

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MASIMO CORPORATION,

Petitioner,

v.

APPLE INC.,

Patent Owner

Case IPR2023-00734
U.S. Patent No. 10,942,491

**DECLARATION OF DR. BRIAN W. ANTHONY, PH.D. IN SUPPORT
OF PATENT OWNER RESPONSE**

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charging degradation that occurs from positioning the wireless charging
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I, Brian W. Anthony, of Cambridge, MA, declare that:

I. QUALIFICATIONS AND BACKGROUND

1. My name is Dr. Brian W. Anthony and I have been retained as an expert witness by Apple Inc. in the matter of *Masimo Corporation v. Apple Inc.*, IPR2023-00734, in which Petitioner Masimo has challenged the patentability of claims of U.S. Patent No. 10,942,491 (the “’491 Patent”).

2. My qualifications are summarized below.

3. I am an Associate Principal Research Scientist at the Institute of Medical Engineering & Science at Massachusetts Institute of Technology (MIT). I am also a Principal Research Scientist at MIT’s Mechanical Engineering department, Director of the Master of Engineering in Advanced Manufacturing and Design Program at MIT, Director of Health Technology at the MIT Center for Clinical and Translational Research, a Co-Director of the Medical Electronic Device Realization Center of the Institute of Medical Engineering & Science, and Associate Director of MIT.nano. My current curriculum vitae is attached and some highlights follow.

4. I earned my B.S. in Engineering (1994) from Carnegie Mellon University. I earned my M.S. (1998) and Ph.D. (2006) in Engineering from MIT. My research focused on high-performance computation, signal processing, and electro-mechanical system design.

5. In 1997, I co-founded Xcitex Inc., a company that specialized in video-acquisition and motion-analysis software. I served as the Chief Technology Officer and directed and managed product development until 2006. Our first demo product was an optical ring for human motion measurement used to capture user hand motion in order to control the user's interaction with a computer. Our optical ring included multiple light emitting diodes, multiple photodetectors, techniques for modulation and synchronization, and noise reduction algorithms. We estimated human hand-motion based on how that motion changed the detected light. In our application, we did not try to eliminate motion artifact, we tried to measure it. In developing our ring, we considered well-known problems such as ambient light and noise. Motion Integrated Data Acquisition System (MiDAS) was our flagship video and data acquisition product which relied upon precise synchronization of multiple clocks for optical sensor and video acquisition, data acquisition, and external illumination.

6. Since 1998, I have taught courses at MIT including biomedical signal processing and instrumentation, optical engineering, non-linear optics, large scale systems optimization, electrical engineering in medical technologies, electrical engineering in communications technologies, and design and manufacturing.

7. I became the Director of the Master of Engineering in Advance Manufacturing and Design Program at MIT in 2006. The degree program covers four main components: Manufacturing Physics, Manufacturing Systems, Product

Design, and Business Fundamentals. Many of the courses, projects, and papers my students undertake involve technologies relevant to the patent at issue, for example, sensor devices including non-invasive optical biosensors.

8. In 2011, I co-founded MIT's Medical Electronic Device Realization Center ("MEDRC") and currently serve as co-director. The MEDRC aims to create and deploy revolutionary medical technologies by collaborating with clinicians, the microelectronics, and medical devices industries. We combine expertise in computation; communications; optical, electrical, and ultrasound sensing technologies; and consumer electronics. We focus on the usability and productivity of medical devices using, for example, image and signal processing combined with intelligent computer systems to enhance practitioners' diagnostic intuition. Our research portfolio includes low power integrated circuits and systems, big data, micro electro-mechanical systems, bioelectronics, sensors, and microfluidics. Specific areas of innovation include wearable, non-invasive and minimally invasive optical biosensor devices, medical imaging, laboratory instrumentation, and the data communication from these devices and instruments to healthcare providers and caregivers. My experience with these devices is directly applicable to the technology in the patent at issue.

9. I am currently the Co-Director of the Center for Clinical and Translational Research and Device Realization Lab at the Institute of Medical

Engineering & Science at MIT. My labs design instruments and techniques to sense and control physical systems. Medical devices and manufacturing inspection systems are a particular focus. We develop and combine electromechanical systems, complex algorithms, and computation systems to create instruments and measurement solutions for problems that are otherwise intractable.

10. The research of the Device Realization Lab focuses on product development interests cross the boundaries of computer vision, acoustic and ultrasonic imaging, large-scale computation and simulation, optimization, metrology, autonomous systems, and robotics. We use computation, and computer science, as methodology for attacking complex instrumentation problems. My work combines mathematical modeling, simulation, optimization, and experimental observations, to develop instruments and measurement solutions.

11. My record of professional service includes recognitions from several professional organizations in my field of expertise.

12. I am a named inventor on 10 issued U.S. patents. Most but not all of these patents involve physiological monitoring and other measurement technologies.

13. I have published approximately 100 papers, and have received a number of best paper and distinguished paper awards. A number of papers that I have published relate to physiological monitoring and other measurement and instrumentation technologies.

14. My curriculum vitae, included with this declaration, includes a list of publications on which I am a named author. It contains further details regarding my experience, education, publications, and other qualifications to render an expert opinion in connection with this proceeding.

15. In writing this Declaration, I have considered the following: my own knowledge and experience, including my work experience in mobile systems and networks; my experience in teaching those subjects; and my experience in working with others involved in those fields. In addition, I have analyzed the following publications and materials, in addition to other materials I cite in my declaration:

- EX-1001: U.S. Patent No. 10,942,491 (the “’491 Patent”)
- EX-1002: File History of the ’491 Patent
- EX-1005: PCT Publication No. WO 2005/092182 A1 (“Kotanagi”)
- EX-1006: U.S. Patent No. 6,265,789 (“Honda”)
- EX-1007: U.S. Publication No. 2001/0056243 (“Ohsaki”)
- EX-1008: PCT Publication No. WO 2012/140559 A1 (“Shmueli”)
- EX-1009: European Patent App. No. EP14163114 (“Coppola”)
- EX-1010: U.S. Provisional Patent App. No. 61/976,388 (“Fei”)
- EX-1011: PCT Publication No. WO 2015/034149 A1 (“Choi PCT”)
- EX-1012: U.S. Publication No. US 2015/0214749 A1 (“Park”)
- EX-1014: US 20120221254 A1 (Kateraas)

- EX-1015: U.S. Provisional Patent Application No. 61/932258
(“Park Provisional”)
- EX-1016: U.S. Publication No. 20140135594 A1 (“Yuen”)
- EX-1017: U.S. Patent No. 10,090,712 (“Jabori”)
- EX-1020: PCT Patent Pub. WO 2015150199 A1 (“Coppola PCT”)
- EX-1022: U.S. Patent No. 4,129,124 (“Thalmann”)
- EX-1023: Korean Patent Application No: 10-2013-0107833
(“Choi”)
- EX-1025: U.S. Patent No. 4,163,447 (“Orr”)
- EX-1026: U.S. Patent No. 4,224,948 (“Cramer”)
- EX-1027: U.S. Patent No. 4,248,244 (“Charnitski”)
- EX-1028: PCT Publication No. WO 1982000088 A1 (“Steuer”)
- EX-1029: U.S. Patent No. 4,375,219 (“Schmid”)
- EX-1030: U.S. Patent No. 5,316,008 (“Suga”)
- EX-1031: U.S. Patent No. 5,738,104 (“Lo”)
- EX-1033: US 20050116820 A1 (“Goldreich”)
- EX-1034: US 20070276270 A1 (“Tran”)
- EX-1035: US 20080208009 A1 (“Shklarski”)
- EX-1036: U.S. Patent No. 6,091,530 (“Duckworth”)
- EX-1037: U.S. Patent 6,075,755 (“Zarchan”)

- EX-1038: Y. Mendelson, “A Wearable Reflectance Pulse Oximeter for Remote Physiological Monitoring,” Proceedings of the 28th IEEE (2006)
- EX-1039: Y. Mendelson, “Wearable Wireless Pulse Oximetry for Physiological Monitoring,” PPL Workshop (2008)
- EX-1041: U.S. Publication No. 20150355604 A1 (“Fraser”)
- EX-2008: U.S. Patent Pub. No. 2007/0228404 to Tran et al. (“Tran”)
- EX-2009: U.S. Patent Pub. No. 2005/0274971 to Wang et al. (“Wang”)
- EX-2015: U.S. Patent Pub. No. 2010/0193804 to Brown et al. (“Brown”)
- EX-2016: U.S. Patent Pub. No. 2005/0030518 to Nishi et al. (“Nishi”)
- EX-2017: U.S. Patent No. 7,455,423 to Takenaka (“Takenaka”)
- EX-2023: S. Annam, “Scholar Works at UT Tyler Four-Coil Wireless Power Transfer Using Resonant Inductive Coupling,” Electric Engineering Theses, Paper 19 (2012).

- EX-2024: Z. Atrachchi et al., “Efficiency Examination of The Circular Coils with Two Types of Cross-Sections for WPT System,” UMDC-SDSP (2020).
- EX-2025: Y. Li et al., “Maximizing Transfer Distance for WPT via Coupled Magnetic Resonances by Coupling Coils Design and Optimization,” IEEE Access, vol. 8, pp. 74157–74166 (2020).
- EX-2026: Y. Li et al., “Influences of Coil Radius on Effective Transfer Distance in WPT System,” IEEE Access, vol. 7, pp. 125960–125968 (2019).
- EX-2027: Y. Li et al., “Directional characteristics of wireless power transfer via coupled magnetic resonance,” Electron., Vol. 9, No. 11, pp. 1–14 (2020).
- EX-2028: K. A. Mohamad et al., “Effect of Circular Coil Dimension on Resonant Coupling Wireless Power Transfer System,” J. Telecommun. Electron. Comput. Eng., Vol. 10, No. 2–6, pp. 19–23 (2018).
- EX-2029: A. P. Sample et al. “Analysis, experimental results, and range adaptation of magnetically coupled resonators for wireless power transfer,” IEEE Trans. Ind. Electron., Vol. 58, No. 2, pp. 544–554 (2011).

- EX-2030: G. Vigneau et al., “Design and modeling of PCB coils for inductive power charging,” *Wirel. Power Transf.*, Vol. 2, No. 2, pp. 143–152 (2015).
- EX-2031: R. Vinge, “Wireless Energy Transfer by Resonant Inductive Coupling,” p. 83 (2015).
- EX-2032: F. Wen et al., “Research on optimal receiver radius of wireless power transfer system based on BP neural network,” *Energy Reports*, Vol. 6, pp. 1450–1455 (2020).
- EX-2033 U.S. Patent Pub. No. 2007/0228404 to Tran et al.
(“Tran”)
- EX-2034 U.S. Patent Pub. No. 2005/0274971 to Wang et al.
(“Wang”)
- EX-2035 U.S. Patent Pub. No. 2010/0193804 to Brown et al.
(“Brown”)
- EX-2036 U.S. Patent Pub. No. 2005/0030518 to Nishi et al.
(“Nishi”)
- EX-2037 U.S. Patent No. 7,455,423 to Takenaka (“Takenaka”)
- EX-2040 G. Patancheru, “Wearable Hear Rate Monitoring Unit”
- EX-2041 Pulse Sensor Easy to Use Heart Rate Sensor and Kit
(World Famous Electronics)

- EX-2042 “Bringing Vital Signs Monitoring into the Wearable Domain” (April 2023)

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16. In addition to the above, I have reviewed the declaration of Dr. R. James Duckworth, Ph.D. (EX-1003) and the materials cited therein (some of which are referenced above as well). In addition, I have also reviewed the deposition testimony of Dr. Duckworth (EX-2039).

17. Counsel has informed me that I should consider these materials through the lens of one of ordinary skill in the art related to the '491 patent at the time of the earliest possible priority date of the '491 patent, and I have done so during my review of the above-referenced materials (as well as any additional materials cited and discussed throughout this declaration). I have been informed that the '491 patent claims priority to an application filed on September 2, 2014 (“Critical Date”). I have used this Critical Date in my analysis below.

18. In writing this Declaration, I have considered the following: my own knowledge and experience, including my work experience in the fields of mechanical engineering, computer science, biomedical engineering, and electrical engineering; my experience in teaching those subjects; and my experience in

working with others involved in those fields. In addition, I have analyzed various publications and materials, in addition to other materials I cite in this declaration.

19. My opinions, as explained below, are based on my education, experience, and expertise in the fields relating to the '491 Patent. Unless otherwise stated, my testimony below refers to the knowledge of one of ordinary skill in the fields as of the Critical Date, or before. Any figures that appear within this document have been prepared with the assistance of Counsel and reflect my understanding of the '491 patent and the materials discussed below.

II. LEGAL PRINCIPLES

A. Terminology

20. I have been informed by Counsel and understand that the best indicator of claim meaning is its usage in the context of the patent specification as understood by one of ordinary skill. I further understand that the words of the claims should be given their plain meaning unless that meaning is inconsistent with the patent specification or the patent's history of examination before the Patent Office. Counsel has also informed me, and I understand that, the words of the claims should be interpreted as they would have been interpreted by one of ordinary skill at the time of the invention was made (not today). For my analysis, I have used the

September 2, 2014 (the Critical Date) as the point in time for claim interpretation purposes.

B. Legal Standards for Anticipation

21. I have been informed by Counsel and understand that documents and materials that qualify as prior art can render a patent claim unpatentable as anticipated. I have been informed by Counsel and understand that all prior art references are to be looked at from the viewpoint of a person of ordinary skill in the art (POSITA).

22. I have been informed by Counsel and understand that a challenged claim is unpatentable as “anticipated” under 35 U.S.C. § 102 if it is determined that all the limitations of the claim are described in a single prior art reference. I have been informed by Counsel and understand that, to anticipate a claim, a prior art reference must disclose, either expressly or inherently, each and every limitation of that claim and enable one of ordinary skill in the art to make and use the invention.

23. I have been informed by Counsel and understand that in an *inter partes* review, “the petitioner shall have the burden of proving a proposition of unpatentability,” including a proposition of anticipation, “by a preponderance of the evidence.” 35 U.S.C. §316(e).

C. Legal Standards for Obviousness

24. I have been informed by Counsel and understand that documents and materials that qualify as prior art can render a patent claim unpatentable as obvious. I have been informed by Counsel and understand that all prior art references are to be looked at from the viewpoint of a person of ordinary skill in the art at the time of the invention or the effective filing date, and that this viewpoint prevents one from using his or her own insight or hindsight in deciding whether a claim is obvious.

25. I have been informed by Counsel and understand that a claim is unpatentable for obviousness under 35 U.S.C. § 103 “if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains.” I have been informed by Counsel and understand that obviousness may be based upon a combination of references. I have been informed by Counsel and understand that the combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results.

26. However, I have been informed by Counsel and understand that a patent claim composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art.

27. I have been informed by Counsel and understand that when a patented invention is a combination of known elements, a court must determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue by considering the teachings of prior art references, the effects of demands known to people working in the field or present in the marketplace, and the background knowledge possessed by a person having ordinary skill in the art.

28. I have been informed by Counsel and understand that a patent claim composed of several limitations is not proved obvious merely by demonstrating that each of its limitations was independently known in the prior art. I have been informed by Counsel and understand that identifying a reason those elements would be combined can be important because inventions in many instances rely upon building blocks long since uncovered, and claimed discoveries almost of necessity will be combinations of what, in some sense, is already known. I have been informed by Counsel and understand that it is improper to use hindsight in an obviousness analysis, and that a patent's claims should not be used as a "roadmap."

29. I have been informed by Counsel and understand that an obviousness inquiry requires consideration of the following factors: (1) the scope and content of the prior art; (2) the differences between the claims and the prior art; (3) the level of ordinary skill in the pertinent art; and (4) any objective indicia of non-obviousness, such as commercial success, long-felt but unresolved need, failure of others, industry

recognition, copying, and unexpected results. I understand that the foregoing factors are sometimes referred to as the “Graham factors.”

30. I have been informed by Counsel and understand that an obviousness evaluation can be based on a combination of multiple prior art references. I understand that the prior art references themselves may provide a suggestion, motivation, or reason to combine, but that the nexus linking two or more prior art references is sometimes simple common sense. I have been informed by Counsel and understand that obviousness analysis recognizes that market demand, rather than scientific literature, often drives innovation, and that a motivation to combine references may be supplied by the direction of the marketplace.

31. I have been informed by Counsel and understand that if a technique has been used to improve one device, and a person of ordinary skill at the time of invention would have recognized that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill.

32. I have been informed by Counsel and understand that practical and common sense considerations should guide a proper obviousness analysis, because familiar items may have obvious uses beyond their primary purposes. I have been informed by Counsel and understand that a person of ordinary skill looking to overcome a problem will often be able to fit together the teachings of multiple prior

art references. I have been informed by Counsel and understand that obviousness analysis therefore accounts for the inferences and creative steps that a person of ordinary skill would have employed at the time of invention.

33. I have been informed by Counsel and understand that a proper obviousness analysis focuses on what was known or obvious to a person of ordinary skill at the time of invention, not just the patentee. Accordingly, I understand that any need or problem known in the field of endeavor at the time of invention or effective filing date and addressed by the patent can provide a reason for combining the elements in the manner claimed.

34. I have been informed by Counsel and understand that a claim can be obvious in light of a single reference, without the need to combine references, if the elements of the claim that are not found explicitly or inherently in the reference can be supplied by the common sense of one of skill in the art.

35. I have been informed by Counsel and understand that secondary indicia of non-obviousness may include (1) a long felt but unmet need in the prior art that was satisfied by the invention of the patent; (2) commercial success of processes covered by the patent; (3) unexpected results achieved by the invention; (4) praise of the invention by others skilled in the art; (5) taking of licenses under the patent by others; (6) deliberate copying of the invention; (7) failure of others to find a solution to the long felt need; and (8) skepticism by experts. I understand that

evidence of secondary indicia of non-obviousness, if available, should be considered as part of the obviousness analysis.

36. I have been informed by Counsel and understand that there must be a relationship between any such secondary considerations and the invention, and that contemporaneous and independent invention by others is a secondary consideration supporting an obviousness determination.

37. In sum, my understanding is that prior art teachings are properly combined where one of ordinary skill having the understanding and knowledge reflected in the prior art and motivated by the general problem facing the inventor, would have been led to make the combination of elements recited in the claims. Under this analysis, the prior art references themselves, or any need or problem known in the field of endeavor at the time of the invention, can provide a reason for combining the elements of multiple prior art references in the claimed manner.

38. I have been informed by Counsel and understand that in an *inter partes* review, “the petitioner shall have the burden of proving a proposition of unpatentability,” including a proposition of obviousness, “by a preponderance of the evidence.” 35 U.S.C. §316(e).

III. OVERVIEW OF CONCLUSIONS FORMED

39. This expert Declaration explains the conclusions that I have formed based on my analysis. To summarize those conclusions:

- Based upon my knowledge and experience and my review of the prior art publications listed above, it is my opinion that Kotanagi in view of Honda does not render obvious claim 7, 11, 14, and 16.
- Based upon my knowledge and experience and my review of the prior art publications listed above, it is my opinion that Kotanagi in view of Honda and Choi does not render obvious claims 1-3, 5, 13, and 17.
- Based upon my knowledge and experience and my review of the prior art publications listed above, it is my opinion that Kotanagi in view of Honda and Fraser does not render obvious claims 8 and 15.
- Based upon my knowledge and experience and my review of the prior art publications listed above, it is my opinion that Kotanagi in view of Honda and Orr does not render obvious claim 9.
- Based upon my knowledge and experience and my review of the prior art publications listed above, it is my opinion that Kotanagi in view of Honda and Park does not render obvious claims 12 and 18.

- Based upon my knowledge and experience and my review of the prior art publications listed above, it is my opinion that Kotanagi in view of Honda, Choi, and Park does not render obvious claim 4.
- Based upon my knowledge and experience and my review of the prior art publications listed above, it is my opinion that Kotanagi in view of Honda, and Jabori does not render obvious claims 10 and 19.
- Based upon my knowledge and experience and my review of the prior art publications listed above, it is my opinion that Kotanagi in view of Honda, Choi, and Jabori does not render obvious claim 6.

IV. BACKGROUND KNOWLEDGE OF ONE OF SKILL IN THE ART

40. Based on the foregoing and upon my experience in this area, a person of ordinary skill in the art (“POSITA”) relating to the subject matter of the ’491 Patent as of September 2, 2014 (“Critical Date”) would have had at least a bachelor’s degree in electrical engineering, mechanical engineering, biomedical engineering, computer engineering, physics, or a related field, and would have had at least two years of relevant work experience with capture and processing of data or information, including but not limited to physiological information, or equivalents thereof. Less work experience may be compensated by a higher level of education and vice versa.

41. Based on my background and experiences, I have a good understanding of the capabilities of a POSITA, as I was such an individual at the time of the Critical Date. Moreover, I have taught, participated in organizations, and worked closely with many such persons over the course of my career.

42. In forming my opinions herein, I have applied the above proposed skill level of a POSITA.

43. I have been informed that Petitioner proposes a skill level of a person of ordinary skill in the art that requires “at least a bachelor’s degree in a discipline related to biomechanical devices, such as Mechanical Engineering, Biomedical Engineering, Electrical Engineering, Physics, Industrial Design, or an equivalent discipline, and at least three years of experience working with or developing electronic medical or consumer devices.” Petition, 7.

44. Based on my background and experiences, I have a good understanding of the capabilities of such a person of ordinary skill, as proposed by Petitioner, as I was such an individual at the time of the Critical Date. Additionally, my analysis presented herein remains unchanged even if this skill level is applied.

V. '491 PATENT

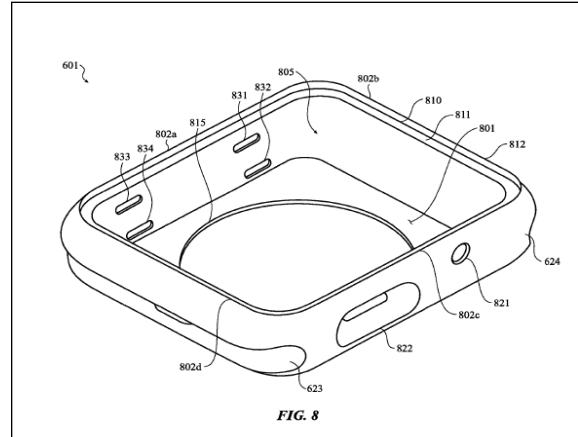
A. Overview of the '491 Patent

45. The '491 Patent relates to “a wearable electronic device” that provides a “wide range” of features, including among others, “wireless power charging” and “health monitoring functionality.” EX-1001, 1:22-28, 1:42-45.

