

Filed on behalf of: InductEV, Inc.

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

INDUCTEV, INC.,
Petitioner,

v.

WITRICITY CORPORATION,
Patent Owner.

Case IPR2024-00140
Patent 8,466,654

**DECLARATION OF DR. MARK ALLEN
IN SUPPORT OF PETITIONER'S REPLY**

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I. Introduction and Qualifications

1. I have been retained as an expert witness on behalf of InductEV, Inc. (“InductEV” or “Petitioner”) in the above-captioned *inter partes* review (“IPR”) relating to U.S. Patent No. 8,466,654 (“the ’654 patent”) (Ex. 1001).

2. I previously provided a declaration in this matter, dated November 3, 2023, in which I provided opinions relating to the level of skill of ordinary persons in the art, the history of resonators and the relevant technology, claim construction, and the teachings of the prior art as they compare to the claims of the ’654 patent.

3. I understand that my original declaration was submitted as Exhibit 1003. I hereby incorporate Exhibit 1003 into this declaration by reference.

4. My experience and qualifications are set forth in Exhibit 1003 and in my curriculum vitae, which I understand was submitted as Exhibit 1004.

5. I have been asked to provide additional expert opinions regarding these matters in response to certain arguments in the Patent Owner Response and certain opinions of Patent Owner’s witness, Dr. Mark Horenstein.

II. Summary Of Materials Reviewed And Considered

6. All of the opinions contained in this Declaration are based on the documents I reviewed and my knowledge and professional judgment. In forming the opinions expressed in this Declaration, while drawing on my experience in the field of wireless power transfer, I reviewed the following documents:

Ex.	Description
1001	U.S. Patent No. 8,466,654 B2 (“’654 patent”)
1002	File History for U.S. Patent No. 8,466,654 B2 (“’654 FH”)
1005	U.S. Patent No. 5,617,003 (“Odachi”)
1006	U.S. Patent No. 7,952,322 B2 (“Partovi”)
1007	U.S. Patent No. 5,669,470 (“Ross”)
1008	Chwei-Sen Wang, <i>Design Considerations for Inductively Coupled Power Transfer Systems</i> (2004) (Ph.D. dissertation, University of Auckland) (“Wang”)
1009	U.S. Patent No. 5,821,638 (“Boys-638”)
1012	U.S. Patent No. 9,774,086 B2 (“Cook-086”)
1013	U.S. Patent Application Publication No. 2010/0231163 A1 (“Mashinsky”)
1014	Malik Elsammany Elbuluk, <i>Resonant Converters: Topologies, Dynamic Modeling and Control</i> (Sept. 22, 1986) (D.Sc. dissertation, Massachusetts Institute of Technology) (“Elbuluk”)
1015	U.S. Patent No. 8,159,183 B2 (“Choi”)
1016	U.S. Patent Application Publication No. 2007/0182367 A1 (“Partovi App.”)
1017	O.H. Stielau & G.A. Covic, <i>Design of Loosely Coupled Inductive Power Transfer Systems</i> , Proceedings of the PowerCon 2000 International Conference on Power System Technology, vol. 1 (Dec. 2000), 85-90 (“Stielau”)
1018	RESERVED
1019	A.W. Green & J.T. Boys, <i>10kHz Inductively Coupled Power Transfer – Concept and Control</i> , Power Electronics and Variable-Speed Drives, Conf. Pub. No. 399 (IEE, Oct. 26-28, 1994), 694-699 (“Green”)
1020	Aiguo Patrick Hu, <i>Selected Resonant Converters for IPT Power Supplies</i> (Oct. 2001) (Ph.D. dissertation, University of Auckland) (“Hu”)

Ex.	Description
1021	Byung-Song Lee & Kyung-Hee Han, <i>Modeling and Analysis of IPT System Used for PRT</i> , Proceedings of the Eighth International Conference on Electrical Machines and Systems – ICEMS 2005, vol. 1 (ICEMS, Sept. 27-29, 2005), 839-842 (“Lee”)
1022	RESERVED
1023	RESERVED
1024	Excerpts from James W. Nilsson & Susan A. Riedel, <i>Electrical Circuits</i> (8th ed. 2008) (“Nilsson”)
1025	Chwei-Sen Wang, et al., <i>Investigating an LCL Load Resonant Inverter for Inductive Power Transfer Applications</i> , IEEE Transactions on Power Electronics, vol. 19, no. 4 (IEEE, July 2004), 995-1002 (“Wang-IEEE”)
1026	<i>Horizontal</i> , Collins English Dictionary, https://www.collinsdictionary.com/us/dictionary/english/horizontal (last visited Nov. 3, 2023)
1027	<i>Horizontal</i> , Cambridge English Dictionary, https://dictionary.cambridge.org/us/dictionary/english/horizontal (last visited Nov. 3, 2023)
1028	<i>Horizontal</i> , The Britannica Dictionary, https://www.britannica.com/dictionary/horizontal (last visited Nov. 3, 2023)
1033	Transcript of the deposition of Mark N. Horenstein, Ph.D., <i>InductEV, Inc. v. WiTricity Corp.</i> , No. IPR2024-00140 (Jan. 21, 2025) (“Horenstein Dep.”)
1034	U.S. Patent No. 8,041,227 B2 (“Holcombe”)
1035	U.S. Patent No. 9,742,204 B2 (“Kurs”)
1036	U.S. Patent No. 9,793,765 (“Cook-765”)
1037	Excerpts from <i>IEEE 100 The Authoritative Dictionary of IEEE Standards Terms</i> (7th ed. 2000) (“IEEE 100 Authoritative Dictionary”)
1038	U.S. Patent Application Publication No. 2007/0188284 A1 (“Dobbs”)

Ex.	Description
1039	Grant A. J. Elliot et al., <i>Multiphase Pickups for Large Lateral Tolerance Contactless Power-Transfer Systems</i> , IEEE Transactions on Industrial Electronics, vol. 57, no. 5 (IEEE, May 2010), 1590–1598 (“Elliot”)
1040	Bruce C. Gabrielson & Mark J. Reimold, <i>Suppression of Powerline Noise with Isolation Transformers</i> , EMC Expo87 (May 19–21, 1987) (“Gabrielson”)
1041	U.S. Patent No. 6,501,364 B1 (“Hui”)
1042	Excerpts from Rudolf F. Graf, <i>Modern Dictionary of Electronics</i> (7th ed. 1999) (“Graf” or “Modern Dictionary of Electronics”)
1043	Excerpts from Raymond A. Serway, <i>Principles of Physics</i> (2d ed. 1998) (“Serway”)
1044	Frederick Emmons Terman, <i>Radio Engineers’ Handbook</i> (1st ed. 1943) (“Terman”)
1045	U.S. Patent No. 9,324,230 (“Chutorash”)
2001	Declaration of Dr. Mark N. Horenstein
2003	Wiley Electrical and Electronics Engineering Dictionary Excerpts
2004	McGraw-Hill Dictionary of Scientific and Technical Terms Excerpts
2006	Excerpts from Wiley Electrical and Electronics Engineering Dictionary, IEEE Press, 2004 – Part 2
2007	S. S. Lau, “Practical Design of 13.56MHz Near Field Communication (NFC) and Radio Frequency Identification (RFID) Antenna using Ferrite Sheet on Metallic Surface by Network Analyzer”, Proceedings of the 2015 IEEE IEEM.(“Lau”)
2008	X. Chen, Y. Lieu, W. Lu, and Y. Dong, Optimal Simulation Study for Wireless Charging Coils with Magnetizers, DOI 1109/PEDG Conference, Aug, 2019. (“Chen”)
2009	W. Lee et al, " A Simple Wireless Power Charging Antenna System: Evaluation of Ferrite Sheet", IEEE Transactions on Magnetics, 53(7) July 2017. (“Lee”)

Ex.	Description
2010	Supplemental Declaration of Dr. Mark N. Horenstein
2011	September 11, 2024 Transcript of Dr. Mark Allen, PH.D. Deposition
2012	Additional Wiley Dictionary Definitions

7. My opinions are also guided by my appreciation of how a person of ordinary skill in the art would have understood the claims of the '654 patent at the time of the alleged invention, which I have been asked to assume is July 8, 2008.

III. Understanding of Legal Principles

8. I am not an attorney. However, I have been informed by counsel of certain legal standards and have applied those standards, described in Exhibit 1003, in formulating my opinions.

