

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD.;
SAMSUNG ELECTRONICS AMERICA, INC.,
Petitioner

v.

OURARING, INC.
Patent Owner.

Case No. IPR2024-00928
U.S. Patent No. 9,582,034

**REPLY DECLARATION OF DR. BRIAN W. ANTHONY
IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 9,582,034**

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LIST OF EXHIBITS¹

Ex. No.	Description
Ex-1001	U.S. Patent No. 9,582,034 (“the ’034 Patent”)
Ex-1002	Declaration of Dr. Brian W. Anthony
Ex-1003	Curriculum Vitae of Dr. Brian W. Anthony
Ex-1004	Prosecution History of the ’034 Patent (Application No. 15/556,062)
Ex-1005	U.S. Patent Publication No. 20120016245 to Niwa (“Niwa”)
Ex-1006	U.S. Patent No. 8,954,135 to Yuen (“Yuen”)
Ex-1007	U.S. Patent No. 10,303,867 to Schröder (“Schröder”)
Ex-1008	Certified Translation of DE 102013012339.9 to Schröder
Ex-1009	Original DE 102013012339.9 to Schröder
Ex-1010	U.S. Patent Publication No. 20140244009 to Mestas (“Mestas”)
Ex-1011	U.S. Provisional Patent Application No. 61/768,279 to Mestas
Ex-1012	U.S. Patent No. 8,700,111 to LeBoeuf (“LeBoeuf”)
Ex-1013	U.S. Patent Publication No. 20120218184 to Wissmar (“Wissmar”)
Ex-1014	INTENTIONALLY LEFT BLANK
Ex-1015	INTENTIONALLY LEFT BLANK
Ex-1016	INTENTIONALLY LEFT BLANK
Ex-1017	INTENTIONALLY LEFT BLANK

¹ Four-digit pin citations that begin with 0 are to the branded numbers added by Samsung in the bottom right corner of the exhibits. All other pin citations are to original page, column, paragraph, or line numbers.

Ex. No.	Description
Ex-1018	INTENTIONALLY LEFT BLANK
Ex-1019	INTENTIONALLY LEFT BLANK
Ex-1020	Claim Mapping Table
Ex-1021	INTENTIONALLY LEFT BLANK
Ex-1022	Parallel Citations (Schröder '867 to Certified Translation of DE 102013012339.9)
Ex-1023	INTENTIONALLY LEFT BLANK
Ex-1024	U.S. Patent No. 4,830,014 to Goodman (“Goodman”)
Ex-1025	U.S. Patent No. 6,745,061 to Hicks (“Hicks”)
Ex-1026	U.S. Patent No. 7,190,986 to Hannula (“Hannula”)
Ex-1027	Volker Konig et al., <i>Reflectance Pulse Oximetry – Principles and Obstetric Application in the Zurich System</i> , 14 Journal of Clinical Monitoring (Aug. 1998) (“Konig”)
Ex-1028	U.S. Patent No. 6,608,562 to Kimura (“Kimura”)
Ex-1029	Kevin K. Tremper et al., <i>Pulse Oximetry</i> , 70 Journal of American Society of Anesthesiologists, Inc. (Jan. 1989) (“Tremper”)
Ex-1030	Y. Mendelson et al., <i>A Wearable Reflectance Pulse Oximeter for Remote Physiological Monitoring</i> , Proceedings of 28th IEEE EMBS Annual International Conference (Aug. 30-Sept. 3, 2006) (“Mendelson 2006”)
Ex-1031	Sokwoo Rhee et al., <i>Artifact-Resistant, Power-Efficient Design of Finger-Ring Plethysmographic Sensors Part I: Design and Analysis</i> , IEEE (2000) (“Rhee 2000 Part I”)
Ex-1032	Sokwoo Rhee et al., <i>Artifact-Resistant, Power-Efficient Design of Finger-Ring Plethysmographic Sensors Part II: Prototyping and Benchmarking</i> , IEEE Proceedings of 22nd Annual EMBS Int’l Conference (July 23-28, 2000) (“Rhee 2000 Part II”)

Ex. No.	Description
Ex-1033	Sokwoo Rhee et al., <i>Artifact-Resistant Power-Efficient Design of Finger-Ring Plethysmographic Sensors</i> , 48 IEEE Transactions of Biomedical Engineering (July 2001) (“Rhee 2001”)
Ex-1034	U.S. Patent No. 6,699,199 to Asada (“Asada ’199”)
Ex-1035	Sokwoo Rhee, <i>Design and Analysis of Artifact-Resistive Finger Photoplethysmographic Sensors for Vital Sign Monitoring</i> , MIT (June 2000) (“Rhee Thesis 2000”)
Ex-1036	C.T. Olofson et al., <i>Machining of Titanium Alloys</i> (1965) (“Olofson”)
Ex-1037	H. Harry Asada et al., <i>Mobile Monitoring with Wearable Photoplethysmographic Biosensors</i> , IEEE Engineering in Medicine & Biology Magazine 28 (May-June 2003) (“Asada 2003”)
Ex-1038	Denisse Castaneda et al., <i>A review on wearable photoplethysmography sensors and their potential future applications in health care</i> , Int J Biosens Bioelectron (2018)
Ex-1039	U.S. Patent No. 7,468,036 to Rulkov et al. (“Rulkov”)
Ex-1040	U.S. Patent Publication No. 2006/0211924 to Dalke et al. (“Dalke”)
Ex-1041	<i>Guidelines To Enhancing The Heart-Rate Monitoring Performance Of Biosensing Wearables</i> (2014)
Ex-1042	U.S. Patent No. 4,880,304 to Jaeb et al. (“Jaeb”)
Ex-1043	Tom Lister et al., <i>Optical Properties of human skin</i> , Journal of Biomedical Optics (2012)
Ex-1044	John G. Webster, <i>Design of Pulse Oximeters</i> , CRC Press (1997)
Ex-1045	U.S. Patent Publication No. 20130211291 to Tran (“Tran”)
Ex-1046	WO 2001/017421A1 to Lindberg (“Lindberg”)
Ex-1047	WO 2011/132009 to Nyiradi (“Nyiradi”)

