

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ANKER INNOVATIONS LTD.,
Petitioner,

v.

POWERMAT TECHNOLOGIES LTD.,
Patent Owner

Case: IPR2024-00995

U.S. Patent No. 9,083,204

**DECLARATION OF PATRICK MERCIER, PH.D.
REGARDING U.S. PATENT NO. 9,083,204**

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Patent Trial and Appeal Board
U.S. Patent and Trademark Office
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EXHIBIT LIST

Exhibit No.	Description
2001	Expert Declaration of Patrick P. Mercier, Ph.D., Nov. 21, 2024
2002	U.S. Pub. No. 2009/0174263 (“Baarman263”)
2003	Defendant’s First Amended Invalidity Contentions of U.S. Patent No. 9,083,204 in view of US2008/0079392A1, <i>Powermat Technologies Ltd. v. Anker Innovations Ltd.</i> , Case No. 5-23-cv-00052 (E.D. Tex.), Apr. 18, 2024.
2004	Defendant’s First Amended Invalidity Contentions of U.S. Patent No. 9,083,204 in view of 2009/0174263, <i>Powermat Technologies Ltd. v. Anker Innovations Ltd.</i> , Case No. 5-23-cv-00052 (E.D. Tex.), Apr. 18, 2024.
2005	U.S. Patent No. 5,455,467 (“Young”)
2006	The American Heritage Dictionary of the English Language (Houghton Mifflin Co., 4th ed. 2006)
2007	Collins English Dictionary (HarperCollins Pub., 7th ed. 2005)
2008	Wiley Electrical and Electronics Engineering Dictionary (John Wiley & Sons, Inc., IEEE Press 2004)
2009	Expert Declaration of Patrick P. Mercier, Ph.D., May 21, 2025
2010	Deposition Transcript of Gary L. Woods, Ph.D., Feb. 20, 2025
2011	The American Heritage Dictionary of the English Language (Houghton Mifflin Co., 4th ed. 2002)
2012	Webster’s II Dictionary (Houghton Mifflin Co., 3rd ed. 2005)
2013	Deposition Transcript of Gary L. Woods, Ph.D., May 16, 2025
2014	Math Centre, <i>Symbols</i> (June 4, 2023)

LISTING OF CHALLENGED CLAIMS¹

Claim Element	Claim Text
[1.P]	An inductive power transfer system comprising
[1.1]	at least one inductive power outlet comprising at least one primary inductive coil wired to a power supply via a driver;
[1.2]	said primary inductive coil for forming an inductive couple having a characteristic resonant frequency with at least one secondary inductive coil wired to an electric load,
[1.3]	said secondary inductive coil associated with an inductive power receiver
[1.4]	wherein said driver is configured to provide a driving voltage across said primary inductive coil,
[1.5]	said driving voltage oscillating at a non-resonant transmission frequency substantially different from said characteristic resonant frequency of said inductive couple,
[1.6]	wherein said inductive power outlet further comprises a signal detector adapted to detect a first signal and a second signal, and
[1.7]	said driver is configured to: provide less power by increasing said non-resonant transmission frequency by an incremental value when said first signal is detected by the detector, and
[1.8]	provide more power by decreasing said non-resonant transmission frequency by an incremental value when said second signal is detected by the detector.
[2]	The system of claim 1 said signal detector being configured to adjust said transmission frequency in response to feedback signals.
[3]	The system of claim 2 wherein said feedback signals carry data pertaining to the operational parameters of said electric load.
[4]	The system of claim 3 wherein said operational parameters are selected from the group consisting of:

¹ For convenience purposes only, I have adopted the numbering of claim limitations advanced in the Declaration of Dr. Gary L. Woods (Ex. 1003). I do not concede the appropriateness of such grouping and numbering of claim limitations.

Claim Element	Claim Text
	required operating voltage for said electric load; required operating current for said electric load; required operating temperature for said electric load; required operating power for said electric load; measured operating voltage for said electric load; measured operating current for said electric load; measured operating temperature for said electric load; measured operating power for said electric load; power delivered to said primary inductive coil; power received by said secondary inductive coil; and a user identification code.
[5]	The system of claim 1 wherein said signal detector is selected from the list comprising optical detectors, radio receivers, audio detectors and voltage peak detectors.
[6]	The system of claim 1 wherein said driver further comprises a voltage monitor for monitoring the amplitude of a primary voltage across said primary coil.
[8]	The system of claim 1 comprising a power converter selected from the group comprising: a transformer, a DC-to-DC converter, an AC-to-DC converter, an AC-to-AC converter, a flyback transformer, a flyback converter, a full-bridge converter, a half-bridge converter and a forward converter.
[10.P]	A method for regulating inductive power transmission from a primary inductive coil, wired to a power supply via a driver, to a secondary inductive coil, wired to an electric load, said method comprising the following steps:
[10.1]	providing an oscillating voltage to said primary inductive coil at an initial transmission frequency f_t substantially different from a characteristic resonant frequency f_R of the system;
[10.2]	inducing a secondary voltage in said secondary inductive coil;
[10.3]	monitoring power received by said electric load;
[10.4]	sending a feedback signal when the monitored power deviates from a predetermined range;
[10.5]	said driver receiving said feedback signal; and

Claim Element	Claim Text
[10.6]	said driver adjusting said non-resonant transmission frequency.
[11]	The method of claim 10 wherein the step of sending a feedback signal further comprises: sending a feedback signal of a first type Sa to said driver, whenever said power drops below a predetermined lower threshold, and sending a feedback signal of a second type Sb to said driver, whenever said power exceeds a predetermined upper threshold.
[12]	The method of claim 10 wherein said initial non-resonant transmission frequency f_t is higher than the characteristic resonant frequency f_R .
[13]	The method of claim 10 wherein the step of said driver adjusting said non-resonant transmission frequency further comprises: said driver reducing said non-resonant transmission frequency by an incremental value df_1 when the received feedback signal is of the first type Sa, and said driver increasing said non-resonant transmission frequency by an incremental value $+df_2$ when the received feedback signal is of the second type Sb.

I. INTRODUCTION

1. My name is Patrick Mercier and I have prepared this declaration at the request of the Patent Owner in this case, Powermat Technologies Ltd. (“Powermat”) regarding U.S. Patent No. 9,083,204 (Ex. 1001, “the ’204 Patent”). I am an independent consultant.

2. I have been asked by Powermat’s counsel to opine on whether the Challenged Claims of the ’204 Patent are rendered obvious by the prior art and to provide supplemental opinions regarding certain claim language in the ’204 Patent. I previously provided opinions regarding certain claim language in the ’204 Patent, and provided my understanding of the level of ordinary skill in the art related to this patent, as well as to explain the relevant technical background related to this patent. *See* Ex. 2001.

3. My opinions are based on my education, research, knowledge, and experience in designing, developing, and testing wireless charging devices and/or systems, including those using inductive charging techniques. My opinions are also based on the documents and information referenced in this declaration, as well as my study of relevant materials, including the ’204 Patent and its file history.

4. I am compensated at an hourly rate of \$250 for my services on this case. I have no financial interest with the Patent Owner or Petitioner and my compensation does not depend upon my opinions rendered or on the outcome of this Petition.

5. My analysis of the materials produced in this matter is ongoing and I will continue to review any new material as it is provided. This declaration represents only those opinions I have formed to date. I reserve the right to amend or supplement my opinions based on additional documents or evidence I am presented, including without limitation any arguments or expert declarations advanced by Petitioner in this case.

6. I am not a legal expert and offer no opinions on the law. However, I have been informed by counsel of the various legal standards that apply, and I have applied those standards in arriving at my conclusions.

7. I am over 18 years of age and, if I am called upon to do so, I am competent to testify as to the matters set forth herein. The following provides an overview of some of my experience that is relevant to the matters set forth in this declaration.

II. QUALIFICATIONS

8. I have devoted my career to the research and development of various types of power circuits and electronic systems, including circuits and systems for

wireless power transfer. I am currently a Full Professor and Vice Chair of the Electrical and Computer Engineering department at the University of California, San Diego. I am the Site Director for the Power Management Integration Center – a National Science Foundation Industry/University Research Cooperative Research Center – and I am the co-director of the Center for Wearable Sensors. My work with both centers includes power circuits and systems. My current CV is attached hereto as Appendix A and my prior engagements as an expert witness is attached hereto as Appendix B.

9. I received my Ph.D. in Electrical Engineering in 2012 and my S.M. in 2008, both from the Massachusetts Institute of Technology. My Ph.D. thesis focused on power delivery in medical devices and on wireless power transfer. I received my B.Sc. degree in Electrical and Computer Engineering in 2006 from the University of Alberta.

10. In 2012, after receiving my Ph.D., I joined the University of California, San Diego as an Assistant Professor. I also am a board member of several companies and co-founded another. Over the course of my educational and professional careers, I have received several honors and awards relating to my teaching and research, including from the IEEE, San Diego County, UCSD, DARPA, and Intel. I am an IEEE Fellow.

11. I have extensively published in the area of power electronics. For example, I was co-editor of a book entitled “Power Management Integrated Circuits” and co-editor of a book entitled “Ultra-low-power Short-Range Radios,” in which I wrote a chapter entitled “Near-Field Wireless Power Transfer.” I have also been published in numerous journals on the topic of power electronics and wireless power transfer, including, for example:

- a. A. Abdulslam, P.P. Mercier, “A Symmetric Modified Multilevel Ladder PMIC for Battery-Connected Applications,” IEEE Journal of Solid-State Circuits, vol. 55, no. 3, pp. 767-780, Mar. 2020. (CICC Special Issue).
- b. S.S. Amin, P.P. Mercier, “A Fully-Integrated Li-ion-Compatible Hybrid 4-Level DC-DC Converter in 28nm FDSOI,” IEEE Journal of Solid-State Circuits, vol. 54, no. 3, pp. 720-732, Mar. 2019. (CICC Special Issue).
- c. C. Kim, S. Ha, J. Park, A. Akinin, P.P. Mercier, G. Cauwenberghs, “A 144 MHz Fully Integrated Resonant Regulating Rectifier with Hybrid Pulse Modulation for mm-sized Implants,” IEEE Journal of Solid-State Circuits, vol. 52, no. 11, pp. 3043-3055, Nov. 2017.

d. L.G. Salem, J.F. Buckwalter, P.P. Mercier, “A Recursive Switched-Capacitor House-of-Cards Power Amplifier,” IEEE Journal of Solid-State Circuits (JSSC), vol. 52, no. 7, pp. 1719-1738, Jul. 2017.

e. D. Ahn and P.P. Mercier, “Wireless Power Transfer with Concurrent 200 kHz and 6.78 MHz Operation in a Single Transmitter Device,” IEEE Transactions on Power Electronics, vol. 31, no. 7, pp 5018-5029, Jul. 2016.

f. L.G. Salem and P.P. Mercier, “A Recursive Switched-Capacitor DC-DC Converter Achieving 2^N-1 Ratios with High Efficiency over a Wide Output Voltage Range,” IEEE Journal of Solid-State Circuits (JSSC), vol. 49, no. 12, pp 2773-2787, Dec. 2014. (ISSCC Special Issue).

g. P.P. Mercier and A.P. Chandrakasan, “Rapid Wireless Capacitor Charging using a Multi-Tapped Inductively-Coupled Secondary Coil,” IEEE Trans. Circuits and Systems I (TCAS-I), vol. 60, no. 9, pp 2263-2272, Sep. 2013.

12. I have also taught tutorials as part of engineering organization conferences. For example, I taught a tutorial entitled “Building Li-ion-compatible

DC-DC Converters in Scaled CMOS” for the IEEE Solid-State Circuits Society CICCedu online mini-course. I also presented a tutorial entitled “Power Management for the Internet-of-Things” at the IEEE Custom Integrated Circuits Conference (CICC), and gave a keynote presentation entitled “Energy-Efficient Power Management Circuits for IoT and Wearable Devices” at the IEEE Sensor Interfaces Meeting.

13. I have extensively researched the Qi wireless power transfer standard and other competing standards, and have even built a prototype that can support concurrent operation for Qi at ~200kHz and a higher frequency standard at 13.56MHz, resulting in a publication in the IEEE Transactions in Power Electronics.

14. I am a named inventor on 24 U.S. patents, including several directed to power circuits and systems. For example, U.S. Patent 9,293,945 is entitled “Multi-Taped Inductively-Coupled Charging System”, U.S. Patent 10,855,115 is entitled “Wireless Power Transfer Device and Method with Dual-Frequency Operation”, and U.S. Patent 10,873,215 is entitled “Resonant Regulating Rectifier with an Integrated Antenna.”

III. LEGAL UNDERSTANDING

15. I am not a lawyer and am not offering any opinions regarding legal matters. However, the legal principles relevant to my opinion herein have been

explained to me by Powermat’s counsel. In this section, I summarize these legal principles as they have been explained to me.

16. I reserve the right to change or formulate new opinions in the event there is a change in the law concerning my opinions provided in this declaration.

A. Burden of Proof

17. I understand that in *inter partes* review (“IPR”) proceedings, the Petitioner bears the burden of proof to prove that the claims that were challenged in the Petition and for which the Board instituted review are unpatentable. It is my understanding that the Petitioner also bears the burden of proving a proposition of unpatentability by a preponderance of the evidence.

18. I further understand that in IPR proceedings, the Petitioner must demonstrate the obviousness of a claim by “a preponderance of the evidence.” I have been informed that the preponderance of the evidence standard requires that a reasonable factfinder would find a material fact more probable than the nonexistence of that fact. I understand that this standard does not permit speculation concerning particular facts and is rather focused on whether the evidence more likely than not demonstrates the existence or non-existence of particular material facts. I have been informed that “preponderance of the evidence” is a lower standard than “clear and convincing evidence” (which requires a fact to be substantially more likely to be true

than untrue), or “beyond a reasonable doubt” (which is an exceedingly high standard that I understand is usually used in criminal matters).

19. Throughout my Declaration, I have applied the “preponderance of the evidence” standard.

B. Anticipation

20. I understand that for a single prior art reference to be anticipating under 35 U.S.C. § 102, it must disclose each element of the claim, arranged as set forth in the claim. If a reference fails to expressly disclose one or more elements of the patent claim, the claim is anticipated only if the missing elements are disclosed inherently in the reference.

21. To establish such inherency, the evidence must make clear to a person of ordinary skill in the art (“POSITA”) that the missing claim element is necessarily present in the prior art reference or is the inevitable outcome of the process or thing that is explicitly described in the prior art. Inherency may not be established by a possibility, or even probability, that a certain result may arise from a given set of circumstances.

22. I understand that, to anticipate a patent claim, a prior art reference must have an enabling disclosure. That is, the reference must provide sufficient

information to allow one skilled in the art to practice what is disclosed without undue experimentation.

23. I understand that in order to show that a particular “publication” is prior art, the “publication” must have been sufficiently accessible to the public interested in the art, and that dissemination and public accessibility are keys to determining whether a reference was “published” in this scene. Accessibility goes to the issue of whether interested members of the public could obtain the information if they wanted to.

24. I understand that a reference is “publicly accessible” upon a satisfactory showing that such document has been disseminated or otherwise made available so that persons interested and ordinarily skilled in the subject matter, exercising reasonable diligence, can locate it. By way of example, I understand that a document may not constitute a printed publication if a customary search would not have rendered the work reasonably accessible even to a person informed of its existence. In this context, I have been informed that the Copyright Office’s housing of a reference does not necessarily show that the reference was made available such that persons interested and ordinarily skilled in the subject matter or art, exercising reasonable diligence, can locate it.

C. Obviousness

25. I understand that a claim may be unpatentable as obvious under 35 U.S.C. § 103 if the subject matter described in the claim as a whole would have been obvious before the effective filing date of the claimed invention to a POSITA to which the claimed invention pertains.

26. I have been informed that, prior to considering the prior art, the claims are first analyzed to determine what subject matter the claims cover. I understand that the claims are read from a POSITA's perspective at the time of the alleged invention. I understand that the words of a claim are generally given their ordinary and customary meaning as understood by a POSITA in view of the entire patent specification in which they are present and the prosecution history of the patent.

27. I understand, nevertheless, that a claim's words may be given a meaning different than their plain and ordinary meaning if: (1) a patentee explicitly and unambiguously defined a term in a different manner as compared to its plain meaning; or (2) a patentee "disclaims" the full scope of a claim term's plain meaning, such as, by clearly and unambiguously stating during prosecution that a claim term does or does not encompass certain subject matter that may otherwise be encompassed by the plain words of the claim.

28. I have been informed that, after construing the claims, the teachings of the prior art are evaluated. I understand that the information that is used to evaluate whether an invention is new and not obvious is generally referred to as “prior art” and generally includes patents and printed publications (*e.g.*, books, journal publications, articles on websites, product manuals, etc.).

29. I understand that although the ultimate question of the obviousness analysis is a legal determination, obviousness is based on many factual inquiries, including: the prior art’s scope and content, the distinctions between the claimed subject matter and the prior art, the level of ordinary skill in the art at the time of the invention, and any “objective indicia” or “secondary considerations” of non-obviousness, which must all be considered.

30. I have been informed that, in ascertaining the scope and content of the prior art, a prior-art reference is deemed relevant if it falls within the field of the inventor’s endeavor, or if it is reasonably pertinent to the particular problem that the inventor was attempting to solve. I understand that a reference is reasonably pertinent if it logically caught an inventor’s attention in considering the problem sought to be solved.

31. I have been informed that, to evaluate the differences between the prior art references and the claimed subject matter, the claimed invention must be

considered as a whole. I understand that this involves demonstrating that a POSITA, facing the same problems as the inventor and without knowledge of the claimed invention, would have recognized the elements in the prior art and combined them in the claimed manner.

32. I understand that there are many rationales for combining prior-art references. For example, I have been informed that it is considered obvious to:

- combine prior-art elements according to known methods to yield predictable results;
- substitute one known element for another to obtain predictable results;
- use the prior-art elements in a predictable way according to their established functions;
- apply a known technique to a known device (method or product) ready for improvement to yield predictable results;
- choose from a finite number of identified, predictable solutions, with a reasonable expectation of success;
- or if there is some teaching, suggestion, or motivation in the prior art that would have led a POSITA to modify a prior-art reference or combine prior-art teachings to arrive at the claimed invention.

33. I understand, however, that a POSITA can come to the claimed invention for completely different reasons than the inventors and therefore does not need to have the same motivations or reasons to combine the prior art as the inventors.

34. I understand that when reviewing the prior art, the prior art cannot be combined or modified with “hindsight.” I have been informed that hindsight designates scenarios when the asserted patent is employed as a framework to pick and choose aspects from the prior art to arrive at the claims. I understand that hindsight also occurs when rationales are adopted that are identified by the patent-at-issue, but would not have been recognized by those in the art. Alternatively, I have been informed that the obviousness analysis is evaluated from the perspective of a POSITA, as of the critical date of the patent-at-issue and with all the prior art before them. I also understand that with this in mind, the analysis includes determining whether the POSITA would have independently arrived at the claimed invention without the help of the patent-at-issue for guidance.

D. Secondary Considerations

35. I understand that to evaluate obviousness, “objective indicia” or “secondary considerations” of non-obviousness must also be considered, and include, among a few others, whether: (1) there was a long-felt need for the claimed invention; (2) the claimed invention has attained commercial success; (3) others have copied the claimed invention; (4) others have attempted but failed to create the alleged invention; (5) there was praise of the invention in the field; and (6) there was skepticism that the claimed invention could be achieved.

E. Claim Construction

36. I understand that the claim construction exercise begins with the language of the claims themselves, and that the general rule is that claim terms are given their plain and ordinary meaning to a POSITA, in view of the specification of the patent, at the time of the invention. I also understand that the intrinsic evidence (*i.e.*, the claims, the written description including the figures, and prosecution history) are the primary sources used in interpreting claim language.

37. I understand that if disputed claim language is clear on its face, the intrinsic evidence should be consulted to determine whether some deviation from the ordinary meaning of the claim language is warranted.

38. When the disputed claim language is not clear on its face, I understand that the intrinsic evidence should be used to resolve, if possible, any lack of clarity. I also understand that the specification is the best evidence of what the patentee intended the term to mean when there is no clear meaning of a claim term, and that the prosecution history may also shed light on the meaning of ambiguous terms. However, I understand that it is improper to import limitations from the specification into a patent claim through claim construction.

39. I have been informed that sometimes the ordinary meaning of claim language as understood by a POSITA may be readily apparent even to lay persons.

I understand that claim construction in such cases involves little more than the application of the widely accepted meaning of commonly understood words.

40. Unless specifically stated otherwise in my analysis, I applied the plain and ordinary meaning to each term as understood by a POSITA.

IV. MATERIALS CONSIDERED

41. In addition to the materials considered in forming the opinions for my previous declaration here (*see* Ex. 2001), I also considered the following materials at the time I formed my opinions regarding the '204 Patent. Among those materials are the '204 Patent; the file history of the '204 Patent and certain prior art cited therein; the Petition for IPR that is the subject of this proceeding; the Declaration of Dr. Gary L. Woods appended thereto; and the Patent Trial and Appeal Board's decision granting institution of this IPR.

42. In addition to these materials, I also relied upon my extensive experience and expertise in designing, developing, and testing wireless charging devices and/or systems, including those using inductive charging techniques. In forming my opinions, I have also taken into account the knowledge and background principles that a POSITA would be familiar with, as well as my experience and training in the field of art.