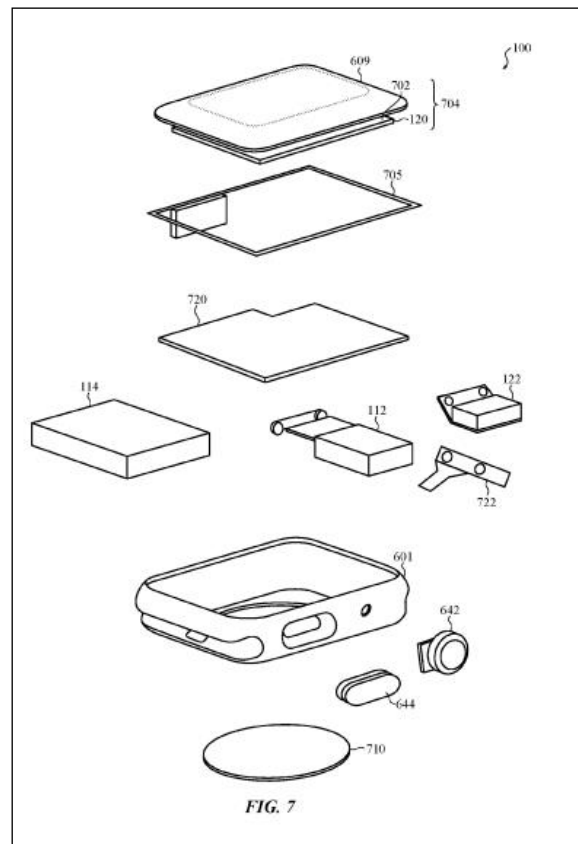
46. The '491 Patent explains that traditional portable devices, particularly wearable electronic devices, had “relatively limited functionality or [were] only able to perform a specialized set of functions or tasks.” EX-1001, 1:35-39. “For example, some traditional electronic wristwatches” were “configured to perform a relatively limited set of functions, including displaying time, date, and performing basic timing functions.” *Id.*, 1:39-42.

47. In contrast, and “compared to some traditional wearable electronic devices,” the '491 patent provides “an expansive feature set” that is “integrated into” the “relatively compact space of a wrist-worn device.” *Id.*, 1:42-45, 1:53-59. In some embodiments, the '491 Patent provides a wrist-worn device that “integrate[s] or combine[s] multiple subsystems”—including a wireless charging receive coil operating in conjunction with a power conditioning circuit and biometric sensors—“into a single device” to provide a wrist-worn device with a wide range of features, including wireless charging and biometric sensing capabilities. *Id.*, 1:22-28, 1:49-59, 7:13-28, 5:32-44, 4:27-52.

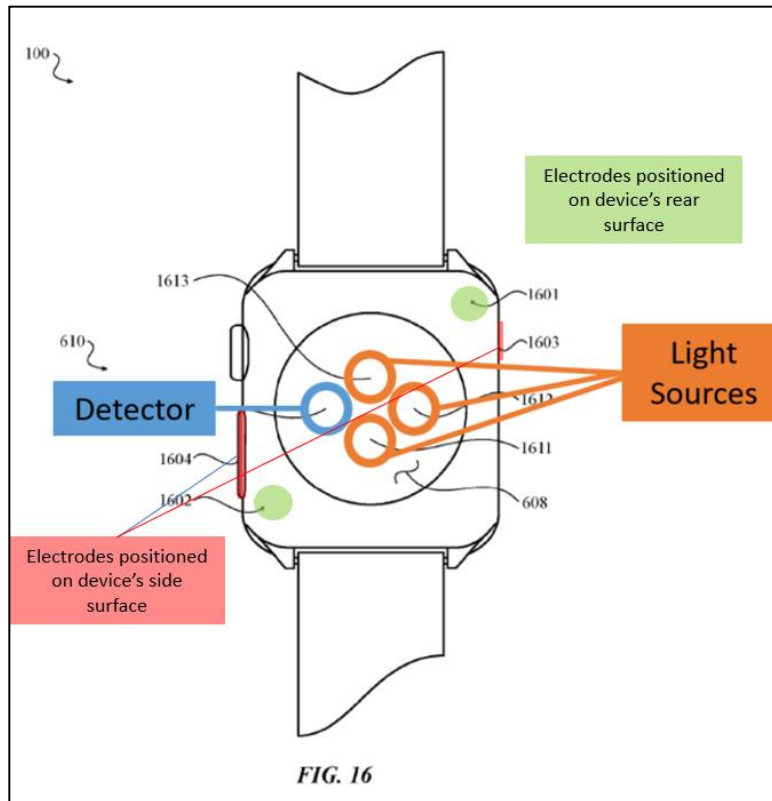
48. The '491 patent provides a device 100 that can facilitate biometric sensing using a “biosensor module” made up of “one or more sensors” that are “used to calculate a health metric,” such as “a heart rate, a respiration rate, blood oxygenation level, a blood volume estimate, blood pressure, or a combination thereof.” *Id.*, 37:49-58; 8:31-41, 13:27-45.



49. The figures on the right show the housing 601 of the device (FIG. 8) as well as an exploded view of an example embodiment of the wearable device, with “a biosensor module 710 ... disposed in an opening formed in the rear surface of the housing 601” (FIG. 7). *Id.*, Figs. 7-8, 28:7-24, 28:51-29:17 (showing and describing the housing as having “a flat bottom portion 801” surrounding an opening, with a “biosensor module 710” being disposed “disposed in the opening formed in the rear surface of the housing”).



50. “In some embodiments, the biosensor module 710 includes the rear cover 608 and may also include a chassis or plate that facilitates attachment of the biosensor module 710 to the housing 601.” *Id.*, 28:7-15. In some embodiments, and as depicted in further detail with reference to FIG. 16, the “biosensor module 710 may include one or more light sources, one or more photodetectors, and one or more electrodes or conductive elements that are configured to detect and measure a physiological condition or property of the user.” *Id.*, Fig. 16 (reproduced and annotated below). Also, as shown below, the rear cover 608 is circular and would be understood as covering the circular opening formed in the rear portion of the housing, as depicted in FIG. 8 above. See EX-1001, 40:43-50 (“rear cover 608 ... is configured to be positioned with the opening of the housing 601”).



51. The light sources 1611-1613 and the detector 1614 on the rear portion of the device “are configured to function as an optical sensor or sensors,” such as “a photoplethysmography (PPG) sensor or sensors.” *Id.*, 38:23-38. “As described above with respect to FIG. 6, in some embodiments, the biosensors are disposed relative to or attached to a rear cover 608 that is formed from an optically transparent material,” and which is positioned within the rear surface opening of the housing. *Id.*, 40:43-50. In this manner, lights are transmitted and received from/to the optical sensors via the rear cover 608.

52. Additionally, the device can include “one or more electrodes” (e.g., electrodes 1601 and 1602 in FIG. 16 above) that can be used to “measure electrical properties of the user’s body.” *Id.*, 13:37-42, 39:40-54.

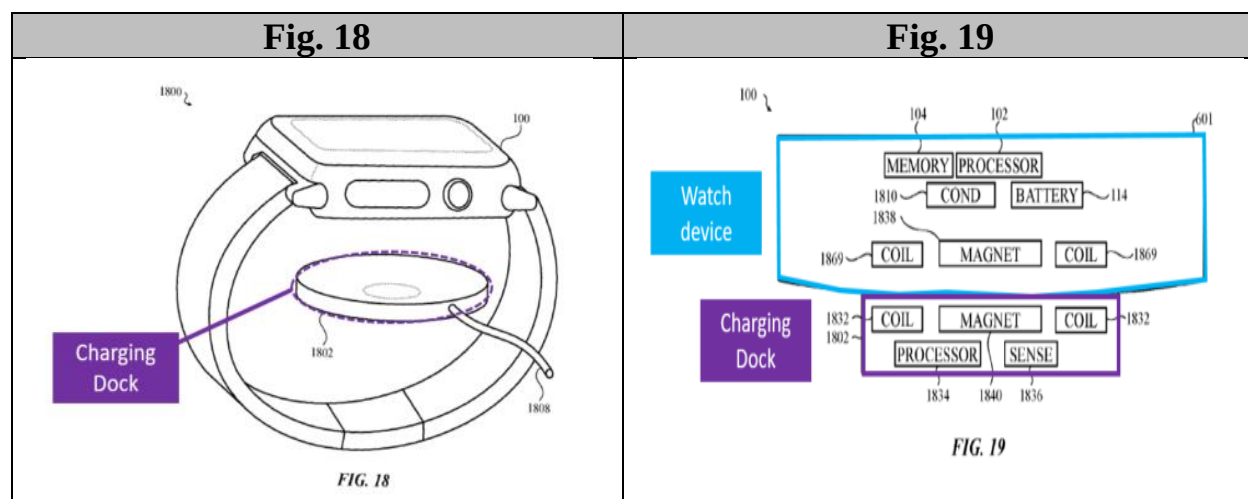
53. As shown above, “a first electrode 1601 and second electrode 1602 are disposed on the rear face of the device 100” that “make[s] contact with the skin of the user’s wrist when the device is being worn” and “a third electrode 1603 and fourth electrode 1604 may be disposed along” sides “of the device body 610” that “come into contact with the skin of the user’s other hand (that is not wearing the device 100).” *Id.* “For example, the third 1603 and fourth 1604 electrodes may be contacted when the user pinches the device 100 between two digits (e.g., a forefinger and thumb).” *Id.*

54. “Using the electrodes of the device, various electrical measurements may be taken, which may be used to compute a health metric or other health-related information. By way of example, the electrodes may be used to detect electrical activity of the user's body. In some cases, the electrodes may be configured to detect electrical activity produced by the heart of the user to measure heart function or produce an electrocardiograph (ECG). As another example, the electrodes of the device may be used to detect and measure conductance of the body. In some cases, the measured conductance may be used to compute a galvanic skin response (GSR), which may be indicative of the user's emotional state or other physiological condition.” *Id.*, 39:63-40:12.

55. In some embodiments, the biosensor module (which integrates some or all the above-described biosensors) is “separate from and attached to the housing

601 of the device 100.” *Id.*, 40:43-50. For example, and as illustrated with respect to Figs. 7 and 16 (shown above), “the biosensors” can be “disposed relative to or attached to a rear cover 608 that is formed from an optically transparent material and is configured to be positioned with the opening of the housing 601.” *Id.*, 40:43-50.

56. In addition to biometric sensing, the ’491 Patent also discloses a device 100 that can facilitate wireless recharging of its rechargeable battery via a charging dock. *Id.*, 1:22-28, 8:55-67. A perspective view of the device 100 and the charging dock 1802 is shown in Fig. 18 (below left; annotated), with a simplified block diagram of the device and charging dock being shown in FIG. 19 (below right; annotated). *See id.*, 6:32-35.



57. As shown above (in FIG. 19), the “interfacing surfaces of the device 100 and the dock 1802” are formed with “complementary geometries,” with the “bottom surface of the device 100” having a convex shape and the “top surface of the dock 1802” having a concave surface, which “follow[s] the same curvature as

the bottom surface of the device 100.” *Id.*, 43:6-9, 44:31-51, 45:15-25. In particular, as shown in the context of FIG. 8 above, the device 100 has a flat surface 801 at bottom portion of the device’s housing, and the rear cover 608 forms a “convex curved surface,” thereby providing the same shape and curvature as the top surface of the dock 1802. *Id.*, 26:25-30. As such, the convex curved surface of the rear cover 608 is depicted in FIG. 19 above, and shows the coil 1869 positioned entirely behind this convex cover. Notably, the flat portion is not shown because FIG. 19 is focused on “relevant aspects of device 100,” where the flat portion is not relevant as that portion is not docked with the dock 1802. *Id.*, 44:18-25.

58. As shown above, an “inductive power transmitter dock 1802 ... is configured to couple to and wirelessly transmit power to an inductive power receiver,” such as the watch device 100. *Id.*, 43:6-9. The charging of the device’s battery 114 is facilitated when the convex-shaped “bottom surface of the housing of the device 100 ... partially contact[s] a top surface of the dock housing.” *Id.*, 45:15-25. In particular, the “internal battery 114 is operably connected to a receive coil 1869 via power conditioning circuit 1810” and the receive coil further includes “one or more windings for inductively coupling with a transmit coil 1832 of the dock 1802.” *Id.*, 44:31-51.

59. When the convex bottom surface of the housing of the device 100 (i.e., the rear cover) contacts the top concave surface of the dock housing, the “receive

coil 1869” receives power from a transmit coil 1832 of the dock 1802 (where the power transfer is facilitated via “electromagnetic induction or magnetic resonance”) and “may pass the received power to [the] battery 114 ... via power conditioning circuit 1810.” *Id.*, 44:31-51, 45:15-25.

60. The ’491 Patent further explains that “the transmit coil 1832” and the “receive coil 1869” could each be “shielded with a shield element” “disposed or formed around a portion of the” coil(s). *Id.*, 44:52-60.

61. In this manner, the ’491 Patent provides a wearable device with different types of biometric sensing and wireless charging capabilities, and recites a specific configuration in which the (1) same rear cover of the device facilitates both wireless power transmission to the receive coil on the device 100 and optical signal transmission to/from the biosensor module and (2) multiple electrodes are positioned on the device’s housing that facilitate measurement of an electrocardiographic characteristic.

B. Prosecution History of the ’491 Patent

62. The application for the ’491 Patent (App. No. 16/826,130) was filed on March 20, 2020. EX-1002, 1476-1480. This application claims priority to multiple applications, the earliest of which was filed on September 2, 2014. *See id.*; EX-1001, pp. 1-2. This application is a continuation of US Application Nos. 15/261,912 (now

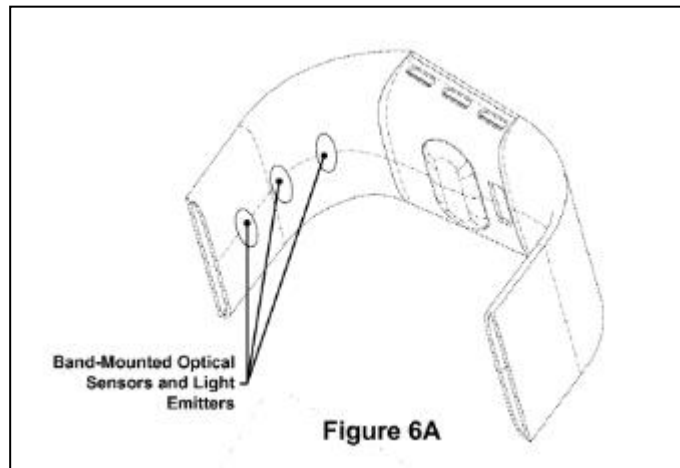
US Patent No. 10,620,591); 15/261,914 (now US Patent No. 10,613,485), and 15/261,917 (now US Patent No. 10,627,783), which are continuations of U.S. Patent App. No. 14/842,617 (now US Patent No. 10,599,101), filed 1 September 2015. See *id.* The application for the '491 Patent further claims priority to a provisional application (App. No. 62/044,974) filed on September 2, 2014.

63. During prosecution, the Examiner issued an office action, rejecting the then-pending claims (pending claims 21-40) on multiple prior art-based grounds. EX-1002, 1119-1131. Specifically, the Examiner rejected the pending claims in view of multiple references, including Hong (EX-2020), Schmid (EX-2021), and Mistry (EX-2005). See *id.* In support of these rejections, the Examiner provided the following pertinent findings and rationale:

- a. “***Hong et al. describe a wearable heart rate monitor in the form of an electronic wristwatch*** (figure 2a). Figure 2C shows that the watch is comprised of ***a housing formed from metal*** (para 164, some or all of the interior or skinside housing consists of a metal material such as nickel-free stainless steel) wherein ***the housing has a rear opening*** (i.e., section of the ***housing bearing sensor protrusion in figure 2c***), a ***touch sensitive display*** positioned partially within the housing (para 272, ***the display screen uses capacitive touch detection***); an attachment band coupled to the

housing and configured to couple the electronic watch to a user (para 108); ***a cover (i.e., protective transparent layer shown in figure 3A)*** covering an optical sensor and creating a seal along the rear opening of the housing (para 148, 155, 165), ***the protective transparent layer may be formed from a dielectric material (e.g., plastic or glass)*** (para 144); and ***an optical biosensor positioned within the rear opening of the housing and configured to transmit an optical signal through the transparent cover via LED sources and receive reflected light via photodetector in order to measure a heart rate of a user*** (figures 2C and 3A-3C, para 136-147, 159).” EX-1002, 1123¹. The following image reproduces FIG. 6A of Hong, showing the rear portion of Hong’s portable monitoring device along with its band, optical sensors, and light emitters. See EX-2020, FIG. 6A.

¹ Emphasis added throughout unless otherwise noted.



- b. “Schmid describes a wrist worn device similar to a wrist watch that includes a first electrode and second electrode (electrodes 21) located on the rear side of housing 2 configured to contact a user's skin when worn on the wrist provide a measure of the user's electrocardiogram (col 5 lines 24-37). Thus, Schmid demonstrates that wrist worn electrocardiogram measurement devices were known in the art. As electrocardiograms are known biometric signals for accessing a patient's health, modification of the health monitor of Hong et al. to include electrodes for measuring an electrocardiogram is considered to have been obvious to one of ordinary skill in the art at the time of the invention since the modification is considered to comprise combining prior art elements according to known methods to yield predictable results....” EX-1002, 1124.

- c. “[T]he cover ... in Hong ... covers the optical sensor and creates a seal along the rear opening of the housing” and “***the protective transparent layer may formed from a dielectric material (e.g., plastic or glass)***” EX-1002, 1124.
- d. “***Hong et al. also teaches*** that the wearable electronic device includes an ***internal rechargeable battery wherein the device may engage a charger such as a docking station*** using magnetic properties between magnets located in the charger and wearable device to facilitate battery recharge (para 305 and 306). ***The transmission of recharge energy from the charger may be wireless (para 306).*** However, Hong et al. is not clear if there is a recharging receive coil located within the device to receive charging energy. ***Mistry et al., similar to Hong et al., describes a wearable sensing device with similar charging features (para 125-129). To facilitate charging of the device, the wearable device or band may include an antenna or coil located therein to receive recharging energy from the charger and is positioned to properly align with the charger coil to optimize power transfer (para 128). The antenna of Mistry et al. is considered similar to the coil as claimed. Both Hong et al. and Mistry et al.***

are considered to teach the necessary elements, or suitable equivalents, for ***functionally providing wireless energy transfer for recharging the battery.***” EX-1002, 1125-1127.

64. Applicant subsequently interviewed the Examiner, with the substance of the interview including a discussion of the cited prior art and Applicant’s proposal to “define the dielectric cover serving as the point for wireless transfer of energy to recharge the electronic watch” in addition to the claim’s existing feature regarding the cover also facilitating optical signal transmission. See EX-1002, 607-609. According to the Examiner, while “further search and consideration would be required,” “[s]uch amendment would overcome the prior art of record.” *Id.*, 607.

65. Consistent with the discussion during the interview, Applicant filed a response that included claim amendments reciting that the rear cover—which can be optically transparent or formed of a dielectric or non-conductive material—is configured to transmit/receive both optical signals and wireless power signals. See EX-1002, 593-603 (see amended claims 21, 28, and 35 that recite these features); see also *id.*, 600 (memorializing interview discussion where the examiner “indicated that amendments similar to those presented herein would likely overcome the pending rejections”).

66. This response and the corresponding claim amendments resulted in allowance of the claims in the next action. See EX-1002, 468-473, 10-12. The

application subsequently issued as the '491 Patent on March 9, 2021. EX-1001, p. 1; EX-1002, 3.

C. Challenged Claims

67. It is my understanding that Petitioner Masimo challenged claims 1-19 of the '491 Patent. Petition, 15. For ease of reference, I have reproduced these claims below.

1. An electronic watch comprising:

a housing formed from a metal material and defining a rear opening along a rear portion of the housing;

a touch-sensitive display positioned at least partially within the housing;

a band coupled to the housing and configured to couple the electronic watch to a user;

a cover formed from a dielectric material and forming a seal along the rear opening of the housing;

an optical sensor positioned within the housing and configured to transmit an optical signal through the dielectric material of the cover;

a charging coil positioned within the housing and configured to receive wireless power through the dielectric material of the cover;

a first electrode positioned along a rear surface of the electronic watch; and

a second electrode positioned along the rear surface of the electronic watch, wherein:

the electronic watch is configured to measure a heart rate using the optical sensor, and

the electronic watch is configured to measure an electrocardiogram using the first electrode and the second electrode.

2. The electronic watch of claim 1, wherein:

the cover defines at least one window for the optical sensor; and

the cover protrudes outward from a rear housing surface of the housing.

3. The electronic watch of claim 1, wherein:

the cover is formed from a transparent substrate; and

the transparent substrate comprises one or more of a glass or a sapphire material.

4. The electronic watch of claim 1, wherein:

the electronic watch further comprises a first magnet positioned within the housing;

the first magnet is configured to couple to a second magnet positioned within a charging dock; and

the first and second magnets are configured to maintain alignment of the electronic watch with respect to the charging dock.

5. The electronic watch of claim 1, wherein:

the electronic watch further comprises a near-field communication system; and

the near-field communication system is configured to transmit signals through one or more of the housing or the cover.

6. The electronic watch of claim 1, wherein:

the cover defines a convex exterior profile; and

the convex exterior profile facilitates alignment between the cover and a mating surface of an external wireless charging device.

7. A wearable electronic device comprising:

a housing formed from a conductive material and defining a first opening opposite to a second opening;

a band attached to the housing and configured to secure the wearable electronic device to a user;

a display positioned in the first opening;

a cover comprising a non-conductive material and positioned over the second opening, the cover forming a portion of an exterior surface of the wearable electronic device;

a biosensor module positioned below the cover configured to pass an optical signal through a window defined within the non-conductive material of the cover; and

a wireless charging receive coil aligned with the second opening and below the cover, the wireless charging receive coil configured to inductively couple to an external wireless charging device through the non-conductive material of the cover.

8. *The wearable electronic device of claim 7, wherein:*

the window is a first window;

the cover defines a second window; and

the biosensor module comprises:

a light source configured to emit light toward a region of skin of the user through the first window; and

a detector configured to receive light reflected from the region of the skin through the second window.

9. *The wearable electronic device of claim 7, wherein:*

the biosensor module comprises:

at least one light source; and

a set of detectors; and

the at least one light source and the set of detectors are configured to operate as a photoplethysmogram (PPG) sensor.

10. *The wearable electronic device of claim 7, wherein:*

the cover protrudes outward from a rear surface of the housing;

the cover defines a convex exterior profile; and

the convex exterior profile facilitates alignment between the cover and a mating surface of the external wireless charging device.

11. *The wearable electronic device of claim 10, wherein:*

the cover forms a waterproof seal with the housing along a perimeter of the cover.

12. *The wearable electronic device of claim 7, wherein:*

the wearable electronic device further comprises a first magnet positioned within the housing and below the cover;

the external wireless charging device comprises a second magnet; and

the first and second magnets are configured to maintain alignment between the wearable electronic device and the external wireless charging device during a charging operation.