Ex. No.	Description
Ex-1048	U.S. Patent Application Publication No. 2014/0361945 to Misra et al. (“Misra”)
Ex-1049	U.S. Patent Application Publication No. 2014/0361934 to Ely et al. (“Ely”)
Ex-1050	European Patent No. 2281205 (Chen)
Ex-1051	Lawrence K. Au et al., <i>Episodic Sampling: Towards Energy-Efficient Patient Monitoring with Wearable Sensors</i> , Annual International Conference of the IEEE Engineering in Medicine and Biology Society (2009)
Ex-1052	Anastasios Petropoulos et al., <i>Flexible PCB-MEMS flow sensor</i> , Procedia Engineering 47 236-239 (2012) (“Petropoulos”)
Ex-1053	Tianjia Sun et al., <i>Wireless Power Transfer for Medical Microsystems</i> , Springer (2013) (“Sun”)
Ex-1054	U.S. Patent Pub. No. 2014/0187160 to Prencipe (“Prencipe”)
Ex-1055	H. Ardebili and Michael G. Pecht, <i>Encapsulation Technologies for Electronic Applications</i> , William Andrew (2009) (“Ardebili”)
Ex-1056	Ciprian Ciofu et al., <i>Injection and Micro Injection of Polymeric Plastics Materials: A Review</i> , Int’l J. Modern Mfg. Techs. 49 (2013)
Ex-1057	Richard J. Ross, <i>LCP Injection Molded Packages—Keys to JEDEC I Performance</i> , IEEE, 2004 Electronic Components and Technology Conference 1807 (2004)
Ex-1058	Tadamoto Sakai, <i>Encapsulation Process for Electronic Devices Using Injection Molding Method</i> , 12 Advances in Polymer Technology 61 (1993)
Ex-1059	N.J. Teh et al., <i>Embedding of Electronics within Thermoplastic Polymers using Injection Moulding Technique</i> , IEEE, 2000 Int’l Electronics Manufacturing Technology Symposium 10 (2000)

U.S. Patent No. 9,582,034
Reply Declaration of Brian W. Anthony, Ph.D.

Ex. No.	Description
Ex-1060	U.S. Patent No. 6,201,698 to Hunter (“Hunter”)
Ex-1061	U.S. Patent No. 4,012,629 to Simms (“Simms”)
Ex-1062	PGR2024-00039, Ex-2018 (’702 Decl.)
Ex-1063	PGR2024-00030, Ex-2018 (’178 Decl.)
Ex-1064	INTENTIONALLY LEFT BLANK
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Ex-1075	INTENTIONALLY LEFT BLANK
Ex-1076	INTENTIONALLY LEFT BLANK
Ex-1077	INTENTIONALLY LEFT BLANK
Ex-1078	INTENTIONALLY LEFT BLANK
Ex-1079	Dr. Anthony’s Supplemental Declaration
Ex-1080	INTENTIONALLY LEFT BLANK

Ex. No.	Description
Ex-1081	Dr. Mercier's transcript vol. 1
Ex-1082	Dr. Mercier's transcript vol. 2
Ex-1083	INTENTIONALLY LEFT BLANK
Ex-1084	INTENTIONALLY LEFT BLANK
Ex-1085	INTENTIONALLY LEFT BLANK
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I. INTRODUCTION

1. I am the same Brian W. Anthony, Ph.D. that prepared a previous Declaration in connection with Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. (collectively, “Samsung” or “Petitioner”)’s Petition for Inter Partes Review of U.S. Patent No. 9,582,034 (“the ’034 Patent”) (Ex-1001), currently assigned to Oura Health Oy (“Patent Owner” or “PO”), which I understand was filed concurrently therewith. *See generally* Ex-1002. I expressly affirm the entirety of my prior declaration.

2. In preparation for this Reply Declaration, I have considered the materials discussed in my Declaration (Ex-1002) and this Reply Declaration, including, for example, the ’034 Patent, the references cited by the ’034 Patent, the prosecution history of the ’034 Patent, various background articles and materials referenced in my Declaration (Ex-1002) and in this Reply Declaration, the prior art references identified in my Declaration (Ex-1002) and in this Reply Declaration, the Patent Owner’s Response (“POR”), the declaration of PO’s expert, Dr. Mercier from the related PGR proceedings (Ex-1062 and Ex-1063), and all of the exhibits used therein, the PTAB’s decision instituting this proceeding, the transcript of my deposition in this proceeding (Ex-2020 and Ex-2021), and the transcript of the Deposition of Mr. Patrick Mercier from the related PGR proceedings (Ex-1081 and

Ex-1082). In addition, my opinions are further based on my education, training, experience, and knowledge in the relevant field.

3. I am being compensated at my usual and customary rate of \$500 per hour. No part of my compensation depends on the outcome of this proceeding, and I have no other interest in this proceeding. My compensation is in no way contingent on the nature of my findings, the presentation of my findings in testimony, or the outcome of this or any other proceeding. I have no other financial interest in this proceeding.

4. I reiterate the Background and Qualifications, Relevant Legal Standards, Level of Ordinary Skill in the Art, and Technology Background sections of my Declaration (Ex-1002), as if fully set forth herein. Ex-1002 ¶¶4-132.

5. For the following reasons, it remains my opinion that: (1) Claims 1-5, 11, 12, 16, and 17-18 are obvious over Schröder (Ex-1007) (Ground 1); (2) Claims 1-5, 11-13, and 16-18 are obvious over Schröder in view of Yuen (Ex-1006) (Ground 2); (3) Claims 1, 2, 11, 12, and 16-18 are obvious over LeBoeuf (Ex-1012) (Ground 3); and (4) Claims 4 and 5 are obvious over LeBoeuf in view of Wissmar (Ex-1013) (Ground 4).