V. LEVEL OF ORDINARY SKILL IN THE ART

43. I understand that patent claims are to be interpreted from the viewpoint of one of ordinary skill in the relevant art. I am informed that the factors to be considered in determining the level of ordinary skill in the art are: (1) the education level of active workers in the field; (2) the type of problems encountered in the art; (3) prior art solutions to those problems; (4) the speed with which innovations are made; and (5) the sophistication of the technology in the art.

44. I have been asked to assume that the relevant time period for determine the level of skill in the art for the '204 Patent is its earliest claimed priority date, March 17, 2008.

45. In my opinion, at the time of the '204 Patent, a POSITA would have a working knowledge of wireless charging and inductive charging. The person would have gained this knowledge through an undergraduate Bachelor of Science degree in electrical engineering, computer engineering, computer science, or a related field, with at least two years of experience working in the field of wireless or inductive charging device design, or testing of such wireless or inductive charging device testing, or an equivalent combination of academic study and work experience. More education (e.g., a Master's degree) or work experience any relevant field may compensate for a deficit in one of the relevant qualifications stated above.

46. I understand that Dr. Woods has asserted that “a POSITA would have had a bachelor’s degree or higher in electrical engineering, at least three years of experience designing or researching electronic circuits, and familiarity with power electronics and inductive power transfer circuits.” Ex. 1003 at ¶ 20.

47. As a result of my education and experience, under both definitions, I was at least a POSITA at the time of the ’204 Patent, and am still a person of at least ordinary skill in the art and have applied the perspective of a POSITA in my analysis.

VI. BACKGROUND

48. Before discussing my specific opinions, I will first review the ’204 Patent’s disclosure as it would have been viewed by a POSITA. My discussion describes only certain examples of the inventions discussed in the ’204 Patent, and my description here is in no way meant to suggest that the claimed inventions are limited to these examples. The inventions are limited only by the claims.

A. Overview of the ’204 Patent

49. The ’204 Patent is generally directed to an inductive power transmission system, wherein an inductive power outlet may include a primary inductive coil connected to a power supply, and a driver configured to apply an oscillating voltage across the primary coil. *See, e.g.*, ’204 Patent at 1:27-32. When an inductive power receiver is properly aligned with the power outlet, the primary

coil may form an inductive couple with a secondary coil contained in the power receiver. *See, e.g., id.* at 1:32-34, Claim 1 (28:25-45), Claim 10 (29:17-32).

50. The '204 Patent explains that the “strength of an induced voltage in the secondary inductor of an inductive couple varies according to the oscillating frequency of the electrical potential provided to the primary inductor.” *Id.* at 19:52-55. Accordingly, “[t]he induced voltage is strongest when the oscillating frequency equals the resonant frequency of the system.” *Id.* at 19:55-56.

51. The '204 Patent further explains that prior art systems would “typically transmit power at the resonant frequency of the inductive coupling,” which “can be difficult to maintain, as the resonant frequency of the system may fluctuate during power transmission, for example in response to changing environmental conditions or variations in alignment between primary and secondary coils.” *Id.* at 19:65-20:3.

52. Contrary to prior art systems, the '204 Patent proposes that the transmission frequency f_t be selected to lie within the linear or “near-linear” regions of a frequency-amplitude curve (per Figure 6b below), substantially apart from the resonance frequency f_R (or peak) of the inductive couple. *See, e.g., id.* at 21:56-57 (“Referring back to FIG. 6b, the frequency of the transmission is selected to be in the approximately linear region 8 of the curve between a lower frequency value of f_L and an upper frequency value of f_U .”); *id.* at 21:20-23 (“Preferably, the

transmission frequency is selected to lie within one of the near-linear regions of 6, 8 where the slope of the frequency amplitude-graph is less steep.”).

53. I note that regions 6 and 8 in Figure 6b are considered “near-linear” because visually, the curve look straight in those regions; mathematically, the slope in both regions is close to constant and does not vary greatly. In contrast, the regions (4a and 4b) near the resonant frequency are very non-linear: visually, neither looks like a straight line, and mathematically the slope of the curve near the resonant frequency changes greatly.

54. The ’204 Patent achieves near-linear operation by including within the power outlet a driver “configured and operable to transmit a driving voltage which oscillates at a transmission frequency which is **substantially different** from the resonant frequency of the inductive couple.” *Id.* at 21:17-20 (emphasis added).

55. This configuration results in a more predictable system based on the near-linear relationship between the transmission frequency and the operational voltage in this region.

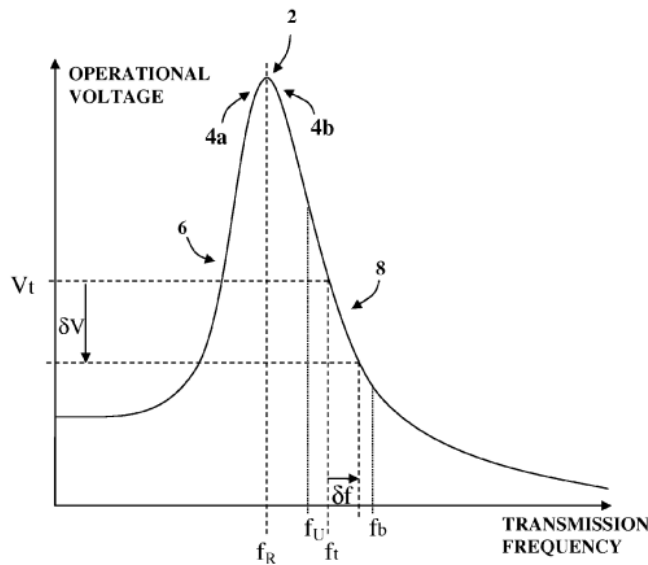


Fig. 6b

Id. at Fig. 6b.

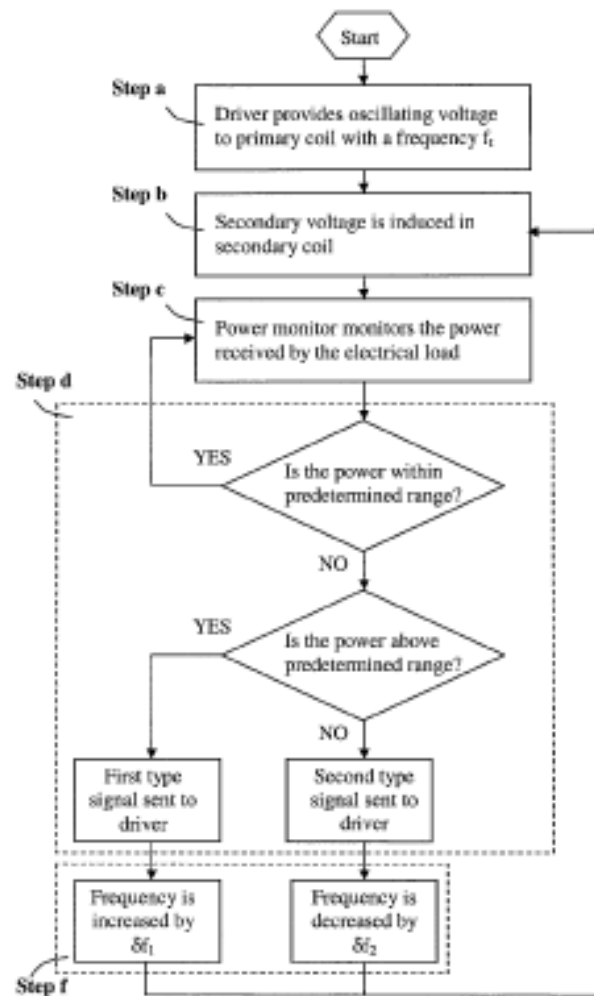
56. The '204 Patent explains, and I agree, that one “advantage of non-resonant transmission is that the transmission frequency may be used to regulate power transfer.” *Id.* at 21:47-49. The '204 Patent explains that in “known inductive transfer systems, power is typically regulated by altering the duty cycle of transmission voltage provided by the driver.” *Id.* at 21:49-51 (emphasis added). However, when a non-resonant transmission frequency is used, the driver “may be configured to adjust the transmission frequency in order to regulate the power transfer.” *Id.* at 21:52-55 (emphasis added).

57. For example, the improved driver in the '204 Patent’s proposed power outlet “may be configured to adjust the transmission frequency [in a linear or near-linear manner] in order to [predictably] regulate the power transfer.” *Id.* at 21:53-55.

In other words, the '204 Patent discloses a linear control technique for regulating power transfer in which “[t]he induced voltage can be increased by reducing the transmission frequency and can be reduced by increasing the transmission frequency.” *Id.* at 21:61-63; *see also id.* at 21:63-65 (explaining that “an increase in transmission frequency of δf produces a decrease in induced voltage of δV ”), Claim 1 (28:25-45), Claim 10 (29:17-32); Claim 13 (29:44-52).

58. A POSITA would appreciate that a linear control system is significantly easier to design and operate than one based on non-linear dynamics. Linear control systems operate predictably: if one parameter increases, for example, a corresponding parameter may go down by a linear, predictable amount. In a non-linear control system, if one parameter increases, for example, the corresponding parameter may go down, but not by a linear, easily predictable amount. This significantly complicates control system design and, importantly, makes determination and achievement of control loop performance and stability much more difficult. Control systems employed in systems like wireless charging need to be stable in order to operate reliably and not overheat or breakdown, as may occur in an unstable system. For these reasons, designers often prefer to design linear control systems when possible.

59. The '204 Patent provides an exemplary flowchart of a power regulation method in Figure 6d, below:



Id. at Fig. 6d; *see also id.* at 22:45-64. A POSITA would understand that the implementation of the power regulation method illustrated in Figure 6d may be implemented using (1) a series of transmitted feedback signals of a first type S_a to indicate to a driver that “the power received by the load is too high” and to “reduce[]” the power received “into the acceptable range, and (2) a series of

transmitted feedback signals of a second type S_b to indicate to a driver that “the power received by the load is too low” and to “increase[]” the power received “into the acceptable range. *Id.* at 22:65-23:5.

60. In contrast, prior art systems conducted power transfer at or near the resonant frequency, or non-linear power regulation through a “detuning” process that is initiated at or near resonant frequency. *See, e.g.*, Ex. 1002 at 104 (explaining that Malpas discloses that ““primary frequency tuning may be used to find the resonant frequency of the pick-up, after which primary voltage variation (or pick-up detuning) may be used to match power flow to immediate power need”” (quoting Ex. 1007 at 20-21)); *see also id.* at 63.

61. Since the operational voltage curve is not straight (i.e., is non-linear) near the resonance frequency, a small change in frequency may, if the original frequency is very close to the resonant frequency, produce a very small change in voltage, whereas if the original frequency is slightly further away from the resonant frequency, a larger change in voltage may be produced. This non-linear response makes control design significantly more challenging, and is in direct contrast to the ’204 Patent, which specifically operates in the near-linear region.

B. Relevant Aspects of the '204 Patent's Prosecution History

62. I have reviewed the prosecution history for the '204 Patent, which contains a number of relevant statements pertaining to both the deficiencies in the prior art, as well as the benefits of the inventions described and claimed in the '204 Patent.

63. On September 30, 2014, the Examiner issued a non-final office action that, among other things, rejected all claims under (1) 35 U.S.C. § 112 as indefinite, and (2) 35 U.S.C. § 103 as obvious based on WO 2006/031133 (Ex. 1007, “Malpas”). Ex. 1002 at 119-120.

64. In a response filed December 30, 2014, the Applicant amended claim 1 to require:

said driving voltage oscillating at a non-resonant transmission frequency ~~significantly different from~~higher than said characteristic resonant frequency of said inductive couple.

...

provide less power by increasing ~~increase~~ said non-resonant transmission frequency by an incremental value when said first signal is detected by the detector, and

provide more power by decreasing ~~decrease~~ said non-resonant transmission frequency by an incremental value when said second signal is detected by the detector.

Ex. 1002 at 96 (emphasis in original).²

65. In doing so, the Applicant distinguished between the power outlet's selected transmission frequency (f_t) and the characteristic resonant frequency of the inductive couple (f_R), addressed above:

As a first matter, Applicant notes that as currently amended claim 1³ recites **two different frequencies**:

² Claim 10 was similarly amended, in relevant part, to recite:

providing an oscillating voltage to said primary inductive coil at an initial transmission frequency f_t ~~which is substantially different from~~ higher than a characteristic resonant frequency f_R of the system.

Ex. 1002 at 98 (emphasis in original). Likewise, Claim 13 was amended, in relevant part, to recite:

said driver reducing said non-resonant transmission frequency by an incremental value df_1 when the received feedback signal is of the first type S_a , and

said driver increasing said non-resonant transmission frequency by an incremental value $+df_2$ when the received feedback signal is of the second type S_b .

Ex. 1002 at 98 (emphasis in original).

³ Any arguments or explanations asserted by the Applicant are equally applicable to claim 10. Ex. 1002 at 104-105.

- 1) a “**transmission frequency**” – this being the rate at which the switching unit of the driving circuit produces the oscillating driving voltage, and
- 2) a “**characteristic resonant frequency** of the inductive couple” – this being the natural frequency of oscillation of the inductive couple formed between the primary coil and the secondary coil, which is also the frequency at which the amplitude of voltage induced in the secondary coil peaks.

Id. at 103 (emphases added).

66. Emphasizing the point, the Applicant elaborated that “these two frequencies do not have the same value,” and highlighted claim 1’s express requirement that the “transmission frequency is **different** from the characteristic resonant frequency of said inductive couple.” *Id.* at 103 (emphasis added).

67. The Applicant also distinguished the amended claim from the Malpas reference, which teaches using a transmission frequency that is at or near resonant frequency:

A person having ordinary skill in the art, upon reading Malpas, would have understood that in order to transmit power to a remote pick-up, it would be necessary to use a transmission frequency ***at or near to the resonant frequency of the pick-up*** (as opposed to the invention recited in instant claim 1, wherein the transmission frequency is selected to be different from the characteristic frequency

of the inductive couple formed between the primary and secondary coils).

Id. at 104 (emphasis in original). Accordingly, the Applicant argued that Malpas teaches away from claim 1 of the '204 Patent:

Malpas *teaches away from* the invention . . . in which the transmission frequency [in the '204 Patent] is deliberately selected to be substantially different from the characteristic resonant frequency of the inductive couple.

Id. at 104 (emphasis in original).

68. On January 20, 2015, the Examiner issued a final office action, maintaining the Malpas obviousness rejection. Ex. 1002 at 78-85. On February 26, 2015, the Applicant conducted an Examiner Interview to discuss the “higher than” claim term. *Id.* at 69. An agreement was reached “that the ‘substantially different’ regarding the driving per Figure 6B and the specification [0160+] would overcome the art of record.” *Id.*

69. In an April 2, 2015 response, the Applicant further amended claim 1, in relevant part to recite:

said driving voltage oscillating at a non-resonant transmission frequency ~~higher than~~ substantially different from said characteristic resonant frequency of said inductive couple.

Ex. 1002 at 56 (emphasis in original).⁴

70. Accordingly, the Applicant argued that “Malpas *teaches away from* the invention . . . in which the transmission frequency [in the ’204 Patent] is deliberately selected to be substantially different from the characteristic resonant frequency of the inductive couple.” Ex. 1002 at 63 (emphasis in original).

71. The Applicant further emphasized that “Malpas describes the need for first tuning the frequency on the primary side to match the pick-up, even when the pick-up is subsequently detuned . . . to control power” and that Malpas “is selected to be as close as possible to the resonant natural frequency of the pick-up,” even though it may later be detuned to match the power flow of an immediate power need. *Id.* at 63.

72. As explained in greater detail below, I agree with the Applicant’s characterization of Malpas in relation to the claims of the ’204 Patent.

⁴ Claim 10 was similarly amended, in relevant part, to recite:

providing an oscillating voltage to said primary inductive coil at an initial transmission frequency f_t ~~higher than~~ substantially different from a characteristic resonant frequency f_R of the system.

Ex. 1002 at 57 (emphasis in original).

73. Malpas teaches of a resonant inductively coupled system that can sweep the transmission frequency from a lower frequency to a higher frequency, or vice versa, until the receiver indicates it has been energized:

[T]he primary supply can perform a frequency sweep from a low frequency to a higher frequency, or vice versa, until feedback shows that the pick-up has been energized

Malpas at 16:27-28 (Ex. 1007 at 17).

74. This is likely suggested, as the largest amount of power transfer to the receiver will occur at the resonance frequency of the system. Malpas, however, does not disclose operation at a frequency that is substantially different from the resonant frequency. In fact, Malpas specifically describes operation near the resonant frequency:

From the feedback provided by the biosensor the primary can lock onto a resonant, or near resonant, frequency of the pick-up and control the power available to it

Id. at 16:28-30

75. Here, Malpas expressly states that regular power transmission will occur at the resonant, or near-resonant frequency. This is specifically described in the '204 Patent as being in a non-linear region, and thus, is not “substantially different” from the resonant frequency.

76. In the April 2, 2015 response, addressing a subsequent office action maintaining the Malpas obviousness rejection, the Applicant clarified that “**substantially different** from said characteristic resonant frequency” refers to the “near-linear” regions of a frequency-amplitude graph:

The claims must be interpreted in light of the specification as they would be understood by one of ordinary skill in the art. As such, one having ordinary skill in the art would appreciate that the term “*substantially different from said characteristic resonant frequency*” recited in claims 1 and 17,⁵ in view of at least Fig. 6b, should be interpreted **to mean that the frequency of the driving voltage is selected so as to lie within one of the near-linear regions of a frequency-amplitude graph associated with the inductive couple.**

Ex. 1002 at 62 (emphasis added). In doing so, the Applicant highlighted Paragraph [0161] of the pending application (now column 21, lines 15-23) and Figure 6b:

It is a particular feature of embodiments of the current invention that the driver 6230 (FIG. 6 a) is configured and operable to transmit a driving voltage which oscillates at a **transmission frequency which is substantially different from the resonant frequency of the inductive couple. Preferably the transmission frequency is**

⁵ Based on the context of the Applicant’s remarks, it appears the Applicant intended to refer to claim 10 and not claim 17.

selected to lie within one of the near- linear regions 6, 8 where the slope of the frequency-amplitude graph is less steep.

'204 Patent at 21:16-23 (emphasis added).

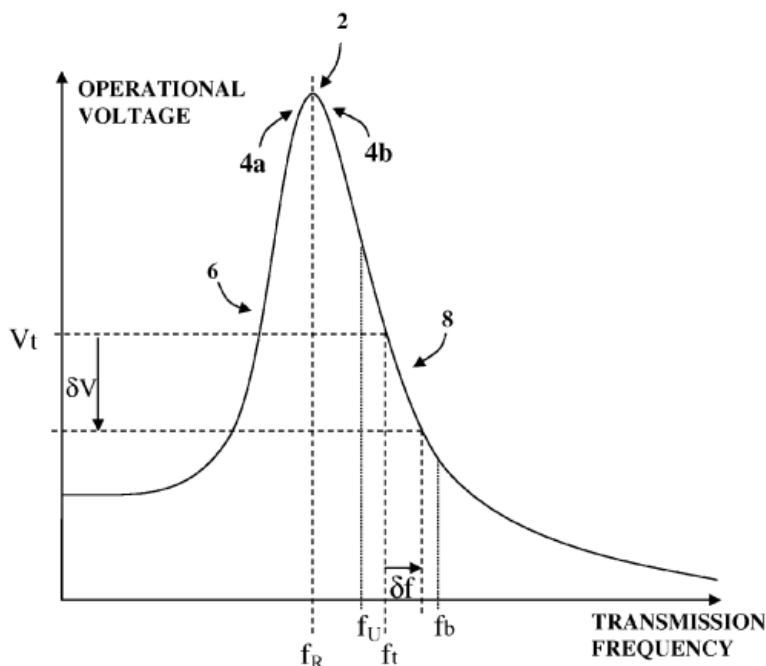


Fig. 6b

Id. at 6b.

77. As explained in greater detail below, I agree with the Applicant's characterization of the claim term "transmission frequency substantially different from said characteristic resonant frequency."

78. For example, I agree that a POSITA would have interpreted the term, based on the specification and the stated goals of the '204 Patent, as referring to the

linear or near-linear regions of a frequency-amplitude graph, as for example, shown in Figure 6B of the '204 Patent.

79. In addition to ensuring greater predictability with respect to induced voltage, as per above, these regions would ensure predictable adjustments in power by way of incremental increases and decreases in transmission frequency, which as a practical matter, cannot occur (in a predictable and reliable manner) if any portion of the operable transmission frequency range is at or even near the resonant frequency f_R . In other words, operation in this region allows for a linear control design.

C. Overview of the Relied-Upon References

80. The four references relied upon by Petitioner to challenge the patentability of claims 1-6, 8, and 10-13 of the '204 Patent are summarized as follows:

1. Onishi (Ex. 1004)

81. U.S. Patent Pub. 2008/0197804 (“Onishi”) is entitled “Power Transmission Control Device, Power Reception Control Device, Non-Contact Power Transmission System, Power Transmission Device, Power Reception Device, and Electronic Instrument.” Onishi was filed on February 15, 2008 and was

published on August 21, 2008. Onishi claims priority to Japanese Patent Application 2007-036745, filed on February 16, 2007.