13. The wearable electronic device of claim 7, wherein:

the wearable electronic device further comprises:

a first electrode positioned along a rear surface of the wearable electronic device; and

a second electrode positioned along the rear surface of the wearable electronic device; and

the wearable electronic device is configured to measure an electrocardiographic characteristic using the first and second electrodes.

14. An electronic device comprising:

a housing defining a first opening and a second opening;

a display positioned at least partially within the first opening;

a biosensor module aligned with the second opening;

a wireless charging receive coil positioned within the housing and aligned with the second opening;

a battery operably coupled to the wireless charging receive coil; and

a cover formed from an optically transparent material and disposed over the biosensor module and the wireless charging receive coil, wherein:

the electronic device is configured to receive wireless power through the optically transparent material of the cover using the wireless charging receive coil; and

the electronic device is configured to measure a heart rate of a user through the optically transparent material of the cover using the biosensor module.

15. The electronic device of claim 14, wherein:

the biosensor module includes an array of optical components; and

the cover defines an array of windows, each window of the array of windows aligned with a respective optical component of the array of optical components.

16. The electronic device of claim 14, wherein:

the biosensor module comprises:

a light source; and

a detector;

the light source and the detector are configured to measure changes in light absorption by a region of skin of the user;

the electronic device is configured to compute the heart rate using the measured changes in light absorption; and the display is configured to display information associated with the heart rate.

17. The electronic device of claim 14, wherein:

the electronic device further comprises:

a first electrode disposed along an exterior of the electronic device; and

a second electrode disposed along the exterior of the electronic device; and

the first and second electrodes are configured to measure an electrocardiographic characteristic of the user.

18. The electronic device of claim 14, wherein:

the electronic device further comprises a magnet that is configured to magnetically couple the electronic device to an external inductive power transmitter dock through the cover.

19. The electronic device of claim 14, wherein the cover protrudes outward from a rear surface of the housing to facilitate alignment between the cover and a mating surface of an external wireless charging device.

D. Interpretations of the Claims at Issue

68. I have been informed by Counsel and understand that the best indicator of claim meaning is its usage in the context of the patent specification as understood by one of ordinary skill. I further understand that the words of the claims should be given their plain meaning unless that meaning is inconsistent with the patent specification or the patent's history of examination before the Patent Office.

69. Counsel has also informed me, and I understand that, the words of the claims should be interpreted as they would have been interpreted by one of ordinary skill as of the effective filing date of the '491 patent, which I have been informed by Counsel is September 2, 2014 (not today). As such, I have been informed by Counsel that I should use September 2, 2014 as the point in time for claim interpretation purposes.

70. I understand the Petitioner is construing the following terms: (1) "non-conductive cover material," (2) "defines at least one window," and (3) "window defined."

71. With respect to the claim phrases "non-conductive cover material," Petitioner states that "a POSITA would have understood that glass and sapphire are electrically non-conductive, dielectric and optically transparent materials." Petition, 8. With respect to the claim phrase "defines at least one window" and "window

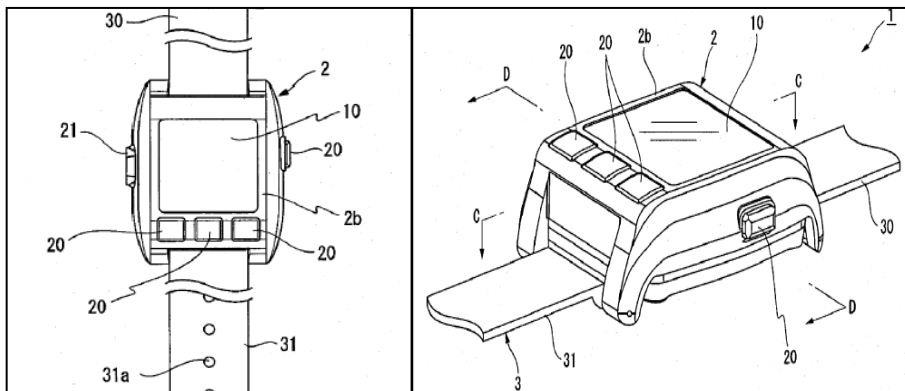
defined,” Petitioner states that “‘to define’ an opening simply means to allow passage of light to a relevant component through an opening.” Petition, 10.

72. I have been asked to apply these constructions for purposes of my analysis here.

VI. OVERVIEW OF THE PRIOR ART

A. Kotanagi (EX-1005)

73. Kotanagi discloses a “biological information measuring device” that is “capable of measuring biological information such as pulse rate while mounted to the wrist (arm).” EX-1005, ¶1, FIGS. 1-2. An example of Kotanagi’s biological information measurement device is shown in FIGS. 1 and 2:



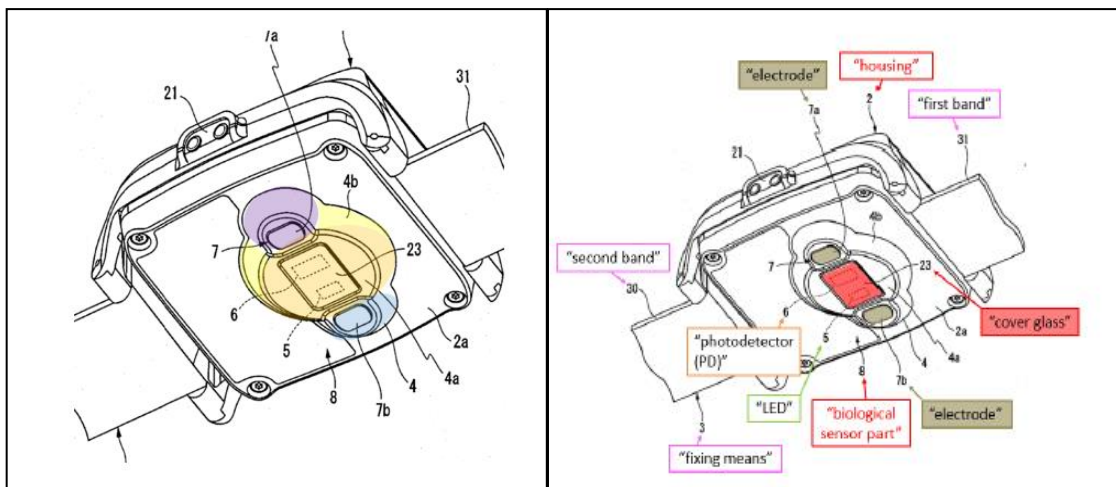
74. Kotanagi explains that, in “conventional” wrist-mounted devices, “movement of the user causes muscles to move” and “changes the thickness (diameter) of the wrist, which leads to the risk that a gap may be formed between”

the device and the body surface. EX-1005, ¶4. “This diminishes adherence, which may prevent accurate biological information from being detected.” *Id.*

75. Moreover, Kotanagi explains that, because a device that “is fixed to the wrist, the feeling of pressure on the wrist increases when attached by a band ... , which makes it difficult to wear for long periods of time.” *Id.*

76. Kotanagi’s “invention” seeks to provide a “a biological information measuring device which enhances adherence and can be worn for a long time without causing discomfort.” EX-1005, ¶5.

77. As shown below, Kotangi’s device provides a protruding part 4 (highlight in the image below on the left) formed in the lower surface 2a of the device’s housing 2. EX-1005, ¶7.

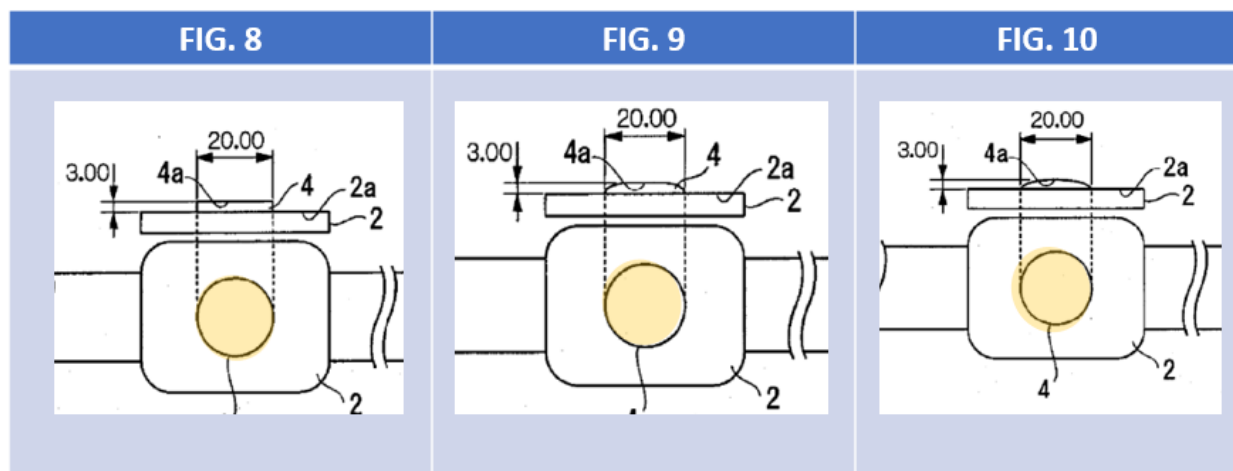


78. As shown in the image above on the right, the protruding part 4 includes components (as shown above on the right) such as a “biological sensor part includ[ed] [in] a main body” of the device, “a light-emitting part,” “a light receiving part,” and

“a contact detection part means for detecting whether the light-emitting part and the light-receiving part are in contact with the living body surface.”

79. Also, as shown above (image on left), protruding part 4 “is formed into a shape combining three circles”—i.e., “by combining, with a central circle [yellow annotation, in figure above on the left], two circles having a smaller diameter than the central circle” [blue and purple annotations, in above figure on the left]. EX-1005, ¶54.

80. Kotanagi also contemplates additional configurations for protruding part 4. For example, instead of forming the protruding part 4 by combining three circles, Kotanagi provides examples in FIGS. 8-10 (shown below) where protruding part 4 is formed “so that the outer periphery is circular” (i.e., formed of a single circle). EX-1005, ¶¶76-81, FIGS. 8-10.



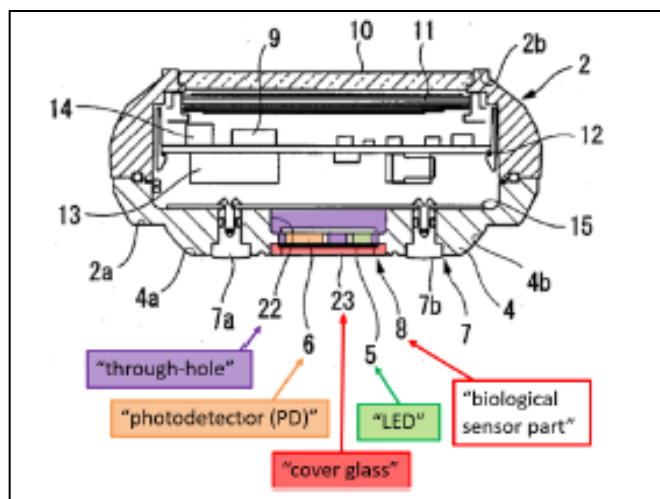
81. In each of these configurations, a “diameter of the protruding part is set to not greater than 20 mm ... so the protruding part can be easily pressed against the

living body surface with light force.” EX-1005, ¶¶36-37, 76-81; FIGS. 8-10 (annotated above).

82. Additionally, the protruding part 4 “protrudes 2 to 4 mm from the lower surface of the main body,” and as a result, Kotanagi explains that the protruding part (and by extension, the device) can be “reliably brought into contact” with the body surface. EX-1005, ¶¶28, 40. “Therefore, unlike in conventional configurations, it is unnecessary to fix the main body so as to strongly press (so as to compress) the main body against the living body surface with the fixing part. Accordingly, the device does not cause discomfort, even when worn for a long time. Moreover, since the adherence of the biological sensor part is enhanced, light can be emitted and received efficiently, and biological information can be detected with high precision.” EX-1005, ¶40.

83. Within the protruding part 4, a biological sensor part 8, which includes a LED 5 and a photodetector (PD) 6, is provided. EX-1005, ¶46.

84. As shown below, the biological sensor part 8 is “formed in the center of the lower surface 4a of the protruding part 4,” with the “LED 5 and the PD 6” being positioned in “the protruding part

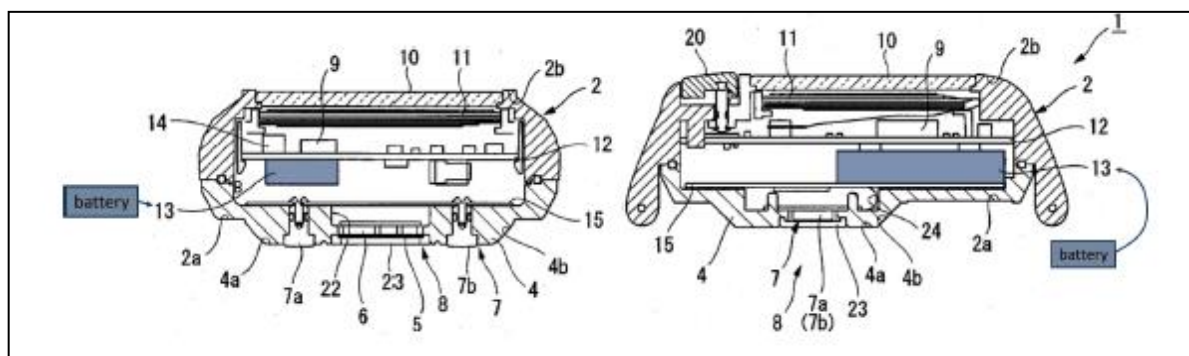


4.” *Id.*, ¶¶55-56. A cover glass 23 covers the through-hole 22 and the biological sensor part 8. EX-1005, ¶55, FIG. 7 (reproduced on right; annotated by Petitioner).

85. Additionally, electrodes 7a and 7b are also “disposed on the lower surface 4a of the protruding part 4 so as to sandwich the LED 5 and the PD 6.” ¶58. The electrodes are provided “so that the tips thereof protrude slightly more than lower surface 4a of the protruding part 4.” *Id.*

86. The electrodes “detect[] whether there is contact with the living body surface” and when such contact is detected, the LED 5 “emit[s] light toward the ... body” and the PD 6 receives reflected light from the “body out of the light emitted by the LED 5” to generate “a pulse signal ... corresponding to the amount of received light.” *Id.*, ¶¶46, 58-59.

87. Kotanagi’s device further includes a battery 13 that powers up the device and its different subcomponents:



EX-1005, FIGS. 6-7 (annotated by Petitioner), ¶53.

88. Kotanagi discloses that the battery 13 can be recharged “by supplying power from an external device such as a recharger.” *Id.*, ¶53; see *id.*, ¶72 (“the

Charging terminal on side surface

30

31

7a

21

4b

7

6

5

23

8

7b

4

4a

2a

3

"photodetector"

"LED"

"biological sensor part"

"cover glass"

on the side surface of the device's housing).

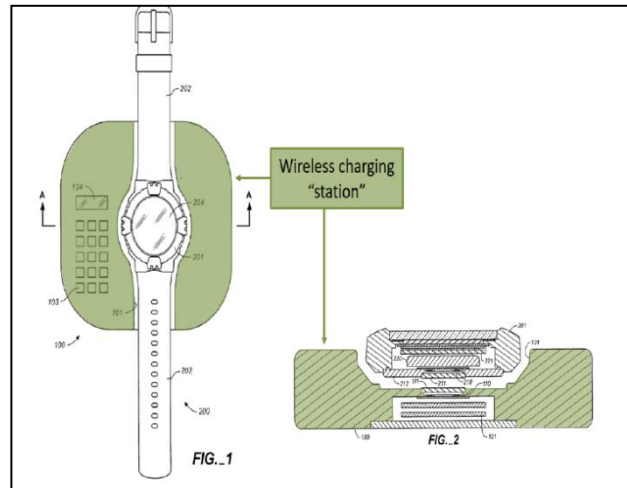
the external connection terminal 21,” Kotanagi
 he like for supplying power to a recharger and
 e provided so as to recharge the rechargeable
 53. However, Kotanagi does not disclose how
 charged in the “contactless state” nor does it
 charging would be performed. *See id.*

mission from a charging unit to" the apparatus

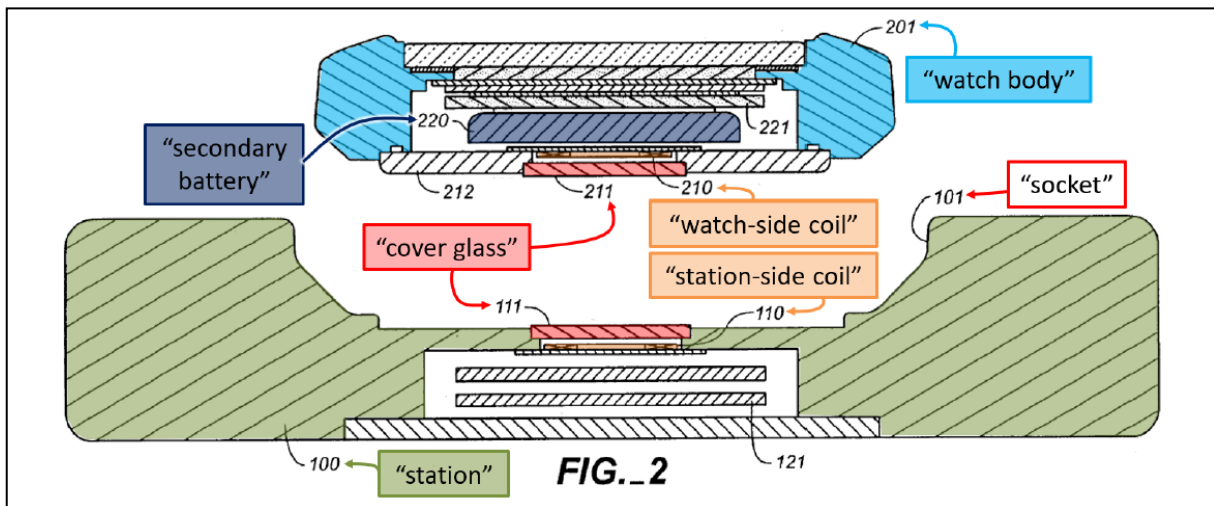
91. In particular, Honda seeks to overcome deficiencies in prior contactless charging implementations. First, Honda recognizes that, when the gap between charging coils in the receiver device (e.g., the electronic watch) and the transmitting device (e.g., the charger) “is increased,” “the degree of magnetic coupling weakens, substantially reducing the charging current to the secondary battery for charging.” *Id.*, 2:39-44. Second, Honda recognizes that metal materials in the housing can create eddy currents, which in turn can “weaken[] the electromagnetic coupling” between the charging coils and limit the quick charging of the device’s battery. *Id.*, 2:44-52, 13:25-32.

92. Honda seeks to address these problems, with one of its goals being to enable “quick” and “efficien[t]” charging of the device’s battery. *Id.*, 2:55-60. To that end, Honda discloses “an electronic apparatus” that “includes a first device and a second device, which perform a power transmission ... through the electromagnetic coupling of coils which are arranged in mutually facing positions in the respective devices,” where the relative inner and outer diameters of coils in the first and second devices can vary by certain predetermined amounts without affecting charge efficiency. *See id.*, 2:66-4:26.

93. As shown in Figs. 1 and 2 (reproduced on right; annotated by Petitioner), an electronic watch 200 is shown seated in a socket 101 of a station 100 to facilitate a charging operation. *Id.*, 6:4-11.



94. An expanded version of FIG. 2 is reproduced below and provides a sectional view of the watch 200 shown in FIG. 1. *Id.*, 6:21-22, FIG. 2 (annotated by Petitioner).



95. As shown above, “a watch-side coil 210 for ... battery charging is arranged in a case back 212 of the watch body 201 and is covered with a cover glass 211. The watch body 201 includes a circuit board 221, connected to a secondary battery 220 and a watch-side coil 210.” EX-1006, 6:22-27. In the charging station

100, a station-side coil 110 is arranged in the portion of the socket 101” that faces “the watch-side coil 210, and is covered with a cover glass 111.” *Id.*, 6:28-35.

96. “The station 100 includes a circuit board 121, to which the station-side coil 110, the input section 103, the display section 104, and a primary power source (unshown) are connected.” *Id.*

97. “When the electronic watch 200 is placed onto the station 100, the station-side coil 110 and the watch-side coil 210 are physically out of contact with each other, but magnetically coupled with each other because the surfaces of coil winding of both coils are generally ... parallel to each other.” *Id.*, 6:36-40. Honda also teaches that the “station side coil 110 and the watch side coil are of an air-core type without any core, to limit the magnetization of a watch mechanism, to avoid an increase in the weight of the watch, and to prevent the exposure of a magnetic metal.” *Id.*, 6:41-49.

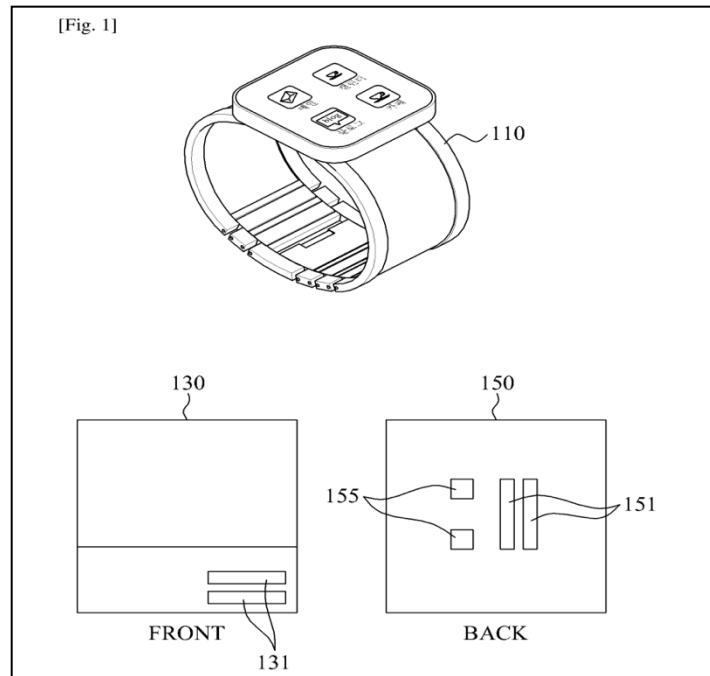
98. Additionally, to reduce the charging inefficiencies stemming from the use of metal materials in the device’s housing, Honda contemplates “the use of an insulating material,” such as glass, for “the external housing” that “results in a transmission efficiency ten times as high as the one achieved by a stainless steel product.” *Id.*, 13:45-48, FIG. 15 (and associated description). Honda, however, recognizes that transparent glass cover are “not preferred from the aesthetic point of view” and “electronic components are subject to deterioration by light, particularly

by ultraviolet lights.” *Id.*, 13:53-67. To “resolve these problems,” Honda teaches that the inner surface of the glass includes a “deposited surface,” “coat[ing] with a plated surface, a printed surface, or foiled surface” or the glass may be “colored with a pigment.” *Id.*, 13:59-64.