II. PATENT OWNER'S ARGUMENTS AGAINST GROUNDS 1 AND 2 FAIL

6. After reviewing the stated materials, it is clear to me that PO and Dr. Mercier only addressed the positions they wished I had made in my prior declaration rather than the Grounds that I did rely on. Instead they focused heavily on embodiments from the prior art that I did not rely on.

7. PO's only dispute to the Schröder and Schröder-Yuen combinations relate only to elements 11[B]/16[B] and 11[D]/16[D(ii)] and dependent claims 12 and 13. PO provides no other arguments against any of the remaining claims that were challenged in Grounds 1 or 2. There are no POR arguments as to independent claim 1 and, nor dependent claims 2-5.

A. Independent Claim 11 is rendered obvious in view of Schröder (Ground 1) or Schröder-Yuen (Ground 2).

1. Element 11[B]: a flexible printed circuit board arranged around a portion of a circumference of an interior surface of the internal housing

a. Schröder (Ground 1) teaches a PCB arranged around a circumference of the interior surface of the internal housing

8. PO relies only on Schröder's Figure 3 embodiment to argue that Schröder does not teach a flexible PCB arranged around a portion of the an interior surface of the internal housing. POR, 20. PO also asserts that Petitioner does not discuss Schröder's Figure 3 (POR, 20). But that is because my declaration actually

relies on the distinct Schröder embodiments depicted in Figures 4-10. Ex-1007, 12:1-3 (describing Figures 4-10 as distinct “possible construction variants”). PO’s expert from the related proceedings (PGR2024-00039 and PGR2024-00030) also agreed that Figure 3 is a different embodiment than Figures 4-10. *See* Ex-1081, 77:15-18 (“Q: And so would you agree that the figure 4 embodiment is a different embodiment from the figure 3 embodiment? A: Yeah. It would -- it would have to be.”). But I relied on teachings related to the Figure 7 construction variant embodiment, with its inlay 12 (i.e. the flexible PCB) arranged between U-shaped ring housing components around the circumference of the internal housing’s interior surface. Ex-1002 ¶172.

9. Schröder’s teachings for these embodiments that “[t]he finger-ring 2 consists of two ring halves 16 and 18. The two ring halves 16 and 18 respectively have a recess into which the inlay 12 is inserted.” Ex-1007, 12:7-10; *see* Ex-1002 ¶¶168-170. PO nor their expert appear to meaningfully dispute this point, with PO’s expert agreeing that “inlay 12, with chip module 10 and various other components on it, is inserted into a recess between ring halves 16 and 18 in Schröder.” Ex-1081, 82:10-12. As I explained, when viewing Schröder’s ring halves 16 and 18 configuration in Figure 7’s in the cross-section arrangement of a consistent yet modified Figure 5, which I have annotated as Figure 5’ below, Schröder’s flexible PCB (inlay 12, purple) is in the “recess” between the external housing component

(18, green) and inner housing component (16, red), which touches the user's finger tissue. Ex-1002 ¶172 (citing Ex-1007, 12:62-65).

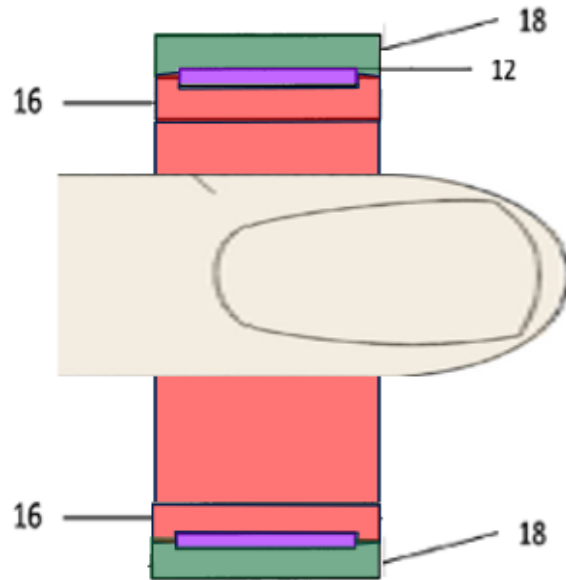
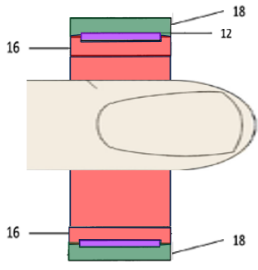
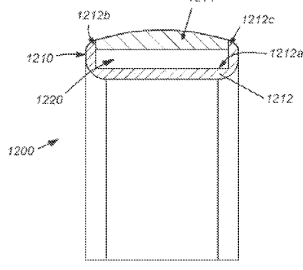


Fig. 5'

10. PO's other arguments about Schröder's teachings all lack merit.

11. **First**, PO appears to dispute that Schröder's Figure 7 depicts the cross-section I explained above, where the ring housing 16 touches and encircles the user's finger and ring housing 18 is exposed to the environment. But PO's own expert speculated that "figure 7 might *be perhaps* an angled cross section." Ex-1081, 84:17-18. But there is no basis for this speculation in Schröder. Ex-1081, 83:20-85:2 (expert claiming that figure 7 is "difficult to interpret" and "at best, it's very unclear."); 85:24-86:22 ("Figure 7, again, at best, is extremely unclear"); 86:23-

87:23 (“he’s just taking a strange cross section through the ring.”). PO’s expert’s view of Schröder’s Figure 7 is simply not credible. PO’s expert admits that, as between Figures 5 and 7, the ring halves are simply rotated by 90 degrees. Ex-1081, 85:3-8. The cross section of the resulting construction variant would look like a standard cross section (a “u-shaped” construction as described by Schröder), similar to what is depicted in the ’034 patent itself, not some “strange” cross section that PO’s expert cannot even adequately explain. Ex-1082, 210:19-214:20.