82. Onishi is directed to “[a] power transmission device [that] performs power-saving power transmission [and] that transmits a small amount of power as compared with normal power transmission when the power transmission device has detected that a battery of a load has been fully charged so that the operation of a charge control device (charge control IC) of the load is maintained, thereby enabling recharging due to a charge management function of the charge control device.” Ex. 1004 at Abstract. When recharging starts “the load state of a power reception device increase” and “the power transmission device detects an increase in the load state and changes power transmission from power-saving power transmission to normal power transmission.” *Id.* In contrast, when the power-saving power reception device is “removed during power-saving power transmission, the power transmission device detects that the power reception device has been removed, and stops continuous power transmission so that unnecessary power consumption does not occur.” *Id.*

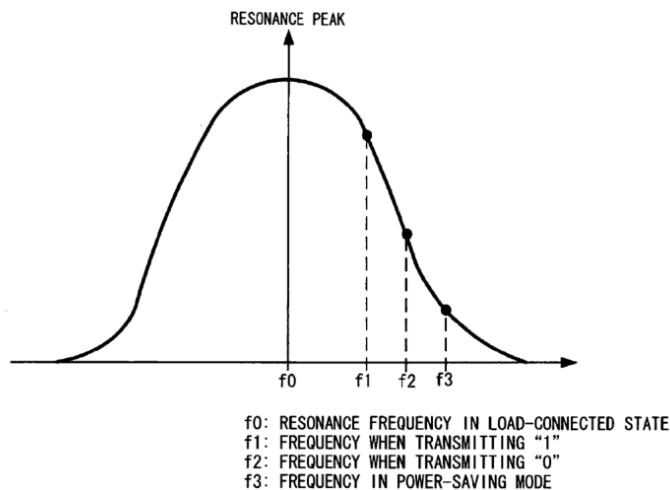
83. Specifically, Onishi discloses a figure for illustrating the “Frequency Used in Power-Saving Mode” that “show[s] the resonance characteristics of the **induction coil** and applications of frequencies,” where “the horizontal axis indicates

the frequency, and the vertical axis indicates the resonance peak value. *Id.* at [0179]-[0180]. Onishi explains that:

[T]he frequency f_1 is a frequency used when transmitting “1” during normal power transmission. The frequency f_1 is a basic frequency during power transmission. The frequency f_2 is a frequency used when transmitting “0” (see FIGS. 3A and 3B). A frequency f_3 is a frequency used in the power-saving mode. As is clear from FIG. 4, the relationship “ $f_1 > f_2 > f_3$ ” is satisfied.

Id. at [1081].

FIG. 4



Id. at FIG. 4 (illustrating the relationship $f_3 > f_2 > f_1$).

2. Purdy (Ex. 1005)

84. U.S. Patent Pub. 2007/0236169 (“Purdy”) is entitled “Battery Charger for Portable Devices and Related Methods.” Purdy was filed on June 14, 2007 and

was published on October 11, 2007. Purdy claims priority to U.S. Patent Application No. 10/776,426, filed on February 11, 2004.

85. Purdy is directed to “a battery charger that may be used with numerous types of portable devices and associated batteries, and yet which may account for differences between the charging parameters thereof.” Ex. 1005 at [0007]. For example, Purdy discloses that “different types of batteries may have different voltage and/or current limits than one another, and different devices may similarly have different voltage and/or current limits as well.” *Id.* at [0009]. Thus, a controller may be used to “advantageously select one or more actual charging parameters to charge the rechargeable battery based upon a comparison of the different portable device and battery charging parameters to avoid damaging one or the other.” *Id.* at [0009].

86. Specifically, the controller disclosed in Purdy may, for example, be configured to: “cause the portable device to identify a battery charge level of the rechargeable battery,” *id.* at [0011]; “select an actual charging parameter such as charging time based upon the charge level of the battery and a maximum charging time for the battery,” *id.* at [0011]; or “provide[] identification signal[s],” *id.* at [0031].

87. Unlike the '204 Patent, Purdy does not disclose or relate “to inductive electrical power transfer.” '204 Patent at 1:19-20. Rather, Purdy is directed to a

“charger 23 [that] . . . includes a **charger connector 24** to be coupled to a corresponding device connector 25 of the portable device 21,” as illustrated below in Figure 1. EX1005 at [0024] (emphasis added); *see also id.* at [0026] (explaining that “the portable device 21 may be a USB compatible device, and the device connector 25 a USB connector”).

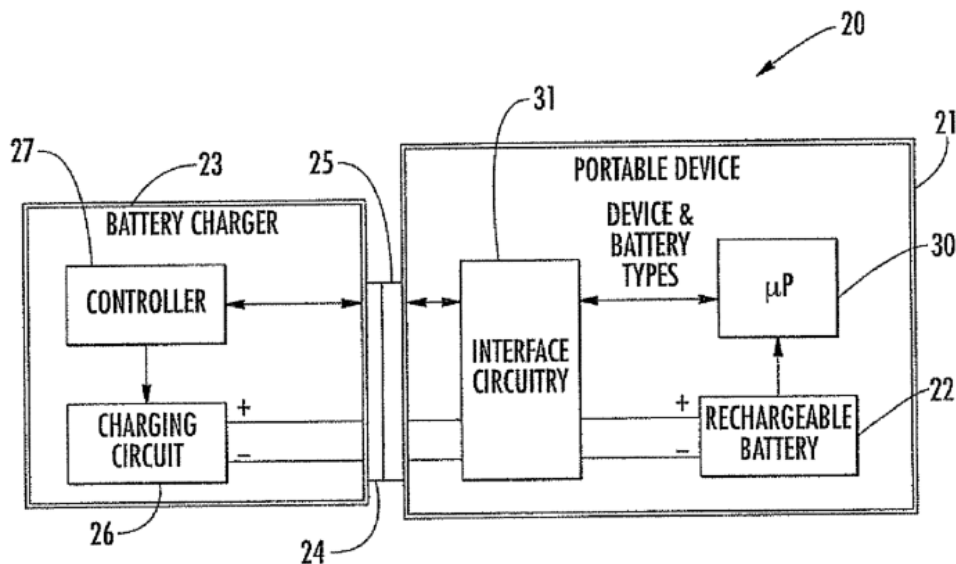


FIG. 1

Purdy at FIG. 1.

3. Baarman392 (Ex. 1006)

88. U.S. Patent Pub. 2008/0079392 (“Baarman392”) is entitled “System and Method for Inductively Charging a Battery.” Baarman392 was filed on September 14, 2007 and was published on April 3, 2008. Baarman392 claims

priority to U.S. Provisional Application No. 60/827,586, filed on September 29, 2006.

89. Baarman392 describes an inductive charging system designed to charge batteries, particularly those with nonlinear charging profiles such as Li-Ion batteries, using a primary and secondary coil setup. Ex. 1006 at [0032]. The system includes a charger circuit with a primary coil and a secondary circuit with a secondary coil, which receives power inductively from the primary coil. *Id.* The charger circuit features a frequency controller that adjusts the frequency of the power applied to the primary coil based on feedback from the secondary circuit. *Id.* This feedback mechanism helps optimize the charging process and prevent overcharging in order to maintain the health and longevity of Li-Ion batteries. *Id.* at [0002].

90. Baarman392 further describes adjusting the operating frequency of the inductive pair in response to the feedback. While power transfer is at its highest when operating at resonance, such as in a tightly coupled system, Baarman392 describes that when the primary coil and the secondary coil are loosely coupled, “significant power transfer can occur when the inverter is operating off-resonance.” *Id.* at [0038]. For example, when a feedback signal is not received, then Baarman392 will decrease the frequency, moving the system towards resonance. *Id.* at [0055]. So long as no feedback signal is received, then “the frequency is repeatedly reduced

[moving closer to resonance] so as to maximize power transfer to the battery” (at resonance). *Id.* at [0058]; *see also id.* at [0038]. Accordingly, the operating frequency can be adjusted based on feedback from the secondary coil.

4. Tocci (Ex. 1009)

91. Ronald J. Tocci, et al., *Digital Systems: Principles and Applications*, Pearson Education International, 10th Edition (2007) (“Tocci”) is a textbook directed to the principles of digital systems.

92. Part of Tocci’s book is dedicated to explaining Boolean algebra. *See, e.g.,* Ex. 1009 at 18. Tocci describes the use of Boolean variables to represent the voltage levels present on wires or at the input/output terminals of a circuit. This binary representation simplifies the design and analysis of digital circuits because it abstracts away the exact voltage values, focusing instead on the logical state (*e.g.,* HIGH or LOW). *Id.*

93. Tocci also discloses the use of Boolean algebra to describe and analyze logic gates, such as OR, AND, and NOT. *Id.* The relationship between the inputs and outputs of these gates is often represented using truth tables. *Id.* A truth table lists all possible combinations of input values and the corresponding output values for a given logic circuit. *Id.*

VII. CLAIM CONSTRUCTION

94. As explained above, I understand that the claim construction begins with the language of the claims themselves, and that the general rule is that claim terms are given their plain and ordinary meaning to a POSITA, in view of the specification of the patent, at the time of the invention.

A. “transmission frequency substantially different from said characteristic resonant frequency of said inductive couple”

95. In my opinion, a POSITA would have—given the specification and prosecution history—interpreted “transmission frequency substantially different from said characteristic resonant frequency of said inductive couple” as referring to a transmission frequency that lies within the near-linear regions of a frequency amplitude graph (e.g., regions 6 and 8 of Figure 6b). A POSITA would have also interpreted the term such that the transmission frequency may be incrementally adjusted (increased or decreased/reduced) while remaining in the near-linear regions of a frequency-amplitude graph (e.g., regions 6 or 8 of Figure 6b). As explained above, operating outside of the near-linear region would result in a less predictable system and obviate the purpose of selecting an initial transmission frequency f_t in the near-linear region in the first place.

96. I base these opinions on my review of the '204 Patent, including its claims, specification, figures, file history, and my knowledge and experience as a POSITA.

1. Claims and Specification

97. Claim 1 recites in relevant part:

said driving voltage oscillating at a non-resonant **transmission frequency substantially different** from said characteristic resonant frequency of said inductive couple.

'204 Patent at 28:43-46 (emphasis added). Claim 10 similarly recites in relevant part:

providing an oscillating voltage to said primary inductive coil at an initial **transmission frequency ft substantially different** from a characteristic resonant frequency f_R of the system.

Id. at 29:21-24 (emphasis added).

98. As an initial matter, it is plain from the claim language itself that the transmission frequency must be meaningfully different from the characteristic resonant frequency of the inductive couple. A POSITA would also presume this difference to serve a purpose, e.g., over a transmission frequency that is simply “different” from the resonance frequency. The specification states the purpose and goal of this requirement quite clearly, namely, to avoid operating at or near the resonance peak to mitigate against large unintended fluctuations in induced voltage.

See, e.g., id. at 19:65-20:3, 21:1-15, 24:17-25. Such fluctuation may occur, for example, at transmission frequencies located in regions 4a or 4b of the frequency-amplitude graph depicted in Figure 6b. *Id.* at 21:1-15.

99. Accordingly, the specification teaches operating in the near-linear regions of a frequency-amplitude graph (e.g., regions 6 or 8 in Figure 6b). One of the benefits to operating in these regions is that incremental adjustments (increases or decreases/reductions) in the transmission frequency result in predictable adjustments to the induced voltage, represented by δV achieved by adjusting the transmission frequency by δf in Figure 6b. *See, e.g., id.* at 21:63-65 (explaining that “an increase in transmission frequency of δf produces a decrease in induced voltage of δV ”).

100. Next, in discussing Figure 6b, the '204 Patent explains:

[T]he frequency of transmission is selected to be in the **approximately linear region 8** of the curve between a lower frequency value of f_L , and an upper frequency value of f_U . A transmission frequency f_t , higher than the resonant frequency f_R of the system, produces an inducted voltage of V_t . The induced voltage can be increased [incrementally] by [incrementally] reducing the transmission frequency and can be [incrementally] reduced by [incrementally] increasing the transmission frequency. For example,

an increase in transmission frequency of δf produces a decrease in induced voltage of δV .

Id. at 21:56-65 (emphases added); *see id.* at 22:61-64 (“If the received feedback signal is of the first type S_a , then the transmission frequency is increased by an incremental value $+\delta f_1$. If the received feedback signal is of the second type S_b , then the transmission frequency is decreased by an incremental value $-\delta f_2$.”).

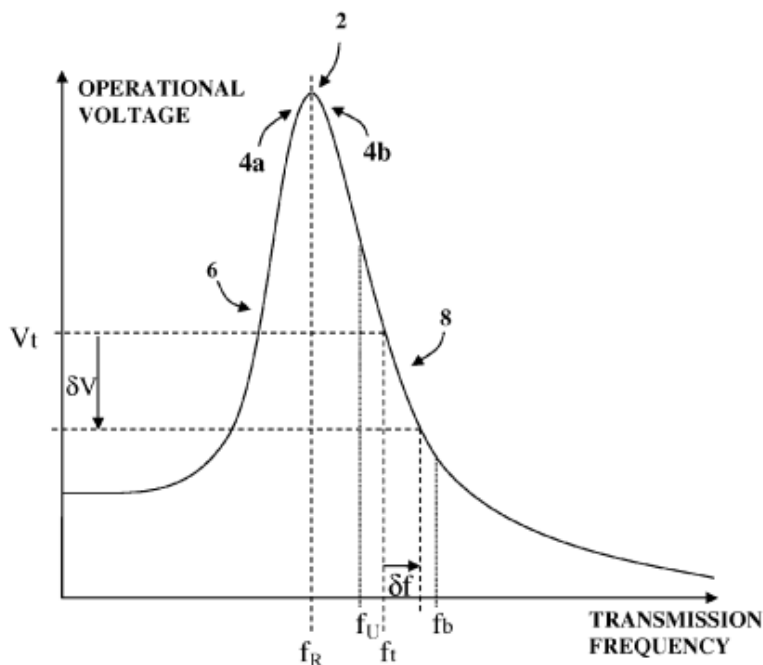


Fig. 6b

Id. at Fig. 6b.

101. Notably, a POSITA would understand that frequency f_U on Figure 6b is the lower bound frequency in the approximately linear region 8, which also corresponds to the frequency that yields the upper bound of the operational voltage,

while frequency f_b on Figure 6b is the upper bound frequency in the approximately linear region 8, which also corresponds to the frequency that yields the lower bound of the operational voltage. A POSITA would understand that f_L and f_b may be regarded as referring to the same thing and may be used interchangeably.

102. Finally, claim 1 of the '204 Patent further requires:

[1.7] said driver is configured to: provide less power by increasing said non-resonant transmission frequency by an incremental value when said first signal is detected by the detector, and

[1.8] provide more power by decreasing said non-resonant transmission frequency by an incremental value when said second signal is detected by the detector.

Id. at 28:41-45.⁶ In other words, the driver is configured to increase/decrease the non-resonant transmission frequency that is substantially different from said characteristic resonant frequency of said inductive couple (*i.e.*, a frequency that lies within the near-linear region of a frequency-amplitude graph). In reading claim 1 as

⁶ Claim 13 of the '204 Patent similarly recites that “the step of said driver adjusting said non-resonant transmission frequency further comprises: said driver reducing said non-resonant transmission frequency by an incremental value df_1 when the received feedback signal is of the first type S_a , and said driver increasing said non-resonant transmission frequency by an incremental value $+df_2$ when the received feedback signal is of the second type S_b .” *Id.* at 29:44-52.

a whole, a POSITA would understand that the '204 Patent is directed to a linear control technique for predictably regulating power transfer.

103. Accordingly, a POSITA would appreciate that the transmission frequency f_t should be selected such that (1) it lies within a near-linear region of an associated frequency-amplitude graph, and (2) such that there is some room for the incremental fluctuation of the transmission frequency (δf) without incurring large unpredictable fluctuations of induced voltage. *See* Ex. 1003 at ¶ 40 (“Based on my review, the specification and file history confirm that a transmission frequency ‘substantially different’ from a characteristic resonant frequency as claimed must at least encompass the frequencies within one of the near-linear regions of the frequency-amplitude graph.”).

2. Prosecution History

104. The prosecution history only reinforces the foregoing interpretation.

105. Per above, and as acknowledged by Dr. Woods, the Applicant explained during prosecution that a POSITA “would appreciate that the term ‘*substantially different from said characteristic resonant frequency*’ recited in claims 1 and 17,⁷ in view of at least Fig. 6b, should be interpreted **to mean that the**

⁷ Based on the context of the Applicant’s remarks, it appears the Applicant intended to refer to claim 10 and not claim 17.

frequency of the driving voltage is selected so as to lie within one of the near-linear regions of a frequency-amplitude graph associated with the inductive couple.” Ex. 1003 at ¶ 39 (quoting Ex. 1002 at 62) (emphasis added).

106. Per above, I agree that a POSITA would interpret “substantially different from said characteristic resonant frequency” in this manner. I note that this argument was made in the context of distinguishing claims 1 and 10 of the ’204 Patent over the Malpas prior art reference. Ex. 1002 at 62-63.

107. Malpas, as explained by the Applicant, discloses selecting a transmission frequency that is “at or near to the resonant frequency” of each target pick-up, and subsequently detuning the pick-up to operate at a non-resonant frequency. *Id.* at 63, 104.

108. Malpas does not, however, disclose operation in the near-linear region because it does not disclose a linear control scheme.

109. Accordingly, in my opinion, Malpas is generally consistent with the prior art systems addressed in the specification of the ’204 Patent; namely, they are configured to operate at some point at or near resonance, and as a result are subject to large fluctuations in induced voltage:

FIG. 6*b* is a graph showing how the amplitude of the operational voltage varies according to the transmission frequency. It is noted that the voltage is at its highest when the transmission frequency is

equal to the resonant frequency f_R of the system, this maximum amplitude is known as the resonance peak 2. It is further noted that the slope of the graph is steepest in the regions 4a, 4b to either side of the resonance peak 2. Thus in inductive transfer systems, which operate at or around resonance, a small variation in frequency results in a large change in induced voltage. Similarly, a small change in the resonant frequency of the system results in a large change in the induced voltage. For this reason prior art inductive transfer systems are typically very sensitive to small fluctuations in environmental conditions or variations in alignment between the induction coils.

'204 Patent at 21:1-15 (emphasis added).

110. It is my opinion that a driver that generally operates at or near resonance would be outside the scope of claims 1 and 10 (even if there are limited instances in which near linear transmission frequencies are used). As stated above, and consistent with prior art systems, including the Malpas reference, a POSITA would recognize such systems as lacking the predictability that the claims of the '204 Patent purport to provide.

3. Board's Preliminary Decision to Institute Review of the '204 Patent

111. In its decision to institute review of the '204 Patent, the Board preliminarily held:

On this record and for purposes of this decision, we determine that—consistent with the Specification’s description of the frequency that is “[p]referably . . . selected” and applicant’s argument regarding the same during prosecution—“a non-resonant transmission frequency *substantially different* from said characteristic resonant frequency of said inductive couple” encompasses frequencies that lie within one of the near-linear regions of a frequency-amplitude graph associated with the inductive couple. *See* Ex. 1001, 21:20-24; Ex. 1002, 70. At this time and for purposes of this Decision, we need not and do not reach the issue of the outer bounds of the scope of “substantially different.”

Paper 7 at 26. The Board further explained—in reference to the ’204 Patent’s discussion of the added benefit of “linear control”—that “Patent Owner has not explained adequately why such a benefit should be read into the claim term ‘substantially different,’ particularly where the quoted Specification support does not explicitly mention linear regulation.” *Id.* at 26.

112. While the ’204 Patent does not use the phrase “linear regulation” or “linear control,” a POSITA would understand this benefit as a central aim of the ’204 Patent. For example, in the summary section of the ’204 Patent, it explains:

It is another **aim of the invention** to present an inductive power transfer system comprising at least one inductive power outlet comprising at least one primary inductive coil wired to a power

supply via a driver; the primary inductive coil for forming an inductive couple with at least one secondary inductive coil wired to an electric load, the secondary inductive coil associated with an inductive power receiver wherein the driver is configured to provide a driving voltage across the primary inductive coil, **the driving voltage oscillating at a transmission frequency significantly different from the resonant frequency of the inductive couple.** Optionally, the driver comprises a switching unit for intermittently connecting the primary inductive coil to the power supply.

Preferably, **the transmission frequency lies within a range in which induced voltage varies approximately linearly with frequency.** Optionally, **the driver is configured to adjust the transmission frequency in response to the feedback signals.**

'204 Patent at 4:1-17 (emphases added); *see also id.* at 22:45-64 (providing one example of a “power regulation method”). Figure 6d in the '204 patent then goes on to explain the power regulation method, showing that the power monitor monitors the power received by the electrical load, and uses this signal in a feedback loop to adjust the operational frequency by incremental amounts. A POSITA would understand this as a classic linear regulation scheme, and a key aim of the '204 Patent.

4. Conclusion on Claim Construction

113. A POSITA would understand that the selection of a transmission frequency within the near-linear regions of a frequency-amplitude graph (*i.e.*, selection of a transmission frequency that is substantially different from the characteristic resonant frequency) will enable a linear control technique for predictably regulating power transfer. Thus, a POSITA would define claim 1's and claim 10's "transmission frequenc[ies] [that are] substantially different from [the] characteristic resonant frequency" to: (1) encompasses frequencies that lie within one of the near-linear regions of a frequency-amplitude graph associated with the inductive couple, and (2) allow for some incremental change (increase or decrease) in frequency while remaining in one of the near-linear regions of the frequency-amplitude graph. A POSITA would further appreciate that (3) a system that has the equivalent of a pick-up frequency that is at or near the resonant frequency is distinguishable from claims 1 and 10 of the '204 Patent.

114. This interpretation is consistent with the power regulation and transmission frequency optimization advantages disclosed in '204 Patent. That is, selection of a transmission frequency within the near-linear regions of a frequency-amplitude graph will enable a linear control technique for predictably regulating power transfer.