99. In addition to its charging capabilities and associated descriptions, Honda additionally discloses that the watch 200 “detects biological information including the pulse rate or the heart rate of the body through an unshown sensor and stores it.” *Id.*, 6:17-20, 8:40-42. Honda, however, does not explain where the “unshown sensor” would be provided or positioned in the device, nor does it disclose or suggest such an “unshown sensor” would facilitate transmission of biometric signals through the rear cover/opening in the described device. *See id.*

C. Choi (EX-1011)

100. Choi relates “to a wearable device performing user authentication using biosignals.” EX-1011, [1]. An example of Choi’s wearable device is shown below (*id.*, FIG. 1):



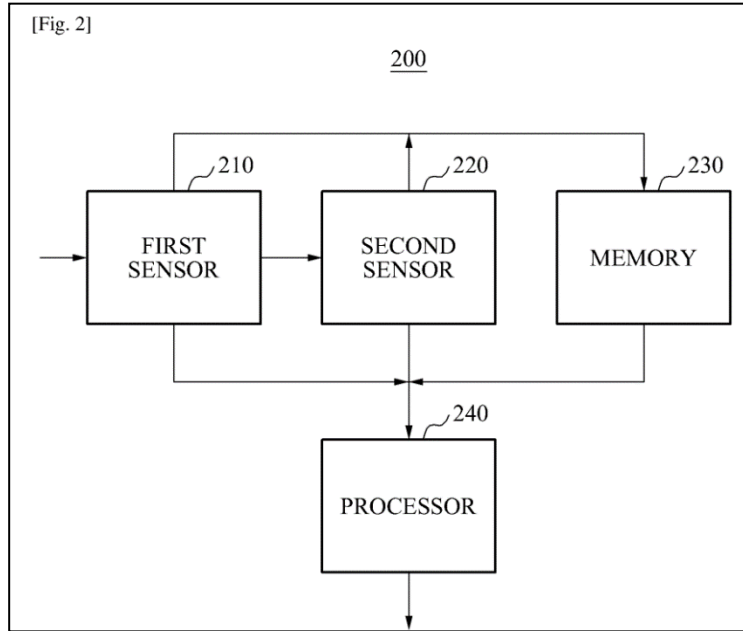
101. As shown, the wearable device includes multiple sensors 131, 151, and 155 provided on the device's front surface 130 and the back surface 150, respectively. EX-1011, [43]-[44].

102. The wearable device detects, “using at least one of the sensors 131, 151, and 155,” a trigger signal. *Id.*, [45]. The trigger signal is generated when the user performs a predetermined gesture, such as, “opening a hand, clenching a fist, rotating a wrist, and/or other gestures known to one of ordinary skill in the art.” *Id.*, [45], [46], [49]. “When the trigger signal is detected,” the wearable device initiates the process of the user authentication. *Id.*, [45]-[50].

103. Once the user authentication process is initiated, the wearable device “authenticate[s] the user, using a second biosignal detected by the sensor 131 provided on the front surface 130 and/or the sensor 151 provided on the back

surface 150. *Id.*, [47]. “The second biosignal may be unique to each user, and be distinguished from the first biosignal” and can include, e.g., an electrocardiogram (ECG) signal, a photoplethysmogram (PPG) signal, a voice of the user, and/or an impedance signal generated by a body of the user.” *Id.*, [47]. “To detect the ECG signal as an example of the second biosignal, a signal detected in at least two different portions of the body of the user may be needed, and thus, the sensors 131 and 151 are provided on the front 130 and on the back 150, respectively. In an example of detecting a biosignal unique to the user from a body part, for example, a voice of the user and/or an impedance signal generated by the body of the user, aside from the ECG signal, a sensor used to receive the second biosignal may be provided on either the front 130 or the back 150.” *Id.*, [52], [54]-56].

104. Choi’s FIG. 2, which is reproduced below, provides a block diagram of the wearable device:



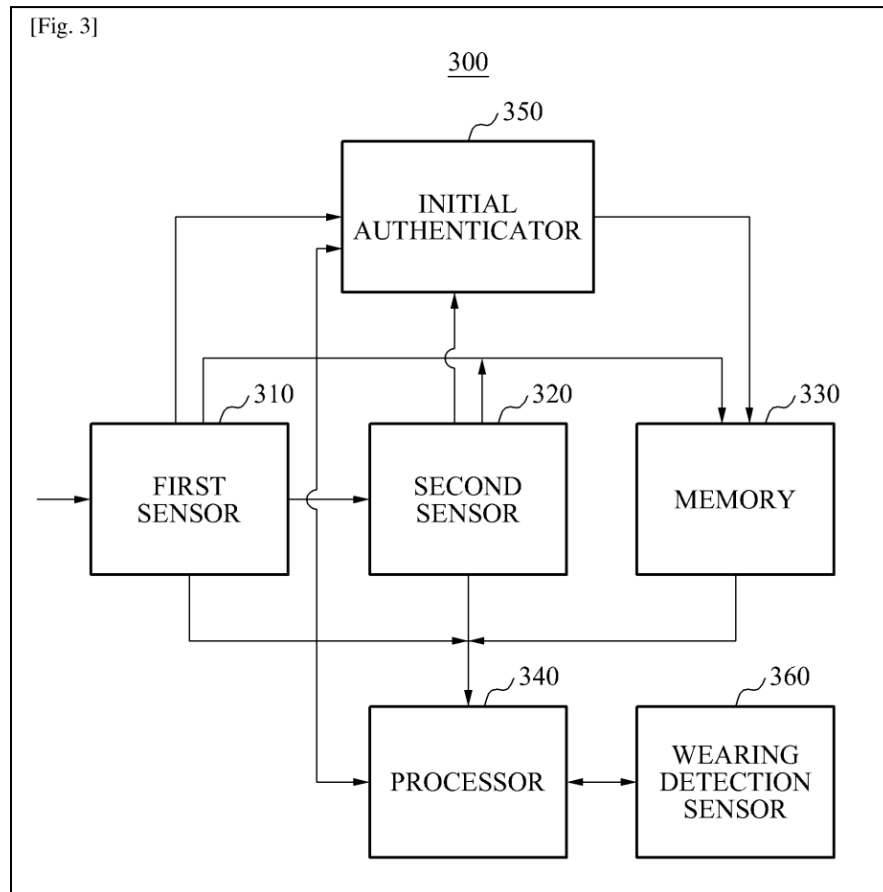
105. As shown, the wearable device 200 includes a first sensor 210, a second sensor 220, a memory 230, and a processor 240. *Id.*, [53].

106. “The first sensor 210 detects a first biosignal generated in response to a gesture performed by a user,” and the “second sensor 220 detects a second biosignal of the user,” which includes, e.g., an ECG signal, a PPG signal, a voice of the user, and/or an impedance signal generated by the body of the user.” *Id.*, [54]-[56].

107. “The processor 240 determines, by referring to the memory 230, whether the first biosignal detected by the first sensor 210 corresponds to the information stored in the memory 230, and initiates a process of user authentication when the first biosignal corresponds to the stored information. The processor 240

authenticates the user by comparing the second biosignal detected by the second sensor 220 to the information stored in the memory 230.” *Id.*, [60].

108. Choi provides “another example” (*id.*, [62]) of a block diagram of the wearable device, as shown below:



109. This embodiment includes the same components as described and shown with reference to FIG. 2 (*id.*, [73]), and further includes an initial authenticator 350 and a wearing detection sensor 360. *See id.*, FIG. 3, [67], [68]-[70].

110. “The initial authenticator 350 receives a gesture and/or a first biosignal and a second biosignal from the user through the first sensor 310 and the second sensor 320, respectively, to set up an initial authentication.” *Id.*, [67]. “The initial authenticator 350 stores, in the memory 330, the first biosignal corresponding to the input gesture and the second biosignal.” *Id.*

111. “The wearing detection sensor 360 detects whether the wearable device 300 is detached from the user. The wearing detection sensor 360 may detect a mechanical movement of a band attached to a portion of a body of the user, by being connected to the wearable device 300, or may detect an electrical signal generated in association with attaching and detaching of the band.” *Id.*, [68]-[69].

112. “For example, the wearing detection sensor 360 may detect a change in which tension or elasticity of the band attached to a wrist of the user increases or decreases. Also, the wearing detection sensor 360 may detect a change in an amount of light detected by a light receiving unit of a photo sensor attached to a back of the wearable device 300, and may detect a change in which an electrical signal or an impedance signal is intensified or weakened when a contact point between the wearing detection sensor 360 and a skin appears or disappears due to the attaching or detaching of the band. Further, the wearing detection sensor 360 may include various sensors that may detect whether the wearable device 300 is worn or not, and may deliver changes detected by the sensors to the processor 340.” *Id.*, [69].

113. Based on the signal received from the wearing detection sensor, the processor 340 controls whether the user authentication is invalid. *Id.*, [69]-[70]. When the wearing detection sensor is provided with a sensor detecting a change of impedance, the wearable device determines whether the wearable device is detached from the user based on the change of the impedance. *Id.*, [98]-[99]. When the wearable device determines that the wearable device is detached from the user (based on a value of the impedance input to the wearable device being greater than a predetermined level or is changed to be less than the predetermined level), the wearable device controls user authentication to be invalid. *Id.*, [99]-[101].

114. In this case, “a usage right assigned to the user through the process of the user authentication that is performed when the user wears the wearable device 300 is withdrawn or nullified” and the “user would need to obtain the usage right” “through the process of the user authentication that is performed again when the user resumes wearing the wearable device 300.” *Id.*, [70], [102].

115. On the other hand, when the wearable device determines that the wearable device is attached to the user (based on “a value of the impedance input to the wearable device” remaining “at the predetermined level” or “increase[ing] to be [at] the predetermined level”), the wearable device controls the user authentication to be maintained. *See id.*, [70], [100]-[104].

116. In summary, Choi discloses a first sensor for detecting a first biosignal to trigger a user authentication process and a second sensor for detecting a second, different biosignal for authenticating the user. *Id.*, Abstract. Choi further discloses an embodiment in which an additional, “wearing detection sensor” is provided, that detects whether the device is attached to the user, based on which the device controls whether the previous user authentication is valid. *Id.*, [98]-[104], [68]-[70].

VII. THE CHALLENGED CLAIMS (CLAIMS 1-19) ARE NOT RENDERED OBVIOUS BY PETITIONER’S PROPOSED COMBINATIONS OF REFERENCES

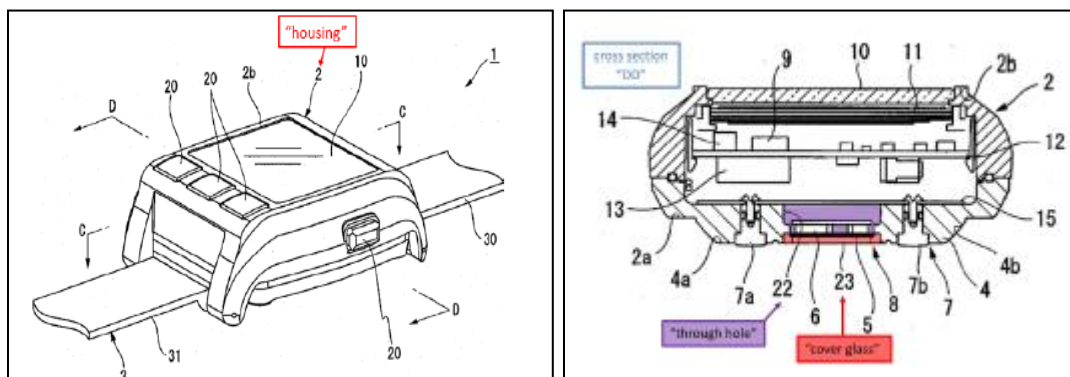
A. The Proposed Kotanagi-Honda Combination Does Not Render Obvious Independent Claim 7

117. Independent claim 7 is reproduced below:

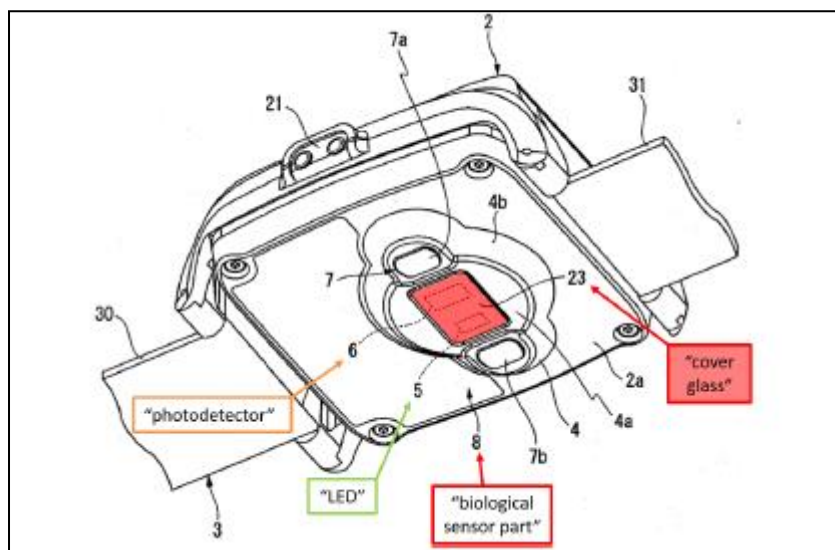
7. A wearable electronic device comprising:
a housing formed from a conductive material and defining
a first opening opposite to a second opening;
a band attached to the housing and configured to secure
the wearable electronic device to a user;
a display positioned in the first opening;
a cover comprising a non-conductive material and
positioned over the second opening, the cover forming a portion
of an exterior surface of the wearable electronic device;
a biosensor module positioned below the cover configured
to pass an optical signal through a window defined within the
non-conductive material of the cover; and
a wireless charging receive coil aligned with the second
opening and below the cover, the wireless charging receive coil
configured to inductively couple to an external wireless charging
device through the non-conductive material of the cover.

118. As shown above, claim 7 recites a “housing formed from a conductive material and defining a first opening opposite to a second opening,” with a “cover comprising a non-conductive material positioned over the second opening” and with “a biosensor module” and “wireless charging receive coil” positioned/aligned “below the cover.” The claim further recites that (1) the “biosensor module” is “configured to pass an optical signal through a window defined within the non-conductive material of the cover,” and (2) the “wireless charging receive coil” is “configured to inductively couple to an external wireless charging device through the non-conductive material of the cover.”

119. Petitioner alleges that (1) the claimed “housing” maps to a metal housing of Kotanagi’s device (Petition, 16-17), (2) the claimed “second opening” maps to the “through-hole 22” in the rear portion of Kotanagi’s device (Petition, 16), and (3) the claimed “cover” maps to Kotanagi’s cover glass 23 that is positioned over the through-hole 22 (Petition, 18-19). *See* EX-1005, FIG. 5 and 7 (reproduced below; annotated by Petitioner).



120. Petitioner further alleges that optical signals pass “through the cover glass” and to the LED 5 and photodetector 6 (the alleged “biosensor module”). Petition, 20-21; EX-1005, Fig. 5 (reproduced below; annotated by Petitioner).

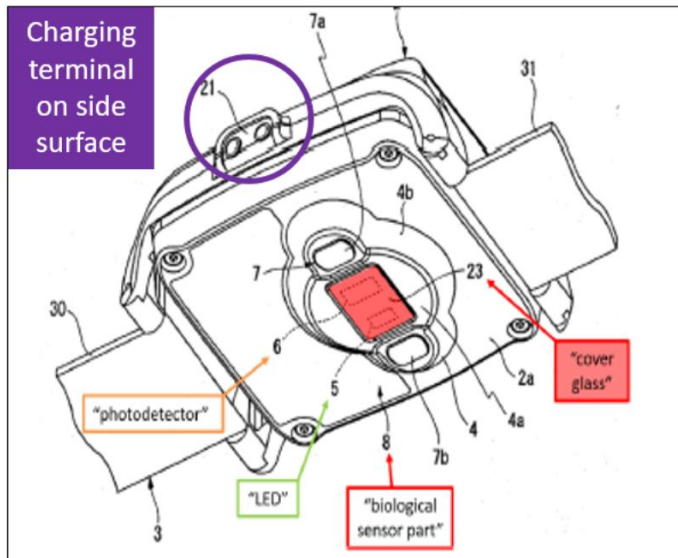


121. Kotanagi states that “an external connection terminal (recharging means) 21 for recharging the rechargeable battery 13 by supplying power from an external device such as a recharger is provided on the side surface of the housing 2.” EX-1005, ¶53. “In addition, rather than the external connection terminal 21,” Kotanagi states that “a transformer or the like for supplying power to a recharger and to the inside of the housing 2 may be provided so as to recharge the rechargeable battery 13 in a contactless state.” *Id.*

122. Even if Kotanagi’s disclosure of battery recharging in a “contactless state” is interpreted as suggesting wireless charging (see EX-1005, ¶53), Kotanagi does not disclose where any alleged wireless charge receiving coil would be

positioned in the device nor does Kotanagi disclose that wireless power could or would pass through rear cover glass 23 (i.e., the alleged cover). *See generally* EX-1005.

123. The only positional reference for charging in Kotanagi is in the context of its disclosure of wired charging via the “side surface of the housing” EX-1005, ¶53 (“an external connection terminal (recharging means) 21 for recharging the rechargeable battery 13 ... is provided on *the*

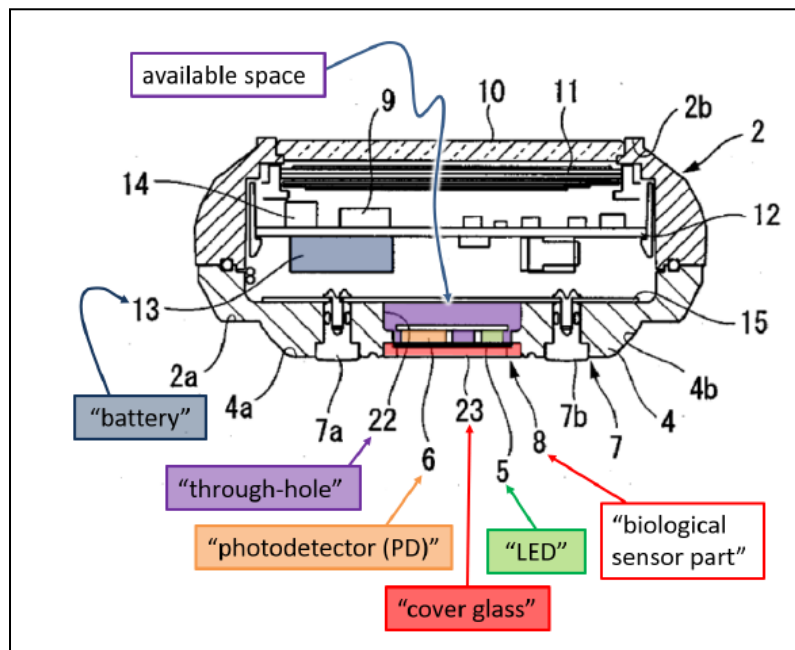


side surface of the housing 2”), Fig. 5 (reproduced above; annotated by Patent Owner and Petitioner; showing connection terminal 21 for charging on the side surface of the device’s housing).

124. Petitioner therefore turns to Honda’s teachings and argues that Kotanagi’s device in view of these teachings would have led a POSITA to modify Kotanagi’s device to enable wireless power transmission through Kotanagi’s cover glass 23 to a device-side wireless charge receiving coil. *See* Petition, 22-30.

125. Specifically, Petitioner contends that a POSITA would have found it obvious to include Honda’s wireless charge receiving coil within certain allegedly

“available space” of through hole 22 that is “behind and around the outside of the other listed components” shown there (as shown below)—thus allegedly resulting in “magnetic flux [that] would pass through the cover glass....” *See id.*



Petition, 24-25 (citing EX-1005, Fig. 7 (annotated by Petitioner)). This argument is incorrect for multiple reasons and ignores critical teachings of Kotanagi and Honda that not only preclude the combination proposed by Petitioner but would have counseled against it.

126. As explained below, Kotanagi imposes size restrictions on the protruding part 4 (to which rear cover glass 23 is fixed, with the cover glass 23 covering through hole 22). This in turn limits the size and positioning of the wireless

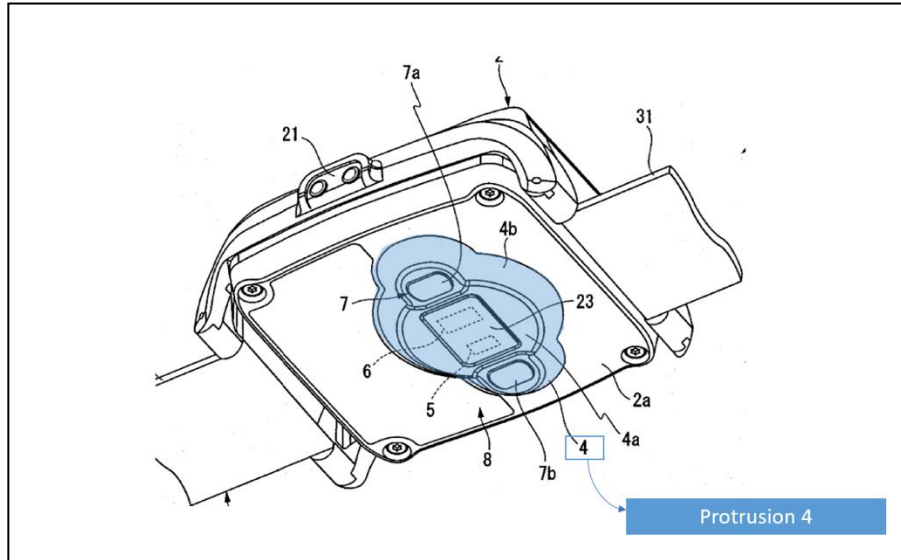
charging receive coil in a manner that is contrary to Honda's teachings and its stated goals and purpose of achieving quick and efficient wireless charging

127. As a result, a POSITA would have not been motivated nor would have a reasonable expectation of success in providing a size-limited wireless charging receive coil in the allegedly available space in Kotanagi's device, particularly given the substantial detrimental impact to wireless charging stemming from the significant increase in distance between the transmit and receive coils, and power transfer reducing eddy currents and magnetization from metallic materials between the coils, as called for by Petitioner's combination.

128. Given these issues in the proposed Kotanagi-Honda configuration (which I have explained in further detail in the following sections), Petitioner has not shown that a POSITA would have configured the device in this manner—particularly when considering that the POSITA would have been aware of other well-known and actually functioning configurations of biometric sensing and wireless charging devices (as corroborated by the Fraser reference) that provide a large wireless charging receive coil around optical elements within the device housing and thereby avoid the detrimental impact to wireless charging that Petitioner's combination injects and ignores. *See* Petition, 28-30 (discussing Fraser).