IV. Claim Construction

9. Independent claims 1, 8, and 13 of the '654 patent each recite a “transmitting antenna” and a “receiving antenna.” '654 Patent cls. 1, 8, 13. In my first declaration, I applied the plain meaning of this term, as the words would be understood to a Person of Ordinary Skill (POSA) in the art in the context of the '654 patent.

10. Dr. Horenstein contends that a POSA would understand “transmitting antenna” to mean “a primary coil that produces a near-field component of flux into free space that is intercepted by a secondary coil to effect resonant inductive coupling.” He contends that a POSA would understand “receiving antenna” to

mean “a secondary coil that intercepts and receives a near-field component of flux in free space that is generated by a primary coil to effect resonant inductive coupling.” Horenstein Decl. (Ex. 2001) ¶ 26. I disagree.

11. The plain meaning of “transmitting antenna” is “an antenna that transmits energy,” and the plain meaning of “receiving antenna” is “an antenna that receives energy.” That is how these terms would be understood by a POSA, and is also how the '654 patent uses the terms. For example, the '654 patent states that that it includes “a transmit antenna 114 for providing a means for energy transmission” and “a receive antenna 118 for providing a means for energy reception.” '654 Patent at 2:26-31.

12. A POSA would not understand the terms “transmitting antenna” or “receiving antenna” to require producing or intercepting “a near-field component of flux in free space.” That phrase does not appear anywhere in the '654 patent, or in its prosecution history, and it is far more specific than a POSA would generally understand the terms “transmitting antenna” or “receiving antenna” to be. '654 Patent, '654 File History (Ex. 1002).

13. Dr. Horenstein relies on two dictionaries, but neither of these dictionaries defines “transmitting antenna” or “receiving antenna” in the way that Dr. Horenstein states. For example, the Wiley Electrical and Electronics

Engineering Dictionary defines a “transmitting antenna” as merely “an antenna which emits electromagnetic radiation.”

transmitting antenna An antenna which emits electromagnetic radiation. There are many types of transmitting antennas, including those utilized in communications, TV and entertainment, radars, and so on. A single antenna may be used for both transmission and reception.

Wiley Electrical Dictionary (Ex. 2003) at 801. Similarly, the Wiley Electrical Dictionary defines a “transmitter” as any “component, device, piece of equipment, system, object, or entity which emits, radiates, or otherwise sends signals.” Wiley Electrical Dictionary (Ex. 2003) at 801. And it defines a “transmitting device” as “a device ... which emits or sends a signal intended for a receiving device.” Wiley Electrical Dictionary (Ex. 2003) at 801. None of these definitions, as a POSA would understand, require that a transmitting antenna produce “a near-field component of flux into free space that is intercepted by a secondary coil to effect resonant inductive coupling.”

14. Similarly, the Wiley Electrical Dictionary defines “receiving antenna” as “an antenna which picks up electromagnetic radiation.”

receiving antenna An antenna which picks up electromagnetic radiation. There are many types of receiving antennas, including those utilized in communications, TV and entertainment, radars, and so on. A single antenna may be able to be used for both transmission and reception.

Wiley Electrical Dictionary (Ex. 2003) at 641. It also defines “receiver” as a “component, device, piece of equipment, or system which accepts information-bearing signals,” and a “receiving device” as a “device ... which picks up or receives a signal emitted or sent by a transmitting device utilizing the same system.” Wiley Electrical Dictionary (Ex. 2003) at 641. None of these definitions, as a POSA would understand, require that a receiving antenna “intercepts and receives a near-field component of flux in free space that is generated by a primary coil to effect resonant inductive coupling.”

15. Dr. Horenstein also relies on the IEEE Wiley Electrical Dictionary and the McGraw-Hill Dictionary of Scientific and Technical Terms to define “antenna” as “a device that radiates and/or receives radio waves.” I agree that these are common definitions of antenna. Throughout this declaration, this is the definition of “antenna” that I am using, except where I explain otherwise. I note that this definition says nothing about near-field components of flux in free space, or resonant inductive coupling, which a POSA would understand are not requirements of antennas, transmitting antennas, or receiving antennas.

16. A POSA would also understand that Dr. Horenstein’s focus on “near-field components” is contrary to the language of the claims. Claim 1, for example is a “transmitter system for wireless power” where the “transmitting antenna [is] configured to generate *a wireless field* for charging a device.” ’654 Patent cl. 1. A

POSA would understand that the terms “wireless power” and “wireless field” are broader than just the near-field. The '654 patent, for example, explains that “wireless power is used herein to mean any form of energy associated with electric fields, magnetic fields, electromagnetic fields, or otherwise that is transmitted from a transmitter to a receiver without the use of physical electromagnetic conductors” – not just the near field. '654 Patent at 2:5-10. A POSA would not understand the term “wireless field” to refer specifically to the electromagnetic near-field, as opposed to the electromagnetic far-field or any other type of field that could be used to transfer energy.

17. Dr. Horenstein's definitions are further incorrect because they require sending and receiving flux “in free space.” But the only mention of “free space” in the '654 patent contrasts the claimed invention with transmitting energy into free space: “transfer of energy occurs by coupling energy from the near-field of the transmitting antenna to the receiving antenna residing in the neighborhood where this near-field is established *rather than propagating the energy from the transmitting antenna into free space.*” '654 Patent 3:14-23. Thus a POSA would understand that, if anything, this passage weighs against an “into free space” requirement.

18. Dr. Horenstein's definitions are further incorrect because they define the transmitting antenna in terms of the existence of the receiving antenna.

According to Dr. Horenstein's definition, having a "transmitting antenna" requires that the transmitted energy be "intercepted by a secondary coil" – if there is no receiving antenna, the "transmitting antenna" does not exist. That is not how a POSA would understand the term. An antenna that transmits energy is a "transmitting antenna" regardless of whether the energy is being received or not. Similarly, Dr. Horenstein defines a "receiving antenna" as requiring the reception of energy "generated by a primary coil." That is wrong for the same reason: an antenna constructed to receive energy is a "receiving antenna" regardless of whether or not it is currently receiving transmissions.

19. I understand that Dr. Horenstein and Patent Owner base their constructions in part on the sentence of the '654 patent that reads "As stated, an efficient energy transfer occurs by coupling a large portion of the energy in the near-field of the transmitting antenna to a receiving antenna rather than propagating most of the energy in an electromagnetic wave to the far field." '654 Patent 2:26-36. A POSA would not understand this passage as meaning that transmission must occur in the near field in order to constitute a "transmitting antenna" or a "receiving antenna." The passage merely states that when "most of the energy" is in the near-field, the transmission may be more efficient. But the claims of the '654 patent are not limited to only the most efficient mode of transfer,

nor is the specification. The '654 patent, for example, also contemplates that “energy may be transferred at a lower efficiency.” '654 Patent 3:14-23.

20. A POSA also would not understand any part of the '654 patent specification as limiting the meaning of “transmitting antenna” or “receiving antenna,” because the patent describes its embodiments as “exemplary.” As the '654 patent explains, “the detailed description set forth below in connection with the appended drawings is intended as a description *of exemplary embodiments* of the present invention and *is not intended to represent the only embodiments* in which the present invention can be practiced.” '654 Patent 1:59-2:1. The patent explains that “the word exemplary” means “serving as an example, instance, or illustration” and “is not necessarily to be construed as preferred or advantageous over other embodiments.” '654 patent at 1:55-57.

21. For all of the above reasons, a POSA would understand the term “transmitting antenna” to mean “an antenna that transmits energy” and the term “receiving antenna” to mean “an antenna that receives energy” in the context of the '654 patent.

V. Ground 1a: Odachi Invalidates Claims 13 and 15

A. Odachi Teaches a “Transmitting Antenna” and “Receiving Antenna”

22. As discussed in my first declaration, Odachi teaches a “transmitting antenna” in the form of a “primary inductive device ... comprised of a core 31 and

a coil 32,” and teaches a “receiving antenna” in the form of a “secondary inductive device ... comprised of a core 3 and a coil 4.” Ex. 1003 ¶¶ 66, 103-105.

23. I understand that Dr. Horenstein contends Odachi's primary and secondary devices are not antennas. Horenstein Decl. (Ex. 2001) ¶ 29. I disagree. Odachi's inductive devices are antennas under both the plain and ordinary meaning, and also under Dr. Horenstein's incorrect constructions.

