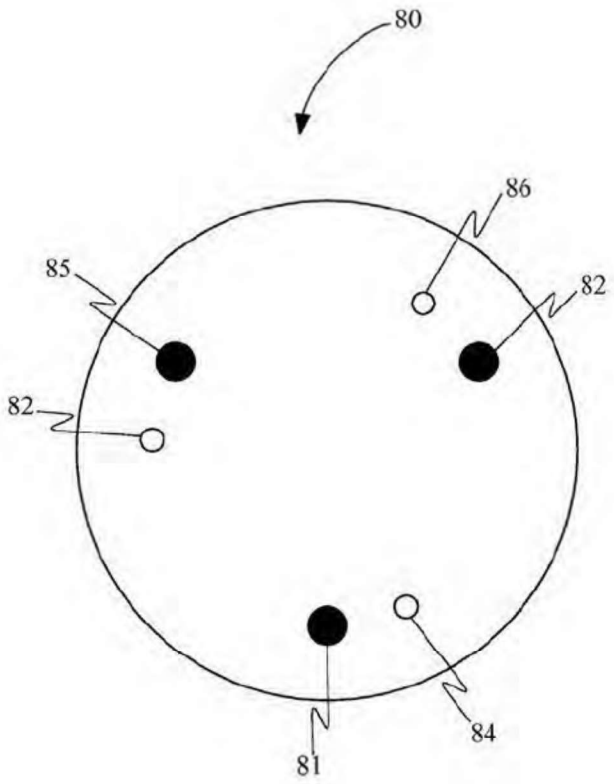


FIG. 6

Id. at Fig. 6, 9:12-25 (identifying "light sources 82, 84, 86"). Moreover, Lumidigm explicitly discloses that "any of the sensor geometries previously disclosed or other equivalent configurations can be used for" the wristwatch embodiment. *Id.* at 11:65-12:2. Given this explicit statement, the evidence indicates that Lumidigm discloses the wristwatch embodiment using the sensor geometry of Figure 6.

c. Element [1B]: "at least three photodiodes arranged on an interior surface of the user-worn device and configured to receive light attenuated by tissue of the user"

Apple contends that Lumidigm discloses "at least three photodiodes." RIB at 72-74; *see* Tr. (Warren) at 1208:25-1209:17. Apple cites to Figure 6 of Lumidigm, depicted above, which shows "three detectors 81, 83, 85." RX-0411 at 9:15-18. Lumidigm also discloses that "[t]he detector type and material is chosen to be appropriate to the source wavelengths and the

MASIMO 2043
Apple v. Masimo
IPR2024-00242

measurement signal and timing requirements," providing examples of "PbS, PbSe, InSb, InGaAs, . . . ," and for a "spectral range from about 350 nm to about 1100 nm, a suitable detector material is silicon." *Id.* at 6:56-63. Dr. Warren testified at the hearing that a detector made of indium gallium arsenide (InGaAs) or silicon would be a photodiode. Tr. (Warren) at 1209:14-17. This testimony is corroborated by references to silicon photodiodes in other prior art references. *See* RX-0035.0053 ("The photodetector is a silicon photodiode"); RX-1221 ("silicon NPN planar epitaxial phototransistors").

Apple further contends that the photodiodes disclosed in Lumidigm are "arranged on an interior surface," citing Figure 2, which depicts "the detector 36 recessed from the sensor surface 39 in optically opaque material 37 that makes up the body of the sensor head 32." RX-0411 at 8:1-4.

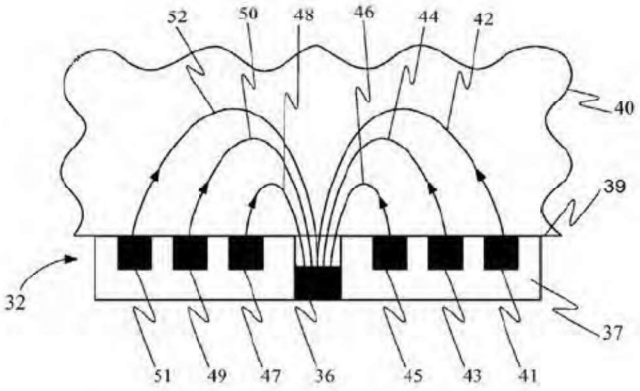


FIG. 2

Id. at Fig. 2; RIB at 73-74. Lumidigm describes this "optical geometry" as a "diffuse reflectance sampling geometry where the light sources and detector lie on the same side of the tissue." RX-0411 at 7:12-14. While one detector is depicted in Figure 2, Apple cites Lumidigm's disclosure that "[t]he detector 36 may comprise a single element, a plurality of discrete elements, or a one- or two-dimensional array of elements." *Id.* at 4:54-56.

MASIMO 2043
Apple v. Masimo
IPR2024-00242

Complainants argue that there is no explicit disclosure of photodiodes in Lumidigm and there is no disclosure of three photodiodes arranged on an interior surface in connection with the wristwatch embodiment. CIB at 130; CRB at 46.

In consideration of the parties' arguments, the undersigned finds that Lumidigm meets the "at least three photodiodes" limitation of '501 patent claim 1. Lumidigm clearly discloses silicon detectors, and Complainants fail to offer any rebuttal to Mr. Warren's testimony, corroborated by other prior art disclosures, that the silicon detectors are photodiodes. *See* Tr. (Warren) at 1209:14-17. Three photodiodes are explicitly disclosed in Figure 6 of Lumidigm. *See* RX-0411 at 9:15-25. As discussed above, Lumidigm contains an express disclosure that "any of the sensor geometries previously disclosed or other equivalent configurations can be used for" the wristwatch embodiment. *Id.* at 11:65-12:2.

Although there is no explicit depiction of three detectors arranged on an interior surface like the single detector in the cross-section of Figure 2, the Federal Circuit has held that "a reference can anticipate a claim even if it 'd[oes] not expressly spell out' all the limitations arranged or combined as in the claim, if a person of skill in the art, reading the reference, would 'at once envisage' the claimed arrangement or combination." *Kennametal, Inc. v. Ingersoll Cutting Tool Co.*, 780 F.3d 1376, 1381 (Fed. Cir. 2015). Relying on this precedent, the Federal Circuit upheld a finding of anticipation based on prior art that "explicitly contemplates the combination of the disclosed functionalities." *Blue Calypso, LLC v. Groupon, Inc.*, 815 F.3d 1331, 1343 (Fed. Cir. 2016). Lumidigm's Figure 2 is a cross-sectional view of the arrangement of light sources and detector depicted in Figure 3, *id.* at 8:33-42, and the arrangement of three light sources and three detectors in Figure 6 is one specifically disclosed alternative to Figure 3. *See id.* at 9:12-25; Tr. (Warren) at 1211:15-20 (cross-section for Fig. 6 would be similar to Fig.

MASIMO 2043
Apple v. Masimo
IPR2024-00242

2).[30] As recognized by Dr. Warren, Lumidigm expressly discloses the use of these source-detector arrangements in the wristwatch embodiment. *See* Tr. (Warren) at 1214:12-1215:4; RX-0411 at 11:65-12:2.[31] Accordingly, the undersigned finds that Lumidigm's disclosures meet this limitation in the context of Lumidign's wristwatch embodiment.

d. Element [1C]: "a protrusion arranged over the interior surface, the protrusion comprising a convex surface"

Apple contends that Lumidigm discloses a protrusion meeting the limitations of '501 patent claim 1. RIB at 74-75. Apple points to sensor head 32 depicted in Figure 2 of Lumidigm, citing a statement in the specification that "[t]he sensor head 32 may also have a compound curvature on the optical surface to match the profile of a device in which it is mounted, to incorporate ergonomic features that allow for good optical and mechanical coupling with the tissue being measured, or for other technical or stylistic reasons." RX-0411 at 7:57-63. Apple relies on Dr. Warren's testimony that a person of ordinary skill in the art would read the disclosure of a "compound curvature" and "realize that a practical implementation of this would be a convex surface." Tr. (Warren) at 1211:2-8.