B. “provide [less/more] power by [increasing/decreasing] said non-resonant transmission frequency by an incremental value” / “[reducing/increasing] said non-resonant transmission frequency by an incremental value [df1/+df2]”

115. In my opinion, a POSITA would have interpreted both (1) “provide [less/more] power by [increasing/decreasing] said non-resonant transmission frequency by an **incremental value**” and (2) “[reducing/increasing] said non-resonant transmission frequency by an **incremental value** [df1/+df2]” consistent with their plain and ordinary meanings.

116. I base this opinion on my review of the ’204 Patent, including its claims, specification, figures, file history, relevant extrinsic evidence (*e.g.*, technical and non-technical dictionaries available to a POSITA at the time of the ’204 Patent), and my knowledge and experience as a POSITA.

1. Claims and Specification

117. Claim 1 recites in relevant part:

provide less power by increasing said non-resonant transmission frequency by an **incremental value** when said first signal is detected by the detector, and

provide more power by decreasing said non-resonant transmission frequency by an **incremental value** when said second signal is detected by the detector.

’204 Patent at 28:40-45 (emphasis added). Claim 13 similarly recites in relevant part:

said driver reducing said non-resonant transmission frequency by an **incremental value df1** when the received feedback signal is of the first type Sa, and

said driving increasing said non-resonant transmission frequency by an **incremental value +df2** when the received feedback signal is of the second type Sb.

Id. at 29:47-52 (emphasis added).

118. I understand that all claim terms are presumed to have meaning. Thus, the use of the term “incremental” in relation to the adjusted transmission frequency is presumed to mean more than simply increasing or decreasing (reducing) the transmission frequency. While the specification does not explicitly define the term “incremental,” it does provide helpful context:

One example of a power regulation method using simple feedback signals is shown in the flowchart of FIG. 6d. The method involves the following steps: (a) The driver **6230** provides an oscillating voltage at a transmission frequency f_t which is higher than the resonant frequency f_R of the system; (b) A secondary voltage is induced in the secondary coil **6320**; (c) A power monitor in the secondary unit **6300**, monitors the power received by the electric load **6340**; (d) If the power received by the electric load **6340** lies within a predetermined range then no action is taken. If the power received by the electric load **E340** is below the predetermined range,

then a feedback signal of a first type S_a is sent to the driver. If the power received by the electric load **6340** is above the predetermined range, then a feedback signal of a second type S_b is sent to the driver; (e) A feedback signal is received by the driver **6230**; (f) **If the received feedback signal is of the first type S_a , then the transmission frequency is increased by an incremental value $+\delta f_1$. If the received feedback signal is of the second type S_b , then the transmission frequency is decreased by an incremental value $-\delta f_2$.**

It is noted that by using the power regulation method described above, when the power received by the load is too high, **a series** of feedback signals of the first type S_a will be transmitted until the power is reduced into the acceptable range. Likewise when the power received by the load is too low, **a series** of feedback signals of the second type S_b will be transmitted until the power is increased into the acceptable range. **It is noted that the positive incremental value δf_1 may be greater than, less than or equal to the negative incremental value δf_2 .**

Id. at 22:45-23:7 (emphases added); *see* Ex. 2013 at 42:24-43:5 (acknowledging that '204 Patent at 22:45-23:7 “provides context for how the term ‘incremental’ is used in the '204 Patent”).

119. In my opinion, the above is entirely consistent with how a POSITA would use and interpret the term “incremental.”

120. Per above, the specification provides an example in which a power monitor in the secondary device continuously monitors power received by the electric load. If it is determined that the power is not within a predetermined “acceptable” range, a feedback signal (S_a or S_b) is sent to the driver, and the transmission frequency is increased or decreased by an incremental value. This process repeats itself, per Fig. 6d, until the monitored power is within “the acceptable range.”

121. In other words, a “series of feedback signals” (S_a or S_b) is sent to the driver, resulting in **a series of incremental increases/decreases** in transmission frequency, until the power has been adjusted to be within “the acceptable range.”

122. Additionally, in the embodiment above, the incremental increases and decreases to the transmission frequency are denoted by the lowercase delta symbols $+\delta$ and $-\delta$, respectively. Both are commonly understood in engineering and mathematics to represent small, gradual changes to variables. Math Centre, *Symbols* (June 4, 2023) (Ex. 2014) (“We sometimes refer to δx as an increment in x . For example if the value of x changes from 3 to 3.01 we could write $\delta x = 3.01 - 3 = 0.01$.”).

2. Relevant Extrinsic Evidence

123. This usage of “incremental” is consistent with how a POSITA would interpret the term, as it connotes a series of small adjustments (*e.g.*, $+\delta f_1$ or $-\delta f_2$) for gradually reaching a particular value (or frequency range in this instance), as opposed to outright selection of that value. *See* Ex. 2013 at 44:24-45:10 (“Q. My question was what would it be mean in the ’204 patent merely to state that the transmission frequency is increased or decreased in response to a feedback signal without using the term ‘incremental value.’ A. The delta F is still there but the word ‘incremental’ is gone. Q. Correct. A. Then I guess a POSITA would have some – would be less certain about what magnitude is expected for delta F1.”). A POSITA would not recognize the latter as involving the increase or decrease in frequency by one or more “incremental” values—only the former, per Fig. 6d. *See, e.g.*, The American Heritage Dictionary of the English Language 889 (Houghton Mifflin Co., 4th ed. 2006) (Ex. 2006) (“increment . . . 5. *Mathematics* A small positive or negative change in the value of a variable.”); Collins English Dictionary 824 (HarperCollins Pub., 7th ed. 2005) (Ex. 2007) (“increment . . . 1 an increase or addition, esp one of a series”); Wiley Electrical and Electronics Engineering Dictionary 365 (IEEE Press 2004) (Ex. 2008) (“increment 1. The process of gradually increasing a quantity or variable.”); Math Centre, *Symbols* (June 4, 2023) (Ex. 2014) (“We sometimes refer

to δx as an increment in x . For example if the value of x changes from 3 to 3.01 we could write $\delta x = 3.01 - 3 = 0.01$.”).

124. Indeed, the feedback loop of Figure 6d would make little sense if the system relied on the selection of a small handful of discrete frequencies. To the contrary, this embodiment relies on incremental increases or decreases (*e.g.*, $+\delta f_1$ or $-\delta f_2$) to **gradually** adjust the transmission frequency to an “acceptable range.” *See* Ex. 2013 at 48:19-49:3 (“Q. How would a person of skill determine the acceptable range? A. In the context of this patent, . . . [t]he acceptable range of power received by the load would be sufficient for the load to perform its function but not so high as to cause unwanted effects. For instance, overheating.”).

125. Moreover, the '204 Patent explains that “the positive incremental value δf_1 may be greater than, less than or equal to the negative incremental value δf_1 .” '204 Patent at 23:5-7. Thus, a POSITA would recognize that the series of incremental adjustments are more than fixed discrete frequency values that have a significant delta between them.

3. Board’s Preliminary Decision to Institute Review of the '204 Patent

126. In its decision to institute review of the '204 Patent, the Board preliminarily held:

[E]ven if a given construction would result in the term “incremental” having little patentable weight, that appears, at this preliminary stage and on the current limited record, to be due to how the claim is drafted rather than as a result of reading out the term, as Patent Owner implies. . . . At this early stage of the proceeding, we do not agree with Patent Owner’s interpretation of “incremental value” and we decline to read into the claim concepts such as a repeating feedback loop, a series of adjustments, and the exclusion of the selection of “discrete frequency values.”

Paper 7 at 31-32. The Board also encouraged the parties to “discuss the meaning of ‘incremental value’ in further briefing” and to “focus primarily on intrinsic evidence.” *Id.* at 32.

127. Patent Owner’s interpretation, which I endorsed in my initial declaration (Ex. 2001), is that a POSITA would have interpreted “provide [less/more] power by [increasing/decreasing] said non-resonant transmission frequency by an incremental value” and “[reducing/increasing] said non-resonant transmission frequency by an incremental value [df1/+df2]” consistent with their ordinary meanings, and that a POSITA would not interpret the selection of a discrete value as constituting an increase or decrease by an “incremental value.” Paper 6 at 26-27; *see also* Ex. 2001 at ¶ 86.

128. The latter excludes a system that relies solely on the selection of a finite number of discrete frequency values, particularly those having a large delta between them, as a POSITA would understand that the concept of selecting from a finite number of discrete values is different from the concept of incremental adjustment. A system that allows for both could certainly fall within the scope of a claim, but a system that **only** allows for selection of a finite number of discrete values, particularly values which are significantly different would not.

129. Put differently, a POSITA would interpret claim 1 to require the **capability** to increase or decrease the non-resonant transmission frequency by way of small (incremental) adjustments.

130. Such an interpretation does not require excluding all systems in which discrete transmission frequencies may be selected.

4. Conclusion on Claim Construction

131. It is my opinion that a POSITA would have interpreted (1) “provide [less/more] power by [increasing/decreasing] said non-resonant transmission frequency by an **incremental value**” and (2) “[reducing/increasing] said non-resonant transmission frequency by an **incremental value** [df1/+df2]” consistent with their plain and ordinary meanings. The specification does not deviate from the plain and ordinary usage of the foregoing language. It is further my opinion that a

POSITA would not interpret the selection of a finite number of discrete values (*e.g.*, particular transmission frequencies), particularly those having significant deltas between them, as constituting an increase or decrease by an “incremental value,” as a POSITA would recognize the latter as connoting a series of small adjustments for gradually reaching such value (rather than simply selecting that value).

VIII. DR. WOODS HAS FAILED TO DEMONSTRATE BY A PREPONDERANCE OF THE EVIDENCE THAT ANY CHALLENGED CLAIM IS UNPATENTABLE

132. In this section, I will show how Dr. Woods fails to demonstrate, by a preponderance of the evidence, that any challenged claim is unpatentable. Note that my decision not to discuss a particular limitation in detail here is not an indication that I agree that limitation is met by the prior art. Rather, I have elected to focus my opinions on the most evident deficiencies in Dr. Woods’s obviousness analysis.

A. Ground 1A: Dr. Woods Fails to Establish that Claims 1-6, 8 and 10-13 are Anticipated by Onishi

133. As explained below, Dr. Woods has not established anticipation by a preponderance of the evidence with respect to Ground 1A. Onishi fails to disclose at least claim elements [1.2], [1.5], [1.7], [1.8], [10.1], and [13]. As claims 2-6, 8, and 11-13 each depend on claim 1 or 10, Dr. Woods cannot show that Onishi anticipates any of claims 1-6, 8, and 10-13.

1. Dr. Woods Fails to Demonstrate that Onishi Anticipates Limitation [1.2]

134. Limitation [1.2] requires “said primary inductive coil for forming an inductive couple having a characteristic resonant frequency with at least one secondary inductive coil wired to an electric load.” Onishi does not disclose an inductive couple having a characteristic resonant frequency.

135. For example, Onishi discloses a “primary coil L1 (power-transmission-side coil) [that] is electromagnetically couple[d] with [a] secondary coil L2 (power-receiving-side coil) to form a power transmission transformer.” Onishi at [0137]. However, Onishi does not disclose that the primary coil L1 and the secondary coil L2 share a characteristic resonant frequency. Rather, Onishi’s discussion of this frequency is only in the context of “the resonance characteristics of the induction coil” (*i.e.*, primary coil L1), *id.* at [0180], not in the context of the resonance characteristics of an inductive couple formed by an induction coil (*i.e.*, primary coil L1) and a secondary coil (*i.e.*, secondary coil L2). *See also id.* at [0135] (explaining that the resonance characteristic frequency is for “one capacitor which forms a resonant circuit together with the primary coil L1”); *id.* at [0171] (“changing the resonance characteristics of the resonant circuit by changing the inductance or the capacitance to change the resonance frequency (resonance peak)”; Ex. 2010 at 8:22-10:14 (testifying that primary coil L1 and the secondary coil L2, at least as described

in Onishi, have different characteristic resonant frequencies), 14:5-15 (testifying that combining the resonant frequencies of the primary coil L1 and the secondary coil L2 is not a simple sum but rather the geometric mean of the two individual resonance frequencies).⁸

136. Although Onishi states that “[t]he resonance characteristics of the primary coil L1 and the secondary coil L2 . . . have a symmetrical and broad mountain shape, as shown in FIG. 4” (Onishi at [0180]), a POSITA would understand that this discussion relates to two independent inductive coils as opposed to an inductive couple formed therebetween. As noted above, the preceding sentence clearly establishes that Figure 4 pertains to the resonance characteristics of the induction coil—not a pair of inductively coupled coils. Grounded in this context, a POSITA would recognize this sentence as referring to the resonance characteristics of independent coils (i.e., the primary or secondary coil).

137. Furthermore, Dr. Woods acknowledged that primary coil L1 and the secondary coil L2 have different characteristic resonant frequencies, and that the characteristic resonant frequency of an inductive couple comprising these two coils

⁸ During cross-examination Dr. Woods acknowledged that “the meaning of Onishi is laid out in Onishi” and “can’t change.” Ex. 2013 at 26:21-24. Accordingly, Dr. Woods opinions and testimony that were provided in IPR2024-00994 regarding Onishi are equally applicable to this IPR.

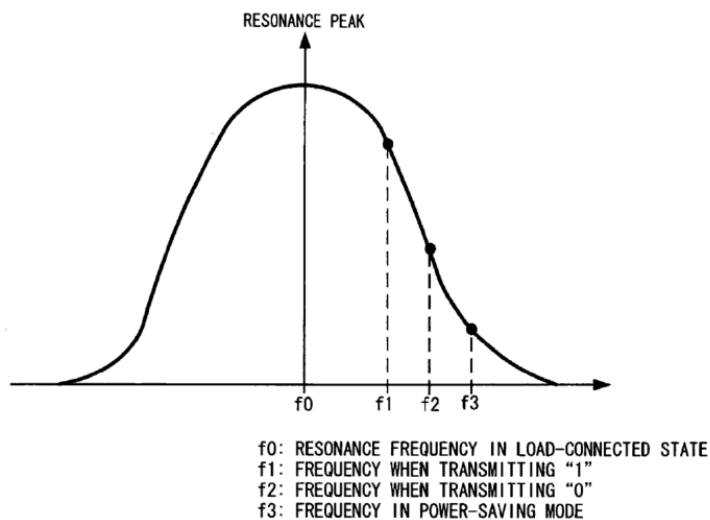
would be different. Ex. 2010 at 9:10-21 (“Q. Similarly, will the coupled system have a different characteristic resonant frequency than the characteristic resonant frequency of the coil and the capacitor in the reception side? A. Yes, the two – yes, the two frequencies – right, each has a separate resonant frequency stand-alone and when you put them together there will be a resonance that is – it’s neither of those, but it’s – right, it’s related. I mean it’s usually in between them.”). I agree with Dr. Woods here. That is, each coil-capacitor pair (e.g., L1 and C1, or L2 and C2) has its own characteristic resonant frequency.

138. In contrast to the above discussion, limitation [1.2] requires that the characteristic resonant frequency pertain to the inductive couple (*i.e.*, based on both a primary and at least one secondary inductor), which is consistent with the specification of the ’204 Patent and the prosecution history. *See, e.g.*, ’204 Patent at 21:34-36 (“the **combined** inductance of the **coil pair** changes which in turn changes the resonant frequency of the **system**”); *id.* at 27:17-20 (“connecting the secondary inductive coil to a transmission circuit for connecting an electric element to the secondary inductive coil thereby increasing the resonant frequency of the inductive power transfer system”); Ex. 1002 at 103 (explaining that “Malpas describes a system in which there is no one-to-one relationship between the transmitter and the receiver” because “Malpas does not relate to the characteristic resonant frequency

of the inductive couple at all, but rather to the resonant frequency of the pick-up alone”).

139. Thus, Dr. Woods’s argument that Onishi—allegedly by way of Figure 4—“discloses that the inductive couple between primary coil L1 and secondary L2 has a characteristic resonant frequency ‘f0’, indicated by the ‘RESONANCE PEAK,’” Ex. 1003 at ¶ 54, is misplaced because Figure 4 only illustrates “a view showing the resonance characteristics of the induction coil.” Onishi at [0180] (emphasis added). Nothing in Onishi indicates that Resonance Frequency f0, or any other frequency identified in Onishi, is the characteristic resonant frequency of an inductive couple formed by an induction coil and a coupled secondary coil.

FIG. 4



Onishi at FIG. 4.

140. Accordingly, Dr. Woods has not demonstrated by a preponderance of the evidence that Onishi anticipates limitation [1.2].

2. Dr. Woods Fails to Demonstrate that Onishi Anticipates Limitation [1.5]

141. Limitation [1.5] requires “said driving voltage oscillating at a non-resonant transmission frequency substantially different from said characteristic resonant frequency of said inductive couple.” Onishi discloses a power transmission device that is configured to operate in two principal power transmission modes—a “normal” mode for charging the battery of a power reception device, and a “power-saving” mode for when the battery is fully charged and requires little to no power (*i.e.*, for maintenance purposes). Onishi categorizes exemplary frequencies, f_1 and f_2 , as “normal” power transmission frequencies, and frequency f_3 as a “power-saving” transmission frequency. *See* Onishi at [0181], [0214], FIG. 4.

142. Dr. Woods alleges that each of frequencies f_1 , f_2 , and f_3 qualify as a “transmission frequency substantially different from said characteristic resonant frequency of the inductive couple.” Ex. 1003 at ¶¶ 58-59. But none of frequencies f_1 , f_2 , and f_3 are described, shown, or otherwise disclosed as occurring within the near-linear regions of a frequency-amplitude graph associated with the inductive

couple, as required by claim 1.⁹ Nor are they otherwise disclosed as substantially different from the characteristic resonant frequency of the inductive couple.

a) Dr. Woods's Reliance on Onishi Figure 4 is Improper

143. Dr. Woods asserts that Onishi discloses “a non-resonant transmission frequency (e.g., frequencies f_1 , f_2 , or f_3) substantially different from said characteristic resonant frequency (e.g., frequency f_0) of said inductive couple.” Ex. 1003 at ¶ 58. In support of this assertion, Dr. Woods argues that “each of frequencies f_1 , f_2 , and f_3 lie in a near-linear region of the frequency-response curve and thus . . . fall within the scope of being ‘substantially different’ from the characteristic resonant frequency f_0 .” Ex. 1003 at ¶ 59.

144. However, as explained in greater detail below, Onishi expressly discloses that the normal power transmission frequencies (*i.e.*, frequencies f_1 and

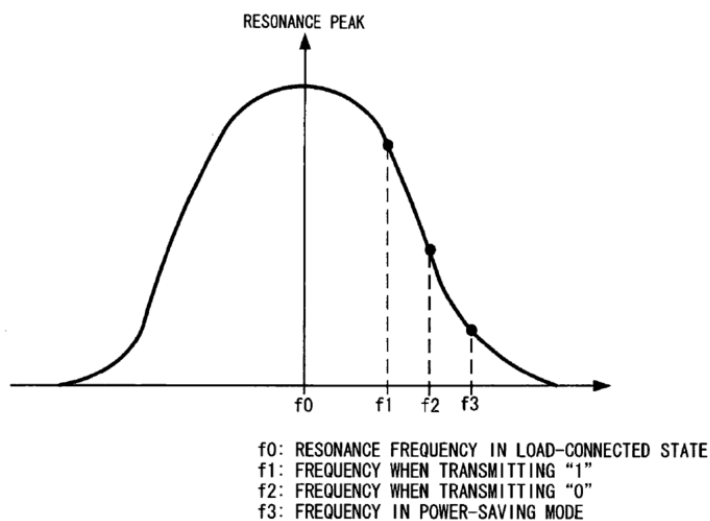
⁹ See Ex. 2013 53:14-15 (“A. Onishi doesn’t say how to calculate frequency F_1 .”); *id.* at 53:19-54:17 (“Q. Does Onishi provide any instructions on how to calculate frequency F_2 ? A. . . . No, Onishi – to my knowledge doesn’t have a formula for calculating F_2 . Q. Does Onishi provide any instructions on how to calculate frequency F_3 ? A. I would say for context, F_2 and F_3 – F_2 , a POSITA would know it has to be different enough from F_1 that the receiver could distinguish the two frequencies because the change in those frequencies – the difference between F_1 and F_2 is how the transmitter sends data to the receiver and to the load in Onishi. F_3 , a POSITA would know the implicit guidance of Onishi is that F_3 is a frequency where less power transfer occurs, enough less that there’s – that there is some power savings.”).

f2) are at or near the resonance frequency, *see* Onishi at [0053] (“The transmission frequency during power-saving power transmission is set at a frequency apart from the resonance frequency (resonance peak) as compared with the frequency during normal power transmission, for example.”); *id.* at [0181] (“In FIG. 4, the frequency f1 is a frequency used when transmitted ‘1’ during normal power transmission. . . . The frequency f2 is a frequency used when transmitting ‘0’ . . .”), and that the power-saving mode frequency (*i.e.*, frequency f3) is set apart from the resonance frequency such that only a small amount of power is transmitted. *Id.* at [0053] (“Note that power-saving power transmission only transmits only a small amount of power which merely maintains the battery charge management function of the load. . . . The transmission frequency during power-saving power transmission is set at a frequency apart from the resonance frequency (resonance peak) as compared with the frequency during normal power transmission, for example.”); *id.* at [0181] (“A frequency f3 is a frequency used in the power-saving mode.”).