Schröder as understood by a POSITA	'034 Figure 12D
 Fig. 5'	 FIG. 12D

12. **Second**, PO argues that Schröder’s “chip module 10” is too large to fit into the recess where inlay 12 is inserted. POR, 21-22. But this argument directly contradicts Schröder’s teachings, and again is based on the Figure 3 embodiment rather than the embodiments I relied on.

13. Schröder specifically states that inlay 12 contains chip module 10, antenna 8, and potentially several other “electronic devices.” Ex-1007, 13:22-47. After being fabricated with these devices placed on one or more layers of “carrier

foil,” the inlay is cut out as a flat ring blank. It is then “rolled up to obtain the form of a finger ring 2.” Ex-1007 14:16-17. The carrier foil containing all of these components, “can be wound around a core ring. The core ring has the form e.g. of a finger-ring 2. Further, the core ring has for example a U-shaped cross-sectional profile.” *Id.* 14:21-24. After being constructed and rolled into a ring shape “[t]he carrier is preferably inserted into a recess in the second component.” *Id.* 15:20-22. PO’s expert cannot dispute any of this. Ex-1081, 118:19-121:6 (“**Q:** And so is it fair that what Schroder – what Schroder is describing is a carrier that has multiple components on it; it’s rolled into a ring shape and then inserted into a recess between the ring components? **A.** Yes. That is what it says. ...”).

14. Despite this, PO’s expert claims that what is shown in Figure 3 contradicts these plain teachings. POR, 21-23. There are a number of issues with PO’s arguments. PO acknowledges that none of the figures are drawn to scale. Therefore, there is no basis to speculate as to the relative size of chip module 10. Moreover, PO’s arguments about Figure 3 simply do not explain why a POSITA would not find obvious the grounds presented in my declaration, which relies on different embodiments (i.e., construction variants) shown in Figures 4-10.

15. Regardless, PO’s argument that chip module 10 is too large to fit within inlay 12 because Schröder teaches to use paste “[s]hould steps or shoulders nevertheless arise.” POR, 21-22 (citing Ex-1007, 14:10-13). But PO’s argument

about the alleged size of chip module 10 relies on bodily incorporation of Schröder's "replaceable chip module," Ex-1007 8:55-56, shown in Figure 3, into Schröder's other "construction variants," (Figs 4-10) where a more generic chip module is used (described in the specification's text as located "on" inlay 12 (Ex-1007, 12:4-13:50), but not illustrated in the figures. But nothing in Schröder suggests that the "replaceable" chip module of Figure 3 would or should be used in the different embodiments shown in Figures 4-10.

16. While PO relies on Schröder's "steps or shoulders" quote out of context, the immediately preceding sentence states that *"[i]deally, a ring blank has a uniform thickness over its total length, in order to avoid later steps or shoulders."* Ex-1007, 14:9-10 (emphasis added). Schröder clearly sets out a preference for a "uniform thickness" of its carrier foil-based inlay to avoid steps and shoulders. Ex-1007, 14:9-13. Schröder repeatedly indicates that the ideal situation is that any components attached to the inlay inside the recess of its ring halves and do not protrude beyond the device. *See* Ex-1007, 13:27-25, 14:9-20. Schröder teaches creating a "depression" in the carrier foil. Ex-1007, 13:27-29. "The depression has the purpose *that the devices to be inserted into the depression should not protrude beyond the carrier foil if possible*, so that an even surface is present on the carrier foil to facilitate a later processing of the carrier foil with inserted devices." Ex-1007, 13:30-35. Indeed, PO's expert agreed that Schröder suggests minimizing the use of

space in the interior recesses. Ex-1081, 112:4-9 (“**Q.** Would you agree that Schroder is at least suggesting an approach to kind of minimize the usage of space and save space in internal components? **A:** It seems like that's the intent of this writing, yeah.”).

17. **Third**, PO asserts that there is no support that Schröder’s inlay 12 is a flexible PCB. POR, 22. But again this contradicts Schröder’s express teachings. Schröder teaches that “[t]he inlay 12 itself consists of a preferably *flexible carrier material*, e.g. PET, *Kapton*, etc.” Ex-1007, 12:28-29 (emphasis added); Ex-1002 ¶172. As I explained in my declaration, Kapton is “commonly used for flexible PCBs because of their thermal stability, mechanical flexibility, and electrical insulation properties.” Ex-1002 ¶172. I further testified that the Wikipedia page for PCB (Ex-2020, 182:5-183:1), describes Kapton as “*a polyimide foil. Used for flexible printed circuits*, in this form common in small form-factor consumer electronics or for flexible interconnects.” Ex-2023, 9 (emphasis added); *see also* Ex-1081, 80:17-81:10 (“Printed flexible circuit boards often use *polyimide*.”) (emphasis added). Moreover, the ’034 Patent describes that its own PCB is also made of “any type of flexible material clear to those of skill, such as *polyimide*.” Ex-1001, 18:20-22 (emphasis added). Schröder teaches a flexible PCB constructed using the same material (a polyimide such as Kapton) that the ’034 Patent teaches for a flexible PCB used in the same manner.

18. Based on my review of Dr. Mercier's deposition transcript, he also agreed. He testified that Schröder's carrier foil may have depressions manufactured into the carrier foil so that electronic devices can be inserted into those depressions. Ex-1081, 105:9-108:9. A POSITA would have understood Schröder's described carrier as a PCB because the key features (substrate, component mounting, conductive pathways, and mechanical and electrical connectivity) align directly with the fundamental characteristics of a PCB or "carrier with components assembled on a substrate and connected to each other using circuitry" as described. In my declaration (Ex-1002), this understanding was discussed in the context of explaining that Schröder's device and similar prior art references disclose or suggest such arrangements. Specifically, the declaration describes Schröder's flexible carrier material (such as PET or Kapton foil), onto which components like chips and other electronic devices can be applied and interconnected—directly aligning with typical PCB construction principles. For instance, I explained that Schröder's teachings would be understood as using a "flexible carrier" or "carrier foil" with components mounted on it, analogous to a flexible PCB or a rigid-flex PCB, depending on the implementation details that a carrier with components assembled on a substrate and connected to each other using circuitry as a PCB. Ex-1002 ¶172.