1. Petitioner ignores the physical restrictions imposed by Kotanagi on its rear protruding part 4 that would limit the size and positioning of the alleged wireless charging receive coil

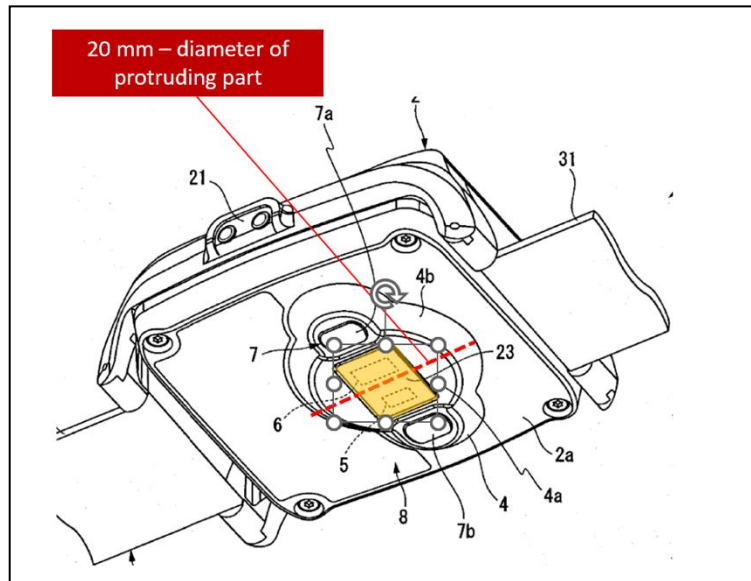
129. Kotanagi sets an upper limit on the diameter of the protruding part 4 shown on the rear surface of its device (annotated in blue below in FIG. 5).



130. Specifically, Kotanagi states that the device “*according to [its] ... invention*” has a diameter of its protruding part 4 “set to **not greater than** 20 mm.” EX-1005, ¶¶36, 37. Kotanagi discloses that the diameter of the protruding part is set to “not greater than 20 mm, so the protruding part can be easily pressed against the living body surface with a light force.” *See id.*, ¶¶36-37, 76-77.

131. I have reproduced Kotanagi’s Fig. 5 below, with a red dashed line annotation added to show the 20 mm diameter of protruding part 4’s outer periphery, and orange annotation added to show cover glass 23 positioned within the protruding

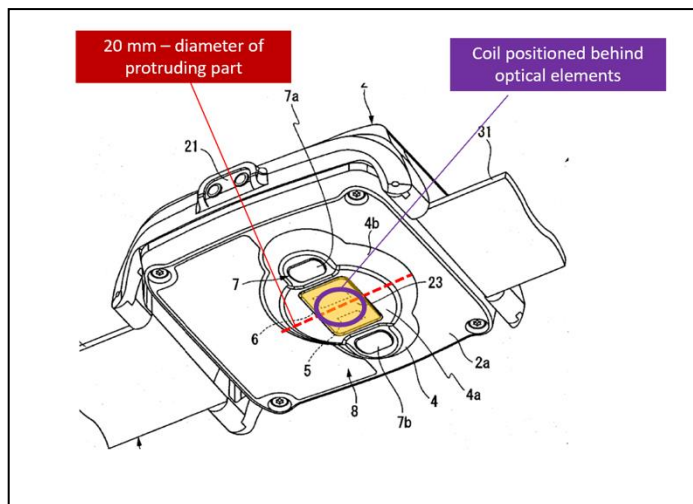
part 4. *See also* EX-1005, FIGS. 8-10 (showing 20 mm diameter of outer periphery of protruding part 4).



132. A POSITA would have recognized that the rectangular cover glass 23 (orange) in the above image has a width that is roughly half (or less than half) of the diameter of the protruding part’s diameter, which would be about 10 mm (if not less).

133. Petitioner contends that the coil would be provided in the “available space” of through hole 22 behind cover glass 23, so as to allow wireless “power to pass through” Kotanagi’s cover glass 23 (the alleged “cover”). Petition, 27-32. I understand that Petitioner’s expert, Dr. Duckworth, similarly testified that the charging coil in the proposed combination would be provided entirely behind the cover glass 23. EX-2020, 47:21-48:6, 26:19-27:7, 51:20-52:8, 55:20-56:7, 42:5-10, 47:21-48:6.

134. A POSITA would have thus understood that, for Honda's wireless charging receiving coil to fit within the available space behind cover glass 23, the coil would have a maximum diameter no greater than the width of the rectangular cover glass (~10 mm; contemplated coil shown below in purple):



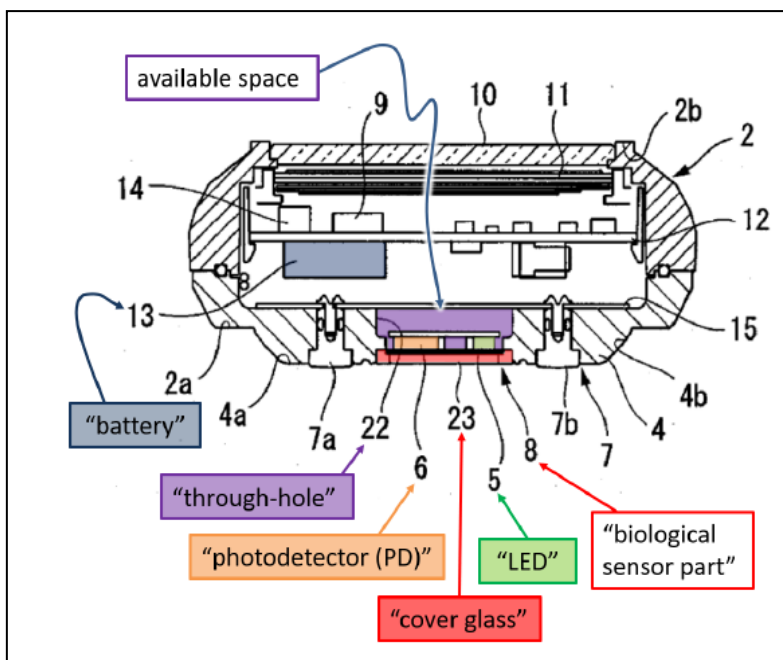
135. In this configuration, a POSITA would have further understood that the coil would be positioned behind the optical elements and the flexible board 24 to which they are affixed. EX-1005, ¶¶55-57 (“the LED 5 and the PD 6 are mounted to one end side of a flexible board 24 that is electrically connected to the sub-board 15, and are disposed in a state in which they are pushed toward the lower surface 2a side of the housing 2 by the elasticity of the flexible board 24”).

136. Therefore, the optical elements do not overlie (and thereby interfere) with the optical transmission path of the LED 5 and PD 6 (referred to herein as the optical elements). *See id.* As discussed below, the additional distance and

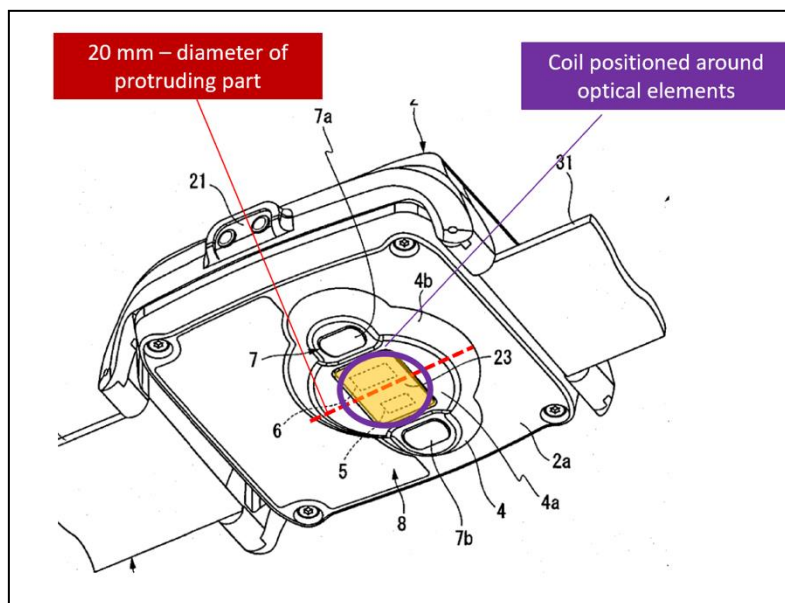
interfering metal structures significantly decreases power transfer, thus further making this configuration an unlikely design choice or implementation for a product.

137. That is because Kotanagi explains the importance of these optical elements being positioned so that they “touch the inside of the glass cover 23” and in doing so, are “as close to the living body surface ... as possible.” EX-1005, ¶55; Petition, 24. Thus, a POSITA would have recognized that the coil would be provided behind the optical elements so as not to frustrate Kotanagi’s goal of providing optical elements as close to the living body surface as possible. *See id.*

138. This is also consistent with Petitioner’s identification of the alleged “available space” behind the optical elements (as shown in Petitioner’s annotated image of Kotanagi below).



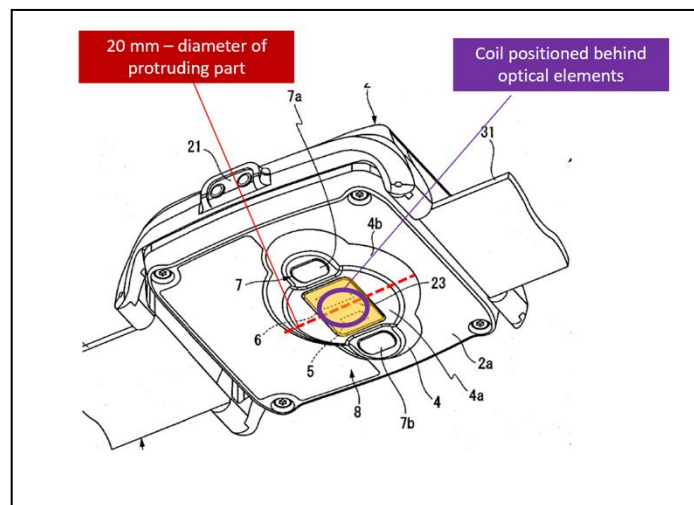
139. Petitioner argues in the alternative that the coil could also be positioned “behind the cover glass, surrounding the LED and PD”; however, in such a configuration, the coil would need to have a relatively larger diameter to encircle the optical elements. Petition, 24-25. Indeed, as shown below, in such a configuration, the coil would extend into the protruding part 4 lower surface 4a beyond cover glass 23. *Id.*



140. A POSITA would not have been motivated nor would have had a reasonable expectation of success in implementing the proposed combination in either of these configurations, as I have further explained in the following sections.

2. A POSITA would have avoided the significant wireless charging degradation that occurs from positioning the wireless charging receive coil behind Kotanagi's optical elements

141. As explained above (see §VII.A.1 above), Kotanagi imposes a size restriction on the protruding part 4 formed in the rear portion of its device, within which the cover glass 23 is positioned over the through hole 22. Despite this size restriction, Petitioner's proposed combination positions the wireless charging receive coil behind the optical elements and the flexible board to which these elements are affixed, as explained above (see §VII.A.1 *supra*).



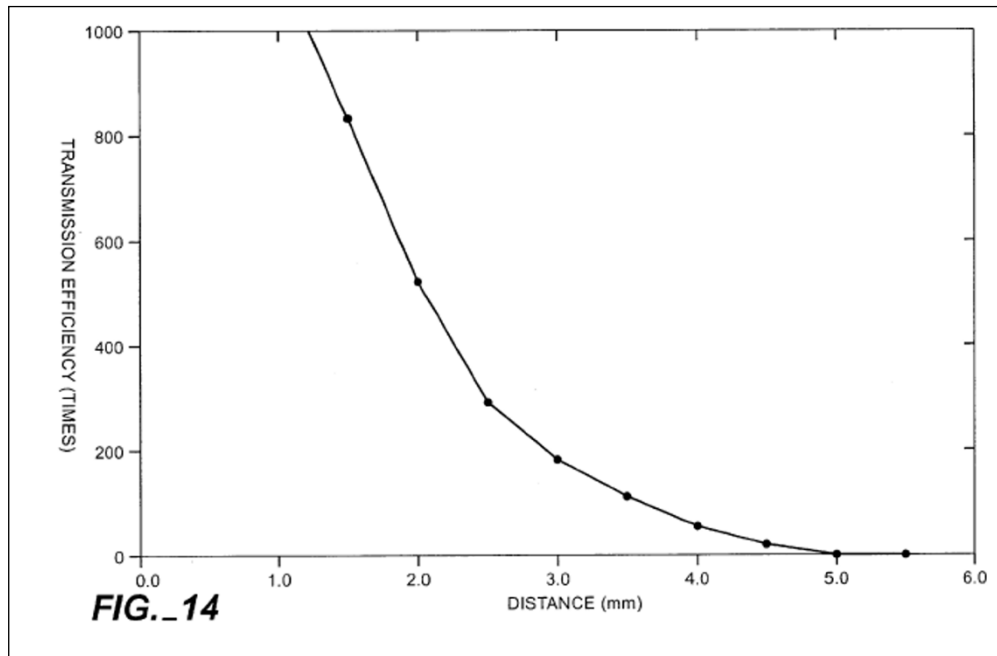
142. Implementing a wireless charging receive coil in the allegedly available space in Kotanagi's device, as Petitioner proposes in its combination, would frustrate Honda's goals and intended purpose to enable "quick" and "efficien[t]" wireless charging by reducing distance between wireless charging coils and avoiding magnetic field degrading materials in the transmission path between the coils. EX-1006, 2:39-3:8, 6:41-45, 13:3-52, 5:9-15, FIGS. 14-15; *see id.*, 3:9-4:32.

143. For the below reasons, Petitioner’s proposed configuration significantly degrades performance of wireless power transmission because it (1) limits the size of the wireless charging receive coil—which has a direct impact on wireless power transmission strength, (2) introduces substantial additional distance between the wireless charging receive and transmit coils, and (3) includes metallic materials in the transmission path between the wireless charging receive and transmit coils—each of which significantly degrade wireless charging efficiency of the already-limited wireless charging receive coil in precisely the manner that Honda seeks to avoid.

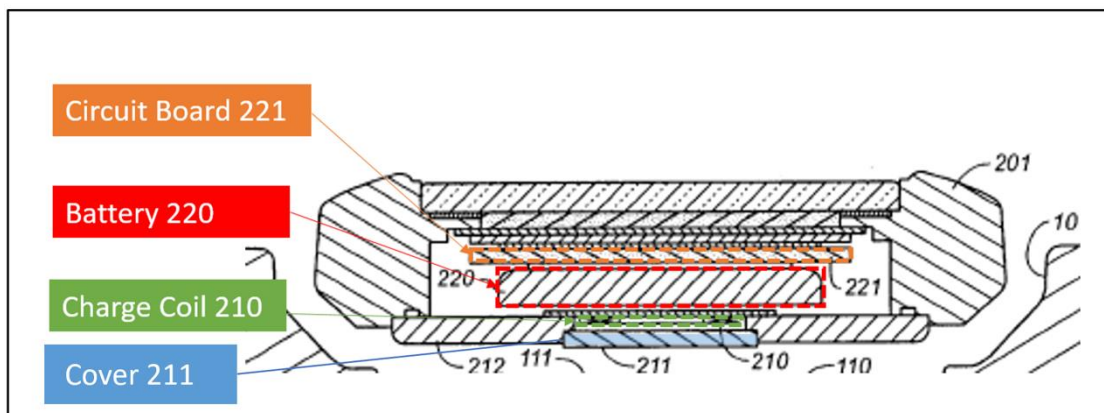
144. **First**, Petitioner’s proposed configuration frustrates Honda’s stated goal of quick and efficient charging achieved by reducing the space between the charging receive and transmit coils. See EX-1006, 2:38-43, 2:55-60 (explaining that, as gap between coils is increased, “the degree of magnetic coupling weakens, substantially reducing the charging current to the secondary battery”), FIGS. 14-15 and associated description at 13:3-64, 5:9-15.

145. Honda recognizes that, as the distance between the coils decreases, the “transmission efficiency increases in accordance with a quadratic curve.” EX-1006, 13:14-16. In fact, Honda teaches that, “at a distance of 3 mm or less” between the transmit and receive coils, “the transmission efficiency is approximately 100 times the one in the conventional art having a distance of 5 mm.” *Id.*, 13:17-19. In other

words, a 2 mm increase in distance between the transmit and receive coils can result in a 100 times charging efficiency degradation. See *id.*, EX-1006, FIG. 14 (reproduced below).



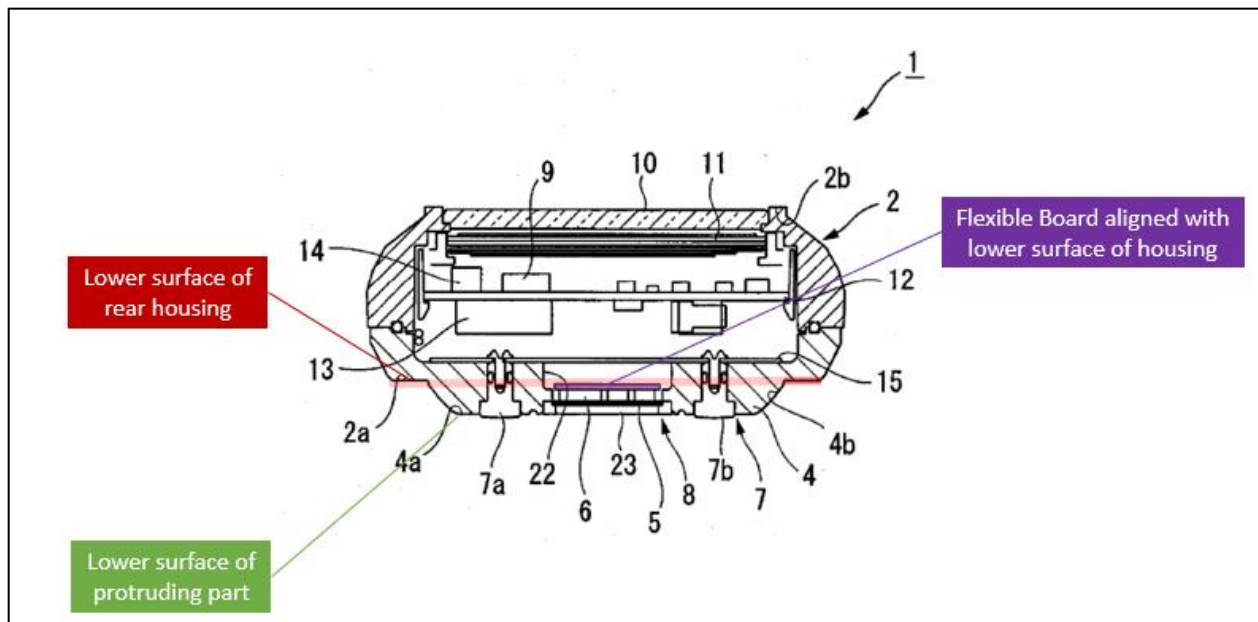
146. A POSITA would have recognized that Honda achieves this high charging efficiency by positioning the wireless charging receive coil (in the wrist-worn device) directly adjacent to the cover glass, as shown below:



See EX-1006, Fig. 2 (annotated; showing Honda's watch embodiment with its wireless charging receive coil (green annotation) positioned directly adjacent to the watch's cover 211 (blue annotation)); FIG. 15 and associated text (describing transmission efficiency in view of materials between coils, when distance between coils is 3 mm).

147. Petitioner's proposed configuration, however, calls for the wireless charging receive coil to be positioned spaced away (i.e., increased distance between coils) from cover glass 23 with optical elements and a flexible board 24 present therebetween—thus resulting in the increased spacing between the wireless charging receive and transmit coils that Honda seeks to avoid. See EX-1006, 2:38-43, 2:55-60, FIGS. 14-15 and associated description at 13:3-64;

148. Relatedly, Kotanagi states that the protruding part 4 has a lower surface 4a that is 2-4 mm lower than rear housing surface's lower surface 2a (EX-1005, ¶¶27-28) and further shows flexible board 24 (to which the LED 5 and photodetector 6 are connected) positioned within protruding part 4 at a location that is aligned with rear housing surface. See *id.*, FIG. 6, ¶¶55-57; FIG. 7 (reproduced below; annotated).



149. Honda in turn seeks to increase wireless power transmission efficiency and provides examples showing transmission efficiency when the spacing between wireless charging receive and transmit coils (including the thickness of materials interposed therebetween) would be 3 mm (which accounts for a cover glass thickness of 1 mm). EX-1006, 13:3-54, FIGS. 14-15, 2:39-60.

150. Assuming that Kotanagi's above-depicted figure (FIG. 5) is drawn to representative relative dimensions, a POSITA would observe that the flexible board 24 is roughly aligned with rear housing's lower surface 2a. And because the distance between the rear housing surface 2a and the lower surface 4a of protruding part 4 is at least 2 mm, elements placed behind this board would be at least 2 mm away from the extent of the protruding part's lower surface, thereby increasing the contemplated space between the coils from 3 mm to 5 mm or more. Moreover, a POSITA would

have recognized that the optical elements would span ~2-4 mm (or more) in depth/vertical dimension. *See, e.g.*, EX-2040, p. 42 (describing a PPG sensor with thickness of 1.6 mm); EX-2041, 2 (pulse sensor data sheet showing 3.6 mm thickness); *see also* EX-2042, 5 (~1 mm thickness of a recent (~2023) sensor with photodetectors and LEDs).

151. And as noted above, an increase in distance from 3 mm to 5 mm results in a 100 times decrease in wireless charging efficiency, which is similar to the amount of charge degradation that Petitioner's proposed configuration would encounter as well. This therefore provides another reason for why positioning the coil elements behind Kotanagi's optical elements would be significantly detrimental to wireless power transmission and efficiency, and would be counter to Honda's stated goals that are geared toward increasing/improving wireless charging efficiency. *See* EX-1006, 2:38-43, 2:55-60, 13:3-64, FIGS. 14-15.

152. **Second**, positioning Honda's wireless charging receive coil behind Kotanagi's optical elements and the flexible board is also contrary to Honda's goal of quick and efficient power transmission because such a configuration would inject the type of noise and interference that Honda expressly seeks to avoid. Specifically, Honda discloses that presence of metal materials between the transmitting and receiving coils, gives rise to eddy currents, which reduce charging efficiency. *See*

EX-1006, 2:48-59 (“eddy currents take place in the electrically conductive metal material, weakening the electromagnetic coupling”), 13:3-32.

153. This is also why Honda provides glass for its rear cover (EX-1006, 13:3-64, FIGS. 14-15). A POSITA would have also recognized that this is also why Honda contemplates air-core type coils (i.e., coils “without any core”) given that such coreless coils “limit the magnetization of a watch mechanism ... and ... prevent the exposure of a magnetic metal.” EX-1006, 6:41-46.