145. To cure Onishi’s deficient written disclosure, Dr. Woods relies on Onishi’s illustration of Frequencies f1, f2, and f3 in Figure 4. Ex. 1003 at ¶¶ 58-59. The stated purpose of this illustration, however, is to show that “the relationship ‘f1>f2>f3’ is satisfied”—*i.e.*, as opposed to showing the actual locations of the frequencies f1, f2, and f3 on a frequency-amplitude graph. Onishi at [0181]. Yet,

even the purpose of this relationship is unclear as Figure 4 illustrates the opposite (i.e., $f_3 > f_2 > f_1$). *See* Ex. 2013 at 59:14-17 (“[A] POSITA would understand that the way Onishi has drawn F1 and F2 and F3, the actual values of those frequencies do not satisfy the inequality in paragraph 181.”).

FIG. 4



Onishi at FIG. 4.

146. In fact, Onishi does not state, nor does Dr. Woods contend, that Figure 4 is drawn to scale, and Onishi provides no dimensions or vertical-axis labels with respect to Figure 4. *See* Ex. 2010 at 22:17-23:19 (acknowledging that Onishi fails to provide any quantitative measure of the values f_1 , f_2 , or f_3); Ex. 2013 at 59:20-60:9 (“Q. [B]ased on the disclosure in paragraph 181 of Onishi, do you agree that it’s possible for the Y axis of figure 4 to represent frequency based on the relationship

F1 being greater than F2 being greater than F3? . . . A. I think – if I understand your question, what I would say is yes, the Y values along this curve at frequencies F1 and F2 and F3 do satisfy the relationship specified by Onishi in paragraph [181].”). This lack of evidence—as understood by a POSITA—renders Dr. Woods’s reliance on Onishi’s Figure 4 for element [1.5] deficient.

147. While Figure 4 of Onishi and Figure 6b of the ’204 Patent both depict parabolic like curves, without dimensions or vertical-axis labels a POSITA would not be able to draw any conclusions regarding any similarities between the two illustrations. For example, if we assume *arguendo* that the vertical axis label in Figure 4 of Onishi is “RESONANCE PEAK,” this does not make sense: this is not a variable that varies with frequency, rather it is a single frequency that is achieved at “peak” impedance, voltage, current or some other electrical characteristic—it is not a variable to be used in this context as a vertical axis of a plot versus frequency. Onishi at Fig. 4.

148. If, on the other hand, we assume *arguendo* that “RESONANCE PEAK” refers to a single point on the curve, then there is no vertical axis label on the plot, and we do not know what is being represented. Thus, without additional information, no conclusions can be drawn regarding the teachings of Figure 4 in Onishi.

149. During cross-examination Dr. Woods acknowledged that the vertical axis is unclear:

Q. And does figure – does figure 4 identify power transfer?

A. The vertical axis is – we don't exactly know what the vertical axis is. A POSITA would take that the mean either power transferred or possibly current delivered to the load, or possibly voltage across the primary coil.

Ex. 2013 at 58:25-59:5. Dr. Woods provided additionally testimony regarding the ambiguity in Figure 4:

Q. Is the resonance peak of a system a single frequency achieved at peak impedance, voltage, current or some other electrical characteristic, or is it a variable that can vary with frequency?

A. I would say in a precise sense, a resonance frequency is what he said, it corresponds to a single point on a graph. But clearly, I mean, Onishi is kind of playing fast and loose here. He labeled the peak “resonance peak,” but – he labeled – the term “resonance peak” appears right above the Y axis. Which I think a POSITA would take to mean that that represents a title for the entire graph, which is the solid line as shown in the figure which exhibits a resonance peak at F_0 .

Ex. 2013 at 64:22-65:14.

150. Accordingly, Dr. Wood’s analyses that rely on Onishi’s illustration of frequencies f_1 , f_2 , and f_3 in Figure 4 are improper and misguided, and do not demonstrate, by a preponderance of the evidence, unpatentability.¹⁰

b) Onishi’s Normal Power Transmission Frequencies (f_1 and f_2) are Not Substantially Different from the Resonant Frequency

151. Neither of Onishi’s normal power transmission frequencies, f_1 and f_2 , qualify as a transmission frequency that is “substantially different from the characteristic resonant frequency resonant frequency of said inductive couple,” as required by claim 1.

152. Assuming *arguendo* that the vertical axis in Figure 4 is referring to a realistic design variable such as voltage, Onishi describes frequencies f_1 and f_2 as being at or near resonant frequency (f_0 in Onishi)—similar to the Malpas reference distinguished by Applicant during prosecution, and contrary to claim 1: “The transmission frequency during power-saving power transmission is set at a frequency apart from the resonance frequency (resonance peak) as compared

¹⁰ Assuming *arguendo* that value exists in a visual analysis of patent drawings that lack quantitative values, it appears—contrary to Dr. Woods’s assertions—that frequencies f_1 and f_3 (as illustrated in Onishi Figure 4) fall outside the near-linear region of the frequency-response curve. See Ex. 1003 at ¶ 59 (arguing that “each of the frequencies f_1 , f_2 , and f_3 lie in a near-linear region of the frequency-response curve”).

with the frequency during normal power transmission, for example.” Onishi at [0053] (emphases added); *see also* Ex. 2010 at 17:14-23 (“Q. What does the word ‘apart’ mean to you in the context of paragraph 53 of Onishi? A. I guess you would say -- I guess Onishi would say distinguishable from. I think that’s a fair word a POSITA might have used at the time. Q. What’s an antonym for ‘distinguishable from’? A. Indistinguishable from.”). This is in part because of the “**broad mountain shape**” of the resonance curve, which results in the normal power transmission frequencies being outside the linear or near-linear region of the resonance curve. Onishi at [0180] (“The resonance characteristics of the primary coil L1 and the secondary coil L2 when the portable telephone 510 is placed on the charger 500 (cradle) (i.e., when load exists with respect to the power transmission device 10) (see FIG. 1A) have a symmetrical and **broad mountain shape**, as shown in FIG. 4, for example.”) (emphasis added). If frequency f_3 , used during the power saving mode in Onishi is describes as being “apart” from the resonance frequency, **unlike the frequency during normal power transmission**, this means that frequencies f_1 and f_2 are not “apart” from the resonance frequency. A POSITA would understand this to mean frequencies f_1 and f_2 are near the resonance frequency.

153. Thus, neither of normal power transmission (f_1 and f_2) are substantially different from the characteristic resonant frequency of the inductive couple, as required by limitation [1.5].

c) Onishi's Power-Saving Mode Frequency (f_3) is Not a Transmission Frequency that is Substantially Different from the Resonant Frequency

154. Onishi's power-saving mode frequency f_3 —while “set at a frequency apart from the resonance frequency” (Onishi at [0053])—is neither described, shown, nor otherwise disclosed as a transmission frequency that is substantially different from the characteristic resonance of the inductive couple.

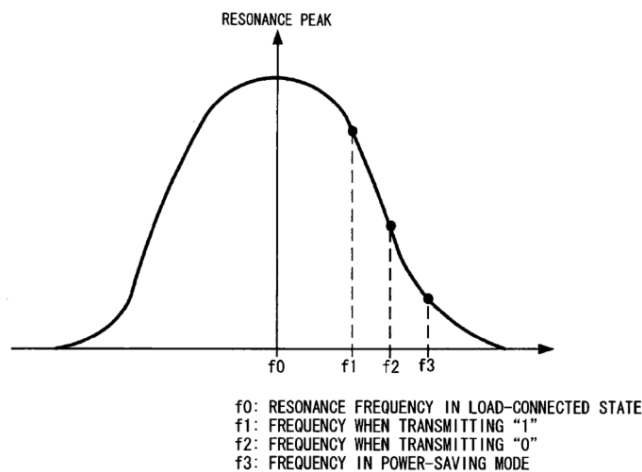
155. *First*, Dr. Woods has failed to demonstrate that Onishi's power-saving mode frequency f_3 falls within the linear or near-linear regions of a “frequency-amplitude graph associated with the inductive couple,” as required by claim 1. Onishi merely describes the frequency f_3 as being “apart” from the resonance frequency f_0 . Simply being “apart,” however, does not establish that the frequency f_3 falls within the near-linear region of the frequency graph associated with the inductive couple.

156. In contrast, as explained in the '204 Patent, the purpose of utilizing the near-linear region of the frequency-amplitude graph associated with the inductive couple is to mitigate against large, unintended fluctuations in induced voltage while

simultaneously allowing room for the incremental—and linearly controlled—fluctuation of the transmission frequency (δf). *See* '204 Patent at 19:65-20:3, 21:1-15, 22:45-64, 24:17-25.

157. ***Second***, assuming *arguendo* that Dr. Woods's reliance on Onishi's Figure 4 is proper—which it is not—the figure is at best unclear as to whether frequency f_3 lies within a near-linear or **non**-linear region of the resonance curve, the latter being in direct contravention of the stated location of the transmission frequency on a frequency-amplitude graph. Ex. 1002 at 62 (explaining that a POSITA “would appreciate that the term ‘*substantially different from said characteristic resonant frequency*’ . . . should be interpreted to mean that the frequency of the driving voltage **is selected so as to lie within one of the near-linear regions** of a frequency-amplitude graph associated with the inductive couple” (emphasis added)).

FIG. 4



Onishi at Fig. 4. Further, operating in the non-linear region of the frequency-amplitude graph (even if not at or near resonance) would only undermine the predictability of the system, contrary to the stated intent of the '204 Patent.

158. **Third**, Onishi describes power-saving mode frequency f_3 as corresponding to the region in which little to no power is transmitted to the receiver. Onishi at [0178] (“a small amount of power is continuously transmitted in the power-saving mode after the battery has been fully charged based on the above consideration”); *id.* at [0186] (“This causes the power transmission control device 20 of the power transmission device 10 to switch the mode from the power-saving mode to the normal charging mode so that full-power power transmission starts, for example. This enables the power reception device 40 to continue to recharge the battery 94.”); *id.* at [0053] (“The transmission frequency during power-saving power

transmission is set at a frequency apart from the resonance frequency (resonance peak) as compared with the frequency during normal power transmission, for example.”). Assuming *arguendo* that the vertical axis of Onishi’s Figure 4 is voltage, in essence what this means is that the power-saving mode frequency falls within the range of frequencies that result in an operation voltage that is approaching zero non-linearly, where supplied power is lower, and thus the power-saving mode frequency is outside the linear and near-linear regions of the resonance curve.

159. Accordingly, the power-saving mode transmission frequency f_3 is not a transmission frequency that is substantially different from the resonant frequency, and thereby does not satisfy the requirements of the claim limitation.

d) Dr. Woods has Not Established that Onishi Discloses a Transmission Frequency that is Substantially Different from the Characteristic Resonant Frequency of the *Inductive Couple*

160. Claim limitation [1.5] requires a “driving voltage oscillating at a non-resonant transmission frequency substantially different **from said characteristic resonant frequency of said inductive couple.**” As demonstrated above in Section VIII.A.1 regarding limitation [1.2], Onishi’s discussion of resonance characteristics, including its description of Figure 4, is limited to the context of the individual coil(s). Therefore, for at least the reasons stated above in Section VIII.A.1, Dr. Woods has failed to demonstrate that Onishi discloses a transmission frequency substantially

different from the characteristic resonant frequency **of the inductive couple**, as required be limitation [1.2]. Dr. Woods has effectively only addressed each of frequencies f1, f2, and f3 relative to the characteristic resonant frequency of the individual coil(s), not of the inductive couple as required by element [1.2].

161. Accordingly, Dr. Woods has not demonstrated by a preponderance of the evidence that Onishi anticipates limitation [1.5].

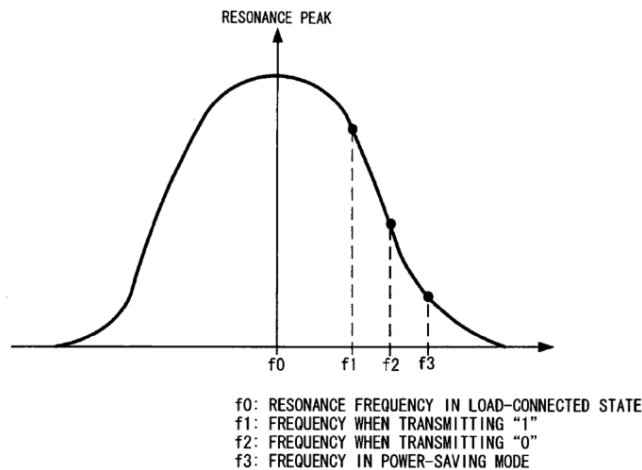
3. Dr. Woods Fails to Demonstrate that Onishi Anticipates Limitation [1.7] and [1.8]

162. Limitation [1.7] requires “said driver is configured to: provide less power by increasing said non-resonant transmission frequency by an incremental value when said first signal is detected by the detector,” and limitation [1.8] requires “[said driver is configured to:] provide more power by decreasing said non-resonant transmission frequency by an incremental value when said second signal is detected by the detector.” Dr. Woods alleges that Onishi discloses (1) “provid[ing] less power by increasing the non-resonant transmission frequency by an incremental value from ‘f1’ or ‘f2’ to ‘f3,’” Ex. 1003 at ¶ 68, and (2) “provid[ing] more power by decreasing the non-resonant transmission frequency by an incremental value from ‘f3’ to ‘f1’ or ‘f2.’” Ex. 1003 at ¶ 69. These arguments fail for several reasons.

163. ***First***, Dr. Woods fails to identify any actual disclosure in Onishi of an **incremental** adjustment to a non-resonant transmission frequency, or any frequency

for that matter. Ex. 2013 at 67:25-68:3 (“Q. Does Onishi ever use the term “increment” or “incremental”? A. Let me check. It doesn’t appear in my text search.”). Dr. Woods’s cited disclosure identifies three preset frequencies—f1, f2, and f3. Ex. 1003 at ¶¶ 68-69 (citing Onishi at [0053], [0171], [0181], [0225]). Onishi explains that “frequency f1 is a frequency used when transmitting ‘1’ during normal transmission,” “frequency 2 is a frequency used when transmitting ‘0,’” and “frequency f3 is a frequency used in the power-saving mode.” Onishi at [0181]. Accordingly, each is a discrete frequency—separated from one another by a large delta—having a distinct purpose. Moreover, even if a difference between frequencies f1 and f2 (*i.e.*, f2–f1) or between frequencies f2 and f3 (*i.e.*, f3–f2) or between frequencies f1 and f3 (*i.e.*, f3–f1) were interpreted as an incremental value, Onishi does not disclose transitioning from one of frequencies f1, f2, or f3 by adding or subtracting such a difference to or from any one of f1, f2, or f3.

FIG. 4



Onishi at Fig. 4.

164. Onishi does not disclose any intervening frequencies, much less incrementally adjusting the transmission frequency to reach any of frequencies f_1 , f_2 , or f_3 . *See* Ex. 2013 at 66:22-67:17 (“Q. Again, my question is, in Onishi’s disclosure, including figure 4 but the disclosure as a whole, does Onishi disclose any intervening frequencies that exist between frequency F_1 and frequency F_2 ? A. No. F_1 and F_2 are distinct. There’s no need in Onishi – a POSITA would understand that Onishi doesn’t need for there to be a frequency that the system uses between F_1 and F_2 . Q. All right, does Onishi disclose any intervening frequencies between F_2 and F_3 ? A. Roughly same answer. There’s no – he doesn’t – Onishi doesn’t mention any other frequencies. Although he – there’s not a lot of guidance on how to choose F_1 and F_2 and F_3 , except that they all must be somewhere to the right of the

resonance.”). In fact, Onishi appears to preclude any other operating frequencies (*see id.*),¹¹ suggesting that these discrete values are selected, rather than reached through incremental adjustments:

The secondary-side (power-receiving-side) control circuit **52** determines that the battery **94** has been fully charged when the light-emitting device (LEDR) has been turned OFF (step **S205**) for five seconds, for example (step **S210**), and transmits the save frame to the primary-side instrument **when the frequency is other than the frequency f3 during power-saving power transmission (i.e., high frequency f1 or f2 during normal power transmission shown in FIG. 4) (step S212).**

Onishi at [0214] (emphasis added).

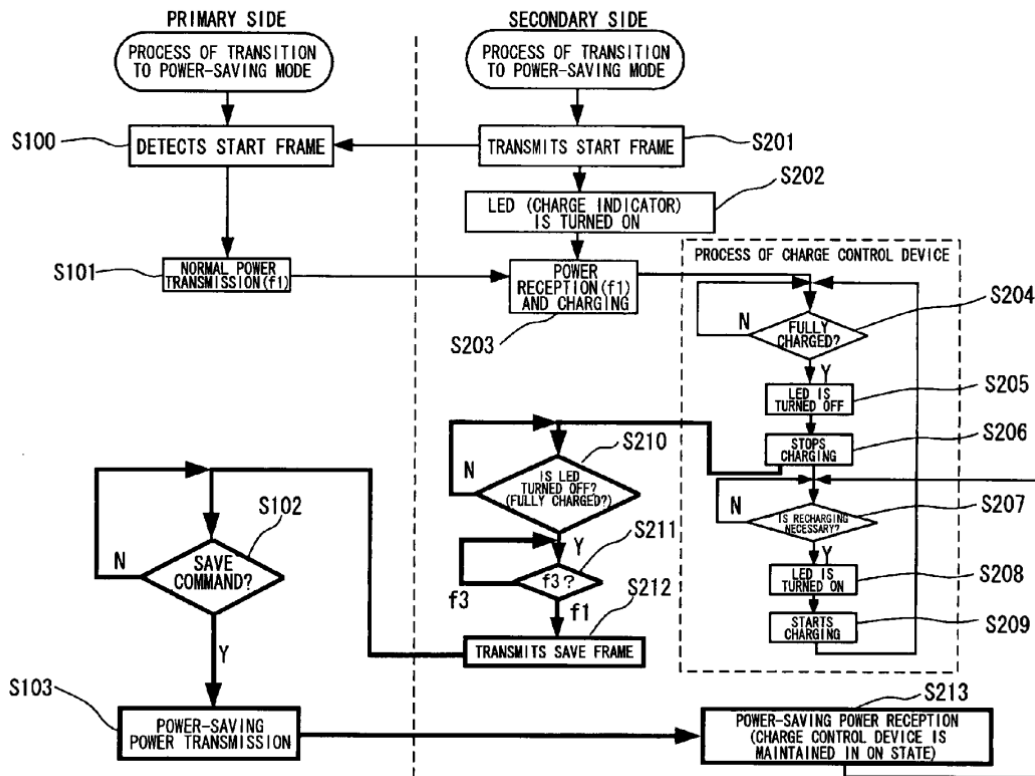
165. For example, the '204 Patent's claimed "incremental value" (*e.g.*, δf as illustrated in Fig. 6b of the '204 Patent) allows any frequency between f_U and f_b to be selected in the linear region, for example by using different incremental values. *See* '204 Patent at 23:5-7 ("It is noted that the positive incremental value δf_1 may be greater than, less than or equal to the negative incremental value δf_2 ."). In contrast, assuming *arguendo* that δf is equal to half the difference between frequencies f_2 and

¹¹ Onishi, Figure 4, shows frequency f_0 ; however, this frequency is depicted as the "resonance frequency," as opposed to a "non-resonant transmission frequency," as required by claim 1.

f1 (*see* Onishi at Fig. 4), a positive incremental adjustment of δf starting, for example, from frequency f1 would result in the selection of a frequency between f1 and f2. This functionality is not disclosed nor is it achievable by Onishi. Similarly, assuming *arguendo* that δf is equal to half the difference between frequencies f3 and f2 (*see* Onishi at Fig. 4), a negative incremental adjustment δf would result in the selection of a frequency between f2 and f3, which is not allowed by Onishi.

166. Yet, even if frequency f2 were interpreted as an incremental change between frequencies f1 and f3, Onishi discloses—as illustrated below in Figure 7—that power transmission can switch from frequency f1 to frequency f3 without stepping through frequency f2. *See, e.g.*, Onishi at [0226] (“The secondary-side instrument **performs normal power reception (frequency f1)**, and supplies power to the load 90 to effect recharging When the battery has been again fully charged . . . , the secondary-side instrument checks that the power transmission frequency is not the power-saving transmission frequency (f3) . . . , and transmits the save frame (including save command) to the primary-side instrument **This causes power-saving power transmission to again start**”). Thus, Onishi does not disclose implicitly or explicitly increasing/decreasing the non-resonant transmission frequency by an incremental value.

FIG. 7



Onishi, FIG. 7.

167. **Second**, Dr. Woods’s interpretation of claim 1 effectively reads out “incremental” from the claims. *See* Ex. 2013 at 47:2-10 (acknowledging that the term “incremental” narrows the scope of the claimed invention). Claim 1 requires increasing/decreasing the non-resonant transmission frequency by an “incremental value.” If any increase or decrease (*e.g.*, from frequency f1 to frequency f2, or from frequency f2 to frequency f3, as Dr. Woods proposes) would qualify as an

“incremental” increase/decrease, then the term is rendered superfluous. Any increase/decrease in a non-resonant transmission frequency—no matter the size—would constitute an incremental change.