Complainants argue that Lumidigm's sensor head 32 is flat, and there is no explicit disclosure of a protrusion comprising a convex surface. RIB at 130-32. Dr. Madisetti testified that Lumidigm's description of curvature to match the profile of a wristwatch would likely result in a concave shape, citing the deposition testimony of Robert Rowe, one of the Lumidigm

[30] Figures 3, 4, and 6 all depict source-detector arrangements in a circular shape that appears the same as the back of the wristwatch depicted in Figure 8B. *See* RX-0411 at Fig. 3, Fig. 4, Fig. 6, Fig. 8B.

[31] In addition, the evidence shows that Figure 2 depicts sensor surface 39 above an "interior surface" where detector 36 is located. *See* RX-0411 at 8:1-4 ("FIG. 2 illustrates a sensor-head geometry wherein the detector 36 is recessed from the sensor surface 39 in optically opaque material 37 that makes up the body of the sensor head 32."); Tr. (Warren) at 1209:19-1210:11; RIB at 73-74.

MASIMO 2043
Apple v. Masimo
IPR2024-00242

inventors. Tr. (Madisetti) at 1331:12-1332:24 (citing CX-0279C (Rowe Dep. Tr.) at 69:8-21). Complainants further argue that the statement regarding Lumidigm's wristwatch embodiment describing different configurations of "sensor geometries" only refers to the arrangement of light sources and detectors—not to the shape of the surface of the sensor head. CIB at 132.

In consideration of the parties' arguments, the undersigned finds that the evidence fails to show, clearly and convincingly, that Lumidigm alone discloses the claimed "protrusion comprising a convex surface" limitation of '501 patent claim 1. As depicted in Figure 2 of Lumidigm, sensor surface 39 of sensor head 32 is flat. While the description of "compound curvature" in Lumidigm's specification allows for the possibility of a convex shape, this is insufficient to show that this limitation is inherent in Lumidigm. *See Guangdong Alison Hi-Tech Co. v. Int'l Trade Comm'n*, 936 F.3d 1353, 1364 (Fed. Cir. 2019) ("An element may be inherently disclosed only if it is necessarily present, not merely probably or possibly present, in the prior art." (internal quotations removed)). Apple has not shown, clearly and convincingly, that a convex protrusion is either explicitly or inherently disclosed in Lumidigm.

Apple further contends that modifying Lumidigm to include the claimed protrusion would be obvious because a protrusion with a convex surface was a "well-known idea" in the prior art. RIB at 104-107. Dr. Warren testified that "it was already well-known that a convex curvature itself could be a useful element in increasing signal quality." Tr. (Warren) at 1211:2-8. He further identified convex protrusions in prior art references Seiko 131 and Cramer. *Id.* at 1230:18-1233:14; RDX-8C.67. Seiko 131 provides that "[w]hen the outside surface of the light transmittance plate is a convex surface, pressure is applied to the light transmittance plate by simply holding the outside surface of the light transmittance plate lightly against the body

MASIMO 2043
Apple v. Masimo
IPR2024-00242

surface, and positive contact between the body surface and outside surface of the light transmittance plate can therefore be improved." RX-0666 at 3:22-28.

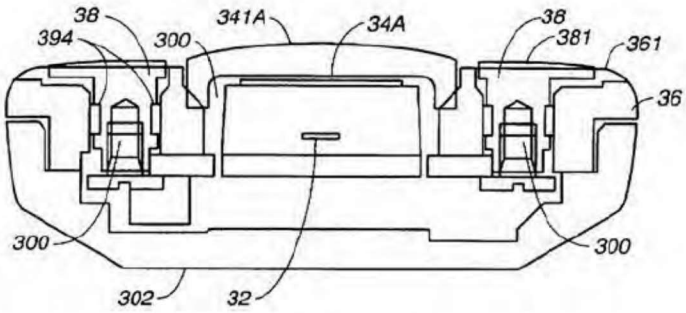


FIG._28

Id. at Fig. 28, 19:5-8 ("outside surface 341A of light transmittance plate 34A may also be convex as shown in FIG. 28."). Dr. Warren testified that "the purpose of this convex surface, as stated in Seiko, is to move residual blood out of the way and increase the quality of the measurement." Tr. (Warren) at 1231:4-8; RDX-8.67.

Cramer discloses raised portions identified as "boss 22" and "boss 22A," wherein "boss 22 serves to isolate the infra-red detector from ambient light" and "boss 22A prevents direct transmission of light between source 24 and detectors 23." RX-0670 at 5:45-51.

FIG. 2

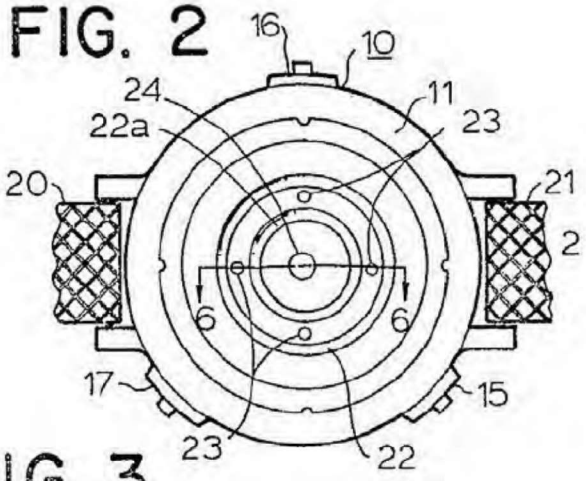
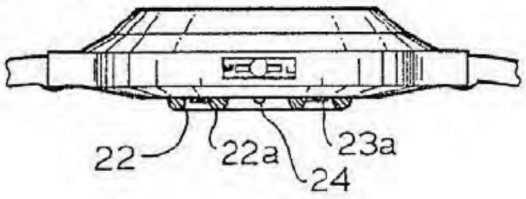


FIG. 3



Id. at Fig. 2, Fig. 3. Cramer further states that "[t]he coaxial arrangement of these three elements provides a relatively large contact surface area resulting in not only effective sensing of a pulse rate but minimum discomfort to the wearer." *Id.* at 5:48-51. Cramer also states that "[t]he circular array of the detector 23 allows the detection of pulses in a substantial arteriolar-capillary bed within the hemispherical region denoted in Fig. 6 for increased signal to noise ratio and energy utilization." *Id.* at 5:51-56. Another prior art reference, U.S. Patent No. 4,880,304 (RX-0665, "Nippon"), describes an embodiment where "the portion of the sensor face containing the LEDs and the optical detector protrudes into the tissue slightly, thereby increasing the signal strength of the detected signal." RX-0665 at 5:12-17, Fig. 3b; Tr. (Warren) at 1245:8-16 (Nippon . . . conveys the idea that, if the detector protrudes slightly into tissue, not only can you get more repeatable coupling, but you can increase the sensitivity of the sensor").

Complainants argue that the claimed protrusion is not obvious in view of Lumidigm. CIB at 130-36. Dr. Madisetti testified that Lumidigm's description of curvature to match the

MASIMO 2043
Apple v. Masimo
IPR2024-00242

profile of a wristwatch would likely result in a concave shape, citing the deposition testimony of Robert Rowe, one of the Lumidigm inventors. Tr. (Madisetti) at 1331:12-1332:24 (citing CX-0279C (Rowe Dep. Tr.) at 69:8-21). Complainants argue that the reference to curvature on Lumidigm's "optical surface" is not the same as Lumidigm's "sensor surface 39." CIB at 131. Complainants further argue that the statement regarding Lumidigm's wristwatch embodiment describing different configurations of "sensor geometries" only refers to the arrangement of light sources and detectors—not to the shape of the surface of the sensor head. *Id.* at 132; *see* Tr. (Rowe) at 1152:7-21 (referring to the "sensor geometries previously disclosed as Figs. 3 through 7," without referencing Figure 2). Complainants argue that there is no motivation to modify Lumidigm to have a convex surface, because such a shape would not match the profile of a user's wrist and would add to the form factor of a wristwatch. RIB at 133-34; Tr. (Madisetti) at 1331:20-25. In addition, Dr. Madisetti identified a prior art reference expressing skepticism of pulse oximetry when there are "[v]ariations in contact pressure between the sensor and the skin," which would be caused by a convex protrusion. Tr. (Madisetti) at 1338:6-13; CDX-0012C.013 (citing CX-1733 at 2:47-57). Joe Kiani testified that Cercacor engineers had preferred concave surfaces for noninvasive sensors before conducting experiments showing that a convex protrusion produced a better signal. Tr. (Kiani) at 98:9-99:16.