19. Despite inlay 12 being constructed of a material widely known for use in flexible PCB's, PO argues that inlay 12 is not a PCB because it allegedly does not

use certain “manufacturing steps” involving “layers” described in the Wikipedia PCB entry that I provided. POR, 22-23. But Wikipedia does not define the scope of what is a PCB, and I never suggested that it did. My reference to Wikipedia was to establish a general understanding that a POSITA would have for a PCB. *See* Ex-2020, 73:12-16 (explaining my reference to Wikipedia “was just a convenient encapsulation of the description of PCB”).

20. Schröder describes the steps used to create its inlay the same way that Wikipedia describes creation of a PCB. For example, Schröder describes a specific procedure using carrier foils consisting of “a flexible plastic material, e.g. PET or Kapton. The carrier foil consists of at least one foil.” Ex-1007 13:35-37. The foils are manufactured by “milling, lasering, etching” and the electronic components are attached to specific foil layers, such that “[a] multilayer carrier foil composite can therefore be produced.” *Id.*, 13:23-51. Moreover, Dr. Mercier agreed that Schröder teaches multiple layers (Ex-1081, 107:23-108:9) and a wiring pattern (*id.*, 106:17-25). Accordingly, Schröder teaches how its inlay 12 is manufactured as a PCB.

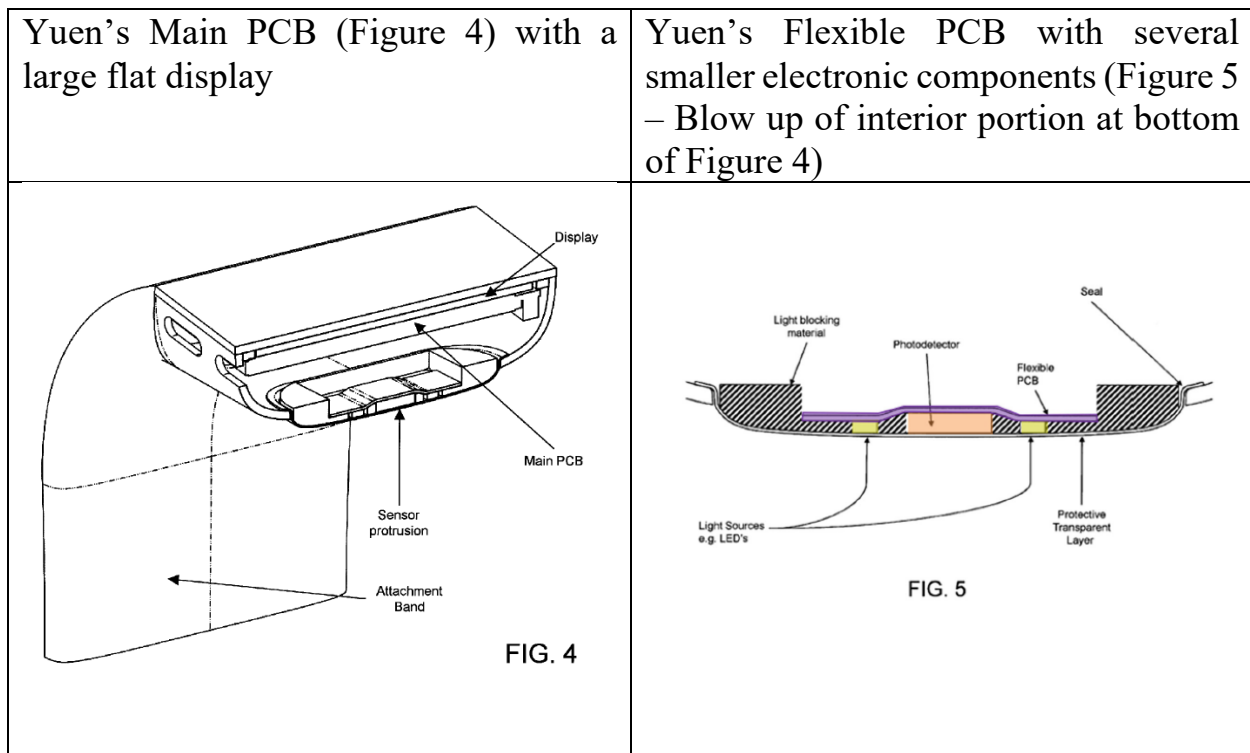
21. PO argues that Schröder used the term “circuit board in other embodiments” to support the notion that a POSITA would not consider Schröder’s inlay to be a PCB. POR, 23. PO is wrong, as I explained above Schröder’s inlay is a PCB and a POSITA would have recognized that. Schröder explaining “inlay 12 serves as a carrier,” Ex-1007, 8:57-58, consistent with what a POSITA would have

understood a PCB is, or its other references to “circuit,” in explaining how its various components are electronically connected. *see, e.g., id.*, 6:20-27 (“the chip module has an electronic circuit in order to discriminate antenna coils 8”), 11:63-67 (“The energy storage device can, for charging, be connected directly to the antenna coil 8 via a rectifier circuit, with the chip module 10 connecting the energy storage device to the antenna coil 8 accordingly by means of a suitable connection device.”). Instead, PO relies on Schröder’s embodiment where its external secure unit 2 is “in the form of an M2M module for vehicles,” and thus unrelated to Schröder’s finger-ring teachings. Ex-1007, 22:39-42. Schröder clearly expressly envisioned the inlay being a circuit board made of flexible circuit board material that had components connected to it. Ex-1007, 12:28-42; *see also id.*, 9:13-15.

b. Schröder-Yuen teaches a flexible printed circuit board (Ground 2).