168. However, as previously explained, Dr. Woods interpretation is inconsistent with the plain and ordinary meaning of “incremental” because the use of the term in relation to the adjusted transmission frequency is presumed to mean more than simply increasing or decreasing (reducing) the transmission frequency. Rather, the incremental changes to the non-resonant transmission frequency must be small or gradual. At a minimum, this would require a suitably small delta between each of frequencies f_1 , f_2 , and f_3 such that a change from one frequency (e.g., f_1) to another (e.g., f_2) is necessarily an “incremental” change. Dr. Woods has not established why this would be the case. Indeed, Onishi contains no such disclosure. There is no indication that f_1 , f_2 , and f_3 are only “incrementally” different. In fact, a POSITA would interpret Onishi as suggesting the latter, in view of the vastly different functions of each of frequencies f_1 , f_2 , and f_3 .

169. Thus, the change from frequency f_1 to frequency f_2 , frequency f_1 to frequency f_3 , or frequency f_2 to frequency f_3 (or frequency f_3 to frequency f_2 , frequency f_3 to frequency f_1 , or frequency f_2 to frequency f_1)—as disclosed by Onishi—does not satisfy the requirements of limitations [1.7] and [1.8].

170. Accordingly, Dr. Woods has not demonstrated by a preponderance of the evidence that Onishi anticipates limitations [1.7] and [1.8].

4. Dr. Woods Fails to Demonstrate that Onishi Anticipates Limitation [10.1]

171. Limitation [10.1] requires “providing an oscillating voltage to said primary inductive coil at an initial transmission frequency f_t substantially different from a characteristic resonant frequency f_R of the system.” Dr. Woods’s argument that this limitation is disclosed by Onishi relies on his argument for limitation [1.5]. Ex. 1003 at ¶ 78. Thus, for at least the reasons explained above in Section VIII.A.2, Dr. Woods has not demonstrated by a preponderance of the evidence that Onishi anticipates limitation [10.1].

5. Dr. Woods Fails to Demonstrate that Onishi Anticipates Limitation [13]

172. Limitation [13] recites: “The method of claim 10 wherein the step of said driver adjusting said non-resonant transmission frequency further comprises: said driver reducing said non-resonant transmission frequency by an incremental value df_1 when the received feedback signal is of the first type S_a , and said driver increasing said non-resonant transmission frequency by an incremental value $+df_2$ when the received feedback signal is of the second type S_b .” As explained above in Section VIII.A.3, Onishi does not disclose an incremental change in the non-

resonant transmission frequency. Thus, for similar reasons explained above, Onishi's alleged disclosure of "reduc[ing] the non-resonant transmission frequency by an incremental value df_1 (e.g., from f_3 to f_1)" and "increas[ing] the non-resonant transmission frequency by an incremental value $+df_2$ (e.g., from f_1 or f_2 to f_3)" fails to satisfy the requirement of limitation [13]. *See* Ex. 1003 at ¶ 86. Accordingly, Dr. Woods has not demonstrated by a preponderance of the evidence that Onishi anticipates limitation [13].

B. Ground 1B: Dr. Woods Fails to Establish that Claims 1-6, 8 and 10-13 are Rendered Obvious by Onishi in View of Purdy

173. Ground 1B differs from Ground 1A only in that Purdy is used for claim limitations [1.6]-[1.8], [2]-[4], and [10.4]-[10.5], but not for claim limitations [1.2], [1.5], [10.1], and [13]. Accordingly, for the reasons that Ground 1A fails with respect to claim limitations [1.2], [1.5], [10.1], and [13] (and therefore all dependent claims), Ground 1B fails as well. Purdy fails to cure the above described deficiencies of Onishi, nor has Dr. Woods made such an allegation.

174. Accordingly, Dr. Woods has not demonstrated by a preponderance of the evidence that Onishi in view of Purdy renders obvious claims 1-6, 8, and 10-13.

C. Ground 2: Dr. Woods Fails to Establish that Claims 1-6, 8 and 10-13 are Rendered Obvious by Baarman392 in View of Tocci

175. Ground 2 fails because Dr. Woods has failed to show with particularity how the combination of Baarman392 and Tocci would render obvious claim elements [1.5], [1.7], [1.8], [10.1], and [13]. Further, a POSITA would not be motivated to combine Baarman392 and Tocci. As such, Ground 2 fails.

1. Dr. Woods Fails to Demonstrate that Baarman392 in View of Tocci Renders Obvious Limitation [1.5]

176. Limitation [1.5] requires “said driving voltage oscillating at a non-resonant transmission frequency substantially different from said characteristic resonant frequency of said inductive couple.” For this limitation, Dr. Woods relies solely on alleged disclosures in Baarman392. Ex. 1003 at ¶¶ 119-120. Specifically, Dr. Woods cites Baarman392’s discussion of an inverter operation at “off-resonance.” Ex. 1003 at ¶ 119. However, Dr. Woods fails to demonstrate that Baarman392 operating “off-resonance” is the claimed “transmission frequency substantially different from said characteristic resonant frequency.”

177. ***First***, Baarman392 describes the general operation of its inverter as in the range between frequency A and frequency B, where frequency B “is **somewhat less** than the resonant frequency.” Ex. 1006, at [0038]. However, frequencies

“somewhat less than the resonant frequency” are—by definition—not **substantially different from** the resonant frequency, as claimed.

178. During cross-examination, Dr. Woods attempted to equate the concepts, but in doing so effectively read out “substantially” from the claim:

Q. Is it your opinion that frequencies that are somewhat less than the resonant frequency are substantially different than the resonant frequency.

A. I don’t know about in general, but **I would say frequency B is - we know it’s not on resonance. Baarman says so. So I would say that makes it substantially different.**

Ex. 2010 at 33:12-20.¹² Put differently, Dr. Woods stated that because frequency B “is **not on [i.e., different from]** resonance . . . that makes it **substantially** different”—*i.e.*, that “different” and “substantially different” are the same. Not only does this conflict with the common usage of “substantial,”¹³ it ignores the

¹² During cross-examination Dr. Woods acknowledged that “the Baarman ’392 reference says what it says” and that “I believe that everything I’ve said about Baarman is internally consistent.” Ex. 2013 at 27:25-29:6. Accordingly, Dr. Woods opinions and testimony that were provided in IPR2024-00994 regarding Baarman392 are equally applicable to this IPR.

¹³ See, e.g., The American Heritage Dictionary of the English Language 1376 (Houghton Mifflin Co., 4th ed. 2002) (Ex. 2008) (“substantial . . . 5. Considerable in importance, value, degree, amount, or extent: *won the election by a substantial margin.*”); Webster’s II Dictionary 699 (Houghton Mifflin Co., 3rd ed. 2005) (Ex. 2009) (“substantial . . . 5. Considerable <a *substantial* snowfall>”).

specification, which expressly excludes off-resonant regions 4a and 4b (described as “to either side of the resonance peak 2”) in Figure 6b from the scope of what is “substantially different from the resonant frequency of the inductive couple.” ’204 Patent at 21:6-8 and 21:16-20.

179. As explained above, claims 1 and 10—as further explained in the specification and the prosecution history—require a transmission frequency that is meaningfully different from the characteristic resonant frequency in order to mitigate against large unintended fluctuations in induced voltage. Accordingly, a POSITA would interpret the transmission frequency of claims 1 and 10 to lie within the near-linear of a frequency-amplitude graph.

180. Here, Baarman392 does not describe or conclusively show either of frequencies A or B as lying within such a region, and if anything, suggests a system lacking in the stability and predictability that the claims of the ’204 Patent attempt to achieve due to the express inclusion of a near (or “somewhat less than”) resonant frequency within the operable transmission frequency range. Accordingly, Baarman392 suggests operation at or near resonant frequency, similar to prior art systems, such as Malpas, distinguished by the Applicant (per Examiner agreement) during prosecution.

181. *Next*, where Dr. Woods describes the range between frequency A and

frequency B as “near-linear,” Baarman392 describes its power transfer curve for this range as “piece-wise linearized by a software lookup table.” Ex. 1006 at [0038].

182. During cross-examination, Dr. Woods explained:

Q. What is piecewise linearization.

A. Well, to a POSITA, piecewise linearization would have meant **taking a curve** and fitting it with a series of straight lines – approximating it with a series of straight line segments.

...

Q. . . . If we’re looking at a graph and there’s a linear line on the graph, would a person of skill use piecewise linearization for a linear line represented on a graph?

A. If the line is sufficiently – in general, for a POSITA in this case or any similar case, if the line is already sufficiently linear for your application, then you don’t have to – then you don’t have to linear – you don’t need piecewise linear unless you’re concerned that perhaps the curve is shifting around.

Ex. 2013 at 69:8-14, 71:20-72:7 (emphasis added). Accordingly, a POSITA would understand that piece-wise linearization is only used if the curve being approximated is non-linear (if the curve were linear, a piece-wise approximation would be unnecessary).

183. Thus, Baarman392 acknowledges that the curve between frequency A

and frequency B is non-linear by the fact that a piece-wise linearization is required. Accordingly, the requirement for approximation by a piece-wise linear function demonstrates that the graph in Figure 3 of Baarman392 does not disclose “the near-linear regions of a frequency-amplitude graph associated with the inductive couple” (Ex. 1003 at ¶ 39 (citing Ex. 1002 at 62)), as a piece-wise linear function is specifically used here to approximate a non-linear curve.

184. **Finally**, assuming *arguendo* that the range between frequency A and frequency B—as disclosed in Baarman392—includes the near-linear region of a frequency-amplitude graph, operation of the inverter between frequency B and the beginning of the near-linear region of the frequency-amplitude curve is performed non-linearly. As explained above, a central aim of the '204 Patent relates to the linear regulation/control for predictably regulating power transfer. However, Baarman392's disclosure of non-linear control would result in unpredictability and fluctuations in power expressly solved by the '204 Patent. Thus, any power regulation that occurs in the non-near-linear portions of a frequency-amplitude curve (*i.e.*, portions that are not substantially different) fall outside the scope of claim element [1.7]. *Id.* Accordingly, Baarman392 does not render obvious claim element [1.7]. *Id.*

185. Dr. Woods has not relied on Tocci to cure these deficiencies in Baarman392. Thus, Dr. Woods has not shown by the preponderance of the evidence that claim element [1.5] would be rendered obvious by Baarman392 in view of Tocci.

2. Dr. Woods Fails to Demonstrate that Baarman392 in View of Tocci Renders Obvious Limitation [1.7]

186. Limitation [1.7] requires “said driver is configured to: provide less power by increasing said non-resonant transmission frequency by an incremental value when said first signal is detected by the detector.” Dr. Woods alleges that Baarman392 discloses a frequency controller that “is configured to provide less power by increasing the non-resonant transmission frequency by an incremental value when a feedback signal is detected that indicates an abnormal charging condition.” Ex. 1003 at ¶ 125.

187. This alleged increase of the transmission frequency—from frequency B to frequency A in Figure 3—would occur at or near the resonant frequency. *See* Ex. 1006 at [0038] (explaining that “[f]requency B is somewhat less than the resonant frequency,” and is thus at or near the resonant frequency); Ex. 2010 at 33:12-20 (“Q. Is it your opinion that frequencies that are somewhat less than the resonant frequency are substantially different than the resonant frequency. A. I don’t know about in general, but I would say frequency B is -- we know it’s not on

resonance. Baarman says so. So I would say that makes it substantially different.”). Accordingly, this adjustment is not an incremental increase to a **non-resonant** transmission frequency in the near-linear region, as required by claim element [1.7]. *See* Ex. 1006 at [0038].

188. For example, the '204 Patent's claimed “incremental value” (*e.g.*, δf as illustrated in Fib. 6b of the '204 Patent) allows any frequency between f_U and f_b to be selected in the linear region, for example by using different incremental values. *See* '204 Patent at 23:5-7 (“It is noted that the positive incremental value δf_1 may be greater than, less than or equal to the negative incremental value δf_2 .”). However, as explained above, operation of the inverter between frequency B and frequency A is performed non-linearly.

189. Accordingly, Baarman392's disclosure of a transmission frequency change that occurs at or near the resonant frequency does not satisfy the requirement of limitation [1.7]. Thus, Dr. Woods has not shown by the preponderance of the evidence that claim element [1.7] would be rendered obvious by Baarman392 in view of Tocci.

3. Dr. Woods Fails to Demonstrate that Baarman392 in View of Tocci Renders Obvious Limitation [1.8]

190. Limitation [1.8] requires “[said driver is configured to:] provide more power by decreasing said non-resonant transmission frequency by an incremental

value when said second signal is detected by the detector.” Dr. Woods alleges that Baarman392 discloses a frequency controller that “is configured to provide more power by decreasing the non-resonant transmission frequency by an incremental value when there is no indication of an abnormal charging condition (e.g., an over-current or over-voltage situation).” Ex. 1003 at ¶ 127.

191. Rather than decreasing the frequency by an incremental value “when a second signal is detected by the signal detector,” as required by claim element [1.8], Baarman392 discloses “the charging step generally includes the steps of incrementally moving the frequency of the power applied to the primary coil closer to resonance **until a feedback signal is received**” Ex. 1006 at [0019]. In other words, reception of a feedback signal causes Baarman392 to stop decreasing the frequency of the power signal applied to the primary coil, rather than “decreasing said non-resonant frequency by an incremental value when said second signal is detected by the detector” as in claim element [1.8]. *See* Ex. 1006, Fig. 7 (Block 150, steps 114, 116, 118, and 112). A POSITA would interpret the latter (detection of the second signal) as effectively triggering the decrease in frequency, which Baarman392 does not disclose.

192. Accordingly, Baarman392’s disclosure of a transmission frequency change that occurs at or near the resonant frequency does not satisfy the requirement

of limitation [1.8]. Thus, Dr. Woods has not shown by the preponderance of the evidence that claim element [1.8] would be rendered obvious by Baarman392 in view of Tocci.

4. Dr. Woods Fails to Demonstrate that Baarman392 in View of Tocci Renders Obvious Limitation [10.1]

193. Limitation [10.1] requires “providing an oscillating voltage to said primary inductive coil at an initial transmission frequency f_t substantially different from a characteristic resonant frequency f_R of the system.” Dr. Woods’s argument that this limitation is disclosed by Baarman392 in view of Tocci relies on its argument for limitation [1.5]. Ex. 1003 at ¶ 153. Thus, for at least the reasons explained above in Section VIII.C.1, Dr. Woods has not demonstrated by a preponderance of the evidence that Baarman392 in view of Tocci renders obvious limitation [10.1].

5. Dr. Woods Fails to Demonstrate that Baarman392 in View of Tocci Renders Obvious Limitation [13]

194. Limitation [13] recites: “The method of claim 10 wherein the step of said driver adjusting said non-resonant transmission frequency further comprises: said driver reducing said non-resonant transmission frequency by an incremental value df_1 when the received feedback signal is of the first type S_a , and said driver increasing said non-resonant transmission frequency by an incremental value $+df_2$

when the received feedback signal is of the second type Sb.” As explained above in Sections VIII.C.2 and VIII.C.3, Baarman392 does not disclose an incremental change in the non-resonant transmission frequency. Thus, for similar reasons explained above, Baarman392’s alleged disclosure of “reduc[ing] the non-resonant transmission frequency by an incremental value $df1$ ” and “increas[ing] the non-resonant transmission frequency by an incremental value $+df2$ ” fails to satisfy the requirement of limitation [13]. *See* Ex. 1003 at ¶ 161. Accordingly, Dr. Woods has not demonstrated by a preponderance of the evidence that Barrman392 in view of Tocci renders obvious limitation [13].

IX. RESERVATION OF RIGHTS

195. In addition to the opinions and evidence expressed herein, I reserve the right to rebut any arguments made or evidence presented in response to this declaration, or to address the specific prior art references asserted in the Petition. I also reserve the right to supplement this declaration based on further investigation or analysis.

X. CONCLUSION

196. I hereby declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful

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Declaration of Patrick Mercier, Ph.D.

false statements and the like so made are punishable by fine and/or imprisonment under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the patent which is under review in this proceeding.

Executed this 21st day of May 2025 in San Diego, CA.

By:

A handwritten signature in black ink, appearing to read "P. Mercier", with a stylized initial "P" and a long horizontal flourish extending to the right.

Patrick Mercier

Appendix A

Patrick P. Mercier

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Professional Highlights

- Currently leading a ~20-person group undertaking high-impact research spanning multiple domains, from near-zero-power integrated circuits, power management, energy harvesting, neural interfaces, wearable physiochemical sensors, RFICs and RF systems, and beyond
- Over 220 peer-reviewed publications, including 30 *ISSCC* papers, 37 *JSSC* papers, and several papers in high-impact journals such as *Science*, *Nature Biotechnology*, *Nature Biomedical Engineering*, *Nature Electronics*, *Nature Communications*, *Advanced Science*, *Energy and Environmental Science*, and more
- Recognized as one of the top contributors of all time at the 2023 *IEEE International Solid-State Circuits Conference (ISSCC)*
- Co-founder and co-director of the successfully industry-supported UCSD Center for Wearable Sensors
- Site Director of the successfully industry/NSF-supported IUCRC Power Management Integration Center, partnered with Dartmouth College
- Multiple young investigator awards: DARPA YFA, NSF CAREER, Beckman YIA
- ISSCC Jack Kilby Award for Outstanding Student Paper
- Over \$40MM in research fundraising to date
- UCSD-wide Academic Senate Teaching Award, and two ECE department teaching awards
- IEEE Fellow, Class of 2025
- ISSCC Executive Committee member; former ISSCC, VLSI, and CICC TPC member
- Startup co-founder (Traq), board member (QuantalRF), and scientific advisory board member (Nanovision and NeuroVigil)
- 24 issued US patents

Education

Ph.D. **Massachusetts Institute of Technology**, Electrical Engineering, June 2012

Thesis title: *Communication and Power Delivery Architectures for Personal Medical Devices* (GPA: 5.0/5.0)

Advisor: Anantha P. Chandrakasan

- S.M. **Massachusetts Institute of Technology**, Electrical Engineering, June 2008
Thesis title: *An All-Digital Transmitter for Pulsed Ultra-Wideband Communication* (GPA: 5.0/5.0)
Advisor: Anantha P. Chandrakasan
- B.Sc. **University of Alberta**, Electrical and Computer Engineering, May 2006
GPA: 4.0/4.0

Related Experience

University of California, San Diego

Vice Chair, Electrical and Computer Engineering (2024-present)
Professor, Electrical and Computer Engineering (2023-present)
Site Director, Power Management Integration Center (2021-present)
Associate Professor, Electrical and Computer Engineering (2018-2023)
Co-Founder/Co-Director, Center for Wearable Sensors (2014-present)
Assistant Professor, Electrical and Computer Engineering (2012-2018)

Expert Witness

Providing expert technical advice, reports, and depositions on a variety of patent litigation cases (2020-present)

NeuroVigil

Scientific Advisory Board Member (2020-present)

Nanovision

Scientific Advisory Board Member (2019-present)

Quantal RF

Board Member (2018-2024)

Traq / Mouthsense Inc.