154. Thus, to achieve its goal of quick and efficient charging, a POSITA would have recognized that Honda seeks to reduce eddy currents and magnetization from metallic materials in the transmission path between the receive and transmit coils.

155. Given these teachings in Honda, a POSITA would have also recognized that Kotanagi’s optical elements and the flexible board 24 to which they are connected—behind which the coil would be positioned in the proposed combination—are typically made of metal-based materials. This is corroborated by multiple references from the relevant timeframe:

- a. EX-2033, Abstract, ¶¶11, 23-25, 29 (light emitting diode (LED) is made from metal-based materials, including among other components, “a metal substrate,” “a metal layer,” “a mirror layer,” and “electrode[s]”);

- b. EX-2034, ¶¶24, 25, 27, 29 (describing use of metal in LEDs, where the LED includes semiconductor layers, electrodes, metal-based carriers, and a reflective layer made of metal);
- c. EX-2035, ¶¶14-15, 29-30 (describing a photodetector that, includes among other components, “a metal layer,” a photodiode having a semiconductor region, and an electrode);
- d. EX-2036, ¶¶1-2, 21-22, 79, 82, 84 (describing a photodetector for portable communication tools as including semiconductor elements and electrodes made of, at least in part, metal);
- e. EX-2037, 3:37-42, 4:6-17, 4:28-32 (describing components of the LED, including electrodes made at least in part of metal, and a metal-based reflector).

156. Thus, positioning elements made of such materials between the transmit and receive coils, per Petitioner’s proposed combination, significantly reduces power transfer efficiency and would be counter to Honda’s teachings and express goals of achieving “quick” and “efficien[t]” wireless charging by avoiding metallic materials in the wireless power transmission path and added spacing between coils. *See* EX-1006, 2:38-43, 2:55-60, 13:3-54, FIGS. 14-15.

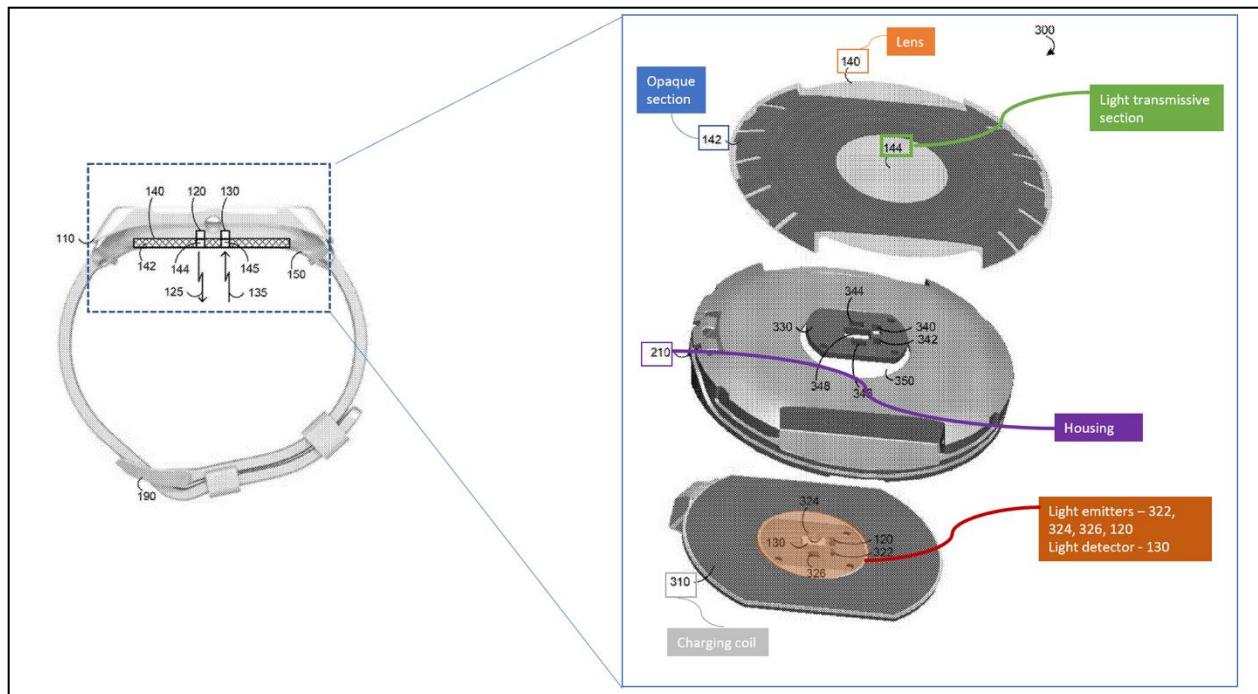
3. A POSITA would have turned to other actually functioning wireless charging configurations to avoid the signal degradation issues in Petitioner's proposed configuration

157. In view of the above-described degradations in wireless signal transmission issues, a POSITA would not have implemented wireless charging in accordance with Petitioner's proposed configuration—particularly when the POSITA would have known of other actually functioning configurations of wireless charging coils and optical elements in rear portions of wrist-worn devices that counteract the signal degradation issues that Honda seeks to avoid or mitigate.

158. A POSITA would have been aware of a wrist-worn device—such as the device disclosed in Fraser—that implements a larger wireless charging receive coil covering a substantial portion of the rear watch surface and in doing so, counteracts the signal degradations stemming from significant area of the coils having interposing materials and/or increased spacing between the wireless charging receive and transmit coils (as Petitioner's proposed configuration demands).

159. However, if Kotanagi's device were so configured to have a larger coil that extends beyond the cover to overlie the rear housing surface in Kotanagi, any inductive-coupling and associated wireless power transmission that occurs, as the claim requires in view of the intrinsic record, would occur through the rear housing surface and not the cover.

160. Specifically, a POSITA in the relevant timeframe would have been confronted with devices, such as those disclosed by Fraser, which provide wireless charging and biometric sensing capabilities, and which describe an express configuration of wireless charging coil and optical elements to enable these dual capabilities. EX-1041, FIGS. 1, 3, ¶¶24-30. A side view and a corresponding exploded view of Fraser's device is provided below (EX-1041, FIGS. 1 and 3 annotated below):



161. As shown in the exploded view (on the right), Fraser's device includes a lens 140 making up the device's rear surface that is directly adjacent to the wearer's wrist/body. EX-1041, ¶¶24-25, FIG. 3. This lens 140 surface includes an opaque section 142 and a light transmissive section 144. *Id.* The housing 210 is provided next and above the lens 140, and the charging coil 310 with the optical elements

(120, 130, 322-326) it encircles are provided above the housing 210. *Id.*, ¶¶24-26, FIG. 3.

162. Thus, Fraser's charging coil 310—much like in Petitioner's proposed combination—is spaced away from a wireless transmit coil (i.e., the lens 140 surface), given that Fraser's device coil is positioned behind the device's housing and the rear device surface (i.e., lens 140), thereby resulting in increased distance between coils. Additionally, Fraser's charging coil includes optical elements in the core section of this coil—which, at least in part, are made from metallic materials (as explained and corroborated above).

163. The main differences between Fraser's device and Petitioner's proposed configuration are that (1) the charging coil is not confined to a ~10mm size and instead extends to cover a substantial portion of the rear device surface (which, in the context of the Kotanagi device would therefore cover the regions beyond the protruding part 4 within which the optical elements are provided) and (2) the charging receive coil is provided behind the device's rear surface that extends beyond the central portion of the lens 140 behind which the optical elements (photodetectors and LEDs) are provided.

164. A POSITA would have recognized that this large coil configuration in Fraser counteracts the above-described degradation in wireless power transmission caused by increasing distance between transmit and receive coils and power transfer

reducing eddy currents in and magnetization of metallic materials within their transmission path, as further illustrated using the following modeling and simulations I described in the following sections.

*(a) Modeling Methodology and Simulation of Different
Wireless Charging Receive Coil Configurations*

165. In the following sections, I have modeled wireless power transmission of a coil as per Petitioner's combination (which is accounted to be about 10 mm in diameter) with a coil of the type shown in Fraser that would cover a substantial portion of the rear housing surface. For purposes of this modeling, I have made the following conservative assumptions:

- a. For purposes of simulation and modeling, I have assumed a device with rear surface that has a width in the range of 30 to 40 mm. In the context of Kotanagi's device, when accounting for the 20 mm diameter of the protruding part 4, I have assumed a Fraser-like coil would extend centrally from the outer extent of the protruding part 4 (at 20 mm) to the extents of the device (at 30 to 40 mm). As such, one example of a coil that would fit in this space is a ring-shaped coil with an inner radius for a central core spanning 12.5 mm in inner radius (i.e., 25 mm in inner diameter) and extending from there to 30 mm extent of the device (i.e., outer radius of 15mm and outer diameter of 30 mm).

Another example of a coil that could fit in this space would be a ring-shaped coil with an inner radius for a central core spanning 17.5 mm in inner radius (i.e., 35 mm in inner diameter) and extending to the 40 mm extent of the device (i.e., outer radius of 20 mm and outer diameter of 40 mm). For purposes of this modeling, I have used a 20-loop coil (and have also considered a 10-loop coil) with a distance between the transmit and receive coils of 3-5 mm.

166. For the 10 mm diameter called for by Petitioner's proposed configuration, I have assumed a coil with an air core type core with a 10 mm outer diameter (i.e., 5 mm outer radius) and a 5 mm inner diameter (i.e., 2.5 mm inner radius). I note that, in my modeling, using a 2.5 mm inner radius achieved a better performance than that of a coil with a smaller radius (e.g., 1 mm or less). As such, to be conservative, I have used the 2.5 mm inner radius because of its relatively better performance. In this modeling, I have used a 20-loop coil (and have also considered a 10-loop coil) with a distance between the transmit and receive coils of 3-5 mm.

167. I performed my modeling using the methodology and approaches highlighted in the following references describing and relating to wireless power transfer modeling: *see, e.g.*, EX-2023 to EX-2032. In particular, for the modeling

and associated simulations, I employed the method of moments computation technique for the analysis of coil antennas. The initial stage in solving electromagnetic problems involves discretizing Maxwell's equations, leading to a matrix-vector system that correlates the applied voltage vector (V) to the current vector (I) representing the surface current on the antenna. The matrix Z , known as the interaction or impedance matrix, serves as the intermediary linking V to I . The overall modeling and simulation is formulated in three key segments:

- a. **Discretization of Metals:** Discretization, achieved through meshing, which facilitates the transition from the continuous antenna geometry to the discrete domain. The metal surface of the antenna is subdivided into triangles.
- b. **Basis Functions:** For the computation of surface currents on the antenna structure, I use Rao-Wilton-Glisson basis functions. These functions encompass pairs of adjacent triangles, resembling small spatial dipoles with linear current distribution. Each triangle is associated with a positive or negative charge.
- c. **Interaction Matrix:** The interaction matrix is a complex dense symmetric matrix, forming an N -by- N square matrix, where N represents the number of basis functions (interior edges in the structure). Completing the interaction matrix involves

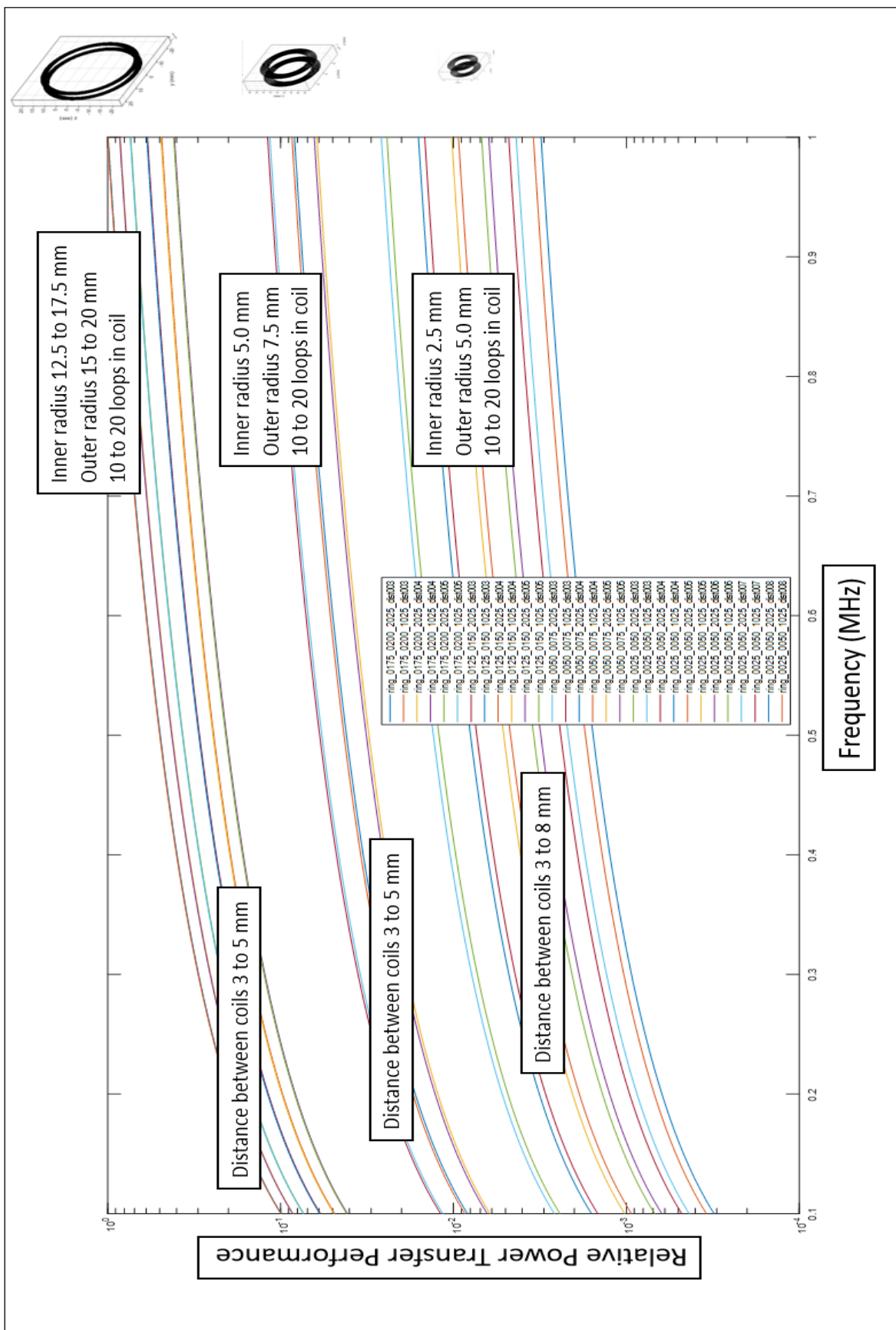
calculating the free-space Green's function between all basis functions on the antenna surface. To compute the interaction matrix, I excited the antenna by applying a voltage at the feeding edge. Consequently, the voltage vector assumes zero values everywhere except at the feeding edge. Solving the resultant system of equations yields the unknown currents. Once these currents are determined, I calculated the field and surface properties of the antenna or antenna array.

168. Using this methodology and approach:

- a. I compare coils of a size of the proposed combination and Fraser-like device (as described above) at the same distance (i.e., same distance between wireless charging transmit and receive coils).
- b. I also show the detrimental impact on power transmission when distance between coils is increased in the context of the smaller coil of the proposed combination..
- c. I also explored a reasonable range of configurations, e.g., with different wire size, number of loops, and inner diameter in order to highlight the dominant implications of diameter.

169. As shown and described below,

- a. when modeling the wireless power transmission of device of such devices, the difference in wireless signal transmission is ***roughly 2 orders of magnitude more*** in a device with a larger coil (i.e., akin to Fraser's device) relative to the proposed combination's device (when assuming that each configuration has transmit and receive coils that have the same distance between them).



- b. This disparity in wireless power transmission indicates that if the Fraser-like device takes **1 hour** to charge the device's battery, Petitioner's proposed configuration would take **100 hours** to charge the same battery.
- c. This modeling does not account for the impact of interfering metal, which would be more detrimental to the smaller coil. Nor does this modeling account for the detrimental impact of increased sensitivity to misalignment, which again would be more significant in the smaller coil of Petitioner's combination.
- d. This modeling does show the negative impact on wireless power transmission as the distance between the transmit and receive coils increases, as called for by Petitioner's proposed configuration. As shown above, when the distance between the coils is increased, the power transmission in the context of the smaller coil would be **over 2 orders** of magnitude (**~2.5 orders of magnitude**) less than in a device with a larger coil (i.e., akin to Fraser's device). This disparity in wireless power transmission indicates that if the Fraser-like device takes **1 hour to charge the device's battery**, Petitioner's proposed

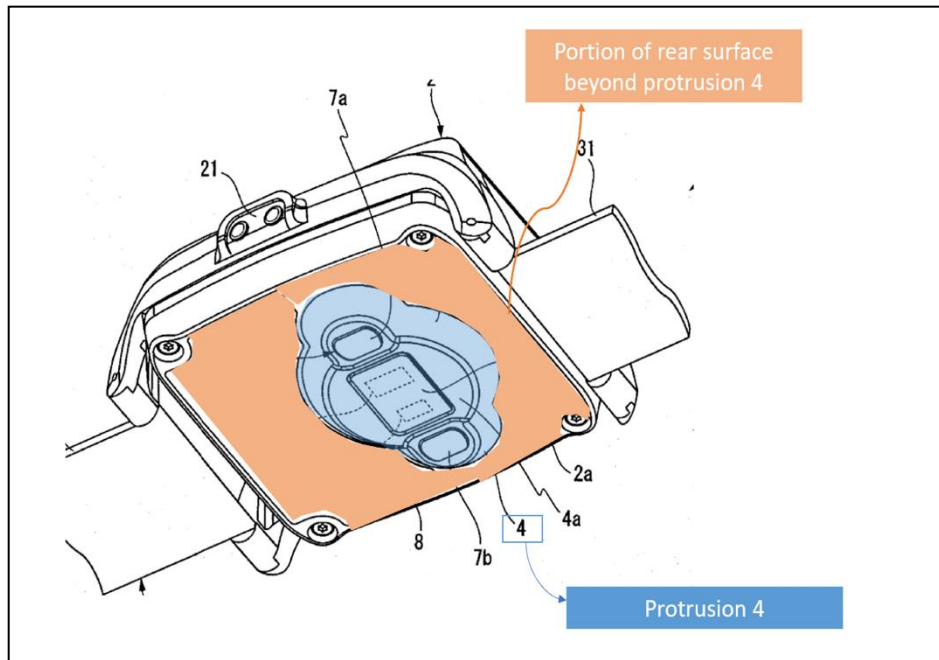
configuration in view of the added distance between the coils would ***take about 500 hours to charge the same battery.***

- e. Consistent with this modeling and simulation, Honda similarly contemplates such a substantial impact to wireless power transmission, noting that as the distance between the coils increases, the transmission efficiency decreases in accordance with a “quadratic curve.” See EX-1006, 13:13-21 (100 times reduction in transmission efficiency as distance between coils increase from 3 to 5 mm).
- f. This modeling therefore indicates the substantially weaker wireless power transmission in the smaller coil in Petitioner’s combination relative to a larger, Fraser-like coil. Note that this modeling still does not account for the impact of interfering metal, which would be more detrimental to the smaller coil; nor does it account for the detrimental impact of increased sensitivity to misalignment, which again would be more significant in the smaller coil in Petitioner’s combination.
- g. A POSITA would have thus recognized and understood the significant detrimental impact to wireless power transmission—e.g., due increased distance between coils and the detrimental

impact of power transfer reducing eddy currents and magnetization from metallic materials in the wireless power transmission path, as required by Petitioner's combination—would be more pronounced and not as readily counteracted in the smaller coil (relative to the larger, Fraser-like coil).

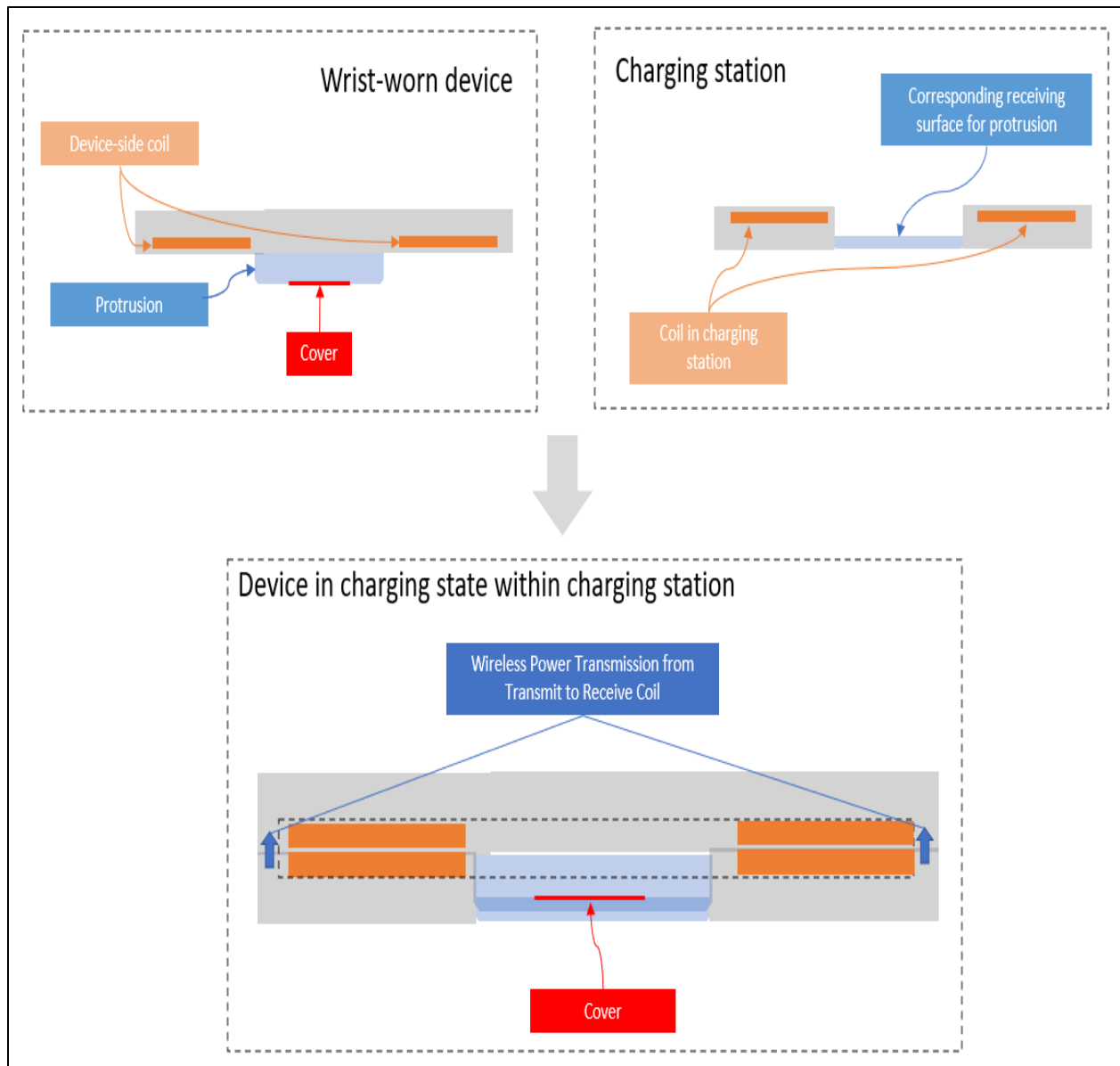
170. Therefore, if a POSITA were to provide the wireless charging receive coil in the rear portion of Kotanagi's device, as Petitioner seeks via its combination, the POSITA would have recognized that such a coil would be much larger and would encompass a larger portion of the device's rear surface—as in Fraser—to counteract the limited wireless power transmission of the smaller coil called for by Petitioner's combination, and the wireless power transmission degradation issues caused by the added spacing and power transfer reducing eddy currents and magnetization from metallic materials in the transmission path between the wireless charging receive and transmit coils

171. Moreover, as shown below, when configuring the wireless charging coil similar to that of Fraser, a POSITA would have recognized that the wireless charge receiving coil would extend beyond the space provided behind Kotanagi's cover glass 23 and even the protruding part 4 of Kotangi's device (because of the space constraints imposed by electrodes 7a and 7b that sandwich the rear cover 23 and optical elements 5 and 6 within the protruding part 4):



172. In such a configuration, and as the above annotated figure illustrates, the “wireless charging receive coil” would not be “below the cover,” as per the claim in view of the intrinsic record. Moreover, a POSITA would have recognized that, in the context of the claim in view of the intrinsic record, any alleged inductive coupling of the wireless charging receive coil and an external wireless charging device would not be “through the non-conductive material of the cover” (i.e., the alleged cover glass 23 in Kotanagi) and instead, would be through the rear housing surface beyond the protruding part 4 (and the cover glass 23 that is affixed to the protruding part 4).