With respect to Cramer, Complainants submit that the convex protrusions are annular rings that are not compatible with the other limitations of the Poeze patents (including Element 1[D] of the '501 patent), such as "openings" or "holes" through the protrusion. CIB at 144-46; CRB at 59. With respect to Seiko 131, Complainants submit that the identified convex protrusion is merely a single transparent window without "openings" or "holes" or "opaque lateral surfaces" (as required by Element [1E] of the '501 patent). CIB at 148-49 (identifying

MASIMO 2043
Apple v. Masimo
IPR2024-00242

"transparent window" in Seiko 131). Complainants further note that Seiko 131 describes a sensor worn on a user's finger, not on the wrist. CRB at 59. Complainants argue that Apple has failed to identify any reason or motivation to modify Lumidigm's wristwatch to incorporate a convex protrusion as disclosed in Cramer or Seiko 131. CIB at 133-34, 151-52; CRB at 60. Complainants further argue that Apple has failed to show that any such combination would have a reasonable expectation of success. CIB at 135, 152-53.

In reply, Apple argues that the "optical surface" described by Lumidigm is the same as the "sensor surface 39" depicted in Figure 2. RRB at 53. Apple further identifies Lumidigm's disclosure of an optical relay "between the sensor surface 39 and the skin 40," wherein "[t]he surface of the light relay can be contoured to fit specific product applications and ergonomic requirements." RX-0411 at 8:19-28. Apple disputes Complainants' interpretation of Mr. Rowe's testimony. RRB at 53-54. Apple further argues that Lumidigm expressly discloses the use of other "geometries" with its wristwatch embodiment. *Id.* Apple submits that there is no evidence that the prior art "taught away" from convex protrusions and cites prior art references recognizing the benefits of convex surfaces applying pressure to a user's skin. *Id.* at 55. Apple argues that both Cramer and Seiko 131 disclose convex protrusions and a person of ordinary skill would have been motivated to combine these structures with Lumidigm with a reasonable expectation of success. *Id.* at 60-62.

In consideration of the parties' arguments, the undersigned finds that Lumidigm's disclosure that the optical surface of its sensor head "may also have a compound curvature," together with prior art knowledge, would have provided one of ordinary skill in the art reason to implement the optical surface in a convex shape for the reasons that are explicitly disclosed in Lumidigm: "to match the profile of a device in which it is mounted, to incorporate ergonomic

MASIMO 2043
Apple v. Masimo
IPR2024-00242

features that allow for good optical and mechanical coupling with the tissue being measured, or for other technical or stylistic reasons." RX-0411 at 7:57-63. In particular, Dr. Warren offers credible testimony that one of ordinary skill in the art would have recognized the benefits of a convex surface at the time of the Poeze patents in terms of signal quality, which is consistent with the disclosures in several prior art references. *See* Tr. (Warren) at 1244:11-1246:3. Seiko 131 identifies a convex surface that improves "positive contact between the body surface and outside surface of the light transmittance plate." RX-0666 at 3:22-28, Fig. 28.[32] Prior art reference Nippon similarly describes increased signal strength from a protrusion into the tissue. *See* RX-0665 at 5:12-17, Fig. 3b; RIB 117, 146; Tr. (Warren) at 1245:8-16. These prior art disclosures show, clearly and convincingly, that one of ordinary skill in the art would have had "technical or stylistic reasons" for implementing a convex curvature for Lumidigm's sensor surface. *See* Tr. (Warren) at 1233:1-14; RX-0411 at 7:57-63.[33]

The evidence of "teaching away" offered by Complainants is not supported by the record evidence. Dr. Madisetti cites a prior art reference that raises concerns about "[v]ariations in contact pressure between the sensor and the skin," but this reference does not discuss convex surfaces. *See* CX-1733 at 2:47-57. Mr. Kiani's testimony that concave surfaces were preferred before the invention of the Poeze patents is not corroborated by any evidence from the relevant

[32] Lumidigm also discloses a "force sensing functionality . . . to ensure firm contact between the sensor and the skin," RX-0411 at 8:11-14, which addresses a stated goal of Seiko 131 to achieve "sufficient pressure against light transmittance plate 34A." RX-0666 at 19:8-13.

[33] The undersigned agrees with Apple that the "optical surface" and "sensor surface 39" refer to the same surface in the context of Lumidigm's Figure 2. *See* RRB at 53-54. In addition, Figure 2 depicts sensor surface 39 above an "interior surface" where detector 36 is located. *See* RX-0411 at 8:1-4 ("FIG. 2 illustrates a sensor-head geometry wherein the detector 36 is recessed from the sensor surface 39 in optically opaque material 37 that makes up the body of the sensor head 32.").

MASIMO 2043
Apple v. Masimo
IPR2024-00242

timeframe.[34] Even if a concave shape would be more likely to conform to the shape of a user's wrist, as argued by Complainants, this does not establish that one of ordinary skill in the art would have avoided a convex shape. As discussed above, several prior art references describe technical benefits associated with a convex protrusion for sensors on the skin.[35]

The undersigned also finds that one of ordinary skill in the art would have been able to implement a convex optical surface in Lumidigm's wristwatch with a reasonable expectation of success. *See* Tr. (Warren) at 1238:1-6. Lumidigm explicitly discloses that its sensor head could have a "compound curvature on the optical surface." *See* RX-0411 at 7:57-63.[36]

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[34] Complainants cite evidence from Apple's [redacted] several years after the priority date for the Poeze patents. This evidence is addressed *infra* in the context of objective indicia of non-obviousness.

[35] There is no evidence that the "form factor" of a convex protrusion would have been relevant to persons of ordinary skill in the art at the time of the Poeze patents—the only evidence that Complainants cite is Dr. Madisetti's conclusory testimony and a statement from Apple's prehearing brief related to the development of the Apple Watch, [redacted]. *See* CIB at 134; RRB at 55. In any case, this issue would not preclude a reason to modify Lumidigm in the manner described above. *See Allied Erecting and Dismantling Co., Inc., v. Genesis Attachments, LLC*, 825 F.3d 1373, 1381 (Fed. Cir. 2016) ("a given course of action often has simultaneous advantages and disadvantages, and this does not necessarily obviate motivation to combine") (internal quotation omitted).

[36] It is unclear whether Apple argues for a specific physical combination of Lumidigm and Cramer, *e.g.*, by applying Cramer's structure of annular rings and photodiodes to the Lumidigm wristwatch. *See* RIB at 103-113. However, to the extent this combination is proposed, Apple does not explain how this combination would fit with the multiple LED/multiple photodiode arrangement relied upon for claim elements [1A] and [1B], particularly because Cramer's raised annular rings are designed to separate Cramer's single LED from Cramer's set of equidistant four photodiodes. *See* RX-0679 at 5:46-48 ("The boss 22A prevents direct transmission of light between source 24 and detectors 23."). In contrast, claim 1 requires at least three LEDs. Similar issues exist for the "protrusion" elements of the '502 and '648 patents, which also require multiple LEDs and photodiodes. *See* CIB at 143 (claim must be considered as a whole). Moreover, the evidence does not clearly and convincingly show that Cramer discloses a protrusion with openings or through holes within it over photodiodes (as required for Elements [1D], [19C], [28F], [8E], [20C-D]). *See* CIB at 144-146. Dr. Warren states that Cramer "describes what it calls a raised boss area, which is essentially a convex protrusion" that "consists of two concentric raised annular areas of opaque material." Tr. (Warren) at 1231:18-22. Dr. Madisetti similarly testified that the alleged protrusion is "just two rings." Tr. (Madisetti) at 1334:23-1335:2. The evidence does not clearly and convincingly show that the two raised rings of Cramer would be considered a single "protrusion."