Co-Founder/Scientific Advisor (2016-present)

Mercier Engineering

Owner, providing engineering and technical expertise to technology companies. (2013-present)

Massachusetts Institute of Technology, Microsystems Technology Laboratory, *Research Assistant* (2006-2012)

Intel Corporation, Circuits Research Lab, *Graduate Technical Intern* (2008)

Selected Honors and Awards

- **IEEE Fellow** – awarded to less than 0.1% of voting members in the IEEE Solid-State Circuits Society – Class of 2025
- **Teacher of the Year Award** – Jacobs School of Engineering at UC San Diego Annual Best Teacher Award Selected by Ballot of the Students – 2023

- **IEEE International Solid-State Circuits Conference (ISSCC) Author-Recognition Award** – Awarded to authors who have contributed more than 20 papers to ISSCC – 2023
- **San Diego County Engineering Council Outstanding Engineer Award** – Awarded annually to a single local engineer who has made significant technical contributions to their society – 2020
- **National Academy of Engineering Frontiers of Engineering Speaker** – A competitive invitation-only event for those who have demonstrated accomplishment in engineering research and technical work with recognizable contributions to advancing the frontiers of engineering – 2019
- **IEEE Solid-State Circuits Society Distinguished Lecturer** – Nominated to deliver invited lectures at local chapters and regional meetings across the world for a two-year term – 2019
- **NSF CAREER Award** – The National Science Foundation’s most prestigious awards in support of early-career faculty – 2018
- **Biocom Catalyst Award** – Awarded to ten academics, entrepreneurs, investors, corporate leaders, and business advisers under 40 years old who are igniting innovation and growth in the San Diego and Los Angeles life sciences industry – 2017
- **IEEE Senior Member** – Elected for showing significant performance over a 10+ year career – 2017
- **Moore Inventor Fellow Finalist** – Selected as a top-10 fellow amongst >200 other applicants at top US universities; received \$25k award – 2017
- **UCSD Academic Senate Distinguished Teaching Award** – Awarded yearly to five distinguished teachers across all departments at UCSD (totaling ~2200 senate members – i.e., the top 0.2% of teachers). First winner in the ECE department since Jack Wolf in 1999. Received 2016
- **DARPA Young Faculty Award** – Awarded to young faculty members who propose high-impact, high-risk research programs – 2015
- **Beckman Young Investigator Award** – Awarded to eight junior faculty members across the US for innovating research within the chemical and biological sciences – 2015
- **Hellman Fellowship Award** – Awarded to junior faculty members who show capacity for great distinction in their research and creative activities – 2014
- **Graduate Teaching Award** – Awarded annually to one (of ~50) faculty in the UCSD ECE department for outstanding teaching and service – 2013
- **Jack Kilby Award** – One awarded per year for outstanding student paper at the *International Solid-State Circuits Conference (ISSCC)* – received 2010
- **Intel Foundation Ph.D. Fellowship** – awarded to 26 applicants across the US – 2009
- **Post Graduate Scholarship** – Natural Sciences and Engineering Council of Canada (NSERC) – 2007, 2009
- **Best Presentation Award**, Microsystems Technology Lab Annual Research Conference – 2008, 2010
- **Julie Payette Postgraduate Research Fellowship** – Awarded to the top 24 Master’s NSERC applicants in Canada – 2006
- **APEGGA Medal** – Highest undergraduate GPA in Electrical Engineering – 2006
- **Atco Electric Centennial Award** – March 2005
- **Schlumberger Scholarship** in Electrical Engineering – 2004, 2005

Other Awards and Recognitions

- **IEEE Custom Integrated Circuits Conference (CICC) 2025** – Best Paper Award Finalist
- **IEEE International Solid-State Circuits Conference (ISSCC) Student Research Preview Poster Award** – 2024
- **IEEE Solid-State Circuits Society (SSCS) Outstanding Reviewer Reward** – 2024.
- **IEEE ISCAS Women in Circuits and Systems (WiCAS)** – Runner Up Paper Award – 2023.
- **IEEE International Symposium on Circuits and Systems (ISCAS)** – Best Runner Up Paper – 2023.
- **Qualcomm Innovation Fellowship (QIF) 2023** – Winner
- **IEEE Applied Power Electronics Conference (APEC)** – Outstanding Presentation Award 2023 – “A Series/Parallel Magnetic-Less Step-Down Converter Based on Piezoelectric Resonators”
- **IEEE Brain Technical Community and IEEE Solid-State Circuits Society** – Brain-Related Best Paper Award 2021 – “An Optically-Addressed Nanowire-Based Retinal Prosthesis with 73% RF-to-Stimulation Power Efficiency and 20nC-to-3°C Wireless Charge Telemetry” presented at ISSCC 2021.
- **IEEE Symposium on Very Large Scale Integration (VLSI Symposium) 2020** – Best Student Paper Award Nominee – “A -105dB THD 87dB-SNDR VCO-based Sensor Front-end Enabled by Background-Calibrated Differential Pulse Code Modulation”
- **IEEE Symposium on Very Large Scale Integration (VLSI Symposium) 2020** – Best Student Paper Award Nominee – “A 4.4μW -92/-90.3dBm Sensitivity Dual-mode BLE/Wi-Fi Wake-up Receiver”
- **Qualcomm Innovation Fellowship (QIF) 2020** – Winner
- **IEEE EMBS Workshop on Brain, Mind and Body – Cognitive Neuroengineering for Health and Wellness 2019** – Third place poster award
- **IEEE Custom Integrated Circuits Conference (CICC) 2019** – Outstanding Student Paper Award Nominee
- **IEEE Custom Integrated Circuits Conference (CICC) 2018** – Outstanding Student Paper Award Nominee
- **IEEE Custom Integrated Circuits Conference (CICC) 2015** – Outstanding Student Paper Award Nominee
- **Qualcomm Innovation Fellowship (QIF) 2014** – Finalist

List of Publications

BOOKS

- [1] S. Ha, C. Kim, P.P. Mercier, G.C. Cauwenberghs, **High-Density Integrated Electrocortical Neural Interfaces**, Elsevier Academic Press, 2019, 187 pages.
- [2] M.M. Hella and P.P. Mercier (eds), **Power Management Integrated Circuits**, CRC Press, 2016, 329 pages.
- [3] P.P. Mercier and A.P. Chandrakasan (eds), **Ultra-low-power Short-Range Radios**, Springer, 2015, 394 pages.

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- [1] F. Laiwalla, V.W. Leung, J. Lee, P. Mercier, P. Asbeck, R. Rao, L. Larson, A. Nurmikko, “Next Generation Microscale Wireless Implant System for High-Density, Multi-areal, Closed-Loop Brain Computer Interfaces,” in **Brain-Computer Interface Research**, C. Guger et al. (eds.), Springer Nature Switzerland, 2021.
- [2] S. Ha, C. Kim, H. Wang, Y.M. Chi, P.P. Mercier, G. Cauwenberghs, “Low-power integrated circuits for wearable electrophysiology,” in **Wearable Sensors – Fundamentals, Implementation and Applications 2nd Edition**, E. Sazonov, Ed., Academic Press, 2021.
- [3] L.G. Salem and P.P. Mercier, “Recursive Switched-Capacitor DC-DC Converters,” in **Power Management Integrated Circuits**, M.M. Hella and P.P. Mercier, Eds., CRC Press, 2016.
- [4] D. Lee and P.P. Mercier, “Introduction to Ultra Low Power Transceiver Design,” in **Ultra-low-power Short-Range Radios**, P.P. Mercier and A.P. Chandrakasan, Eds., Cham, Switzerland: Springer, 2015.
- [5] P.M. Nadeau, A. Paidimarri, P.P. Mercier, and A.P. Chandrakasan, “Architectures for Ultra-Low-Power Multi-Channel Resonator-Based Wireless Transceivers,” in **Ultra-low-power Short-Range Radios**, P.P. Mercier and A.P. Chandrakasan, Eds., Cham, Switzerland: Springer, 2015.
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- [1] N.S.K. Fathy, R. Vatsyayan, A.M. Bourhis, S.A. Dayeh, P.P. Mercier, “A TDMA Neural Recording SoC With IIR-RLS Adaptive Filters for 83.4 dB Artifact Suppression Across 256 Channels,” *IEEE Journal of Solid-State Circuits*, 2025.
- [2] D. Valencia, P.P. Mercier, A. Alimohammad, “An Efficient Brain-Switch for Asynchronous Brain-Computer Interfaces,” *IEEE Transactions on Biomedical Circuits and Systems*, vol. 19, no. 1, pp. 130-141, Feb. 2025.
- [3] W.-C.B. Liu, G. Pillonnet, P.P. Mercier, “An Integrated Dual-Side Series/Parallel Piezoelectric Resonator-Based DC–DC Converter,” *IEEE Journal of Solid-State Circuits*, vol. 59, no. 12, pp. 4162-4174, Dec. 2024.
- [4] H. Lu, P.P. Mercier, “Linear Periodically Time-Variant Digital PLL Phase Noise Modeling Using Conversion Matrices and Uncorrelated Upsampling,” *IEEE Transactions on Circuits and Systems I*, vol. 71, no. 12, pp. 6021-6033, Dec. 2024.
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- [6] W.-C.B. Liu, P.P. Mercier, “Design and Analysis of a Frontside Series/Parallel Piezoelectric Resonator-Based DC-DC Converter,” *IEEE Transactions on Power Electronics*, vol. 40, no. 1, pp. 1389-1403, Sep. 2024.

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- [9] H. Lu, A.G. Gadelkarim, J. Huang, P.P. Mercier, "A 0.69-mW Sub-Sampling NB-IoT Receiver Employing a Linearized Q-Boosted LNA," *IEEE Open Journal of the Solid-State Circuits Society*, vol. 4, pp. 57-68, Jun. 2024.
- [10] D. Valencia, P.P. Mercier, A. Alimohammad, "Efficient In Vivo Neural Signal Compression Using an Autoencoder-based Neural Network," *IEEE Transactions on Biomedical Circuits and Systems*, vol 18., no 3, pp. 691-701, Jun. 2024.
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- [12] J. Wu, A. Akinin, J. Somayajulu, M.S. Lee, A. Paul, H. Lu, Y. Park, S.-J. Kim, P.P. Mercier, G. Cauwenberghs, "A Low-Noise Low-Power 0.001Hz-1kHz Neural Recording System-on-Chip with Sample-Level Duty-Cycling," *IEEE Transactions on Biomedical Circuits and Systems*, vol. 18, no. 2, pp. 263-273, Apr. 2024.
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- [14] H. Lu, H.R. Kooshkaki, P.P. Mercier, "A Mixer-First Receiver with On-Demand Passive Harmonic Rejection," *IEEE Solid-State Circuits Letters*, vol. 7, pp. 46-49, Jan. 2024.
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- [45] J. Lee, V. Leung, A. Lee, J. Huang, P. Asbeck, P.P. Mercier, S. Shellhammer, L. Larson, F. Laiwalla, A. Nurmikko, "Neural recording and stimulation using wireless networks of microimplants," *Nature Electronics*, no. 4, pp. 604-614, Aug. 2021.
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TUTORIALS

- [1] P.P. Mercier, "Enabling Standards-Compliant Wireless Communications at >100x Lower Power," *Tutorial Presented at the International Microwave Symposium (IMS)*, Atlanta, GA (virtual due to COVID-19), Jun. 2021.
- [2] P.P. Mercier, "Interface Circuits for Wearable and Implantable Sensing Systems," *Tutorial presented at the IEEE International Solid-State Circuits Conference (ISSCC)*, San Francisco, CA, Feb. 2020.
- [3] P. P. Mercier, "Physiochemical Interface Circuits for Wearable and Implantable Sensing Systems," *IEEE Solid-State Circuits Society ISSCCedu online mini-course*, San Francisco, CA, Feb. 2020.
- [4] P.P. Mercier, "Building Li-ion-compatible DC-DC Converters in Scaled CMOS," *IEEE Solid-State Circuits Society CICCedu online mini-course*, Austin, TX, Apr. 2019.
- [5] P.P. Mercier, "Power Management for the Internet-of-Things," *Tutorial presented at the IEEE Custom Integrated Circuits Conference (CICC)*, Austin, TX, Apr. 2019.
- [6] P.P. Mercier, "Nanowatt wake-up radios: exploring power and sensitivity trade-offs," *Tutorial presented at the IEEE International Microwave Symposium (IMS)*, Philadelphia, PA, June 2018.
- [7] P.P. Mercier, "Design of Low-Power Wake-up Radios for IoT Applications," *Tutorial presented at the IEEE Custom Integrated Circuits Conference (CICC)*, San Diego, CA, April 2018.

- [8] P.P. Mercier, “Unawareables: new wearable sensors and circuits for unobtrusive health and fitness monitoring,” *Tutorial presented at the IEEE European Solid-State Circuits Conference (ESSCIRC)*, Leuven, Belgium, Sep. 2017.
- [9] P.P. Mercier, “Improving Battery-Life of Deeply Duty-Cycled IoT Nodes via Ultra-Low-Power Wake-up Receivers,” *Tutorial presented at the IEEE International Microwave Symposium (IMS)*, Honolulu, HI, Jun. 2017.
- [10] P.P. Mercier, “Ultra-Low-Power RC Oscillators,” *Tutorial presented at the IEEE International Microwave Symposium (IMS)*, Honolulu, HI, Jun. 2017.

INVITED ABSTRACTS, PRESENTATIONS, AND POSTERS

- [1] P.P. Mercier, “Unaware-ables: Low-Power, Robust, and Useful Wearable Devices”, *Presented at the IEEE International Microwave Symposium*, Denver, CO, Jun. 2022.
- [2] P.P. Mercier, “Energy-Efficient Power Management Circuits for IoT and Wearable Devices,” *Keynote presentation at the IEEE Sensors Interface Meeting*, Veldhoven, The Netherlands, May 2022.
- [3] P.P. Mercier, “Energy Harvesting and Self-Powered Sensing for Miniaturized IoT and “Unawareable” Devices,” *Presented at the PSMA International Energy Harvesting Workshop (EnerHarv)*, Raleigh, NC, Apr. 2022.
- [4] P.P. Mercier, “Enabling Low-Power yet Standards Compatible Wireless Communication via Wake-up Receivers and Backscatter Circuits for the IoT,” *Presented as an IEEE SSCS Society-wide Webinar*, Jan. 2022.
- [5] P.P. Mercier, “Energy Harvesting and Self-Powered Sensing for Next-Generation “Unawareables” and IoT,” *Presented at the Sensors Converge Conference*, (virtual due to COVID-19), Sep. 2021.
- [6] P.P. Mercier, “Ultra-low-power integrated circuits and physiochemical sensors for next-generation unawareables,” *IEEE Solid-State Circuits Society Distinguished Lecture at Oregon IEEE Solid-State Circuits Society local chapter*, Hillsboro, OR (virtual due to COVID-19), Jun 2021.
- [7] P.P. Mercier, “Ultra-Low-Power Integrated Circuits and Physiochemical Sensors for Next-Generation Unawareables”, *Presented at the International Symposium on Advanced Sensor Technology*, Seoul, Korea (virtual due to COVID-19), Mar. 2021.
- [8] P.P. Mercier, “Energy-Efficient Communication Technologies for Emerging Internet-of-Things Applications,” *IEEE Solid-State Circuits Society Distinguished Lecture at the SSCS Northern Virginia Section*, (virtual due to COVID-19), Oct. 2020.
- [9] P.P. Mercier, “Hybrid Converters for Mobile and IoT Applications,” *Presented at the Integrated Power Conversion and Power Management Conference (PwrSoC)* (virtual due to COVID-19), Nov. 2020.
- [10] P.P. Mercier, “Low-Power Communication Circuits and Technologies for Emerging Internet-of-Things Applications,” *IEEE Solid-State Circuits Society Distinguished Lecture at the SSCS Princeton Central Jersey Section*, (virtual due to COVID-19), Nov. 2020.
- [11] P.P. Mercier, “Energy-Efficient Communication Technologies for Emerging Internet-of-Things Applications,” *Presented at the 2020 RFID Conference*, (virtual due to COVID-19), Oct. 2020.
- [12] P.P. Mercier, “Energy-Efficient Communication Technologies for Emerging Internet-of-Things Applications,” *IEEE Solid-State Circuits Society Distinguished Lecture at the SSCS Utah Section*, (virtual due to COVID-19), Oct. 2020.

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- [14] P.P. Mercier, "Ultra-low-power integrated circuits and physiochemical sensors for next-generation unawearables," *IEEE Solid-State Circuits Society Distinguished Lecture at the Beijing IEEE Solid-State Circuits Society local chapter*, (virtual due to COVID-19), May 2020.
- [15] P.P. Mercier, "Low-Power Wireless Systems: Opportunities and Challenges," *Presented at the DARPA MTO Offsite Planning Meeting on the U.S.S. Midway*, San Diego, CA, Dec. 2019.
- [16] P.P. Mercier, "Ultra-low-power integrated circuits and physiochemical sensors for next-generation unawearables," *IEEE Solid-State Circuits Society Distinguished Lecture at the Scotland and UK IEEE Solid-State Circuits Society local chapter*, Edinburgh, UK, Sep. 2019.
- [17] P.P. Mercier, "Ultra-low-power integrated circuits and physiochemical sensors for next-generation unawearables," *IEEE Solid-State Circuits Society Distinguished Lecture at the Maryland/Virginia/DC IEEE Solid-State Circuits Society and Circuits and Systems local chapter*, College Park, MD, Sep. 2019.
- [18] P.P. Mercier, "Ultra-low-power integrated circuits enabling next-generation IoT applications," *Presented at the National Academy of Engineering Frontiers of Engineering event*, San Diego, CA, Jun. 2019.
- [19] P.P. Mercier, "Ultra-low-power integrated circuits and physiochemical sensors for next-generation unawearables," *IEEE Solid-State Circuits Society Distinguished Lecture at the San Diego IEEE Solid-State Circuits Society local chapter*, San Diego, CA, May. 2019.
- [20] P.P. Mercier, "Unwearables: Addressing Sensor, Circuit, and Energy Harvesting Challenges in Next-Generation Wearable Devices," *Presented at the IEEE Custom Integrated Circuits Conference (CICC)*, Austin, TX, Apr. 2019.
- [21] P.P. Mercier, "Ultra-Low-Power Integrated Circuits and Physiochemical Sensors for Next-Generation Unwearables," *Presented at the DARPA Actuation, Sensing, and Control for Rapid Injury Response Workshop*, Arlington, VA, Apr. 2019.
- [22] P.P. Mercier, "Ultra-Low-Power Integrated Circuits and Physiochemical Sensors for Next-Generation Unwearables," *Presented at the University of Southern California*, Los Angeles, CA, Nov. 2018.
- [23] P.P. Mercier, "Unwearables: new wearable sensors, circuits, and analytics for unobtrusive monitoring," *Presented at the SEMI MEMS & Sensors Executive Congress*, Napa, CA, Nov. 2018.
- [24] P.P. Mercier, "Ultra-small near-zero-power radios, implants, and sensing systems," *Presented at the DARPA Microsystems Exploratory Council Millimeter-Scale Wirelessly Powered Sensors Workshop*, Los Angeles, CA, Jul. 2018.
- [25] P. P. Mercier, "Wearable Sensors", *Presented at the US Marine Corps Innovation Event*, La Jolla, CA, Feb. 2018.
- [26] P.P. Mercier, "The Next Industrial Revolution: IoT, Wearables, and AI," *Presented at the Next Business Forum*, Seoul, South Korea, Nov. 2017.
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- [28] P.P. Mercier, "Non-Invasive Blood Alcohol Monitoring," *Presented at the Biomedical Technology Exhibition, sponsored by the American Institute for Medical and Biological Engineering (AIMBE) in partnership with the Congressional Research and Development Caucus and the Congressional Robotics Caucus*, Capitol Hill, Washington, DC, May 2017.

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- [32] P.P. Mercier, "Physiochemical Sensor Technologies and Ultra-Low-Power Integrated Circuits for Next-Generation "Unawearables" Systems," *Invited Seminar at the Microsystems Technology Lab at MIT*, Cambridge, MA, Dec. 2016.
- [33] P.P. Mercier, "Transcutaneous Power of Single-Chip Implants," *Presented at the Sensors Global Summit*, La Jolla, CA, Dec. 2016.
- [34] D. Ahn, P.P. Mercier, "A 200-kHz/6.78-MHz Wireless Power Transmitter Featuring Concurrent Dual-Band Operation," in *Proc. IEEE International SoC Design Conference (ISOC)*, Jeju, South Korea, Oct. 2016. DOI: 10.1109/ISOC.2016.7799763
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- [36] P.P. Mercier, "Wearables: an opportunity for healthcare?," *Presented at the 5G Connected Healthcare Workshop*, La Jolla, CA, May 2016.
- [37] P.P. Mercier, "New Circuit Topologies & Techniques for High-Efficiency Power Conversion in Compact Form Factors," *Invited seminar presented at UCLA and Intel Corporation*, Apr. 2016.
- [38] P.P. Mercier, "Energy-Efficient Wearable Sensors," *Presented at the UCSD Orthopaedic Surgery Research Conference*, April 2016.
- [39] P.P. Mercier and L.G. Salem, "Multi-Ratio Switched-Capacitor DC-DC Converters for Power Management Applications," *Presented at the International Symposium on Quality Electronic Design*, Santa Clara, CA, Mar. 2016.
- [40] P.P. Mercier, "Energy-Harvesting for Autonomous Operation of Low-Power Wireless Sensors," *Presented at the Sensors Global Summit*, La Jolla, CA, Nov. 2015.
- [41] P.P. Mercier, "Enabling energy-autonomous wearable and implantable sensors through energy harvesting and near-zero-power electronics," *Presented at the KAIST-UCSD Joint Symposium on Wearable Devices*, Daejeon, Korea, Oct. 2015.
- [42] P.P. Mercier, "Enabling wide output voltage range switched-capacitor DC-DC converters," *Presented at a SRC/SONIC eWorkshop*, Jun. 2015.
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- [46] P.P. Mercier, "A Tutorial on Wireless Power Transfer and Miniaturized DC/DC Power Converters," *Presented at SPAWAR Systems Center Pacific*, San Diego, CA, June 2014.

- [47] P.P. Mercier, "New Advances in Wearable Devices, Biosensors, and Analytics", Panelist at the *Digital Health Forum of San Diego: The Future of Wearable Technologies in Healthcare*, La Jolla, CA, June 2014.
- [48] P.P. Mercier, "Breaking down power barriers: efficient and miniaturized energy management and energy harvesting," *Presented at the Huawei Power Summit*, San Diego, CA, May 2014.
- [49] P.P. Mercier S. Bandyopadhyay, A.C. Lysaght, K.M. Stankovic, A.P. Chandrakasan, "Powering Wireless Devices from the Biologic Battery in the Inner-Ear," *IEEE International SoC Conference*, Irvine, CA, Oct. 2013.
- [50] P.P. Mercier and V. Sridharan, "Low-Power Transmitters for Body-Area Networks," *IEEE Symposium on Power Amplifiers for Wireless Communication*, La Jolla, CA, Sep. 2013.
- [51] P.P. Mercier, "Powering a 2.4 GHz Radio from the Biologic Battery in the Inner-Ear," *Presented at the CMOS Emerging Technologies Symposium*, Whistler, BC, Canada, Jul. 2013.
- [52] P.P. Mercier, "Electrochemical energy harvesting from the inner-ear," *Presented at the INC-IEM Neuroengineering Seminar Series*, La Jolla, CA, Mar. 2013.
- [53] A.C. Lysaght, P.P. Mercier, S. Bandyopadhyay, A.P. Chandrakasan, and K.M. Stankovic, "Endocochlear Potential Powered Electronics" *Associated for Research in Otolaryngology Annual MidWinter Meeting*, vol. 36, Baltimore, MD, Feb., 2013.
- [54] P.P. Mercier, "Enabling study and control of insects through extreme miniaturization of wireless electronics," *Presented at Burapha Univeristy*, Chonburi Province, Thailand, Dec., 2012.
- [55] P.P. Mercier, "nW Energy Harvesting: What can it do for you?," *Presented at the Office of Naval Research Power and Energy Systems 6.1 Program Review*, San Diego, CA, Nov. 2012.
- [56] P.P. Mercier, "Ultra-Low-Power Radios for Miniaturized Sensing Systems," *Presented at the Center for Wireless Communications Semiannual Research Review*, La Jolla, CA, Nov. 2012.
- [57] P.P. Mercier, "Zero-Leakage Electronics and Opportunities in Miniaturized Wireless Systems," *Presented at the Center for Magnetic Recording Research Review*, La Jolla, CA, Oct. 2012.
- [58] P.P. Mercier, "Cyborg Insects and Autonomous Sensors: How Efficient Radios can Enable the Next Generation of Connectivity," *Presented at the Qualcomm Research Center*, San Diego, CA, Oct. 2012.
- [59] A. Paidimarri, P. Nadeau, P.P. Mercier, and A. Chandrakasan, "Ultra-low Power FBAR-based Multi-Channel Transceivers," *Presented at the ISSCC Student Research Preview*, San Francisco, CA, Feb. 2012.
- [60] P.P. Mercier, "Self-Powered Personal Microsystems for Medical Monitoring Applications," *Presented at TechConnect World*, Boston, MA, Jun. 2011.
- [61] P.P. Mercier, "Attaining Extreme Energy Efficiency in Body-Area Networks Using Electronic Textiles," *Presented at the MEDRC Next Generation Medical Electronic Systems Workshop*, Cambridge, MA, May, 2011.
- [62] P.P. Mercier, "Connected Health for Remote Patient Monitoring," *Presented at the MTL Annual Research Conference (MARC)*, Cambridge, MA, Jan. 2010.
- [63] P.P. Mercier, "Personal Medical Connectivity: Research Overview," *Presented at the Intel Digital Health Group*, Hillsboro, OR, Oct. 2009.
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- [65] P.P. Mercier, "An Energy-Efficient UWB Transmitter with Dual Capacitively-Coupled Digital Power Amplifiers," *Presented at the Center for Integrated Circuits and Systems*, Cambridge, MA, Apr. 2008.