1. Odachi Teaches Antennas Under the Plain Meaning

24. Odachi's primary inductive device is a “transmitting antenna” under the plain and ordinary meaning because it is an antenna that transmits energy.

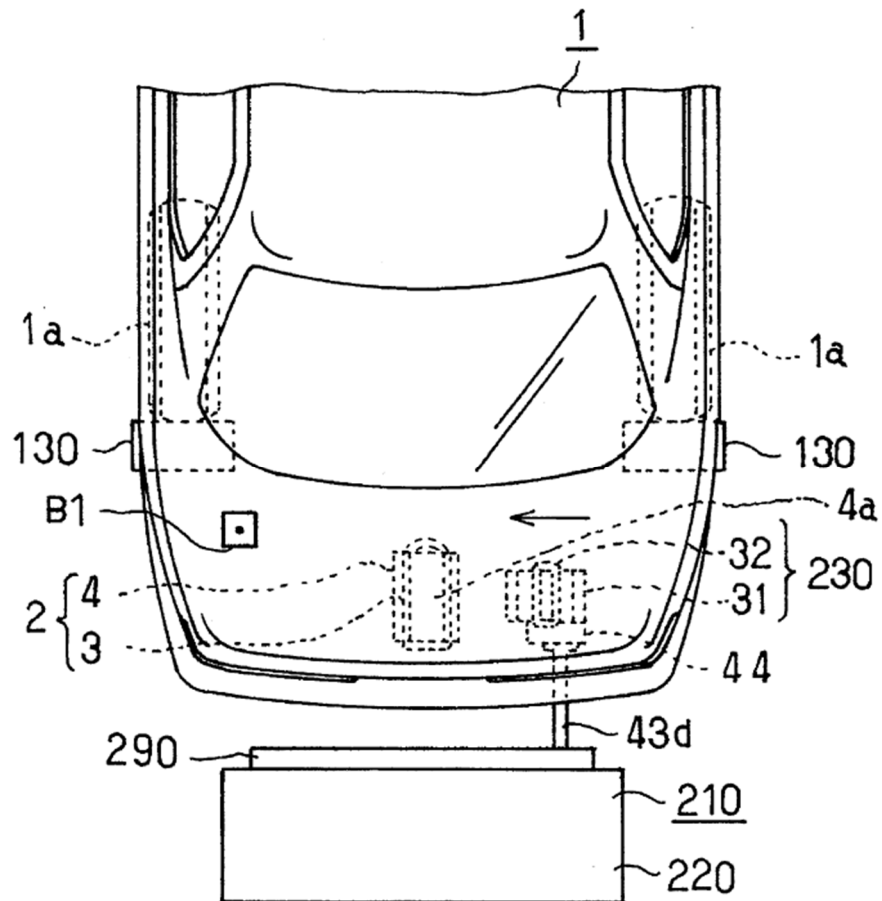
25. The primary inductive device is “comprised of a core 31 having an E-shaped cross section” and “a coil 32 wound around the center projection 31a of the E-shape core.” Odachi at 8:40-54. The primary coil “is formed in an oval shape.” Odachi at 8:40-54.

26. A POSA would recognize that Odachi's oval-shaped coil structure is a loop antenna, which is the same exemplary antenna structure disclosed in the '654 patent: a “loop” or coil of wire (also called a “magnetic antenna”) that can be “configured to include ... a physical core such as a ferrite core”. '654 patent at 2:59-66.

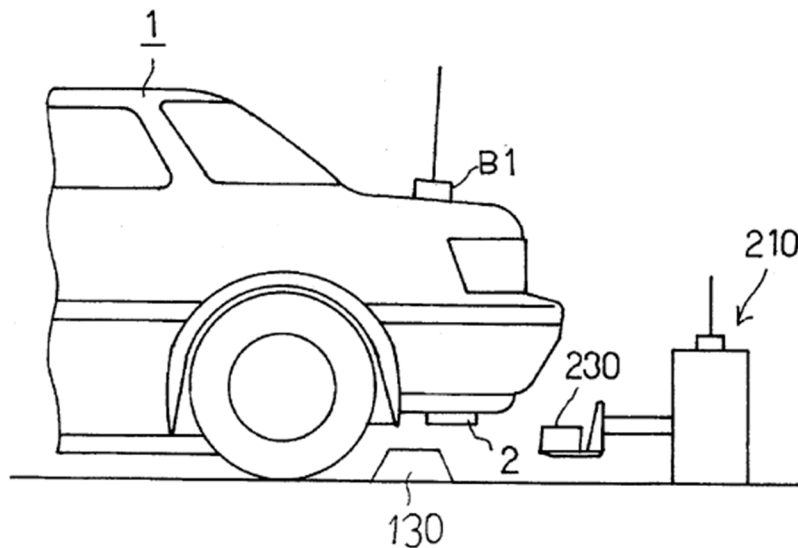
27. During Odachi's positioning process, “an electric current I_{RMS} flow[s] in the coil of the primary inductive device.” Odachi at 3:38-4, 5:18-38 (“AC check

current I_{RMS} ”). As the check current flows, the primary coil is moved horizontally across the space where secondary coil is mounted on the vehicle. Odachi at 6:1-27. As the primary coil with AC current flowing approaches the secondary coil, “an electromotive force is induced in the secondary coil.” Odachi at 6:1-27; 7:27-38 (“the AC current flowing in the primary coil 14 induces a similar current in the secondary coil 4 under the effect of electromagnetic induction ... and the AC current [is] thus transferred from the primary to the secondary”). The relative coupling between the primary and the secondary coil can be determined by “monitoring a voltage V_{RMS} which is induced across the secondary coil by application of an AC voltage across the primary coil.” Odachi at 13:39-64.

28. When the current begins to flow through the primary coil, and induces a current in the secondary coil, there is a “spaced distance” between the primary device and the secondary device. Odachi at 6:1-12. As shown below, when the primary coupler is at its rightmost operative home position and first begins to have AC current running through it, there is a distance between the primary coupler in the X-axis direction and the Y-axis direction (and, although not visible in this figure, in the Z-axis direction).



Odachi at Fig. 11. This spaced distance between primary coupler (item 230) and secondary coupler (item 2) can also be seen, for example, in Odachi's Figure 6.

Fig. 6

Odachi Fig. 6; *see also* Fig. 12 (showing space between coils).

29. The primary coupler and the secondary coupler remain a distance apart at least throughout the positioning process, during which time AC current is flowing through the primary coil, inducing a current in the secondary coil. Odachi at 11:18-12:7 (describing positioning in the X and Z axis directions), 13:39-64 (describing monitoring of V_{RMS} induced at secondary coil).

30. Accordingly, a POSA would understand that Odachi's primary coupler is a "transmitting antenna" at least because it transmits energy to the secondary coil during the positioning process, by way of the AC current flowing in the primary coil that induces an electromotive force (an AC current and voltage) in the secondary coil. Odachi 2:23-65, 5:18-25, 6:1-27, 13:39-64, Cl. 1 ("moving said primary inductive device relative to said secondary device so that a variable

electromotive force is induced in the other”), Cl. 3 (“flowing a charging current in said primary coil thereby to induce an electromotive force in said secondary coil”).

31. A POSA would also understand that, by functioning as a loop antenna (i.e. being a conductor carrying an alternating current), Odachi’s primary device radiates electromagnetic waves. For example, the Principles of Physics textbook by Serway confirms that “electromagnetic waves are radiated by *any* circuit carrying an alternating current.” Serway (Ex. 1043) at 711 (“whenever a charged particle undergoes an acceleration, it *must* radiate energy by electromagnetic radiation”). Because Odachi’s primary coil has an “AC check current” or “AC charging current” flowing through it, a POSA will understand that the primary coil radiates waves. Odachi at 5:18-25, 7:27-50, 13:39-64 (“application of an AC voltage across the primary coil”).

32. A POSA would further understand that Odachi’s primary device generates radio waves, as that is the mechanism of action for a loop antenna. The Radio Engineers’ Handbook by Frederick Terman, for example, explains that a “loop antenna is essentially a coil of any convenient cross section ... carrying a radio-frequency current”). Terman (Ex. 1044) at 813. A POSA would have understood that a wireless power transfer system like Odachi’s would operate in the radio frequency spectrum. For example, the IEEE Dictionary defines a “radio wave” as “includ[ing] frequencies up to 3 THz” – an upper limit many orders of

magnitude higher than the range in which any wireless power transfer system would operate – confirming that the waves Odachi radiates would be radio waves. IEEE 100 Authoritative Dictionary (Ex. 1037) at 915 (also defining “radio transmission” as “transmission of signals by means of radiated electromagnetic waves other than light or heat waves”); Graf (Ex. 1042) at 620 (defining radio waves as “electromagnetic wave at a frequency lower than 3000 GHz”); Wang 38 (inductively coupled power transfer system operations “between several kHz and many MHz”), Ross 5:43 (“conventional” ac signals are “60 Hz or 400 Hz” but wireless power transfer system operates “in the range 1-10 kHz”).