MASIMO 2043
Apple v. Masimo
IPR2024-00242

Based on the above, the evidence shows clearly and convincingly that Lumidigm's disclosure of an optical surface that can have "compound curvature" would have provided a reason for one of ordinary skill in the art to modify the optical surface of Lumidigm's wristwatch embodiment to form a "protrusion comprising a convex surface," and this modification would have had a reasonable expectation of success.

e. Element [1D]: "a plurality of openings extending through the protrusion and positioned over the three photodiodes"

With respect to the "plurality of openings" limitation, Apple cites to Lumidigm Figure 2, which depicts "the detector 36 recessed from the sensor surface 39 in optically opaque material 37 that makes up the body of the sensor head 32." RX-0411 at 8:1-4. While one detector is depicted in Figure 2, Apple cites Lumidigm's disclosure that "[t]he detector 36 may comprise a single element, a plurality of discrete elements, or a one- or two-dimensional array of elements." *Id.* at 4:54-56. Apple submits that Lumidigm thus discloses openings positioned over one photodiode or multiple photodiodes. RIB at 75-76.

Apple further contends that the use of openings and holes for photodiodes was well known in the art and disclosed in Cramer and Seiko 131. RIB at 107-110. Dr. Warren testified that openings over photodiodes were well-known at the time of the Poeze patents, recognizing that "[a] detector can't detect light without some sort of opening above it." Tr. (Warren) at 1192:25-1193:6. He identified U.S. Patent No. 3,769,974 (RX-0473, "Smart") as a prior art reference with an example of an opening for a photodiode. *Id.* at 1193:7-18; RDX-8C.10; *see* RX-0473 at Fig. 1, 3:17-19 ("An annular inner wall 59 is formed of opaque epoxy and blocks the direct transmission of light from the diodes 16 to the phototransistor sensor 28."). In Seiko 131, Apple identifies an opening between the detector and the user's tissue. RIB at 108 (citing RX-0666 at Fig. 28). With respect to Cramer, Apple cites a datasheet for a detector identified in

MASIMO 2043
Apple v. Masimo
IPR2024-00242

Cramer—the CLT 2160 detector, which was described by Dr. Warren as a "can detector" that includes an opening between the photodiode and the surface of the detector. Tr. (Warren) at 1231:23-1232:9, 1234:3-8; *see* RX-0670 at 5:33-35 ("A suitable detector is the type CLT 2160 photo diode produced by Clairex Electronics, Inc."); RX-1221 (CLT 2160 datasheet).

Complainants dispute Lumidigm's disclosure of this limitation, arguing that there is no protrusion meeting the limitations of the claim and because three photodiodes are not explicitly disclosed in the configuration of Figure 2 or in connection with the wristwatch embodiment. CIB at 138.

With respect to Seiko 131, Complainants argue that there is only one photodiode and one opening, which does not extend through the light transmittance plate identified as the claimed convex surface. CIB at 148-49; CRB at 60-61. With respect to Cramer, Complainants argue that the openings over the photodiodes are between the "boss 22" and "boss 22A" that are identified as convex protrusions and thus do not extend through these protrusions. CIB at 145-46. Complainants further argue that the CLT 2160 datasheet is undated and was not authenticated by any witness. CRB at 63-64.

In consideration of the parties' arguments, the evidence clearly and convincingly shows that Lumidigm meets the "plurality of openings . . . positioned over the three photodiodes" limitation of '501 patent claim 1. As discussed above, the undersigned agrees with Complainants that there is no convex protrusion in Lumidigm, but Lumidigm discloses an opening extending through a protrusion that is positioned over a detector in Figure 2, and as discussed above in the context of the "at least three photodiodes" limitation, Lumidigm clearly shows that the placement of the detector in Figure 2 corresponds to the source-detector arrangement of Figure 3, and that the arrangement of three sources and three detectors in Figure

MASIMO 2043
Apple v. Masimo
IPR2024-00242

6 is a disclosed alternative to Figure 3 for use in the wristwatch embodiment. *See* RX-0411 at 7:5-9:25, 11:65-12:2, Fig. 2, Fig. 3, Fig. 4, Fig. 6, Fig. 8B. Under this arrangement, there is an opening positioned over each photodiode. *See* Tr. (Warren) at 1211:15-20 (cross-section in Fig. 6 would be similar to Fig. 2, with each photodiode recessed an opening over each photodiode). Dr. Warren's testimony and the disclosures in prior art references such as Smart also confirm that such openings over photodiodes were known in the art at the time of the Poeze patents. *See* Tr. (Warren) at 1192:25-1193:18; RX-0473 at 3:17-19, Fig. 1.

Further, as discussed in Part IV.E.1.d *supra*, a person of skill in the art would have reason to implement to modify the optical surface 39 of Lumidigm to form a "protrusion comprising a convex surface." This modified optical surface of the sensor head, like the optical surface of Lumidigm shown in Fig. 2, would extend over the photodiodes and the openings over them. *See* Tr. (Warren) at 1210:13-1211:14; *id.* at 1212:4-10 (sensor head would have same number of openings as photodiodes); RIB at 75. Accordingly, the evidence clearly and convincingly shows that this limitation of '501 patent claim 1 is met by Lumidigm's disclosures.

f. Element [1E]: "the openings each comprising an opaque lateral surface, the plurality of openings configured to allow light to reach the photodiodes, the opaque lateral surface configured to avoid light piping through the protrusion"

With respect to the "opaque lateral surface" limitation, Apple again cites to Lumidigm Figure 2, which depicts "the detector 36 recessed from the sensor surface 39 in optically opaque material 37 that makes up the body of the sensor head 32." RX-0411 at 8:1-4. Lumidigm further provides that "[t]he recessed placement of detector 36 minimizes the amount of light that can be detected after reflecting off the first (epidermal) surface of the tissue." *Id.* at 8:4-7. Lumidigm notes that "reflections from the top surface of tissue (known as 'specular' or 'shunted' light) are

MASIMO 2043
Apple v. Masimo
IPR2024-00242

detrimental to most optical measurements." *Id.* at 7:66-8:1. The effect of the recessed placement of the detector is described as an "optical blocking effect." *Id.* at 8:7-10.

Complainants argue that Lumidigm's disclosure of "optical blocking" is directed to light that is reflected off the surface of the tissue, which is distinct from "light piping." CIB at 139-40; *see* Tr. (Madisetti) at 1340:8-10. Complainants cite the specification of the Poeze patents, which describes "light piping (e.g., light that bypasses measurement site 102)." JX-001 at 22:48-50. At the hearing, Mr. Kiani described light piping as "light that goes from the LED directly to the photodetector, without going through the tissue." Tr. (Kiani) at 100:14-24.

The evidence clearly and convincingly shows that Lumidigm meets the "opaque lateral surface" limitation of '501 patent claim 1. There is no dispute that Lumidigm discloses an opaque lateral surface in the opening for a detector in Figure 2. Complainants argue that Lumidigm fails to explicitly recognize that this surface is "configured to avoid light piping," but Dr. Warren testified at the hearing that the "shunted" light described in Lumidigm "is what is called light piping in this matter." Tr. (Warren) at 1212:22-1213:3. The undersigned finds Dr. Warren's testimony on this issue to be credible and convincing, and Lumidigm's descriptions of reflections that are "specular" or "shunted" light are consistent with the meaning of "light piping" as that term is used in the context of the Poeze patents, because Lumidigm recognizes that this light bypasses the measurement site inside the user's tissue. *See* JX-0001 at 22:48-50; RX-0411 at 7:66-8:7. This is also consistent with Mr. Kiani's testimony regarding "light piping," because the "shunted" light described in Lumidigm goes from the emitters to the detector without passing through the tissue. Tr. (Kiani) at 100:14-24 (goal is to avoid light that has not gone "through the tissue"). Moreover, Lumidigm expressly discloses that the placement

MASIMO 2043
Apple v. Masimo
IPR2024-00242

of the detector creates an "optical blocking effect" that avoids "specular" or "shunted" light, *id.* at 7:66-8:10, and the evidence shows that this configuration would avoid light piping.