- [66] P.P. Mercier, "A 22pJ/pulse All-Digital UWB Transmitter in 90nm CMOS," *Presented at the International Solid-State Circuits Conference (ISSCC) Student Forum*, San Francisco, CA, Feb. 2008.
- [67] P.P. Mercier, "Fully Integrated Pulsed-UWB Transceivers for Small Lightweight Flying Vehicles," *Presented at the MTL Annual Research Conference (MARC)*, Waterville Valley, MA, Jan. 2008.
- [68] P.P. Mercier, "Cost Modeling for Vertically Integrated Chip Sets," *Presented at the CMOS Emerging Technologies Workshop*, Banff, AB, Canada, Jul. 2006.

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- [2] J. Wang, P. Mercier, A.F. Yeknami, S. Imani, "Self-Powered Biosensors," U.S. Patent 11,633,134, Apr. 25, 2023.
- [3] P.-H. Wang, P. Mercier, "BLE and/or WiFi Compliant and Blocker-Resilient Wake-up Receiver and Method," U.S. Patent 11,570,709, Jan 31, 2023.
- [4] H. Wang, P. Mercier, "Near Zero Power Fully Integrated Digital Conversion, Sensors, and Sensing Methods," U.S. Patent 11,444,633, Sep. 13, 2022.
- [5] S. Amin, P. Mercier, "Li-ion-compatible fully-integrated hybrid converter," U.S. Patent 11,356,017, Jun. 7, 2022.
- [6] P. Mercier, H. Wang, "Stabilized voltage and current reference generator and circuits," U.S. Patent 11,334,105, May 17, 2022.
- [7] J. Wang, P. Mercier, "Flexible epidermal multimodal health monitor," U.S. Patent 11,122,982, Sep. 21, 2021.
- [8] X. Wang, P. Mercier, "Low Power Transmitter Oscillator Circuits and Methods," U.S. Patent 10,897,240, Jan. 19, 2021.
- [9] P. Mercier, H. Wang, "Near Zero Power Charging to Digital Converter, Sensors, and Sensing Methods," U.S. Patent 10,877,439, Dec. 29, 2020.
- [10] C. Kim, G. Cauwenberghs, P.P. Mercier, S. Ha, J. Park, A. Akinin, "Resonant Regulating Rectifier with an Integrated Antenna," U.S. Patent 10,873,215, Dec. 22, 2020.
- [11] P. Mercier, D. Ahn, "Wireless Power Transfer Device and Method with Dual-Frequency Operation," U.S. Patent 10,855,115, Dec. 1, 2020.
- [12] P.-H. Wang, H. Jiang, D. Hall, P. Mercier, "Low Power Wake-up Receiver," U.S. Patent 10,804,946, Oct. 13, 2020.
- [13] C.-K. Cheng, P. Mercier, S.-H. Weng, "Electrical Wearable Capacitive Biosensor and Noise Artifact Suppression Method," U.S. Patent 10,729,379, Aug. 4, 2020.
- [14] J. Wang, A.J. Bandodkar, P. Mercier, "Non-invasive and Wearable Chemical Sensors and Biosensors," U.S. Patent 10,722,160, Jul. 28, 2020.
- [15] S. Ha, G. Cauwenberghs, C. Kim, J. Park, P.P. Mercier, A. Akinin, H. Wang, C.H. Maier, "Radio Frequency Powered Adiabatic Stimulation with Energy Replenishment," U.S. Patent 10,716,948, Jul 21, 2020.
- [16] T. Nguyen, H. Garudadri, P. Mercier, A. Boothroyd, C. Mackersie, "External Device Leveraged Hearing Assistance and Noise Suppression Device, Method and Systems," U.S. Patent 10,701,495, Jun. 30, 2020.

- [17] J. Park, P. Mercier, “Low power magnetic field body area network,” U.S. Patent 10,623,112, Apr. 14, 2020.
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- [19] L.G. Salem, P.P. Mercier, “Switched capacitor DC-to-DC converter and power conversion control methods,” U.S. Patent 10,374,511, Aug. 6, 2019.
- [20] L.G. Salem, P.P. Mercier, “Multi-level adiabatic charging methods, devices and systems,” U.S. Patent 10,348,300, Jul. 9, 2019.
- [21] L.G. Salem, J.F. Buckwalter, P.P. Mercier, “Switched Capacitor House of Cards Power Amplifier,” U.S. Patent 10,333,477, Jun. 25, 2019.
- [22] L.G. Salem, P.P. Mercier, “Successive approximation digital voltage regulation methods, devices and systems,” U.S. Patent 10,224,944, Mar. 5, 2019.
- [23] K. Stankovich, A. Chandrakasan, P. Mercier, S. Bandyopadhyay, A. Lysaght, “Energy Extraction,” U.S. Patent 9,369,005, Jun. 14, 2016.
- [24] P.P. Mercier and A.P. Chandrakasan, “Multi-Taped Inductively-Coupled Charging System,” U.S. Patent 9,293,942, Mar. 22, 2016.

Teaching Experience

University of California, San Diego

La Jolla, CA

Instructor

Spring 2020: ECE 165 – Digital Integrated Circuits (92% instructor rating – **even during fully virtual instruction due to COVID-19**)

Fall 2019: ECE 203 – Biomedical Integrated Circuits and Systems (94% instructor rating – **TA won the best ECE TA Award**)

Spring 2019: ECE 165 – Digital Integrated Circuits (96% course rating)

Fall 2018: ECE 203 – Biomedical Integrated Circuits and Systems (95% instructor rating)

Winter 2018: ECE 165 – Digital Integrated Circuits (100% instructor rating)

Winter 2018: ECE 203 – Biomedical Integrated Circuits and Systems (91% instructor rating)

Spring 2017: ECE 165 – Digital Integrated Circuits (100% instructor rating)

Spring 2017: ECE 203 – Biomedical Integrated Circuits and Systems (93% instructor rating)

Fall 2016: ECE260A - VLSI Digital System Algorithms and Architectures (93% instructor rating)

Spring 2015: ECE 165 – Digital Integrated Circuits (**100% instructor & course rating from an 82 student class – ECE dept. record**)

Winter 2015: ECE 203 – Biomedical Integrated Circuits and Systems (93% instructor rating)

Fall 2014: ECE260A - VLSI Digital System Algorithms and Architectures (87% instructor rating)

Spring 2014: ECE 165 – Digital Integrated Circuits (**100% instructor & course rating from a 77 student class – ECE dept. record**)

Winter 2014: ECE 203 – Biomedical Integrated Circuits and Systems (98% instructor rating)

Spring 2013: ECE 283 – Biomedical Integrated Circuits and Systems (99% instructor rating)

Winter 2013: ECE 165 – Digital Integrated Circuits (94% instructor rating)

Massachusetts Institute of Technology

Cambridge, MA

Teaching Assistant

Spring 2010: MIT EECS Course 6.776 – High Speed Communication Circuits.

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Powermat Ex 2009

Funding

Energy-Efficient Microsystems Lab

As PI of the Energy-Efficient Microsystems Lab, I have raised over \$40MM for research at UCSD from the following sources:

- DARPA
- NIH
- NSF
- The Arnold and Mabel Beckman Foundation
- Semiconductor Research Corporation
- ONR
- iARPA
- Army Research Lab
- KETI
- NextFlex
- The Fetzer Franklin Fund
- The Hellman Foundation
- Samsung
- Qualcomm
- Dockon Inc.
- Mouthsense Inc.
- Peregrine Semiconductor
- IMA Life North America
- Moore Foundation
- University of California Multi-Campus Research Programs and Initiatives
- California Energy Commission
- The UCSD Center for Brain Activity Mapping
- The UCSD Center for Wireless Communications (corporate sponsored)
- The UCSD Center for Wearable Sensors (corporate sponsored)
- The Power Management Integration Center (corporate sponsored)

UC San Diego Center for Wearable Sensors

As co-director of the Center for Wearable Sensors, I have been instrumental in fundraising over \$7MM from corporate partners, with the bulk of this funding used to support collaborative

efforts across six engineering departments, the School of Medicine, and the Department of Visual Arts.

Power Management Integration Center

As Site Director of the Power Management Integration Center, I have help recruit corporate members to support research at both UCSD and at Dartmouth College.

Service

Journal service

- Guest Editor – *IEEE Open Journal of the Solid-State Circuits Society (OJ-SSCS) Special Issue on Low-Power RF Circuits and Systems (2023)*
- Guest Editor – *IEEE Journal of Solid-State Circuits* Special Issue on the 2018 *International Solid-State Circuits Conference (ISSCC) (2018)*
- Associate Editor – *IEEE Solid-State Circuits Letters* (2017-2023)
- Associate Editor – *IEEE Transactions on Biomedical Circuits & Systems* (2013-2023)
- Associated Editor – *IEEE Transactions on VLSI* (2015-2017)
- Guest Editor – *IEEE TBioCAS Special Issue on the 2014 International Solid-State Circuits Conference (ISSCC) (December, 2014)*
- Guest Editor – *IEEE TBioCAS Special Issue on the 2013 International Solid-State Circuits Conference (ISSCC) (December, 2013)*

Conference service

- Executive Committee member – Demo Chair – *IEEE International Solid-State Circuits Conference (ISSCC) (2022-present)*
- Technical Program co-Chair – *IEEE Sensor Interfaces Meeting (2022-2024)*
- Subcommittee Chair – Power Management – *IEEE Custom Integrated Circuits Conference (CICC) (2021-2023)*
- Technical Program Committee member – *IEEE VLSI Circuits Symposium (2018-2022)*
- International Technical Program Committee member – *IEEE International Solid-State Circuits Conference (ISSCC) Technology Directions subcommittee (2017-2022)*
- Technical Program Committee member – *IEEE Custom Integrated Circuits Conference (CICC) (2017-2023)*
- Technical program committee – *IEEE Biomedical Circuits and Systems Conference (BioCAS) (2014-2015)*
- Session chair – *International Symposium on Low-Power Electronics and Design (ISLPED) (2014)*
- Technical program committee - *CMOS Emerging Technologies Research Symposium (2013-2016)*

Peer reviewer (2009-present)

- *IEEE Journal of Solid-State Circuits (JSSC)*
- *IEEE Transactions on Circuits and Systems I (T-CAS I)*
- *IEEE Transactions on Circuits and Systems II (T-CAS II)*
- *IEEE Transactions on Microwave Theory and Techniques (T-MTT)*
- *IEEE Sensors Journal*
- *IEEE Transaction on Power Electronics*

- *Journal of Low Power Electronics and Applications (JLPEA)*
- *IET Circuits, Devices & Systems*
- *IEEE International Conference on Ultra-Wideband (ICUWB)*
- *IEEE Transactions on Biomedical Circuits & Systems (TBioCAS)*
- *IEEE Transactions on Biomedical Engineering (TBME)*
- *IEEE International Conference on Circuits and Systems (ISCAS)*
- *IEEE Biomedical Circuits and Systems Conference (BioCAS)*
- *IEEE Journal of Emerging and Selected Topics in Power Electronics*
- *IEEE Transactions on Industrial Electronics*
- *Nature Nanotechnology*
- *Advanced Materials*
- *Nature Biomedical Engineering*
- *Science Advances*

Grant review service

- NSF SenSE panel reviewer (July 2020)
- NSF ECCS panel reviewer (February 2019)
- NSF ECCS panel reviewer (January 2018)
- NSF ECCS panel reviewer (March 2015)
- ARL ARL Director's Research Initiative (DRI) reviewer (June 2015)

UCSD Campus-wide Service

- Chair, Academic Senate Faculty Affairs Committee (2024-present)
- Co-Director – *Center for Wearable Sensors* – including 23 faculty across four engineering departments, the School of Medicine, and Arts and Humanities (Department of Visual Arts). Funding comes from the membership of 6-10 corporate partners. (2014-present)
- Site Director – *Power Management Integration Center* – includes 5 faculty across multiple engineering departments. Funding comes from the membership of 8-12 corporate partners. (2021-present)
- Vice Chair Academic Senate Faculty Affairs Committee (2023-2024)
- Chair, UCSD Academic Senate Awards Committee (2020-2022)
- Member, UCSD Academic Senate Awards Committee (2018-2020)
- Member, Office of Research Affairs Center Launch Review Panel. (2017-2018)
- Member, UCSD School of Public Health Advisory Committee (2017-2019)
- UCSD representative on Capitol Hill – presented to congressional staffers via an event hosted by the American Institute for Medical and Biological Engineering, then met, alongside UCSD's Executive Director of Government Research Relations, with the offices of three San Diego Congressmen and one California Senator to discuss research at UCSD. (2017)
- Faculty representative, Campus-wide commencement ceremony (2017)
- Organizer & presenter, KAIST-UCSD Symposium on Micro/Nanotechnologies and Electronics for Next-Generation Mobile, Wearable, and IoT Systems, Deajeon, Korea (2015)
- Faculty representative, Welcome Week Convocation Ceremony (2013)

UCSD ECE Departmental Service

- Vice Chair, ECE Department (2024-present)
- Member, Faculty search committee, Systems Focus (2024)
- Adhoc committee member, faculty review files (2x in 2024)
- Chair, ECE Faculty Awards Committee (2023-present)

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Powermat Ex 2009

- Chair, ECE Admissions Steering Committee (2020-2022)
- Member, ECE Admissions Committee (2019-present)
- Medical Devices and Systems curriculum advisor (2018-2020)
- ECE 50th Anniversary planning committee (2015-2016)
- MS Exam committee (2014-present)
- Alumni Initiative (2014-2020)
- Undergraduate/Graduate Affairs and Student Award Nomination committee (2012-2014)
- Medical Devices and Systems curriculum director (2013-2014)
- Medical Devices and Systems Ad-hoc committee - responsible for creating a new program in this area (2012-2013)

Co-Chair, Microsystem Technology Lab Annual Research Conference (2011)

Annual research conference with over 200 academic and industrial attendees. Responsible for steering committee leadership and conference organization including: solicitation of papers, managing paper edits, keynote speaker invitation, opening and closing remarks, and general planning. Created interactive attendee activities to solicit social and technical engagement amongst industry members and students. Cited by a high-ranking industry member as “the best student run conference in the country”.

Broader Impacts & Outreach

- Presented a webinar at BioXTech, a country-wide club founded and run by high school women interested in the intersection of biology and technology, and answered questions about technology and gave career advice (2023)
- Featured in the publication entitled “Building Blocks for Better Science: Case Studies in Low-Cost and Open Tools for Science”, which describes my work in low-cost COVID-19 symptoms monitoring devices (2020)
- Guest instructor at Hands-on-Technology summer camp at Wangenheim Middle School focused on accelerating the understanding of computer science in elementary and school-aged children (2014-present)
- Directly mentored ten B.S., M.S., and Ph.D. students from historically underrepresented backgrounds, including two high school students (2012-present)
- Directly mentored two high school students from historically underrepresented backgrounds (2013, and 2016-2017)
- Keynote speaker at ENSPIRE: one of the largest outreach at UCSD, where over 300 middle-school children visit UCSD to learn about higher education and engineering (Feb. 2015)

Press Articles

Prof. Mercier’s work across several different projects and his expert opinion have been featured in hundreds of press articles and in other forms of media (e.g., TV and radio). A few select articles/videos are shown below.

- [1] Adee, S. “Cyborg moth gets a new radio,” *IEEE Spectrum*, Feb. 2009.
<http://spectrum.ieee.org/robotics/military-robots/cyborg-moth-gets-a-new-radio>
- [2] Dillow, C. “Researchers turn animals ears into bio-batteries,” *Popular Science*, Nov. 7, 2012.
<http://www.popsci.com/science/article/2012-11/building-batteries-mammalian-inner-ear>
- [3] Doyle, K. “A chip powered by the battery in your ear,” *Popular Mechanics*, Nov. 7, 2012.

- http://www.popularmechanics.com/how-to/blog/scientists-tap-into-the-battery-in-your-ear-14556133?click=pm_latest
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<http://spectrum.ieee.org/tech-talk/biomedical/devices/using-the-inner-ears-biological-battery>
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<http://www.technologyreview.com/news/541041/bluetooth-alternative-communicates-through-your-body/>
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<http://spectrum.ieee.org/tech-talk/consumer-electronics/gadgets/body-talk-with-magnets>
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<http://phys.org/news/2015-08-mouth-health-markers-transmits-wirelessly.html>
 - [15] Pell, R., "Smart Mouth Guard Monitors Health Markers in Real Time," *EE Times*, Sep. 2, 2015.
http://www.eetimes.com/document.asp?doc_id=1327580
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- [23] “Smartphone case delivers blood glucose readings in one device,” *The Engineer*, Dec. 7, 2017.
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- [24] The Doctors TV Show on CBS, “Could a Temporary Tattoo Help Detect Your Alcohol Content Level?” *The Doctors*, Nov. 7, 2018.
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Appendix B

EXPERT WITNESS PRIOR ENGAGEMENTS

Professor Patrick P. Mercier, Ph.D.
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Case: Shaun Flanenry v. Evolve Skateboards
Case Number: No. 84375-COA
Court: Court of Appeals of Nevada
Expert witness for: Plaintiff
First retained: June 2021
Scope of work: Wrote an expert witness rebuttal report
Deposed or testified?: No
Case status: Closed

Case: Charles Hwang v Test Rite Products Corporations et al.
Case Number: No. 2:22-cv-01259
Court: Central District of California
Expert witness for: Defendant
First retained: September 2022
Scope of work: Studied patents and prepared technical questions for a witness deposition
Deposed or testified?: No
Case status: Closed

Case: Bel Power Solutions Inc v. Monolithic Power Systems Inc
Case Number: No. 6:21-CV-655-ADA
Court: US Western District of Texas Waco Division
Expert witness for: Defendant
First retained: March 2022
Scope of work: Wrote a claim construction brief
Deposed or testified?: No
Case status: Uncertain

Case: Powermat Technologies Ltd. V. Anker Innovations Ltd.
Case Number: 5:23-cv-00052-RWS and other related cases (e.g., IPRs)
Court: US District Court for the Eastern District of Texas Texarkana Division
Expert witness for: Plaintiff
First retained: January 2024
Scope of work: Wrote expert witness rebuttal and IPR reports, testified in depositions
Deposed or testified?: Yes, deposed twice – once for district court case, once for IPR
Case status: Ongoing

Case: Masimo Corp., et al. v. Apple Inc.
Case Number: 8:20-cv-00048-JVS (JDEx)
Court: US District Court, Central District of California, Southern Division
Expert witness for: Defendant
First retained: June 2024
Scope of work: In progress, but so far involved in multiple expert witness reports and deposition/trial prep for invalidity and non-infringement
Deposed or testified?: Not yet
Case status: Ongoing

Case: Powermat Technologies Ltd. V. Belkin International, Inc.
Case Number: 2:24-CV-02595-AH-PVC
Court: US District Court for the Central District of California
Expert witness for: Plaintiff
First retained: November 2024
Scope of work: Wrote an expert declaration in support of claim construction
Deposed or testified?: Yes, deposed
Case status: Ongoing

Case: Samsung Electronics Co., Ltd.; Samsung Electronics American, Inc. v. Ouraring, Inc.
Case Numbers: PGR2024-00030 and other related IPRs and cases
Venue: United States Patent and Trademark Office IPR
Expert witness for: Defendant
First retained: February 2025
Scope of work: Preparing of expert witness declaration for IPR
Deposed or testified?: Not yet
Case status: Ongoing

Case: Vampire Labs LLC v. Apple Inc.
Case Number: 1:24-cv-013770DII
Venue: US District Court for the Western District of Texas, Austin Division
Expert witness for: Defendant
First retained: May 2025
Scope of work: Expert witness work to include report writing, deposition, and trial
Deposed or testified?: Not yet
Case status: Ongoing