33. A POSA would further understand that Odachi’s secondary device is a “receiving antenna” because it is an antenna that can receive radio waves, for the same reasons described above, including that it is structured as a “loop antenna” as described in the ’654 patent (a coil wrapped around a core); ’654 Patent 2:59-66. The secondary device receives energy transmitted from the primary device as part of the generation of an electromotive force (an AC current and voltage) in the secondary coil. Odachi 2:23-65, 5:18-25, 6:1-27, 13:39-64, Cls 1-3.

2. Odachi Teaches Antennas Under Patent Owner’s Construction

34. For largely the same reasons that I explained above, Odachi’s primary and secondary devices also meet Dr. Horenstein’s definition of a “transmitting antenna” and a “receiving antenna.”

35. For example, Odachi explains that during alignment, the “primary coil 32,” and “secondary coil 4” are not in contact with each other, and have no intervening solid material – there is only space (air) between them. Odachi at 8:50-54, 2:32-37 (“spaced distance”), 6:1-45 (“spaced distance”), Figs. 6, 7, 11, 12 (showing air between coils). Across this distance, “electromagnetic induction occurs between the coupler and the receptacle,” which a POSA would understand to mean that Odachi’s primary coil produces a near-field component of flux into free space, that is intercepted by the secondary coil. Odachi at 6:6-8. As a result, “an electromotive force is induced in the secondary coil.” Odachi at 6:6-8. This confirms that the primary coil “produce[s] a ... component of flux into free space that is intercepted by a secondary coil,” and conversely, the secondary coil “intercepts and receives a ... component of flux in free space that is generated by a primary coil,” under Patent Owner’s construction. This does not appear to be in dispute, since even Dr. Horenstein agrees that where two transformer cores are not connected, “the flux lines ... bridge the air gap.” Horenstein Decl. (Ex. 2001) ¶ 28.

36. A POSA would understand that the above-described flux is transmitted in the “near field” of Odachi’s primary coil. As Dr. Horenstein agreed, “localized wireless power transfer systems ... rely primarily on the near field component of the field produced by their primary antenna.” Horenstein Decl (Ex.

2001) ¶ 24. I agree, and this is what a POSA would see in Odachi – energy transmitted primarily in the near field, and not in the far-field, which is typically reserved for long-distance communication. A contemporaneous patent 9,324,230 to Richard Chutorash confirms this, explaining that “magnetic field induction” is “near field communication” and explaining that “near field,” “induction field,” “near zone,” and “within a small number of wavelengths” are all synonyms. Chutorash (Ex. 1045) at 2:60-66; 5:4-7.

37. In my prior declaration, I explained that to the extent Odachi's devices are in contact when charging, it would have been obvious instead to implement Odachi wirelessly, such that its primary coupler never makes contact with its secondary coupler at any point. Ex. 1003 ¶¶136-140. This version of Odachi would teach the claimed “transmitting antenna” and “receiving antenna” under either construction as well, for all of the same reasons that I explained above and in my prior declaration. When implemented wirelessly, Odachi's primary coil would radiate energy, and this would be transmitted in the near field in free space to the secondary coil, in the same manner I explained above.

3. Odachi is Not a Traditional Transformer

38. Dr. Horenstein argues that Odachi's primary and secondary devices “form[] a transformer with a completed core that has no air gap.” Horenstein Decl. (Ex. 2010) ¶¶ 11, 12. I disagree.

39. Odachi shows that, at the times relevant to the claims, there is a “spaced distance” between Odachi’s primary device and its secondary device, essentially creating a large air gap between the devices, in multiple directional axes.

Fig. 12

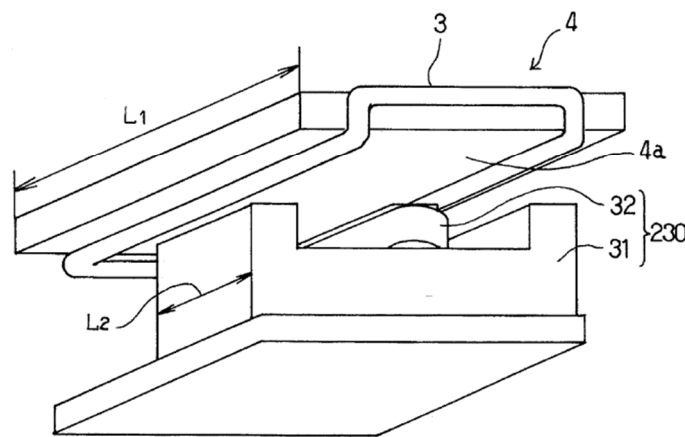
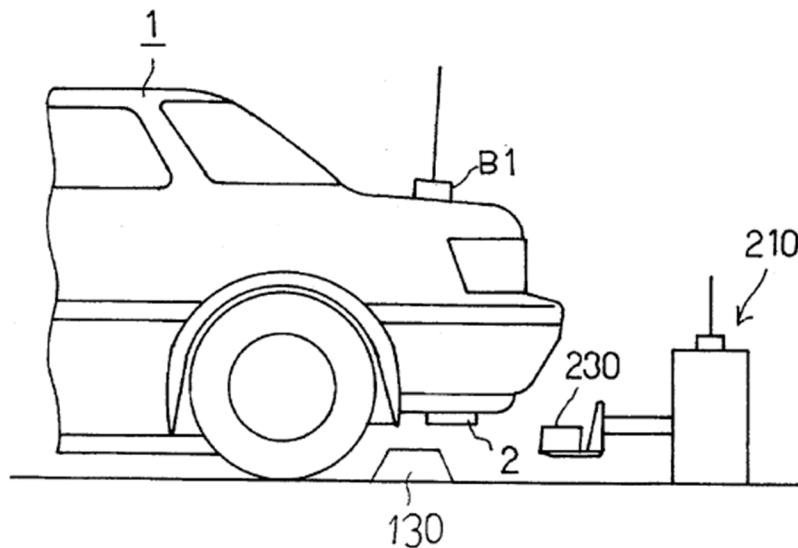


Fig. 6



Odachi Figs. 6, 12.

40. A POSA would have understood that Odachi's arrangement uses a coil to intentionally transfer energy across a potentially-changing distance in the near-field or far-field, making it an antenna. By contrast, a traditional transformer does not contemplate changing distances between the primary and secondary coil. For example, as the Wang reference explains, "[i]n a traditional transformer, the primary and secondary are fixed on a common core for tight coupling." Wang 13. In inductively-coupled power transfer systems, by contrast, one coil "is allowed to move freely relative to" the other coil. Wang 13, 82. Odachi is more similar to the latter, and thus is not a "traditional transformer," as I explain further below.

41. Dr. Horenstein focuses on Odachi's system at the point in time when all positioning has already occurred and the primary device is placed with its core contacting the core of the secondary device. But the claims of the '654 patent require a transmitting antenna and a receiving antenna at the time of "test[ing] coupling" and "adjust[ing] an x-y alignment of the transmitting antenna." '654 Patent cl. 1. The same is true of claim 13, which requires "guiding a receiving antenna" and then "moving one of the receiving antenna and the transmitting antenna." '654 Patent cl. 13. At the time Odachi is "moving" its antenna, "test[ing] coupling," and "adjust[ing]" antenna positioning, Odachi's primary and secondary are not in contact with each other, but rather are a "spaced distance" apart. Odachi

at 6:1-40, Fig. 6, Fig. 12. Thus, a POSA would understand that the relevant analysis of Odachi is when its primary and secondary devices are a distance apart, not when they are together. The fact that certain claims of the '654 patent also recite a “second alignment position” or “charging a device” does not alter my opinion. The structure of Odachi’s coils makes them antennas at least during positioning and initial energy transfer, and a POSA would not believe that a structure that meets the definition of an antenna ceases to be considered an antenna simply because it later comes closer to or in contact with another structure. Odachi’s antennas – which are structured the same as the “loop antennas” in the '654 patent - remain antennas. '654 patent at 1:15-17; 2:59-63; Odachi at 8:1-54.