Apple also points to lateral surfaces in other prior art references, arguing that this limitation is obvious in combination with Seiko 131 or Cramer. Apple cites lateral surfaces around the photodiode disclosed in Seiko 131. RIB at 108 (citing RX-0666 at 10:30-36, Fig. 28). With respect to Cramer, Apple relies on the datasheet for the CLT 2160 detector, which was described by Dr. Warren as a "can detector" that "would be made from aluminum or stainless steel or some material that was impervious to light as a means to prevent light piping." Tr. (Warren) at 1231:23-1232:9, 1234:3-8; *see* RX-0670 at 5:33-35 ("A suitable detector is the type CLT 2160 photo diode produced by Clairex Electronics, Inc."); RX-1221 (CLT 2160 datasheet). Apple also cites Cramer's disclosure of "light blocking rings" that "isolate the photo detector from direct view from the light source and from view of the ambient light when the lower face is in contact with the wearer's body e.g. the wrist." RX-0670 at 2:46-51. One of these rings identified as "boss 22A prevents direct transmission of light between source 24 and detectors 23." *Id.* at 5:46-48. Apple further cites disclosures in Webster recognizing the problem of an "optical shunt," which is "when some of the light from the LEDs reaches the photodiode without passing through an arteriolar bed." RX-0035.0202. Webster recommends that "[o]ximeter probes should be manufactured of black opaque material that does not transmit light, or enclosed in an opaque plastic housing." *Id.*

Complainants argue that the alleged opaque lateral surfaces in Seiko 131 were not previously identified in Apple's prehearing brief or in any hearing testimony and are not supported by any teachings in Seiko 131. CRB at 63. With respect to Cramer, Complainants

MASIMO 2043
Apple v. Masimo
IPR2024-00242

argue that there is no explicit disclosure of opaque material and further argue that the CLT 2160 datasheet is unreliable. *Id.* at 63-64.

Because the claimed opaque lateral surfaces are set forth in Lumidigm, it is unnecessary to address whether they are disclosed by Lumidigm in combination with Seiko 131 or Cramer. However, the undersigned agrees with Complainants that Apple has failed to identify any opaque lateral surfaces in Seiko 131.[37] With respect to Cramer, the undersigned agrees with Apple that one of ordinary skill in the art would have recognized that the CLT 2160 detectors have opaque lateral surfaces. *See* Tr. (Warren) at 1234:3-8; RX-1221.[38] Webster's reference to an "optical shunt" is consistent with the description of light piping discussed above.

Accordingly, the undersigned finds that the "opaque lateral surface" limitation of '501 patent claim 1 is disclosed in Lumidigm in the context of Lumidigm's wristwatch embodiment.

g. Element [1F]: "one or more processors configured to receive one or more signals from the photodiodes and calculate a measurement of the physiological parameter of the user"

With respect to the "one or more processors" limitation, Apple cites to Lumidigm's disclosure that its "portable electronic device comprises an electronic arrangement for performing a standard function of the portable electronic device, a biometric sensor, and a processor," and "[t]he processor is configured to operate the electronic arrangement to perform the standard function and to operate the biometric sensor." RX-0411 at 3:21-31; RIB at 77-79. Lumidigm further discloses that after light signals are detected, "the signals can be digitized and

[37] Regardless of whether Apple's contentions are timely, Apple's shading of unlabeled structures in Figure 28 of Seiko 131 that are allegedly opaque lateral surfaces does not appear to be supported by the evidence of record. *See* RIB at 108.

[38] The undersigned finds the CLT 2160 datasheet to be reliable evidence. Complainants have not identified any timely-raised objection to the admission of RX-1221, and this exhibit appears to be reliable on its face.

MASIMO 2043
Apple v. Masimo
IPR2024-00242

recorded by standard techniques," and "[t]he recorded data can then be processed directly or converted." *Id.* at 9:58-62. A schematic for managing the functionality of the biometric sensor is illustrated in Figure 9, which depicts a "computer system" with "hardware elements that are electrically coupled via bus 342, which is also coupled with the biometric sensor 356." *Id.* at 12:56-66, Fig. 9. "The hardware elements include processor 332" and a "processing acceleration unit 346 such as a DSP or special-purpose processor." *Id.* at 12:66-13:14; *see* Tr. (Warren) at 1213:4-1214:1.

Complainants argue that Lumidigm fails to explicitly disclose that its processor calculates a measurement of a physiological parameter and does not explicitly describe a processor in the "wristwatch" embodiment. CRB at 49; *see* CIB at 124-29.

In consideration of the parties' arguments, the undersigned finds that Lumidigm meets the "one or more processors" limitation of '501 patent claim 1. Complainants' arguments were addressed above in the context of the preamble, and as discussed above, Lumidigm teaches that the "wristwatch" embodiment is one of the "portable devices" suitable for functionalities including the measurement of a physiological parameter. *See* RX-0411 at 3:35-47, 11:60-12:2, 19:18-28. With respect to the processing hardware depicted in Figure 9, Lumidigm explicitly notes that some of the components could be used in portable devices. *Id.* at 12:58-61. Moreover, a "processor" is explicitly claimed in Lumidigm as part of a "portable electronic device," where the processor "is further configured to operate the biometric sensor to perform a nonbiometric function," including a "spectrometer function," with examples provided of "an alcohol-monitor function, a bilirubin-monitor function," and "a hemoglobin-monitor function."

MASIMO 2043
Apple v. Masimo
IPR2024-00242

Id. at 25:32-45 (claims 10, 11, 12).[39] Dr. Warren testified that this limitation is met by Lumidigm with respect to calculating a measurement of a physiological parameter. *See* Tr. (Warren) at 1213:4-1214:1. Accordingly, Lumidigm clearly discloses a "processor" that receives signals from a sensor and calculates a measurement of a physiological parameter.

The undersigned further finds that, to the extent Lumidigm does not disclose such a processor, one of ordinary skill in the art would have had a reason to implement such calculations and a reasonable expectation of success in Lumidigm's "wristwatch" embodiment, because Lumidigm explicitly notes that its extended functionality is "especially suitable" for mobile devices. *See id.* at 17:67-18:2.

Accordingly, the undersigned finds that the "one or more processors" limitation of '501 patent claim 1 is met by Lumidigm.

h. Element [12]: "wherein the convex surface of the protrusion is an outermost surface configured to contact the tissue of the user and conform the tissue into a concave shape"

Claim 12 of the '501 patent depends from claim 1, further requiring that "the convex surface of the protrusion is an outermost surface configured to contact the tissue of the user and conform the tissue into a concave shape." As discussed above in the context of the "protrusion" limitation of '501 patent claim 1, the undersigned finds that a convex protrusion is neither explicitly nor inherently disclosed in Lumidigm but that one of ordinary skill in the art would have reason to modify Lumidigm's optical surface to form a convex protrusion.

Apple contends that this limitation is obvious in view of Lumidigm alone or in combination with Seiko 131 or Cramer, because a person of ordinary skill in the art would have

[39] As discussed above in the context of the preamble, there is a presumption that these functions are enabled, and Complainants have not provided evidence rebutting Lumidigm's enablement of measurements for physiological parameters other than blood oxygen.

MASIMO 2043
Apple v. Masimo
IPR2024-00242

understood that a convex protrusion would conform the user's tissue into a concave shape. RIB at 79, 106. Dr. Warren described the limitation in claim 12 as "an obvious statement," recognizing that "if you have a convex surface and you position it next to tissue, any pressure at all will conform the tissue into a concave shape." Tr. (Warren) at 1214:2-11. Complainants do not raise any arguments with respect to claim 12 that are significantly different from those addressed above in the context of claim 1. *See* CRB at 46-47, 71-73. Accordingly, in view of the unrebutted testimony of Dr. Warren, the undersigned finds that one of ordinary skill in the art would have known that a convex surface in contact with the tissue of the user would conform the tissue into a concave shape.