22. PO asserts that the “main PCB” of Yuen “is several times the diameter of a finger worn ring,” and therefore cannot be applied to a finger worn device. POR, 24. But PO’s argument misses the mark for two reasons, (1) I rely on Yuen’s flexible PCB as evidence that flexible PCBs were well-known to those of skill in the art, not to Yuen’s main PCB, and (2) Yuen specifically teaches smaller form factors for its invention.

23. *First*, Petitioner identified Yuen’s frequent use of a flexible PCB in a multitude of locations. *See* Ex-1006, 2:38-39 (“[I]n one embodiment, the light sources and photodetector are placed on a flexible PCB”); 12:35-38, Fig. 5. While Yuen does teach a “main PCB” supporting its display in Figure 4, Yuen also teaches a much smaller flexible printed circuit board in its sensor protrusion, as shown in Figure 5, hosting other small electronic devices. A POSITA would have implemented Yuen’s flexible PCBs teaching in a wearable device, like Schröder’s ring.



24. Consistent with Schröder’s teachings, Yuen explicitly teaches “a flexible printed circuit board” that may have a variety of electronic components

attached to it. Ex-1006, 2:38-39; Pet., 24, 25. Moreover, I explained during my deposition that Yuen's flexibility teachings allows for shaping the PCB around a user's body parts: "The photodetectors on a flexible or pliable substrate such as flexible PCB allow the inner surface to adapt to the shape of the user's appendage." Ex-2021, 354:22-356:4.

25. *Second*, Yuen teaches a variety of sizes and form factors for its wearable device. PO incorrectly asserts that "[i]t is beyond dispute however, that the PCB disclosed in Yuen *cannot* be applied to a finger worn device." POR, 24 (emphasis in original). But Yuen explicitly teaches applications in smaller form factors: the "biometric monitoring device... may also be integrated and worn in a necklace, chest band, bra, patch, glasses, *earring, or toe band*." See Ex-1006, 24:35-37 (emphasis added); Ex-1002 ¶86. An "an earring or [a] toe band" would put the device in the same general size as that of a device to be worn on a finger, such as Schröder's ring. Ex-1002, ¶162; *see also* Ex-2021, 390:2-392:2; *see also* Ex-1081, 161:12-19 (PO's expert in a related PGR acknowledging "ring" and "band" can be synonymous). A POSITA would have understood the similarities between fingers and toes that they are both "composed of small bones" with similar bone and vein structures. Ex-1002, ¶162. A POSITA reading Yuen "would understand the various design trade-offs in order to... accomplish that and how to accomplish a toe band," (Ex-2021, 391:12-392:2) because the mere change in proportional size of PCB

would have been an obvious change for a POSITA. Yuen explicitly teaches a flexible printed circuit board to be used in wearable devices of various sizes and shapes.

c. A POSITA would have combined Schröder and Yuen (Ground 2)

26. PO argues that by using Yuen in combination with Schröder, I “[i]mplicitly acknowledges Schröder’s failure to disclose [the flexible printed circuit board] limitation.”. POR, 23. That is just not the case. As I discussed above, in my prior declaration, and during my deposition, Schröder teaches a flexible printed circuit board. *See supra* II.A.1.a; Ex-1002 ¶172; Ex-2020, 182:5-11. Yuen simply provides additional evidence that one of skill in the art would have known how to implement flexible PCBs in wearable devices of different form factors. *See supra* II.A.1.b.

27. Next, PO asserts that Yuen’s PCB cannot be bodily incorporated into Schröder’s ring because of the size and shape differences between Schröder and Yuen. POR, 24. But I did not suggest in my declaration that the actual physical parts of Yuen’s embodiments were to be incorporated directly into the ring of Schroder. Ex-2021, 351:3-356:11 (“I’m *not* proposing wholesale copying of that PCB.”). As discussed above, Yuen teaches smaller form factors for its device. *See supra* Section II.A.1.b. And a POSITA would have known how to size a ring’s components, to allow such components to fit within the ring. Ex-1002 ¶163; Ex-1081, 147: 20-22

(“Q: And would you agree that around 2013 there was a general drive towards making electronic components smaller? A: Yes.”). My deposition testimony and prior declaration as to how and why a POSITA would have been motivated to combine Schröder’s and Yuen’s teachings are consistent with the teachings of Schröder and Yuen. Ex-2021, 352:22-353:18 (“a POSITA could also recognize the benefit of making that into a smaller device that could fit on a ring”); Ex-1002 ¶163 (“A POSITA would have understood, therefore, that Yuen and Schröder disclose interrelated teachings based on routine technologies that would have been amenable to various well-understood and predictable combinations to provide smaller and more comfortable wearable devices.”).

28. PO argues that there is no “advantage” to the combination because there is no evidence of Schröder’s shortcomings. POR, 24-25. But as stated in my prior declaration, Yuen teaches that it was well known in the art to use a flexible PCB in a wearable device. *See* Ex-1006, 2:38-39 (“the light sources and photodetector are placed on a flexible PCB.”). It would be clear to a POSITA that the teachings of Yuen would be a reasonable option to consider. Ex-1002 ¶174 (“A POSITA would have been motivated to have Yuen’s flexible printed circuit board as Schroder’s flexible carrier material in order to provide electrical connection to all of the components inside the finger ring with an explicit flexible printed circuit board, and would have had a reasonable expectation of success in doing so.”). Yuen provides evidence of a

suitable design or implementation choice for a POSITA. Regardless of the presence or absence of “shortcomings,” a POSITA to have been motivated to combine a secondary reference’s teachings, such as Yuen’s teaching. A POSITA would routinely consider what is known in the art in order to improve upon a device. I further understand from counsel that primary references do not have to show a shortcoming in order for a POSITA to look at what a secondary reference would suggest as an improvement, which is consistent with how a POSITA would review technical materials. Here, Schröder’s inlay 12 would have been understood by a POSITA as a PCB and, moreover, a POSITA would have reasonably considered Yuen’s teaching of the use of a flexible PCB with sensors inside a wearable device.