42. Odachi’s system also does not meet Dr. Horenstein’s own definition of a transformer. He relies on the Wiley Electrical Dictionary, which explains that “a transformer has no moving parts and consists of two or more coils separately wrapped around a magnetic core.” Horenstein Decl. (Ex. 2010) ¶ 34, ¶ 41 (requiring a “core common to both primary and secondary coils”). In Odachi’s system, however, the primary coil is wrapped around 31, while the secondary coil is wrapped around a *separate* core, core 3. Odachi at 8:1-27, Figs. 11, 12. And Odachi’s system has movable parts. Odachi’s entire positioning system is based on mounting the primary coil on a support arm that “move[s]” relative to the secondary coil. Odachi at 7:4-38, 6:6-8 (noting “the spaced distance” between

primary and secondary couplers “is reduced gradually ... when the former coupler comes close to the latter receptacle”), Figs. 11-12. Thus, as a POSA would understand, Odachi’s devices are not a “traditional transformer,” but are each a loop antenna under the commonly understood meaning: a “loop” or “coil” of wire wrapped around a “core.” ’654 patent at 1:15-17; 2:59-63; Odachi at 8:1-54.

4. Odachi’s Devices Are Antennas Even If they Act Like Transformers

43. Even if Dr. Horenstein were correct that Odachi “functions as a traditional transformer” at times, a POSA would not understand this to exclude Odachi’s primary and secondary devices from also being considered antenna. Coupled coils used to transfer energy over a potentially-changing distance – as Odachi teaches – would have been understood by a POSA to be “antennas” even if sometimes configured similarly to a transformer.

44. For example, U.S. Patent No. 9,793,765, which shares three of the same inventors as the ’654 patent, explains that a system “us[ing] transmit and receiving antennas” can “react similarly to a loosely coupled transformer, with one antenna inducing power into the other.” Ex. 1036 (“Cook-765”) at 1:38-45; *see id.* at 3:21-23 (“resonator loop ... acts like a 1:1 transformer”). The Cook-086 patent says the same. Ex. 1012 (Cook-086) at 2:61-3:5. The Ross prior art – which Dr. Horenstein does not dispute teaches two antenna – similarly teaches “coupling between the coils” that “is the same type of coupling that occurs in a transformer.”

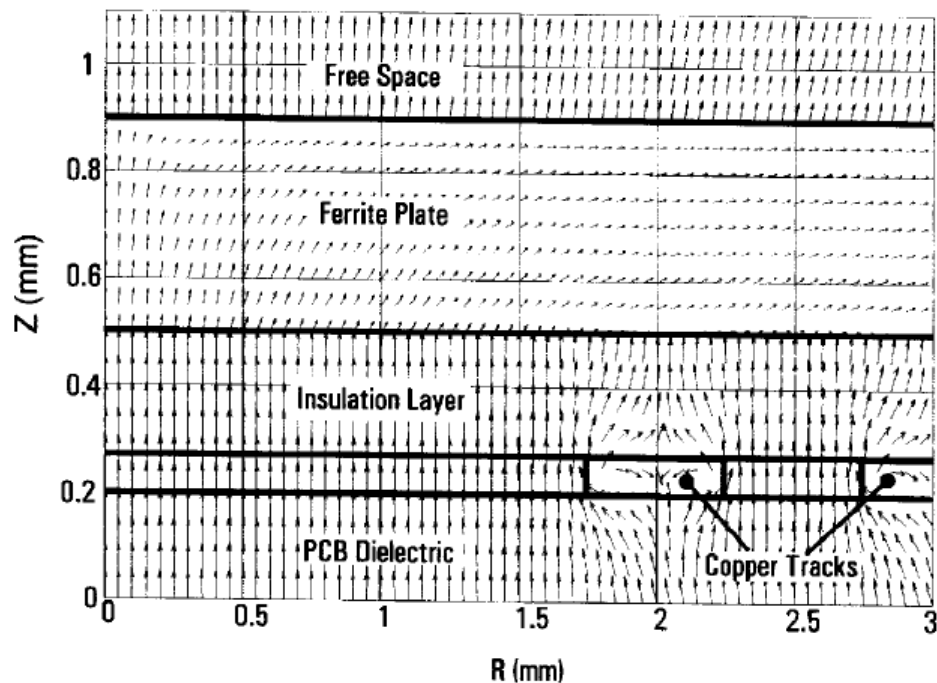
Ross (Ex. 1007) at 9:30-43. And the Partovi application confirms that “coils ... for inductively charging or supplying power” can “also function as an antenna.” Ex. 1016 at cl. 8. Each of these references confirms, as a POSA would have known, that a device that functions like a transformer can nonetheless be considered a transmitting or receiving antenna.

45. Dr. Horenstein argues that if Odachi “were somehow to exhibit the behavior of an antenna, the flux lines would leave the gap area and enter into the air space distal to the magnetic circuit.” Horenstein Decl. (Ex. 2010) ¶ 69. I agree—that is exactly what happens. As I explained above, the presence of an AC current in the primary coil radiates electromagnetic waves, at least some of which escape the core. Dr. Horenstein asserts the flux lines of Odachi “do not” leave the gap area, but provides no explanation for why this would be true.

46. I note that the assertion in Dr. Horenstein’s second declaration that flux lines do not leave the gap area is contrary to Dr. Horenstein’s first declaration, in which he admits that “in a practical transformer, a small amount of flux ... will escape the core.” Ex. 2001 ¶ 27; *see also* ¶ 33 (asserting only that “most of the flux lines” – not all of them – intersect the secondary coil due to “leakage flux”).

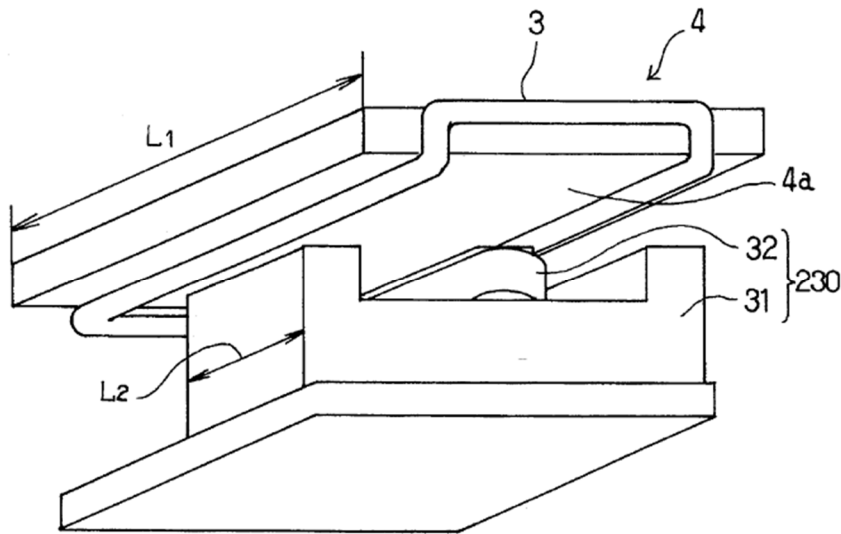
47. Dr. Horenstein further argues that because Odachi’s primary coil is wrapped around a magnetic core, that means it will not radiate electromagnetic waves, and no magnetic flux escapes the core. That is not correct. Any conductor

through which AC current flows will radiate electromagnetic waves. Serway (Ex. 1043) at 711. As a POSA would have understood, the purpose of a magnetic or ferrite core is to guide or shape the electromagnetic fields. *See* Hui (Ex. 1041) at 3:28-29 (explaining that “ferrite material guides the magnetic field”). But this does not mean that waves are not radiated, or that no electromagnetic field radiates away from the core. Hui (Ex. 1041) at 4:8-10 (“the ferrite plate cannot completely guide the H-field”). This can be seen in Fig. 5, below, from the Hui patent. The presence of a “ferrite plate” helps shape the magnetic flux, but it does not contain the flux or prevent the flux from radiating into “free space.”