***

As discussed above, Lumidigm explicitly discloses a user-worn wristwatch device configured to non-invasively measure physiological parameters of a user that meets the limitations of claim 1 requiring at least three LEDs, at least three photodiodes, a plurality of openings for each photodiode with opaque lateral surfaces, and a processor configured to calculate measurements of physiological parameters, and the evidence shows that one of ordinary skill in the art would have reason to modify the optical surface of the sensor head in Lumidigm's wristwatch to form the claimed protrusion comprising a convex surface based on Lumidigm's explicit suggestion of a sensor head with a "compound curvature" for "technical or stylistic reasons." RX-0411 at 7:57-63. For these and the other reasons discussed above, the evidence thus shows that a combination of elements disclosed in Lumidigm and known in the prior art would have yielded a wristwatch meeting each limitation of claims 1 and 12, and one of ordinary skill in the art would have had a reasonable expectation of success in making such a combination. Further, as discussed *infra*, secondary considerations of non-obviousness do not

MASIMO 2043
Apple v. Masimo
IPR2024-00242

weigh significantly against a finding that claim 12 of the '501 patent is obvious. Accordingly, the undersigned finds that claim 12 of the '501 patent is invalid as obvious.

2. '502 Patent Claim 22

As discussed below, the evidence fails to clearly and convincingly show that claim 22 of the '502 patent is rendered obvious by Lumidigm alone or in combination with other prior art.

a. Element [19 preamble]: "A user-worn device configured to non-invasively measure an oxygen saturation of a user, the user worn device comprising:"

The preamble of '502 patent claim 19 requires "[a] user-worn device configured to non-invasively measure an oxygen saturation of a user." As discussed above in the context of the preamble of '501 patent claim 1, Lumidigm discloses a user-worn wristwatch embodiment with a biometric sensor configured to measure a physiological parameter. *See* RX-0411 at 3:35-47, 11:60-12:2, 19:18-28, claim 12. With respect to measuring oxygen saturation, Apple cites Lumidigm's teaching that "changes in blood flow cause spectroscopic changes that may be detected" with its biometric sensor, noting that "these spectroscopic changes are correlated with oxygenation and/or hemoglobin levels in the blood." RX-0411 at 19:22-26. Apple relies on Dr. Warren's opinion that one of ordinary skill in the art would have been able to implement pulse oximetry functionality in Lumidigm's wristwatch. Tr. (Warren) at 1216:10-25. Dr. Warren points to efforts by his students to measure blood oxygen at the wrist as early as 2002, *id.* at 1195:24-1196:10, and Apple cites prior art reflectance pulse oximeters that existed decades before the Poeze patents. *See* RX-0484.

Complainants argue that Lumidigm's disclosure is insufficient to teach a blood oxygen measurement in a wristwatch. CIB at 126-29; CRB at 44-46. Dr. Madisetti characterizes Lumidigm's description of an oxygen saturation measurement as "vague" and "aspirational." Tr.

MASIMO 2043
Apple v. Masimo
IPR2024-00242

(Madisetti) at 1330:20-1331:11. Complainants further argue that a person of ordinary skill would not have known how to implement the measurement of oxygen saturation or any other physiological parameter in Lumidigm's wristwatch embodiment and that Lumidigm provides no motivation for doing so. CIB at 128-29; Tr. (Madisetti) at 1340:20-1341:14. Complainants argue that implementing such functionalities in a wristwatch would not have a reasonable expectation of success, citing testimony from Apple engineers expressing skepticism that blood oxygen could be measured at the wrist. CIB at 129. Complainants cite evidence that Apple took [redacted]. *See* CRB at 86-87.

In reply, Apple argues that using Lumidigm's wristwatch to measure a physiological parameter such as blood oxygen would have been obvious to one of skill in the art. RRB at 51-52. Apple cites evidence that Dr. Warren experimented with measuring pulse oximetry on the wrist with his students at Kansas State University in 2002. Tr. (Warren) at 1195:24-1196:10, 1216:10-25; RX-0632 (2002 photograph); RX-0504 (2005 poster); RX-0508 (2005 article). Apple submits that the development timeline for implementing pulse oximetry in the Apple Watch is not relevant to the obviousness of the Poeze patents, because the [redacted]. RIB at 144-46; RRB at 68-69.

In consideration of the parties' arguments, the undersigned finds that the evidence of record fails to show that one of ordinary skill would have been enabled to measure oxygen saturation in the Lumidigm wristwatch. As discussed above in the context of the '501 patent, Lumidigm describes "extended functionality" including measurements of "oxygenation and/or hemoglobin levels in the blood," and states that such functionalities are "especially suitable when the biometric sensor is comprised by a portable device, such as a portable electronic device."

MASIMO 2043
Apple v. Masimo
IPR2024-00242

RX-0411 at 17:64-18:2, 19:18-28. The specification explicitly identifies "a watch" as an example of a "portable electronic device having extended functionality." *Id.* at 3:21-37. Lumidigm thus contemplates blood oxygen measurement in a wristwatch as one implementation of its "extended functionality," but the Federal Circuit has held that "when the prior art includes a method that appears, on its face, to be capable of producing the claimed composition," the patentee may rebut this evidence by presenting "sufficient reason or authority or evidence, on the facts of the case, to show that the prior art method would not produce or would not be expected to produce the claimed subject matter." *In re Kumar*, 418 F.3d 1361, 1368 (Fed. Cir. 2005); Part IV.G.1.a *supra* (discussing additional relevant authority).

In rebuttal to Lumidigm's blood oxygen disclosure, Complainants have presented persuasive evidence that persons of ordinary skill in the art would not have expected to successfully measure blood oxygen in a wristwatch at the time of the Poeze patents. *See* CIB at 126-29; CRB at 44-46. Mr. Rowe, the "primary inventor" of Lumidigm, *see* Tr. (Rowe) at 1146:18-1147:3, acknowledged that he never made a device that calculated blood oxygen at Lumidigm, Inc. CX-0297C (Rowe Dep. Tr.) at 118:4-119:8.[40] Complainants have also cited testimony from numerous Apple engineers describing the significant difficulty of performing pulse oximetry at the wrist. *See* Tr. (Mannheimer) at 1012:12-1013:6 (admitting that in 2014, he believed that pulse oximetry at the wrist would be a challenge, that he "did not know if it could be done," that "the wrist is just enormously different from the physiological perspective," and

[40] There is little to no technical description of the blood oxygen functionality in Lumidigm, let alone in the wristwatch embodiment specifically. *See* CIB at 126; RX-0411 at 19:24-28.

MASIMO 2043
Apple v. Masimo
IPR2024-00242

that the signal at the wrist is "enormously weak")[41]; *see also id.* at 998:21-999:6 (products he previously worked on "operated on a much more vascularized tissue bed, usually fingers or forehead . . . [t]he wrist is "just an incredibly different beast"); CX-0299C (Waydo Dep. Tr.) at 166:4-167:5 ("The wrist is one of the most difficult places on the body to do almost every physiological measurement"); CX-0295C (Shui Dep. Tr.) at 108:13-21 ("[redacted]. The watch is worn on the wrist, and the wrist is well known for its lack of signal."). The blood oxygen measurement described in Lumidigm is characterized as relying on "spectrographic changes that may be detected" by its biometric sensor, which are "correlated with oxygenation and/or hemoglobin levels." RX-0411 at 19:22-26. The testimony of Apple engineers shows the difficulty in calculating blood oxygen from such spectra if obtained at the wrist, [redacted]; Tr. (Land) at 983:2-12 [redacted]; *see* CIB at 169-171.

Apple counters this evidence with Dr. Warren's testimony describing pulse oximetry experiments at Kansas State University in 2002-05, RRB at 52-53, but there is little evidence that wrist-based blood oxygen levels were successfully measured in a watch-type environment. With

[41] Dr. Mannheimer had worked on pulse oximetry technology at Nellcor from 1987 to 2008, before joining Apple. *See* Tr. (Mannheimer) at 994:9-25, 1009:2-8. He was hired by Apple because of his "extensive experience" in pulse oximetry and biosensing in general. Tr. (Land) at 963:10-15.