173. This is also illustrated using the following mockups of the combination’s device and charging station:



174. As shown in the above sectional mockups of the device and the charging station (at the top), (1) the device's larger coil would surround protruding part/protrusion 4 and extend to overlie the areas of the rear surface beyond the protrusion and (2) the charging station would be shaped to receive the rear surface of such a device, including a shaping that accommodates the device's protruding part 4 (see Petition, 25-26, 83-89).

175. When such a device is inserted into the complementary-shaped charging station (as illustrated at the bottom of the above mockups), the device-side coils and the station-side coils are adjacent to each other, and separated by the respective device and charging station's housing

176. In this configuration, Kotanagi's protrusion, and the rear cover 23 disposed within it, would be spaced away from the coils and therefore would not be the conduit for the inductive coupling and associated wireless power transmission between the coils.

177. In summary, a POSITA would have recognized that positioning the coil in the allegedly available space behind the optical elements would limit the size of the coil, and by extension, reduce the device's wireless power transmission rate and efficiency. This configuration would also be contrary to Honda's goals of enabling quick and efficient wireless charging, which are achieved by avoiding the very structural aspects mandated by Petitioner's proposed configuration—namely, (1) spacing between the coil and the rear device cover and (2) from power transfer reducing eddy currents and magnetization from metallic materials in the wireless power transmission path.

178. When considering the above-described issues in the combination's proposed configuration, Petitioner has not shown that a POSITA would have configured the device in this manner—particularly when considering that the

POSITA would have been aware of other well-known and actually functioning configurations of biometric sensing and wireless charging devices (as corroborated by the Fraser reference) that provide a large wireless charging receive coil around optical elements within the device housing and thereby avoid the above-described issues that Petitioner's combination injects.

179. Indeed, as Fraser corroborates, a POSITA would have also recognized that such a large coil would expand beyond the identified cover of the combination's device. And in that case, the wireless charging receive coil would not be "below the cover" and any inductive coupling that occurs between the wireless charging receive coil and the external charging station, as the claim requires in view of the intrinsic record, would be through the device's rear housing surface beyond the protruding part 4 and not through the "non-conductive material of the cover" (i.e., cover glass 23 in Kotanagi).

180. In summary, Petitioner has, at best, presented a device configuration in which a wireless charging coil **could** be provided in Kotanagi's through hole 22. However, Petitioner has not shown that a POSITA **would** have configured the device in the proposed manner when considering the detrimental impact to wireless charging stemming from this configuration and given the order of magnitude alternative available that avoids those issues. On this record, Petitioner has not

shown why or how Petitioner's proposed combination would render obvious claim 7.

4. A POSITA would have also avoided the significant wireless charging degradation that occurs from positioning the wireless charging receive coil around Kotanagi's optical elements

181. In Petitioner's alternative configuration, the wireless charging receive coil would be positioned around Kotanagi's optical elements. Specifically, Petitioner contends that "a POSITA would have ... enlarge[d] Kotanagi's opening and cover glass to make room for a coil behind the cover glass, surrounding the LED and PD." Petition, 24-25

182. In this proposed configuration, Petitioner has not shown that the opening and the cover glass could or would in fact be expanded, given the size restrictions imposed by Kotanagi on the rear protruding part 4 and the presence of other components like the electrodes 7a and 7b on this surface that limits any contemplated expansion of the cover glass and the opening. *See also* EX-2039, 47:21-48:6, 26:19-27:7, 51:20-52:8, 55:20-56:7, 42:5-10 (Petitioner's expert testified in deposition that the device-side wireless charging receive coil would be positioned only behind the cover glass 23).

183. Petitioner cites no evidence teaching or suggesting that the opening in Kotanagi's housing and its cover glass 23 can be expanded. Petition, 24-25, 29-30.

Even Petitioner's reliance on Fraser does not support this modification. Specifically, Petitioner relies upon Fraser's teachings of its coil surrounding light emitters (see Petition, 29 (citing EX-1041, [0026], FIG. 3)), but provides no evidence or analysis indicating any feasible expansion of a cover glass or opening in the housing—particularly in the context of Kotanagi's device, as Petitioner's proposed modification would require. EX-1041, [0026], FIG. 3. Petitioner has therefore failed to show that a larger wireless charging receive coil, when positioned around the optical elements 5 and 6, would or could still fit behind just cover glass 23, as required by Petitioner's proposed configuration. EX-2039, 47:20-48:6.

184. Moreover, Fraser demonstrates that the wireless charging receive coil would be positioned around and beyond the sensor components provided in the central portion of the rear housing. EX-1041, [0026], FIG. 3. Thus, in view of Fraser—which Petitioner relies upon—when the coil surrounds the optical elements, a POSITA would have recognized that the coil would expand beyond the cover glass 23 and would not fit behind the cover glass 23 behind which the optical elements are positioned. This is further evidenced by Petitioner's own assertion that the cover glass 23 of Kotanagi's device would need to be expanded to fit the coil behind it—i.e., confirming that the coil would not fit behind Kotanagi's cover glass 23. See Petition, 24-25, 28-30 (confirming that cover glass and opening would need to be expanding, thus suggesting that the coil would not fit behind Kotanagi's cover glass).

185. A POSITA would have thus understood that the coil would expand to overlies portions of the housing/protruding part 4, much like in Fraser where the coil overlies a substantial portion of the bottom device surface beyond the centrally located optical elements. This would result in the same power transmission degradations stemming from interposing metal housing materials between coils, as contemplated by Petitioner’s combination (as described above in §§VII.A.2-3 *supra*). EX-2039, 20:15-22:2, 25:3-26:3, 45:13-19, 55:20-56:7 (testifying that the proposed Kotanagi-Honda combination would have a metal housing and that the protruding part is formed in the housing), 47:21-49:7, 28:17-20, 30:20-32:1 (testifying that if coil expands beyond the cover glass and is “behind conductive material,” then there would be “weakening of the electromagnetic coupling,” which would “degrade the transfer of power from a transmit coil to a receive coil”).

186. Even assuming this to be the case for argument’s sake, such a configuration would be counter to and in fact, would frustrate Honda’s goals of seeking to enable quick and efficient charging of the device, as further explained below.

187. **First**, positioning the coil around Kotanagi’s optical elements would not avoid the above-described signal degradation stemming from providing metallic materials in the core of the coil—which again are counter to Honda’s teachings. EX-1006, 6:41-45, 13:25-32, 2:43-65; *see* §§VII.A.2-3.

188. Moreover, in wireless power transfer systems that utilize inductive coupling, central components or materials (e.g., optical elements) within the wireless charging coil would change and shape the magnetic field and the overall efficiency of energy transfer. When any components are positioned in the central portion of the coil, the specific effects these central components impart are dictated by their inherent properties, such as electrical conductivity, magnetic permeability, size, and orientation, as well as by the engineering design of the coil assembly. Thus, The insertion of a central component within an inductive coil can lead to multiple outcomes:

- **Modulation of Inductance:** The central material/component directly influences the coil's inductance. For instance, a ferromagnetic core would typically affect the inductance due to its high magnetic permeability, thereby affecting the coil's and the system's power transfer capability.
- **Magnetic Field Modification:** Central components/materials can also impact the magnetic field between the transmit and receive coils, and can therefore impact power transfer.
- **Saturation Concerns:** Materials in the central components can become magnetically saturated when the magnetic domains within the

material are fully aligned and can cause non-linear inductance behavior, which can be detrimental to the system's performance.

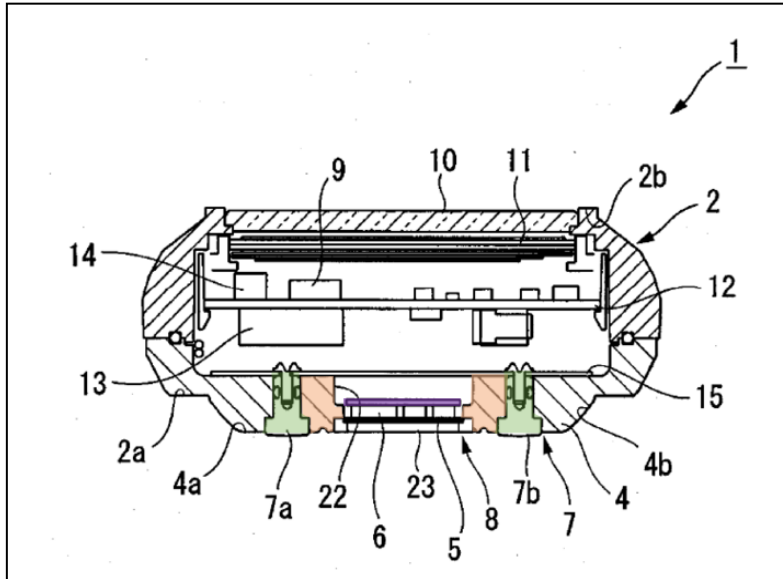
- **Thermal Considerations**: Central components that are made of materials that cause eddy currents, like conductive metallic materials, can absorb energy that is then dissipated in the form of heat, leading to losses and thermal dissipation challenges. This effect is more pronounced in smaller coils where the surface-to-volume ratio is high, making them more susceptible to thermal buildup than larger coils.
- **Coupling Efficiency Changes**: The efficiency with which power is transferred between transmit and receive coils can be altered by the central/core component/materials. A conductive metallic material which introduces losses or disrupts the magnetic field reduces coupling efficiency.
- **Design and Manufacturing Implications**: Integrating a component into the coil requires careful consideration of the assembly and housing of the device. Design complexities may increase, and additional costs may be incurred, especially if the component necessitates specialized fabrication techniques, additional structures, magnetic materials, or shielding.

- In summary, the impact of central components can have a direct impact on wireless power between charging receive and transmit coils. However, for a smaller coil, the negative influence of any central component is more pronounced, when compared to a larger coil due to the limited space and higher surface-to-volume ratio. For instance, a conductive material that induces eddy currents would have a relatively larger adverse effect on efficiency in a smaller coil compared to a larger one.
- Thus, when approaching coil and core design from an optimization perspective, smaller coils present more restrictive design parameters and space. Indeed, smaller coils offer significantly less freedom in design space and reach a lower maximum efficiency compared to larger coils, where there is more latitude for material and component selection and configuration. As a consequence, making positive changes to configurations with a large or small coil serves to more significantly improve the large coil's power transmission performance in comparison. Additionally, when making negative changes (e.g., including eddy-current and magnetization inducing central components in the coil's core—as is the case in Petitioner's combination), the small coil encounters a more significant relative

deterioration in wireless power transmission due at least in part to the smaller coil's lower maximum efficiency and lower surface to volume ratio.

189. **Second**, a POSITA would have recognized that wireless charging efficiency is directly related to the size and number of turns of the charging coil, and as shown in my simulations comparing designs with 10 or 20 loops. In the proposed configuration, however, the space limitations imposed by Kotanagi around the optical elements and between the cover and the flexible board (to which the optical elements are affixed) would reduce the number of possible turns of the charging coil, which in turn would place significant constraints on the wireless charging capability of the coil and the device as a whole.

190. For example, Kotanagi discloses and shows electrodes 7a and 7b that are “disposed on the lower surface 4a of the protruding part 4 ... sandwich[ing] the LED 5 and the PD 6.” EX-1005, ¶58. In addition, Kotanagi's device includes (1) portions of housing in the remaining lateral/horizontal space between the optical elements and the electrodes (shown in orange below) and (2) flexible board 15 (shown in purple below) that restricts the vertical space between cover 23 and this board (to which the optical elements are attached).



191. Thus, under Petitioner’s proposal for the combination, if the wireless charging receive coil is positioned around the optical elements 5 and 6, a POSITA would have recognized that such a coil would not extend much further—horizontally or vertically—given the presence of housing, electrodes, and the flexible board adjacent to the optical elements 5 and 6

192. As a consequence, the coil, while slightly larger in diameter than the coil in Petitioner’s first proposed configuration (as discussed above in the context of §§VII.A.2-3), would nevertheless have significantly fewer turns/winding in the horizontal and vertical directions, which would directly (and negatively) impact wireless power transmission.

193. Also, as explained below, the wireless power transmission of such a coil would be at least **1 order of magnitude less in power transmission relative to a larger coil** as in Fraser device (see §§ VII.A.2-3 *supra*).

194. In more detail and as explained in the following paragraphs, I have modeled wireless power transmission of a coil as per Petitioner's combination with a coil of the type shown in Fraser that would cover a substantial portion of the rear housing surface.

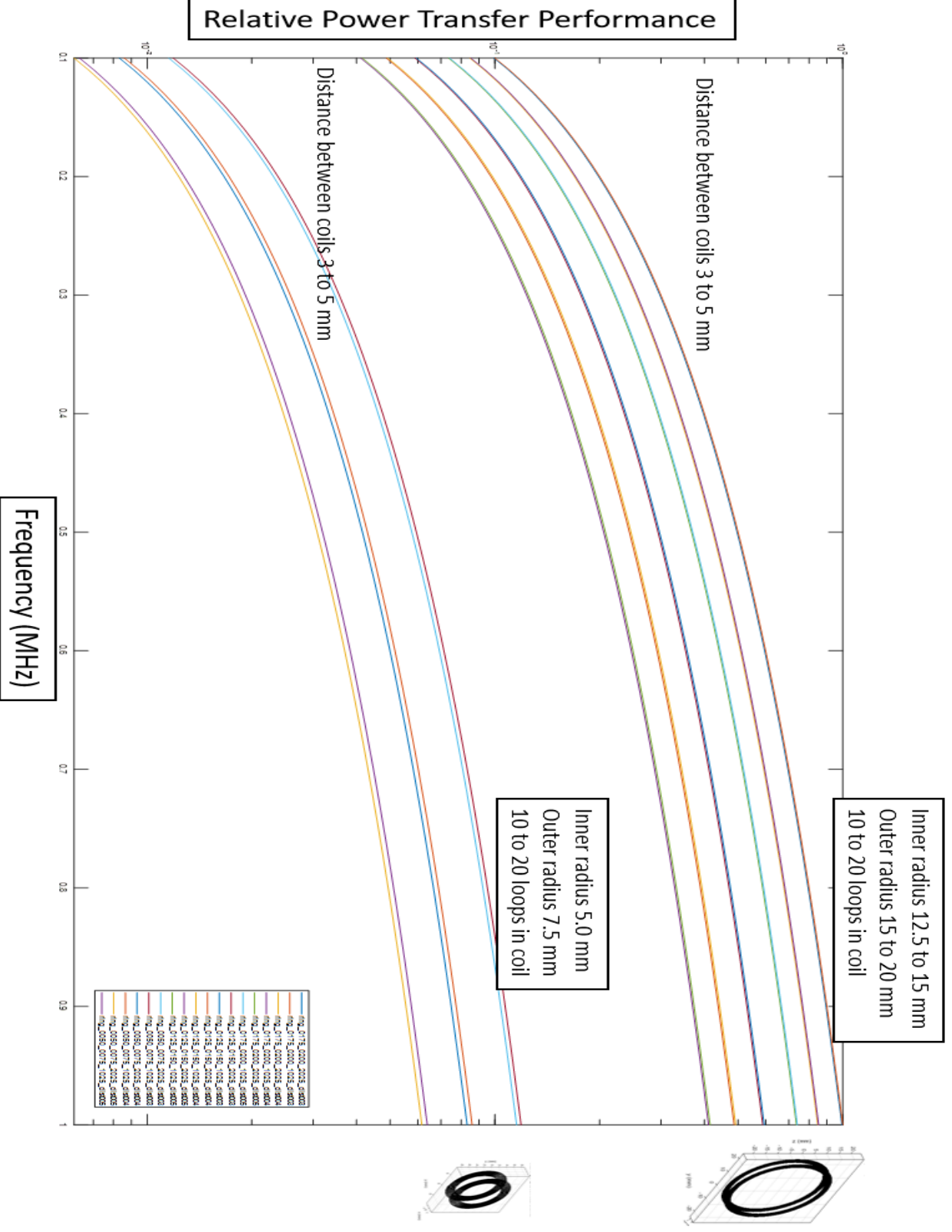
- a. For purposes of this modeling, I have applied the similar conservative assumptions as those described above with respect to the configuration discussed in §VII.A.3.a. Specifically, I have assumed a Fraser-like coil as noted above. I have assumed a Fraser-like coil would extend centrally from the outer extent of the protruding part 4 (at 20 mm) to the extent of the device (at 30 to 40 mm).
- b. As such, one example of a coil that could fit in this space would be a ring-shaped coil with an inner radius for a central core spanning 12.5 mm in inner radius (i.e., 25 mm in inner diameter) and extending from there to 30 mm extent of the device (i.e., outer radius of 15mm and outer diameter of 30 mm). Another example of a coil that could fit in this space would be a ring-shaped coil with an inner radius for a central core spanning 17.5 mm in inner radius (i.e., 35 mm in inner diameter) and extending to the 40 mm extent of the device (i.e., outer radius of 20 mm and

outer diameter of 40 mm). In this modeling, I have used a 20-loop coil (and have also considered a 10-loop coil) with a distance between the transmit and receive coils of 3-5 mm.

- c. For the coil to encircle/surround the optical elements in Petitioner's proposed configuration, I have conservatively assumed a coil with an air core of inner diameter 10 mm (i.e., inner radius of 5 mm) so as to at least span the extent of the optical elements (although Kotanagi's configuration suggests a greater diameter would be needed to encircle the elements). Given the presence of housing, electrodes, and flexible board adjacent to the optical elements, the number of windings possible are limited for this particular space. Nevertheless, even for this configuration, I have used a 20-loop coil (and have also considered a 10-loop coil) with a distance between the transmit and receive coils of 3-5 mm.
- d. Moreover, in this configuration, I have estimated the coil as having an outer diameter of 15 mm (i.e., outer radius of 7.5 mm). That is because, when accounting for the fact that the extent of the protruding part is 20 mm, there would likely be enough space for the coils to extend 5 mm laterally (i.e., from inner diameter

extent to an outer diameter extent) but not to the 20 mm extent of the protruding part 4—given the above described space constraints.

- e. And when modeling the wireless power transmission of such devices (in the manner described above with reference to §VII.A.3.a), the difference in wireless signal transmission is **1 order of magnitude** more in a Fraser-like device relative to the proposed combination's device.



- f. This disparity in wireless power transmission indicates that if the Fraser-like device takes **1 hour** to charge the device's battery, Petitioner's proposed configuration would take **10 hours** to charge the same battery given the above-described sizing and coil separation considerations.
- g. This modeling/simulation does not account for the significant detrimental impact to wireless power transmission and charging efficiency, from power transfer reducing eddy currents and magnetization from metallic materials in the wireless power transmission path—which would be more pronounced in the already-weak power transmission/efficiency of the smaller coil (relative to a Fraser-like device that has a substantially higher signal transmission rate and efficiency that can more readily offset the detrimental of such charge-degrading factors).
- h. Nor does this modeling/simulation account for the detrimental impact of increased sensitivity to misalignment, which again would be more significant in the smaller coil in Petitioner's combination.

195. Given the above-described issues in this proposed configuration, Petitioner has not shown that a POSITA would have configured the device in this manner—particularly when considering that the POSITA would have been aware of other well-known and actually functioning configurations of biometric sensing and wireless charging devices (as corroborated by the Fraser reference) that provide a larger wireless charging coil around optical elements within the device housing that is more capable of avoiding or counteracting the detrimental impact to wireless charging that Petitioner’s combination calls for.

196. A POSITA would have also recognized—in view of Fraser—that such a large coil would expand beyond the identified cover of the combination’s device. And in that case (and as explained above in §VII.A.3), any inductive coupling and associated wireless power transmission that occurs, as the claim requires in view of the intrinsic record, would pass through the device’s rear housing surface beyond the protruding part 4 and not the cover or the alleged second opening behind it.

197. In summary, Petitioner has presented a device configuration in which a wireless charging coil **could** be provided in Kotanagi’s through hole 22. However, Petitioner has not shown that a POSITA **would** have configured the device in the proposed manner when considering the detrimental issues stemming from this configuration and given the substantially better alternative available that avoids those issues.

198. Therefore, for the above reasons, Petitioner has failed to show that the proposed Kotanagi-Honda combination would render obvious claim 7.

B. The Proposed Kotanagi-Honda Combination Does Not Render Obvious Independent Claim 14

199. Claim 14 is reproduced below:

*14. An electronic device comprising:
a housing defining a first opening and a second opening;
a display positioned at least partially within the first opening;
a biosensor module aligned with the second opening;
a wireless charging receive coil positioned within the housing and aligned with the second opening;
a battery operably coupled to the wireless charging receive coil; and
a cover formed from an optically transparent material and disposed over the biosensor module and the wireless charging receive coil, wherein:
the electronic device is configured to receive wireless power through the optically transparent material of the cover using the wireless charging receive coil; and
the electronic device is configured to measure a heart rate of a user through the optically transparent material of the cover using the biosensor module.*

200. Independent claim 14 recites, in relevant part, “an electronic device” that has “a housing defining ... a second opening,” and “a biosensor module” and “wireless charging receive coil” that are “aligned with the second opening.” The claim further recites “a cover ... disposed over the biosensor module and the wireless

charging receive coil” wherein the device “is configured to receive wireless power through ... the cover using the wireless charging receive coil.”