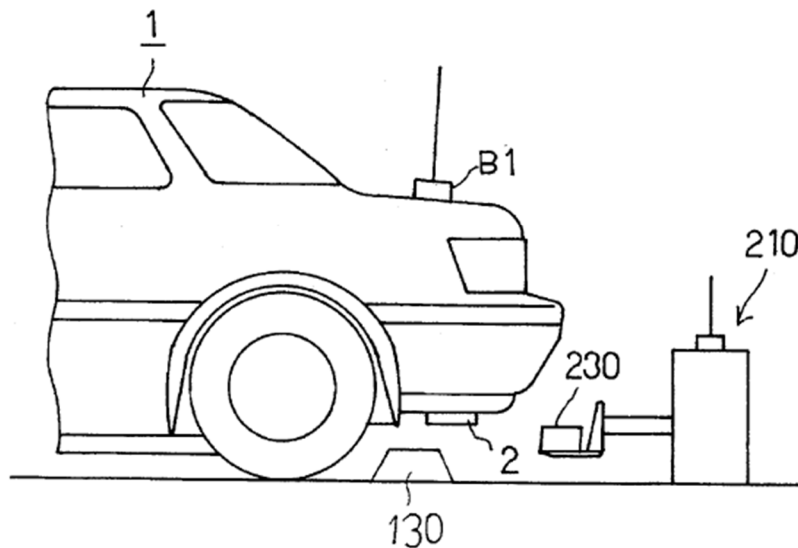
FIG.5

48. A contemporaneous patent, U.S. 2007/0188284 to Dobbs, explains this concept as well. As a POSA would have known, the purpose of a core is to

“preferably shunt and align magnetic flux such that magnetic field lines escape therefrom primarily only in regions of core airgaps.” Dobbs (Ex. 1038) at Abstract. Odachi’s primary device has considerable “airgaps” – the core is open on the top-side in the direction of the receiving coil (upward in the figure below).



Odachi Fig. 12. And this figure shows the point in time when the primary and secondary devices are relatively close to each other. At other times relevant to the claims, the cores are considerably further apart, creating even more significant “airgap” between them, while still transmitting energy from the primary to the secondary to perform positioning:

Fig. 6

Odachi Fig. 6. As Dobs confirms, the “magnetic field lines escape” from these airgaps. Dobbs (Ex. 1038) at Abstract.

49. As Dobbs further explains, the existence of a ferrite core does not prevent electromagnetic radiation. Dobbs’ Fig. 2 shows a cross-section of a coil within a magnetic core, in an arrangement similar to how Dr. Horenstein contends Odachi works:

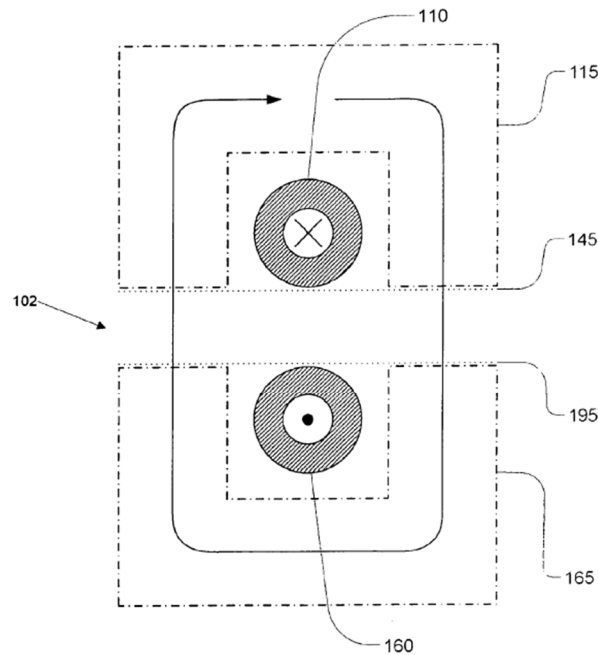


FIG. 2

Dobbs Fig. 2. Dobbs explains, as a POSA would have understood, that although the coil “windings” are surrounded by “core half-shells 115, 116,” the “power coupling devices ... will generate a dipole field and *will radiate strongly to the surrounding space.*” Dobbs [0054]. This is equally true in Odachi: the primary coil will radiate strongly to the surrounding space, despite the presence of a core.

50. Other references confirm the same. For example, the Elliott paper titled Multiphase Pickups for Large Lateral Tolerance Contactless Power-Transfer System explains that a system (like Odachi’s) whose pickup consists of “a coil of wire to capture magnetic flux” can operate “very similar to a transformer,” with “ferrite ... used to direct the magnetic flux and improve the coupling.” Elliott (Ex.

1039) at 1591. But Elliott nonetheless acknowledges the existence of “radiated fields” that must be accounted for. Elliott (Ex. 1039) at 1591.

51. Even if Dr. Horenstein were correct that Odachi was a transformer, it would not change the fact that it radiates energy. As a POSA would have understood, “any transformer ... radiate[s] magnetic fields.” Gabrielson (Ex. 1040) at 6.

52. Dr. Horenstein only once addresses the scenario where Odachi’s primary and secondary are not in contact. He asserts that when there is “a small gap between the cores in Odachi,” the system still “functions as a traditional transformer.” Horenstein Decl. (Ex. 2010) ¶ 70. I do not agree that Odachi functions as a traditional transformer. For one, Odachi’s primary and secondary frequently have much more than the “small gap” shown by Dr. Horenstein, and they are movable relative to each other, as I described above. Odachi’s cores are also spaced apart by considerable distances, as much as half the width of a standard automobile. Odachi Figs. 6, 11, 12. At these distances, a POSA would understand that energy from Odachi’s primary coil will not exclusively be transferred from the primary core to the secondary core across a distance of many inches or feet, as Dr. Horenstein contends. Dr. Horenstein’s assertion that the energy transmitted by Odachi’s primary coil will remain entirely in the cores, and not be spread through the air, is incorrect. The flux lines will spread and disperse in multiple dimensions,

and there will be at least some radiated energy, as demonstrated by Elliott, Gabrielson, Hui, and Dobbs' explanation that a coil wrapped around a core will radiate energy.

53. I understand that Dr. Horenstein contends Odachi does not meet his definition of an antenna because Odachi produces energy only in the “induction-field,” and not in the “near field.” Horenstein Decl. Ex. 2010 ¶ 42. I disagree. Dr. Horenstein's opinion is based on his conclusion that Odachi is a “transformer,” which is untrue for the reasons that I described above. But even if it were true, a POSA would understand that a transformer-like structure produces a near-field component. For example, U.S. Patent No. 9,742,204, also to WiTricity, explains that “electric transformers are examples of devices that utilize [a] short range, near-field energy transfer scheme.” Ex. 1035 (“Kurs”) at 2:16-23. Another contemporaneous patent, U.S. 8,041,227 to Wayne Holcombe, similar confirms that “transformers can be thought of as extreme near-field devices... for these devices the near-fields are used to transfer or store energy.” Ex. 1034 (“Holcombe”) at 7:3-10; *see* 7:11-22 (“a small loop antenna ... will have mostly magnetic fields ... within its near-field”).

54. Dr. Horenstein is also incorrect because he relies on a diagram he drew himself, purporting to show that what he calls the “local (induction) field” is separate from the “near field,” and therefore energy in the local (induction) field

in Odachi is not in the “near field.” Horensten Decl. (Ex. 2010) ¶ 37. That is not how a POSA would understand the terms. Dr. Horenstein relies on the Wiley IEEE Dictionary, which defines the near field as “the electromagnetic field extending no further than a distance of $2D^2/\lambda$,” and defines everything beyond that point as the far field. Ex. 2006 at 275, 498. Thus, as a POSA would understand, there is no lower bound on the near-field: the entire range from the point of the antenna (zero D away) up to $2D^2/\lambda$ away would be considered the near field – including the area that Dr. Horenstein calls the induction field. Even if Dr. Horenstein were correct that Odachi emits energy in the induction field, this is also within the near field.

55. Dr. Horenstein’s opinion also relies on the existence of a closed magnetic circuit where magnetic field lines “cannot leave” the core of Odachi. Horenstein Decl. Ex. 2010 ¶ 42. That is incorrect as well. As I discussed above, at the times relevant to the claims, Odachi’s primary coil is a “spaced distance” apart from its secondary coil, and energy from the primary will extend out to the secondary coil in free space – not remain contained within the core. Odachi refers to its system as a “magnetic circuit” only when the coils are fully aligned and the cores are “in abutment relation” to each other – i.e. when the primary core is touching the secondary core for complete charging. Odachi at 4:34-47. During the alignment process, as discussed above, Odachi is not a closed magnetic circuit because energy is transferred from the primary coil into free space, some of which

is received (with varying degrees of coupling at varying positions) by the secondary coil.