MASIMO 2043
Apple v. Masimo
IPR2024-00242

respect to the work done with Professor Warren's undergraduate students cited by Respondents (*see* RRB at 52), Dr. Warren testified that his students "worked with [these sensors] on their wrists" (Tr. at 1216:23-25) and took measurements from various locations on the body, including wrists (Tr. at 1186:8-16, 1196:8-10, RDX-8.88). He provided no testimony regarding the results of those measurements. Apple also does not identify measurements of oxygen saturation at the wrist in the corroborating documents provided by Dr. Warren. *See* RIB at 64-67; RRB at 52-53; CRB at 45-46; RX-0504 (referencing wrist as a "viable" measuring site but only presenting data from finger and head); RX-0508.0007, .0012 (referencing "different body locations (*e.g.*, wrist, forehead or ear lobe) that have noticeably different vascular profiles" and presenting data from the thumb). Apple also argues that methods for pulse oximetry were well-known at the time of the Poeze patents, RRB at 51, but Apple's evidence for prior art blood oxygen measurements relies on measurements at other locations on the body—not at the wrist. *See, e.g.,* RX-0484 (describing measurement of blood oxygen at the finger).[42,43]

On the evidence of record, the presumption of enablement is overcome with respect to configuring Lumidigm's wristwatch to measure blood oxygen at the time of the Poeze patents.

[42] Apple argues that its engineers' testimony related solely to "adding that known functionality into the limited space of a small consumer device" (RRB at 47), but the testimony at issue indicates broader signal issues.

[43] Mr. Kiani testified at the hearing that he could have done a "conventional pulse oximeter" on the wrist "30 years ago" (Tr. (Kiani) at 114:20-22), but this testimony is less persuasive on this issue than the testimony of the Apple engineers, particularly given Mr. Kiani's testimony that many conventional pulse oximetry devices do not work. *See* Tr. (Kiani) at 102:20-21, 121:18-24. As discussed above, Apple documents [redacted]. CX-0177C at 13.

MASIMO 2043
Apple v. Masimo
IPR2024-00242

Accordingly, Apple has not shown that the preamble limitations of '502 patent claim 19 are met by Lumidigm.[44]

b. Element [19A]: "a plurality of emitters configured to emit light, each of the emitters comprising at least two light emitting diodes (LEDs)"

There is no dispute that Lumidigm discloses a plurality of emitters. *See* RIB at 80-82; CIB at 123. As discussed above in the context of the LEDs limitation of '501 patent claim 1, Lumidigm discloses "a plurality of light sources" that "may comprise light emitting diodes ('LEDs')," including "sets of LEDs." RX-0411 at 6:22-53. Lumidigm discloses several configurations with light sources arranged in sets of at least two:

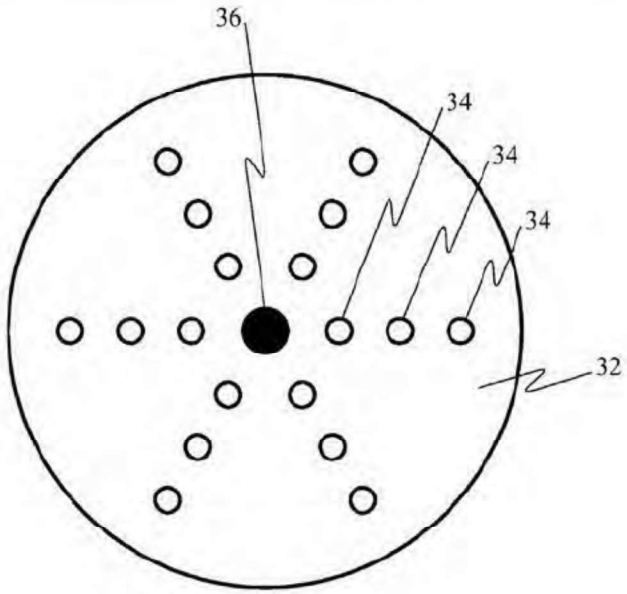


FIG. 3

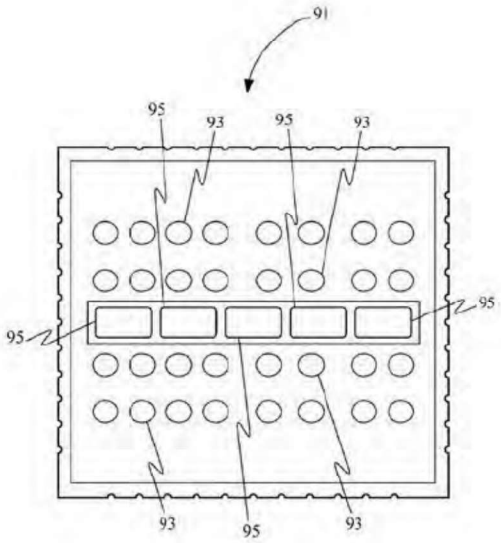


FIG. 7A

Id. at 8:33-42 (Fig. 3), 9:26-34 (Fig. 7A); *see also* RIB at 81 (identifying Figs. 3, 5, 7A, and 7B). Lumidigm explicitly discusses the benefits of pairs of light sources, noting that two light sources

[44] The evidence regarding the difficulty in achieving blood oxygen measurements at the wrist, as discussed above, also shows the lack of clear and convincing evidence of a reasonable expectation of success for the asserted obviousness arguments.

having the same wavelength "can be combined to increase the resulting signal-to-noise ratio of the measurement," while two light sources with different wavelengths can "provide unique and useful information about the tissue optical properties." *Id.* at 7:34-53.

c. Element [19B]: "four photodiodes arranged within the user-worn device and configured to receive light after at least a portion of the light has been attenuated by tissue of the user"

As discussed above in the context of the "photodiodes" limitation of '501 patent claim 1, the evidence shows that Lumidigm discloses silicon detectors that are photodiodes, and the sensor geometries disclosed in Lumidigm's specification can be used in the "wristwatch" embodiment in a configuration for receiving light that has been attenuated by tissue of the user. *See* RX-0411 at 6:56-63, 11:65-12:2. Lumidigm discloses two specific configurations with arrays of at least four detectors:

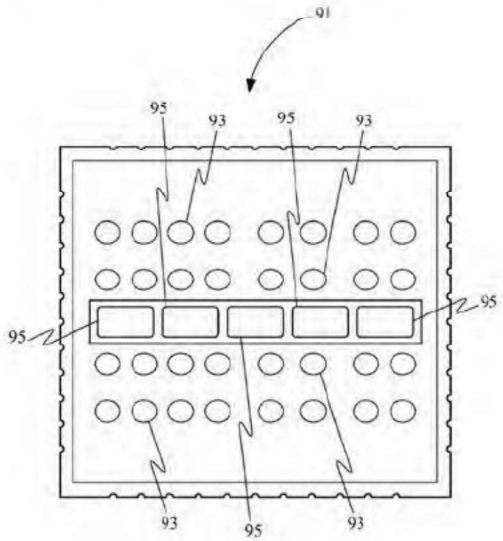


FIG. 7A

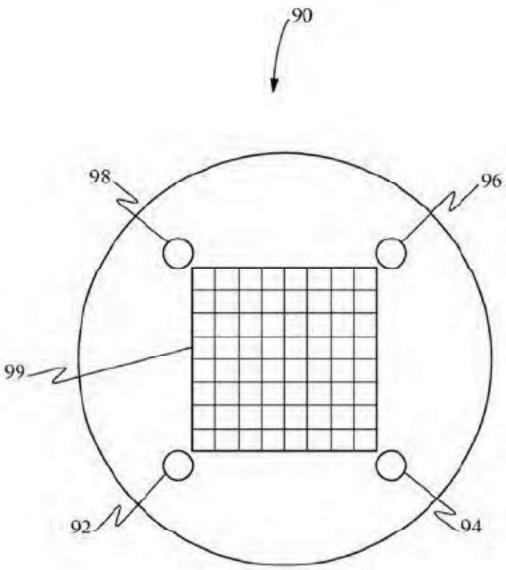


FIG. 7B

Id. at 9:26-45, Fig. 7A, Fig. 7B; Tr. (Warren) at 1221:10-15; RDX-8.37; RIB at 82. Lumidigm describes the benefits of such detector arrays, wherein "[t]he signal detected at each of the array