201. Similar to its analysis for claim 7, Petitioner alleges that the claimed “second opening” maps to through hole 22 in Kotanagi’s device (Petition, 32) and the claimed “cover” maps to Kotanagi’s cover glass 23 (Petition, 35-37). Also, similar to its claim 7 analysis, Petitioner states that wireless power would be received by a wireless charging receive coil through the cover. Petition, 37-40.

202. As described with reference to claim 7, a POSITA would not have been motivated nor would have had a reasonable expectation of success in providing the wireless charging receive coil in this alleged second opening in the manner proposed by Petitioner given the significant wireless signal degradation issues stemming from this proposed configuration. *See §VII.A.1-4 supra.*

203. Additionally, and as explained above, Petitioner has not shown that a POSITA would have configured the device in this manner—particularly when considering that the POSITA would have been aware of other well-known and actually functioning configurations of biometric sensing and wireless charging devices (as corroborated by the Fraser reference) that provide a large wireless charging receive coil around optical elements within the device housing and thereby avoid the detrimental issues that Petitioner’s combination injects. *See §§VII.A.1-4 supra.*

204. A POSITA would have also recognized (in view of Fraser) that such a large coil would expand beyond the identified cover of the combination's device. In such a configuration, any wireless power transmission that occurs, as the claim requires in view of the intrinsic record, would pass through the device's rear housing surface beyond the protruding part 4 and not through the alleged cover (i.e., cover glass 23 in Kotanagi) or the alleged second opening (i.e., through hole 22) behind it. *See §§VII.A.1-4 supra.*

205. In summary, Petitioner has also provided a device configuration in which a wireless charging coil ***could*** be provided in Kotanagi's through hole 22. However, Petitioner has not shown that a POSITA ***would*** have configured the device in the proposed manner when considering the detrimental impact to wireless charging stemming from this configuration and given the substantially better alternative available that avoids/counteracts those issues.

206. Therefore, for the above reasons and for the reasons described with reference to §VII.A.1-4 *supra*, Petitioner has failed to show that the proposed Kotanagi-Honda combination would render obvious claim 14.

C. The Proposed Kotanagi-Honda-Choi Combination Does Not Render Obvious Independent Claim 1

207. Independent claim 1 has been reproduced below:

1. An electronic watch comprising:

a housing formed from a metal material and defining a rear opening along a rear portion of the housing;
a touch-sensitive display positioned at least partially within the housing;
a band coupled to the housing and configured to couple the electronic watch to a user;
a cover formed from a dielectric material and forming a seal along the rear opening of the housing;
an optical sensor positioned within the housing and configured to transmit an optical signal through the dielectric material of the cover;
a charging coil positioned within the housing and configured to receive wireless power through the dielectric material of the cover;
a first electrode positioned along a rear surface of the electronic watch; and
a second electrode positioned along the rear surface of the electronic watch, wherein:
the electronic watch is configured to measure a heart rate using the optical sensor, and
the electronic watch is configured to measure an electrocardiogram using the first electrode and the second electrode.

1. *The Proposed Combination Does Not Render Obvious Limitation [1g]*

208. Limitation [1g] recites an electronic watch that includes “a charging coil positioned within [its] housing” formed “from a metal material,” wherein the charging coil is “configured to receive wireless power through the dielectric material of the cover” in the “rear opening of the housing.”

209. Similar to its analysis for claim 7, Petitioner alleges that the claimed “rear opening” maps to through hole 22 in Kotanagi’s device (Petition, 42-43) and

the claimed “cover” maps to Kotanagi’s cover glass 23 (Petition, 46-47). Also, similar to its claim 7 analysis, Petitioner alleges that wireless power would be received by a wireless charging receive coil through the cover. Petition, 48-49, 53-54.

210. As described with reference to claim 7, a POSITA would not have been motivated nor would have had a reasonable expectation of success in providing the wireless charging receive coil in this alleged second opening in the manner proposed by Petitioner given the significant wireless signal degradation issues stemming from this proposed configuration. *See* §VII.A.1-4 *supra*.

211. Additionally, and as explained above, Petitioner has not shown that a POSITA would have configured the device in this manner—particularly when considering that the POSITA would have been aware of other well-known and actually functioning configurations of biometric sensing and wireless charging devices (as corroborated by the Fraser reference) that provide a large wireless charging receive coil around optical elements within the device housing and thereby avoid the detrimental issues that Petitioner’s combination injects. *See* §§VII.A.1-4 *supra*.

212. A POSITA would have also recognized (in view of Fraser) that such a large coil would expand beyond the identified cover of the combination’s device. And in such a scenario, any wireless power transmission that occurs, as the claim

requires in view of the intrinsic record, would pass through the device's rear housing surface beyond the protruding part 4 and not through the alleged cover (i.e., cover glass 23 in Kotanagi) or the alleged second opening (i.e., through hole 22) behind it. See §§VII.A.1-4 *supra*.

213. In summary, Petitioner has presented a device configuration in which a wireless charging coil ***could*** be provided in Kotanagi's through hole 22. However, Petitioner has not shown that a POSITA ***would*** have configured the device in the proposed manner when considering the detrimental impact to wireless charging stemming from this configuration and given the substantially better alternative available that avoids/counteracts those issues.

2. *The Proposed Combination Does Not Render Obvious Limitations [1h] and [1j]*

214. These limitations recite that “a first electrode positioned along a rear surface of the electronic watch; and a second electrode positioned along the rear surface of the electronic watch,” wherein the “the electronic watch is configured to measure an electrocardiogram using the first electrode and the second electrode.”

215. Petitioner contends that these limitations would have been obvious in view of Kotanagi's teachings of electrodes on its rear surface and Choi's teachings of sensors on front and back of the device to detect an ECG signal. Petition, 51-54.

216. Specifically, Petitioner contends that “a POSITA would have used Kotanagi’s existing electrodes and Choi’s teachings to either: (1) use signals from Kotanagi’s existing electrodes to obtain an ECG; or (2) add one or more additional electrodes to Kotanagi (as taught by Choi) and use both it and the existing electrodes to obtain an ECG.” Petition, 52.

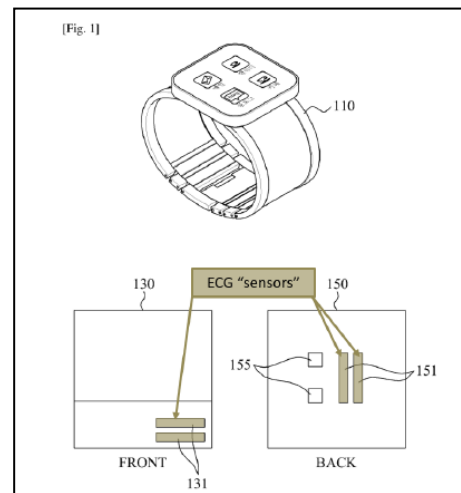
217. As an initial matter, Petitioner’s obviousness arguments are flawed because they are premised on characterizations of the references that are refuted by their express teachings.

218. **First**, as part of its obviousness analysis, Petitioner incorrectly alleges that “Kotanagi’s rear electrodes interact with the optical sensor to achieve pulse measurement.” Petition, 51. The rear electrodes do not “achieve pulse measurement,” as Petitioner argues. Instead, Kotanagi explains that these electrodes “have a function of detecting whether there is contact with the living body surface B based on the potential difference between the electrodes” and when contact is detected, the “data processing part 9” of Kotanagi’s device “control[s] the operation of the LED 5 so as to emit light from the LED 5.” EX-1005, ¶¶59, 13. Thus, the function of the electrodes is to detect skin contact—and not to “achieve pulse measurement,” which is performed using different components of Kotanagi’s device. *See id.*

219. **Second**, Petitioner argues that a POSITA would have considered Petitioner’s proposed alternative electrode arrangements given that (1) Kotanagi allegedly teaches that more than two electrodes may be provided (Petition, 51-52), and (2) Choi teaches that front and back sensors may not be needed for ECG measurements (*id.*).

220. As to the first assertion, even if the cited disclosure in Kotanagi is interpreted as teaching or suggesting more than two electrodes, these electrodes would still be implemented to perform the stated function for Kotanagi’s electrodes—i.e., to detect skin contact and not to perform an ECG measurement. Indeed, Kotanagi does not teach or suggest ECG measurements by its device. See *generally* EX-1005.

221. Petitioner’s second assertion in view of Choi is refuted by Choi’s disclosures. Choi teaches that “[t]o detect the ECG signal ... a signal detected in at least two different portions of the body of the user may be needed, and thus, the sensors 131 and 151 are provided on the front 130 and back 150, respectively.” EX-1011, ¶52, FIG. (reproduced on right; annotated by Petitioner).



222. Choi further states that, when detecting an impedance signal generated by the body of the user, *aside from the ECG signal*, a sensor used to receive the ... signal may be provided on either the front 130 or the back 150.” *Id.* Thus, these teachings in Choi contemplate ECG sensor positioning on two different surfaces—instead of only a single surface, as characterized by Petitioner.

223. When considering Kotanagi’s and Choi’s actual teachings, and as explained further below, Petitioner has failed to demonstrate why or how a POSITA would have combined the teachings of these references in the proposed manner.

224. Petitioner first asserts that a POSITA would have been “motivated ... to expect success in combining the teachings of Kotanagi and Choi” because, per Petitioner, they “both teach a watch with both optical and electrode biosensors.” Petition, 53. Petitioner does not explain why or how a potential difference measurement in Kotanagi’s device by its electrodes makes those electrodes “biosensors.”

225. Petitioner also argues that (1) Choi and Kotanagi provide “similar electrodes” that generate “analogous” measurements and (2) “[b]ecause Kotanagi already has multiple electrodes, any further modification from Choi (e.g., to process electrode signals differently or to add an electrode)” would have been obvious. See Petition, 53. These arguments are flawed for the reasons I explain below.

226. Kotanagi does not disclose or contemplate any ECG capability, nor does it disclose or suggest electrode positioning on any surface other than the device's rear surface, nor any additional signal processing or electronics. EX-1005, ¶¶13, 59.

227. Indeed, ECG electrodes and contact detection electrodes (as well as their associated electronics) serve different purposes and operate differently. For example, ECG electrodes, along with the accompanying instrumentation system (which generally includes signal amplification and signal filtering), as well as the computation system (which generally involves digital mixing and further filtering), are highly specialized components tailored for the precise measurement of the intricate electrical signals generated by the heart's activity.

228. These electrodes and their associated systems are designed to capture, process, and interpret the minute electrical impulses emanating from the heart muscles. The signal generated by the heart is often faint and intricate, necessitating a sensitive and specialized setup for its accurate detection and analysis.

229. In contrast, electrodes (and the electronics to which they are attached) designed for determining physical/skin contact essentially function as switch closure detectors, serving the purpose of answering whether "contact been established?" Their role is to discern whether there is an open or closed circuit between the electrodes and the object or body with which they come into contact. Unlike the

complex waveforms of ECG signals, these electronic systems are concerned with registering the presence or absence of a physical contact. When contact is established, they enable the flow of current or signal from the device not from the body, indicating a closed circuit. Conversely, when contact is absent, they detect an open circuit, signifying the absence of connectivity.

230. In summary, ECG electrodes and their associated systems are precision instruments honed for the intricacies of cardiac electrical activity, while electrodes in electronic systems (as disclosed in Kotanagi) for contact are substantially different and less complex given their simple function of detecting whether a connection exists.

231. Moreover, even if Kotanagi is interpreted as contemplating multiple electrodes, given the skin contact detection function of the electrodes, Kotanagi's electrodes would be positioned only on its device's rear surface—i.e., the surface in contact with the arm/wrist/body of the device wearer—and functions to detect skin contact. *Id.*

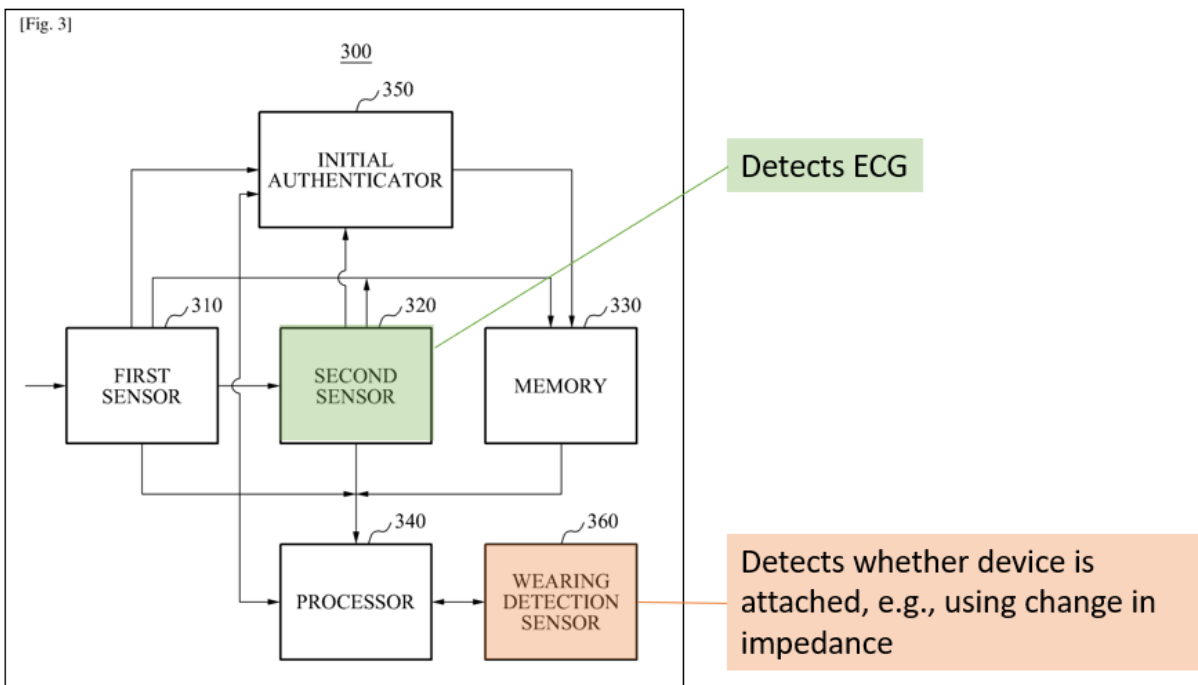
232. Positioning any of Kotanagi's electrodes on a device surface other than the surface that contacts the wrist of the wearer would frustrate the above-described skin contact detection function of Kotanagi's electrodes. Thus, there would be no reason or motivation to position electrodes on a front surface of Kotanagi's device

(as Petitioner seems to suggest in view of Choi), when considering that doing so would be counter to the skin contact detection function of this device.

233. Moreover, Petitioner has also not explained why or how the potential difference measurements in Kotanagi are “analogous” to ECG measurements in Choi. Notably, Petitioner and its expert do not explain any similarity in the processes and effects between measuring a potential difference between the pair of electrodes for purposes of skin contact (as in Kotanagi) and the use of electrodes for determining ECG (as in Choi), which have notable differences as a POSITA would have recognized (for at least the reasons I have described above).

234. Even assuming for argument’s sake that ECG measurements are analogous to impedance detection (as Petitioner contends without support and which I have explained above to not be the case), and even if ECG measurements would result in Kotanagi’s watch having “improved biosensing,” as Petitioner asserts (Petition, 27-28), Petitioner has not shown how such functionality would be implemented in Kotanagi’s device. Petitioner has not shown that signals from the same electrodes in Kotanagi—which only have a skin contact detection function—and/or any additional electrodes, would be leveraged to achieve ECG measurements—again given how different the two functions and the associated electrodes and accompany systems are for performing these functions (as I explained above). *See* Petition, 53-54.

235. Even Petitioner’s argument that “process[ing] electrode signals differently” in Kotanagi would have been obvious based on Choi is incorrect for the reasons I have described above and for the following additional reasons. Petition, 53-54. Specifically, Petitioner has not shown that Choi teaches using the same electrodes for both skin contact detection and ECG measurements. On the contrary, Choi teaches using a wearing detection sensor that detects whether the band is attached to the user, which is different and separate from the sensor used to detect ECG, as shown below. EX-1011, FIG. 3 (reproduced below; annotated), [68]-[70], [98]-[102].



236. Moreover, although Choi describes detecting a “second biosignal”—which can include ECG or impedance—using sensors on the front and/or back

surface of its device (EX-1011, [47], [54]-[56]), Petitioner has not identified any teaching in Choi that shows use of the **same** sensor(s) for detecting **both** ECG and impedance—or that **both** ECG and impedance are even used as the second biosignal.

237. In fact, Choi uses the second biosignal to authenticate the user (EX-1011, [47], [54]-[56]) and Petitioner has not identified any teaching in Choi disclosing or suggesting that **both** ECG and impedance are used or would be used as the second biosignal for this authentication function.

238. Moreover, even if both ECG and impedance are detected, Choi’s disclosure of a separate wearing detection sensor that uses impedance signals to detect “wearing detection” would suggest to a POSITA that Choi contemplated separate sensors for ECG and impedance measurements. This is again consistent with the fundamental differences between ECG and skin contact detection systems and their associated electrodes (as I have explained above).

239. For at least these reasons, Petitioner and its expert have not shown that the same electrodes in Kotanagi—which have a skin contact detection function—would be leveraged alone or in combination with additional electrode(s)—to generate signals that would be “process[ed]” “differently” to additionally obtain ECG measurements. See Petition, 53.

240. And, if Petitioner’s combination seeks to reconfigure Kotanagi’s electrodes to generate ECG measurements (instead of detecting skin contact), that

would frustrate Kotanagi's specific goal and purpose of using the electrodes to ensure skin contact and enhance adherence of its wrist-worn device to the wearer's body. See EX-1005, ¶5 ("an object thereof is to provide a biological information measuring device which enhances adherence").

241. Finally, as part of its obviousness analysis, Petitioner identifies references that purportedly disclose watches with ECG functionality, and further alleges that configuring the electrodes to "measure an ECG would have" been "an application of 1980-era technology." Petition, 54.

242. The reference to "1980-era technology" appears to be referring to the non-ground reference, Schmid (EX-1029), which was filed and issued in the early 1980s and which was used by Petitioner as part of its analysis for this limitation. EX-1029, p. 1; see Petition, 52 (citing EX-1029, FIG. 1, 3:7-15, 4:34-45).

243. However, a POSITA would not have had a reasonable expectation of success in implementing an "electronic watch [that] is configured to measure an electrocardiogram using the first and the second electrode" in view of Schmid. That is because, while Schmid's electrodes are used to measure ECG, Schmid's wrist-worn device is not configured to measure ECG. In particular, Schmid's electrodes on its wrist-worn device are coupled to a separate apparatus that is configured to measure ECG and thus, its wrist-worn device itself is not "configured to measure" ECG signals. See, e.g., EX-1029, 1:6-11 (the "invention relates to ... electrode

assemblies adapted to determine bioelectrical conditions, *especially in association with an apparatus for evaluating and/or plotting such signals as, for example, in EKG evaluations*”), 5:3-10 (“The heart-frequency measuring assembly shown in FIG. 1 comprises a housing 2 which can be similar to a *wristwatch housing or case and which contains the electrodes* in an electrode set or a plurality of such electrode sets, *which can be connected by cables, contact pins or the like to a conventional recording, evaluation or registration circuit e.g. the electronics of a conventional EKG machine.*”), 6:29-35 (“The housing 2 is also provided with contact sleeves 3 *enabling the cable connection between the electrodes and a remote circuit, e.g. an EKG machine*, for use especially when the electrodes are applied to other body portions.”).

244. Also, just because ECG measuring watches were known in the art, as Petitioner contends (Petition, 54), does not demonstrate why or how Kotanagi’s existing electrodes—which have a skin contact detection function—alone or in combination with additional electrode(s), would be configured to measure ECG.

245. Petitioner has therefore not shown the obviousness of limitations [1h] and [1j] in view of Kotanagi’s and Choi’s teachings.

246. Therefore, for the above reasons and for the reasons described with reference to §VII.A.1-4 *supra*, Petitioner has failed to show that the proposed Kotanagi-Honda combination would render obvious claim 1.

D. The Proposed Combination of Kotanagi-Honda-Choi Combinations Do Not Render Obvious Claims 13 and 17

247. Claims 13 and 17 are reproduced below:

*13. The wearable electronic device of claim 7, wherein:
the wearable electronic device further comprises:
a first electrode positioned along a rear surface of
the wearable electronic device; and
a second electrode positioned along the rear
surface of the wearable electronic device; and
the wearable electronic device is configured to measure
an electrocardiographic characteristic using the first and second
electrodes.*

*17. The electronic device of claim 14, wherein:
the electronic device further comprises:
a first electrode disposed along an exterior of the
electronic device; and
a second electrode disposed along the exterior of
the electronic device; and
the first and second electrodes are configured to
measure an electrocardiographic characteristic of the
user.*

248. Petitioner contends that “a POSITA would have understood that Kotanagi in view of Choi teaches” both these limitations. Petition, 60-61. For the reasons described above with reference to claim 1 (*see §VII.C.2 supra*), Petitioner has not shown that Kotanagi’s wrist-worn device would be “configured to measure an electrocardiographic characteristic using the first and second electrodes” as required by these claims and in view of the teachings of the Choi reference.

249. For at least these foregoing reasons, Petitioner has failed to show that the proposed Kotanagi-Honda-Choi combination would render obvious claims 13 and 17.

E. The Proposed Combinations Do Not Render Obvious Claims 2-6, 8-12, 15, 16, and 18-19

250. Claims 2-6, 8-12, 15, 16, and 18-19 are not rendered obvious by the presented combination for at least the reasons described above with reference to independent claims from which these claims depend. *See §§III, VII.A-D supra.*

VIII. ADDITIONAL REMARKS

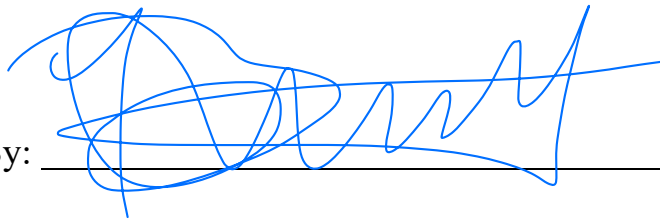
I currently hold the opinions set expressed in this declaration. But my analysis may continue, and I may acquire additional information and/or attain supplemental insights that may result in added observations.

I hereby declare that all statements made of my own knowledge are true and that all statements made on information and belief are believed to be true. I further declare that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of the Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patents issued thereon.

Dated: _____

Jan 14 2024

By: _____

A handwritten signature in blue ink, consisting of a series of loops and a long horizontal stroke, positioned above a horizontal line.