56. For all of the above reasons, and those in my first declaration, Odachi teaches the claimed “transmitting antenna” and “receiving antenna” under any construction.

B. Odachi Discloses Alignment “Response to Detecting A Degree Of Coupling”

57. As discussed in my first declaration, Odachi moves its primary coil “responsive to detecting a degree of coupling in the first alignment position.” Ex. 1003 ¶¶110-125. Specifically, Odachi sends an AC current through its primary coil as the primary coil sweeps from its starting home position (the claimed first alignment position) across and past the secondary coil. Odachi 10:64-11:32, 5:54-6:45. As the arm is moved, Odachi constantly measures either the amplitude of the check current I_{RMS} , or the voltage V_{RMS} at the secondary coil. Odachi 10:64-11:32, 13:29-64, Figs. 4-5. At each position of the primary coupler, the current I_{RMS} or V_{RMS} is compared to a pre-established reference value, and the points where the measurement crosses over or under the pre-established reference value are indicated as X_1 and X_2 . Odachi 6:10-45, 13:29-64, Figs. 4-5. The system then takes the midpoint of X_1 and X_2 , called X_A , and moves the primary antenna to that point, which will be a position of increased coupling. Odachi 6:33-57, 7:51-58, 11:42-59, 13:53-64, Figs. 4-5. As a POSA would understand, the I_{RMS} and V_{RMS}

values at every position – including the first value taken when the primary coupler is in its home position – indicate the degree of detected coupling at that position, and are used in the calculation of X_1 , X_2 , and X_A . Odachi 6:33-57, 7:51-58, 11:42-59, 13:53-64, Figs. 4-5

58. Dr. Horenstein appears to agree with me on how Odachi works, but contends that the determination of X_A is *only* responsive to the degree of coupling at X_1 and X_2 . Horenstein Decl. ¶ 63. I do not agree. All of the measured values, including the very first value, are an integral part of Odachi's positioning system. The sweep necessarily measures the level of coupling at every position – including the home position – in order to determine X_1 and X_2 , which in turn are used to determine X_A . Thus, the movement of the primary coupler to position X_A is “responsive to” all of the coupling measurements that were made during the sweep, not just X_1 and X_2 . Odachi 6:33-57, 7:51-58, 11:42-59, 13:53-64, Figs. 4-5.

59. Dr. Horenstein's opinion is further wrong because it draws an artificial distinction between “the first alignment position” (i.e., the position of the primary coupler when current first starts flowing and the first measurement is taken) and the X_1 position. But a POSA would understand that these are not necessarily two separate positions. Depending on the location of the vehicle coil, the first measurement position could be the X_1 position. In Odachi's figures, the X_1 , X_2 , and X_A positions shown in Figures 4 and 5 are largely centered on the

graph, which indicates that the vehicle coil of Odachi was largely centered in the parking space. *See* Figs. 4, 5, 11. But Odachi's teachings are not limited to vehicles parked in the center of the parking space. If the vehicle was parked off-center (rightward in Figure 11), X_1 would be detected sooner (leftward on the graphs of Figures 4 and 5). A POSA would understand that Odachi is designed to account for poor parking, since it considers "a wider range of permissible distances within which the vehicle could be parked for coupling." Odachi at 2:15-19.

60. If the vehicle were parked far enough off-center (rightward in Figure 11), then the secondary coil would begin very close to the primary coil. As a result, the very first measurement (taken at the $X=0$ or home position) would exceed the predetermined reference threshold, and would become position X_1 . *See* Odachi 6:33-57, 7:51-58, 11:42-59, 13:53-64, Figs. 4-5, 11. In that case, this limitation would be met even under Dr. Horenstein's incorrect interpretation that Odachi's system is only "respons[ive] to detecting a degree of coupling" at X_1 , because the first alignment position would be the X_1 position.

61. The same is possible if the vehicle coil is mounted off-center on the vehicle, rather than dead center. If the coil is mounted far off-center (rightward in Figure 11), a POSA would understand that it would be close to the primary coil when the primary coil starts its sweep, such that the very first measurement (in the first alignment position) could be the X_1 position, satisfying Dr. Horenstein's

interpretation. *See* Odachi 6:33-57, 7:51-58, 11:42-59, 13:53-64, Figs. 4-5, 11. In the case of the off-center vehicle coil, this could occur even while the vehicle's tires remain parked on Odachi's wheel stops. Odachi at Figs. 6, 7, 11; 8:1-12.

62. I understand from counsel that Patent Owner has contended that Odachi does not contemplate off-center vehicle parking or off-center vehicle coils. I disagree. A POSA would understand that the centered coils shown, for example, in Figure 11 are merely exemplary, and would understand Odachi to teach that the vehicle could be placed anywhere on the vehicle that could be in range of the support arm. Odachi at 1:59-65 (faulting the prior art for having "the range of permissible crosswise distances within which the vehicle should be parked" as "too small"). Similarly, a POSA would understand that Odachi contemplates off-centered parking, consistent with its stated goal of providing "a wider range of permissible distances within which the vehicle should be parked for coupling." Odachi at 2:15-20.

63. Patent Owner's interpretation, in which Odachi only teaches well-parked cars with centered coils, would defeat the need for Odachi's positioning system at all. As a POSA would understand, if all cars were well-parked with centered coils, there would be no need for a movable support arm: the primary coil could simply remain fixed in the center of the parking space. Thus, a POSA would

understand that Odachi teaches the application of its system to off-centered parking jobs and off-centered vehicle coils.

VI. Ground 1b: Odachi and Wang Render Obvious Claims 1, 7, and 18.

A. A POSA would combine Odachi and Wang

64. As discussed in my first declaration, it would have been obvious to a POSA to implement a compensating capacitor (as taught in Wang) into Odachi's system, making the system resonant. Ex. 1003 ¶¶ 145-55. This was a well-known technique, often employed by POSAs at the time to boost the power transfer capability of wireless power systems, resulting in more efficient transfer at a higher power or current, or over larger distances. Ex. 1003 ¶¶ 145-55.

65. I understand Dr. Horenstein argues that a POSA would not combine Odachi and Wang because compensating capacitors are only used for “weak coupling,” while Odachi “teaches a transformer that provides tight coupling.” Horenstein Decl. (Ex. 2010) ¶ 73-74. I disagree.

66. As I explained in the prior section, Odachi is not a traditional transformer. Moreover, at the times relevant to this analysis (i.e. during Odachi's positioning process), the primary and the secondary are not tightly coupled, but have varying degrees of coupling ranging from near-zero (when the primary is far from the secondary) to relatively strong (when the primary is closer to the secondary). Odachi at 6:1-45 (explaining that “the magnitude of the current [i.e.

the degree of coupling] varies with the function of the spaced distance between the primary coupler 6 and the secondary receptacle 2”). These varying degrees of coupling are reflected in Odachi’s Figures 4 and 5. Because Odachi is not a tightly-coupled transformer, a POSA would have recognized the benefits of adding a compensating capacitor to Odachi, including more efficient energy transfer, or transfer at higher voltage or current, or over a longer distance, by “boost[ing] the power transfer capability” of Odachi’s system. Wang 47; Ex. 1003 ¶¶ 145-155.

67. In addition, I explained in my prior declaration that it would have been obvious to implement Odachi wirelessly, with no physical contact between its cores. Ex. 1003 ¶¶ 136-140. In this scenario, because of the increased air gap Odachi’s system will have relatively weaker coupling, and so would see increased benefit from the inclusion of a compensating capacitor.

B. Odachi and Wang Teach Transmitting Antennas

68. I understand Dr. Horenstein contends that the combination of Odachi and Wang does not teach a transmitting antenna or receiving antenna. This is wrong for the reasons I already explained above: Odachi teaches those elements.

C. Odachi Teaches an Alignment Controller to Test Coupling

69. I understand that Dr. Horenstein repeats his argument, which I addressed above, that Odachi does not disclose testing coupling or moving

antennas “based on a degree of the coupling” at the first position. This argument is wrong for the same reasons I explained previously.