2. Elements 11[D]/16[D(ii)]: the [external]/[internal] housing portion configured to seal the at least one component and the printed circuit board in an internal space defined by the interior surface of the [internal]/[external] housing.

a. Schröder teaches that at least one component and its PCB are sealed in an internal space between the external housing portion and internal housing.

29. PO argues that Schröder’s inlay 12 does not contain any components, and therefore can’t meet the limitation that the PCB is sealed in the internal space. POR, 26-27. As I have discussed above, Schröder’s inlay 12 is a PCB and has at least one component.

30. The majority of PO’s position on this element focus on Schröder’s Figure 3, and its “hinged cover” 14. POR, 26-27. As I discussed above, this is non-

responsive to my position, which relies on the different construction variants of the Figures 4-10 embodiments. Ex-1007, 12:1-3 (describing Figures 4-10 as distinct “possible construction variants”); *see also, e.g.* Ex-1081, 77:15-18. Regarding these different embodiments, I explained, for example Figures 6-8 of Schröder are different “structural configurations” than Figure 3. *See* Pet., 28-29 (citing; Ex-1007, 12:1-4). I specifically referenced Figures 7 and 8 to show that the inlay 12 and its components are sealed between the internal and external housing. *See* Ex-1002, ¶188 (“the U-shaped housing components extend from external housing component 18 to internal housing component 16 and are connected to each other to surround and seal inlay 12 (and its component).”). Figures 4-10’s variants simply do not have a “replaceable chip” or “hinged cover” as in Figure 3. So, PO’s arguments based on these features is not responsive to my positions.

31. PO next argues that “Schröder does not disclose a printed circuit board with at least one component.” POR, 27. This is directly contrary to what Schröder actually says, and what Dr. Mercier and I seem to agree on. Schröder’s inlay/carrier may have at least 3 components on it: “[b]esides the chip module 10, at least one further electronic component can also be located on the carrier, e.g., a display unit or a further antenna coil 8.” Ex-1007, 12:40-42; *see also, e.g.*, Ex-1081, 82:10-12 (PO’s expert agreeing that “inlay 12, with chip module 10 and various other

components on it, is inserted into a recess between ring halves 16 and 18 in Schröder.”).

32. PO appears to base its position on a narrow view of the term “component,” but the specification confirms that “component” is broad term. For example, the specification explains “the term “components” is considered to ***generally include*** any of the modules depicted and/or described in FIG. 2, as well as any other modules described herein.” Ex-1001, 10:15-17 (emphasis added). Moreover, dependent claims 13 and 18 further recite that “the at least one component comprises at least one LED.” Ex-1001, claims 13 and 18. PO focuses only on chip module 10 but ignores Schröder’s explicit teaching of how its “inlay 12 ***can have at least one chip module 10 ... with at least one further electronic device... arranged on the inlay 12.***” Ex-1007, 12:62-65; 9:13-15 (emphasis added). Schröder’s chip module 10 and “further electronic device” are examples of “components” just like the various modules and LEDs described in the ’034 specification. Ex-1001, 10:15-17.

33. PO briefly mentions that a POSITA would not have been motivated to modify Schröder the modification “would require a complete redesign of Schröder.” POR, 27. This is false. PO’s argument relies on bodily incorporation of Schröder’s chip module as shown in Figure 3, which as has previously been addressed, is the embodiment that I did not rely on.

b. Yuen teaches sealing its electronic component and PCB in the internal space

34. PO next argues that Yuen's waterproof sealant does not "cure" Schröder of the deficiencies of not having "a printed circuit board and component sealed in a space." POR, 28. But, as I explained above, Schröder teaches all of this. I simply rely on Yuen to provide additional teachings related to well-known techniques to provide a water-tight seal for the internal components of a wearable device, such as Schröder's ring. Specifically, Yuen teaches "accommodating a watertight seal for the sensor package." Ex-1006, 14:66-15:4. Yuen further explains using "watertight glues, hydrophobic membranes such as Gore-Tex, O-rings, sealant, grease, or epoxy to secure or attach the optical sensor package/module and the device body." Ex-1006, 15:10-14. Yuen also expressly teaches a motivation for why a POSITA would do so. Ex-1006, 14:59-66 (preventing liquid ingress into the body of the biometric monitoring and increase durability and prevent damage to the internal components); Ex-1002, ¶167 ("a POSITA would have been motivated to seal Schröder's finger ring [with the teachings of Yuen to have] a watertight seal in order to make it stronger, more durable, and efficient during all of the user's daily activities.").

B. Dependent Claims 12 and 13 are rendered obvious over Schröder (Ground 1) and Schröder-Yeun (Ground 2)

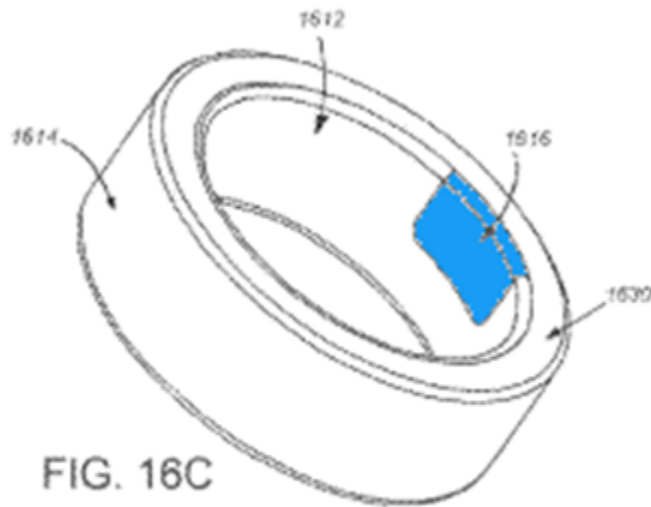
1. Schröder or Schröder in view of Yuen teaches “the external housing portion comprises a substantially transparent external potting” of claim 12 and “at least one LED configured to emit at least one of a visible light, infrared radiation, and ultraviolet radiation through the external potting” of claim 13.

a. Schröder’s window is formed of “substantially transparent external potting.”