MASIMO 2043
Apple v. Masimo
IPR2024-00242

elements then represents a different source-detector separation with respect to the light from a given light source." *Id.* at 9:39-41.

d. Element [19C]: "a protrusion comprising a convex surface including separate openings extending through the protrusion and lined with opaque material, each opening positioned over a different one associated with each of the four photodiodes, the opaque material configured to reduce an amount of light reaching the photodiodes without being attenuated by the tissue"

As discussed above in the context of the "protrusion" limitation of '501 patent claim 1, Lumidigm's disclosures provide a reason to modify the optical surface of Lumidigm to form a protrusion comprising a convex surface. *See* Part IV.E.1.d. However, the evidence does not clearly and convincingly show how or why the "array"-type detectors in Lumidigm relied upon by Apple for Element [19B] would be formed with separate openings through the protrusion for individual photodiodes in the array. *See* RIB at 82; CIB at 143 (noting requirement to treat each claim as an integrated whole); CRB at 55 (same). For this limitation, Apple simply refers to the reasoning provided for the three-photodiode configuration relied upon for Element [1B] (which relies on the single diode example in Figure 2 of Lumidigm), but that configuration does not appear similar to the "array" configurations cited by Respondents for Element [19B], and no clear and convincing testimony linking Figs. 7A and 7B to separate "openings" through the protrusion for individual (or subsets of) diodes in an array has been provided.[45] *See* RIB at 72-

[45] Lumidigm explains that "detector 36" may be "a single element, a plurality of discrete elements, or a one- or two-dimensional array of elements." RX-0411 at 6:54-56. Fig. 2 shows a single opening over detector 36 which, if anything, would appear to suggest a single opening over an array, rather than separate openings over individual diodes in the array. While Apple argues that the Figs. 7A and 7B are merely "illustrative," and that Lumidigm's sensor "can include any number and arrangement of photodiodes" (RIB at 82), Apple did not clearly present any other specific LED/photodiode arrangement in its analysis of Element [19B] for assessment in view of the claim as a whole. *See* Tr. (Warren) at 1221:10-15 and RDX-8.37; RIB at 82.

MASIMO 2043
Apple v. Masimo
IPR2024-00242

74, 83-84; RX-0411 at 9:26-45 (discussing the "detector array" structure); CIB at 143 (arguing that Apple does not show obviousness based on claim as an integrated whole).

With regard to Figure 7B, Dr. Warren testified with regard to a different limitation that "one of ordinary skill could essentially choose any four of the photodiodes within this arrangement . . . and then include an opening over each one" (Tr. (Warren) at 1225:23-1226:1) but this testimony of what one of ordinary skill in the art could theoretically do is insufficient to clearly and convincingly show that Lumidigm discloses this arrangement, or provide a reason for one of ordinary skill in the art to modify Lumidigm to do so. *See Adidas AG v. Nike, Inc.*, 963 F.3d 1355, 1359 ("The obviousness inquiry does not merely ask whether a skilled artisan could combine the references, but instead asks whether 'they would have been motivated to do so.'").

Apple also argues that Element [19C] is rendered obvious based on a combination with Cramer, which Apple contends includes four diodes in a circular array, with separate openings with opaque lateral surfaces positioned over each of the photodiodes. *See* RIB at 108-110. As discussed above in Part IV.E.1.d, the evidence does not clearly and convincingly show that one of skill in the art would have a reason to combine the specific structures of Cramer with Lumidigm, and Cramer only includes one LED (which would not meet the "plurality of emitters" requirement of Element [19A])). *See* n.36 *supra*.

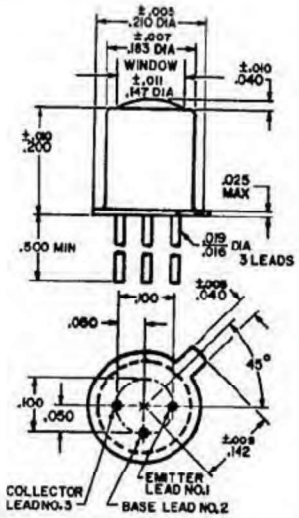
e. Element [19D]: "optically transparent material within each of the openings"

With respect to the "optically transparent material" limitation of '502 patent claim 19, Apple identifies Lumidigm's disclosure of "an optical relay (not shown) between the sensor surface 39 and the skin 40" that "transfers the light . . . from the skin back to the detector(s)." RX-0411 at 8:19-23; RIB at 84-85. Lumidigm provides examples of these optical relays, including "fiber-optic face plates and tapers, individual optical fibers and fiber bundles, light

MASIMO 2043
Apple v. Masimo
IPR2024-00242

pipes and capillaries, and other mechanisms known to one of skill in the art." *Id.* at 8:23-26. Dr. Warren testified at the hearing that one of ordinary skill in the art would understand an "optical relay" to be an optically transparent material. Tr. (Warren) at 1221:16-1222:25; RIB at 84-85.

Apple further argues that this limitation would be obvious because the use of transparent materials within openings was well-known at the time of the Poeze patents. RIB at 111-113; Tr. (Warren) at 1193:23-1194:14, 1221:16-1222:9; RDX-8C.11 (citing RX-0670; RX-0665; RX-0666; RX-0667; RX-0648). Apple also points to the "light transmittance plate" disclosed in Seiko 131, wherein "[a] transparent window is formed on the top of sensor frame 36 . . . by means of light transmittance plate 34, which is a glass plate." RX-0666 at 10:30-32. With respect to Cramer, Apple identifies the datasheet for the CLT 2160, which depicts a "window on top of can." RX-1221; *see* RX-0670 at 5:33-35.



PHYSICAL DIMENSIONS — in accordance with JEDEC (T018) outline except for window on top of can.
All dimensions in inches. Collector electrically connected to case. Leads gold plated Kovar.

RX-1221. Apple further argues that Cramer discloses a further layer of clear transparent windows between the detectors and the skin. Tr. (Warren) at 1234:22-1235:12; RDX-8C.73 (citing RX-0670 at Fig. 6).

Complainants argue that Lumidigm's disclosure of an "optical relay" does not meet the "optically transparent material" limitation and is not disclosed in connection with Lumidigm's "wristwatch" embodiment. CIB at 138-39. Dr. Madisetti does not agree with Dr. Warren's opinions with respect to this limitation. *See* Tr. (Madisetti) at 1330:2-5.[46] Complainants argue that Seiko 131 fails to disclose multiple openings or optically transparent material within multiple openings. CIB at 148-49. Complainants argue that with respect to Cramer, the alleged windows are between the annular rings and are not "within" the openings. CIB at 146-47.

In consideration of the parties' arguments, the undersigned finds that Lumidigm clearly discloses "optically transparent material" over openings associated with photodiodes, but the evidence does not clearly and convincingly show a reason to incorporate such material "within" each opening. Lumidigm describes an optical relay that is comprised of optically transparent material. *See* RX-0411 at 8:19-26; *see* Tr. (Warren) at 1221:16-1222:25. The optical relay in Lumidigm is not "within" the opening depicted in Figure 2, however—it is located "between the sensor surface 39 and the skin 40." RX-0411 at 8:19-26, Fig. 2.[47] Apple appears to have

[46] Complainants argue that Apple should be precluded from arguing that Lumidigm discloses a "lens" because this contention was not disclosed in Apple's pre-hearing brief, RIB at 138-39, but there was no objection to Dr. Warren's testimony regarding a "lens" at the hearing, and Apple explains that the testimony merely represents Dr. Warren's opinion that one of ordinary skill in the art would understand Lumidigm's "optical relay" to be a "lens." RRB at 57-58.

[47] Seiko 131 similarly discloses a "light transmittance plate" that is positioned above its sensor but is not "within" any opening. *See* RX-0666 at 10:30-32. Cramer also discloses annular windows that do not appear to be associated within "each" opening. *See* Tr. (Warren) at 1234:22-1235:12; RDX-8C.73 (citing RX-0670 at Fig. 6).

MASIMO 2043
Apple v. Masimo
IPR2024-00242