35. PO argues that Schröder’s “window for displaying a visual security feature” is not formed of a “substantially transparent external potting,”² by attempting to limit the external potting to form the ring’s overall form factor. POR, 29. But Claim 12 recites that the external housing “comprising a substantially transparent external potting,” and *not* that it is entirely made of transparent potting. As I explained before, “partially comprising... seems as if that construction is all potting, which would *not* be what’s claimed.” Ex-2021, 471:4-14. Instead, a part of the external housing component is made of substantially transparent material, which could be potting. *Id.*, 473:6-20.

² I note that PO only focuses on the substantially transparent external potting. PO does not dispute Schröder and Schröder-Yuen’s teachings of the internal housing component comprising a substantially transparent internal potting that allows for visible light, infrared radiation, or ultraviolet radiation to emit through the internal potting of claims 17 and 18.

36. But Schröder teaches that its housing may indeed be made of metal (Ex-1007, 12:14-15), and have “transparent regions, e.g. windows” for visual security features. Ex-1007, 9:26-34. While PO is improperly attempting to narrow what materials can be considered a “potting,” Schröder’s “transparent regions, e.g. windows” are just like the ’034 Patent’s Figure 16C, which includes a “cutaway portion 1616” with “potting 1630” provided on top and is “transparent to allow for transmission of light through the cutaway portions 1616.” Ex-1001, 20:51-57. The ’034 specification further supports that the potting is not required to form the ring’s form factor by explaining how “potting 1630” is provided on top of “cutaway portion 1016” and is “transparent to allow for transmission of light through the cutaway portions 1616.” Ex-1001, 20:51-57. Schroder’s window for displaying a visual security feature explicitly discloses that its external housing component includes a “substantially transparent material” with “transparent regions, e.g. windows” for visual security features. Ex-1007, 9:26-34. The substantially transparent external potting to form the overall form factor is not claimed.



37. PO then argues that the “substantially transparent external potting” must be “transparent to all light,” but that is also not required by the claims. POR, 29-30. Claim 13 requires that “at least one of visible light, infrared radiation, and ultraviolet radiation” is emitted through claim 12’s “substantially transparent external potting.” Ex-1001, Cls. 12 and 13. This is further supported by the specification that explains that the transparent material is transparent to “visible light, infrared radiation, and ultraviolet radiation.” Ex-1001, 2:2-6. PO’s expert in a related proceeding further explained that if the transparent material is transparent to a “particular wavelength of light and nothing else, then... it would be substantially transparent to that one wavelength and not the others,” Ex-1082, 183:8-185:25, but that does not mean it is required to be transparent to “all visible light”, it means substantially non-blocking to the wavelengths to which it is intended to allow to pass through. Ex-1082, 177:20-181:13. Thus, the transparent material does not need to

be transparent to “all light,” to all wavelengths, or the entire visible spectrum. Rather, it simply requires transparency sufficient for the light-emitting components to function as described, namely, to emit visible and infrared light that can reach and return from the tissue. PO’s attempt to narrow claim 12’s “substantially transparent material” is unsupported by the ’034 claims, ’034 specification, and expert testimony.

38. Schröder teaches that at least visible light is emitted through transparent regions on the external housing component. Schröder teaches a light-emitting diode is configured to emit visible light through external “transparent regions, e.g., windows” incorporated into the surface (Ex-1007, 9:28-34) when the LED displays a sequence of colors or the optical display (made of LEDs) transmits “application specific data.” Ex-1007, 8:32-53; Pet., 36-37. Schröder’s LED light is emitted through the transparent region of external housing of Schröder’s ring in order to provide the security-relevant data to the user (Ex-1002, ¶ 209) which is all that is required by claims 12 and 13.

b. Schröder-Yuen teaches a window made of “substantially transparent” potting

39. PO includes one sentence arguing that Schroder-Yuen’s window is not a potting material without any support. POR, 30. As previously explained, Yuen’s window explicitly teaches that the LED (visible light) passes through the transparent

potting of the window, which is all that is required of the claims. Ex-1002, ¶210; Ex-1006, 10:55-58 (“a window (for example, a visually opaque window) in the housing to facilitate optical transmission between the optical sensors and the user.”).

40. But as I explained, a POSITA would have been motivated to include Yuen’s transparent window into Schröder’s finger ring to improve Schröder’s window by allowing “for more accurate sensor readings and to protect LED or optical display from ambient conditions.” Ex-1002 ¶207; *see also id.*, ¶158 (“the use of transparent materials as interior and exterior windows to allow for light to be emitted through and sensed for data acquisition.”).

III. PO WAIVED ITS ARGUMENTS TO GROUNDS 3 AND 4

41. PO did not address Grounds 3 or 4 or LeBouef’s and Wissmar’s teachings in its POR at all and thus the LeBouef-based grounds are unrebutted. I understand that the Board determined that “Petitioner demonstrates a reasonable likelihood of prevailing on its challenge of claim 1 as unpatentable over LeBoeuf. I also understand that PO has waived its arguments to Grounds 3 and 4. I reiterate all of the opinions expressed in my prior declaration.

IV. THERE IS NO EVIDENCE OF OBJECTIVE INDICIA OF NON-OBVIOUSNESS

42. I understand that PO has not put forth any evidence of objective indicia of non-obviousness to consider. Accordingly, there are no secondary considerations in the record that alter my conclusions regarding obviousness.

V. CONCLUSION

43. All of the challenged claims are obvious over the prior art.

44. In signing this declaration, I understand that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I acknowledge that I may be subject to cross-examination in this case and that cross-examination will take place within the United States. If cross-examination is required of me, I will appear for cross-examination within the United States during the time allotted for cross-examination.

45. I declare that all statements made herein of my knowledge are true, that all statements made on information and belief are believed to be true, and that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

46. I declare under penalty of perjury that the foregoing is true and correct.

Respectfully Submitted,



Dr. Brian W. Anthony