70. I understand Dr. Horenstein makes a further argument that Odachi does not disclose “basing the y-axis adjustment on a degree of coupling.” I disagree, for two reasons. First, Odachi discloses that “positioning of the primary coupler in the vehicle longitudinal direction may be conducted in the same method as in the positioning along the X-axis. Odachi 14:29-32; *see also* Odachi 4:65-5:4 (explaining that “the longitudinal direction of the vehicle” is the “Y-axis”). Thus, a POSA would understand that Odachi discloses basing the y-axis adjustment on a degree of coupling just as it does for the x-axis adjustment.

71. Even if this were not the case, a POSA would understand this limitation to be met because claim 1 does not require adjusting the y-axis alignment specifically based on the degree of coupling. The claim recites “based on the degree of coupling ... adjust[ing] an x-y alignment.” ’654 Patent cl. 1. Thus, even if Dr. Horenstein were correct that only the x-axis is adjusted based on the degree of coupling, and the y-axis were adjusted by some fixed amount, that would still constitute adjusting the x-y alignment based on the degree of coupling, as a POSA understands the term.

D. Odachi Teaches a “remote receiving antenna”

72. I understand Dr. Horenstein contends that Odachi does not disclose a system that “transmits power to a remote receiving antenna.” Horenstein Decl. (Ex. 2010) ¶ 84. I do not agree.

73. As I explained above, at the times relevant to the '654 patent claims, Odachi's primary coupler is a “spaced distance” apart from its secondary coupler, which a POSA would understand to indicate a remote receiving antenna. Odachi at 6:1-45. Even when only the AC check current, and not a full current, is flowing through the primary coil, this leads to a “current induced in the secondary coil” across a spaced distance,” which a POSA would understand to constitute transmitting power to a remote receiving antenna. Odachi at 6:1-45.

74. Moreover, as I explained in my prior declaration, it would have been obvious to modify Odachi to be wireless, such that the primary and secondary devices are never in contact with each other, which would meet this limitation both during positions and even during final charging. Ex. 1003 ¶¶ 136-140.

VII. Ground 1c: Odachi, Wang, and Partovi render obvious claims 4-6

75. I understand that Dr. Horenstein argues that a POSA would not combine Odachi with Wang and Partovi because Partovi uses “pancake coil[s].” Horenstein Decl. (Ex. 2010) ¶ 47. I disagree.

76. As I explained in my prior declaration, a POSA would have understood Partovi's teaching of the benefits of an array of coils to be applicable to any size or shape of coil. Ex. 1003 ¶ 185. As such, a POSA "could and would have created an array of coils each having the same size and shape as Odachi's original oval primary coil," which would "reduce any compatibility concerns with Odachi's existing secondary coil." Ex. 1003 ¶ 185. Nothing in Dr. Horenstein's declaration changes my opinion. A POSA would understand that the fundamental teachings of Partovi are not specific to pancake coils, but are generally that an array of antennas can provide charging coverage over a wider area. Partovi 6:33-40, 8:52-9:6. A POSA would and could have implemented this in a variety ways, including using the size and shape of Odachi's original coil, rather than Partovi's pancake coils. In this manner, there would be no compatibility concerns – the communication from Odachi's primary to secondary would operate in the same manner as originally described, emanating from whichever one of the array of primary coils is activated. Ex. 1003 ¶¶ 179-195.

VIII. Ground 2: Ross and Wang Render Obvious Claims 8-10, 12-14, 16, and 19

A. A POSA would combine Ross and Wang

77. I understand that Dr. Horenstein contends a POSA would not combine Wang with Ross because of a difference in frequencies. Horenstein Decl. (Ex. 2010) at ¶ 111. I disagree.

78. Ross teaches that “the preferred coupling frequency of the ac current is in the 1-10 kHz range.” Ross at 5:40-43. Wang states that it is “often necessary to increase the frequency to between several kHz and many MHz, depending on the application requirements.” Wang 38. A POSA would view these ranges as compatible, as they overlap. Wang’s “several kHz” is within “the 1-10 kHz” range disclosed in Ross. Ross at 5:40-43; Wang 38. Even if that were not the case, Wang teaches that an increased frequency is beneficial to increase coupling strength, and a POSA would understand that this teaching could be applied to Ross, increasing Ross’s originally disclosed frequency by as little as “several kHz” or as much as “many MHz” for further increased “coupling strength ... depending on the application requirements.” Wang 38.

79. Dr. Horenstein also claims that Ross would not benefit from the higher efficiency of a compensated capacitor because Ross has “a high operating efficiency ... as high as 95% or 96%.” Horenstein Decl. (Ex. 2010) at ¶ 113. That is not correct. Ross describes a new, highly efficient type of battery that it claims to have invented, and states that in combination with “frictionless magnetic bearings” and a “windless evacuated chamber where the rotor spins,” the overall efficiency of the battery may be quite high in powering the motor. Ross at 5:39-39; 1:5-10 (describing “electromechanical battery”). This statement has nothing to do with the efficiency at which Ross transfers power from its primary coil to its

secondary coil, which would be improved with a compensating capacitor for the reasons I previously explained. Ex. 1003 ¶¶ 226-236.

80. Even if Ross's statement had meant that it was 95% efficient in wireless energy transfer, a POSA would still recognize yet further efficiency from the addition of a compensating capacitor as Wang explains. Ex. 1003 ¶¶ 226-236. The fact that Ross is already fairly efficient would not prevent a POSA from trying to make it more efficient, given that this could be easily accomplished using the well-known and obvious technique of adding a compensating capacitor.

B. Ross Discloses Moving the Receiving Antenna Based On Degree of Coupling

81. I understand that Dr. Horenstein contends that Ross does not teach “an alignment controller configured to sense a degree of coupling of said receiving antenna and the transmitting antenna based on a detection of the coupling that is measured at the receiving antenna, the alignment controller being further configured to move said receiving antenna from the first alignment position to a second alignment position to better align the receiving antenna with the transmitting antenna” in claims 8-10, 12, and 19. Horenstein Decl. (Ex. 2010) ¶116. He makes a nearly identical argument with respect to claims 13, 14, and 16. Horenstein Decl. (Ex. 2010) ¶122. I disagree in both cases, for the reasons described below.

82. Dr. Horenstein's opinion is based on his conclusion that "Ross discloses the use of sensors such as optical sensors ... to position the vehicle." Horenstein Decl. (Ex. 2010) ¶119. That is incorrect, or at least, incomplete. Ross does first describe the use of "vehicle sensors" to "sense the position of the [vehicle] relative to the roadway power transmitting module." Ross at 12:33-62. But Ross further explains that "the vehicle sensors 60 comprise a variety of different types of sensors," which can include "electromagnetic sensors." Ross at 13:5-15. Ross then further explains that "when the [vehicle] is traveling (being driven," and also "when the vehicle is stopped," the system can "monitor[] the change in the amplitude of the inductively received power signal as the coil 42 is laterally moved in one direction or the other," keeping "the induced power signal at a peak or maximum level." Ross at 13:15-31. Ross explicitly states that this type of sensing can be performed "instead of using the sensors 60 or in combination with using the sensors 60." Ross at 13:15-31. Thus, the fact that Ross discloses sensors does not contradict the fact that it also discloses sensing coupling at the vehicle coil "instead of" or "in combination with using the sensors." Ross at 13:15-31.

83. Dr. Horenstein argues that when Ross "monitor[] the change in the amplitude of the inductively received power signal as the coil 42 is laterally moved in one direction or the other," there is "no moving of the coil 42 from a first

alignment position to a second alignment position with a better alignment.” Horenstein Decl. (Ex. 2010) ¶120. I disagree. As Ross explains, the vehicle is initially brought to rest at a location “within a rough tolerance” of “the optimum lateral position.” Ross 12:33-62. The “optimum lateral alignment” is the position that “allows a maximum amount of power to be coupled from the embedded coil to the onboard coil.” Ross at 9:60-66. Ross then “further controls the lateral position” of the receiving coil, moving the coil assembly until it is “more closely aligned” with the “optimum lateral position.” Ross at 12:33-62.

84. The explanation of how the system determines the movement of the receiving coil from the “rough tolerance” position to the “more closely aligned” position is provided in the following column of Ross: “when the [vehicle] is traveling (being driven),” and also “when the vehicle is stopped,” the system can “monitor[] the change in the amplitude of the inductively received power signal as the coil 42 is laterally moved in one direction or the other,” keeping “the induced power signal at a peak or maximum level.” Ross at 13:15-31. As a POSA would understand, this measures the coupling (the amplitude of the inductively received power signal at the vehicle coil) first at the roughly aligned position, and then moves the coil “in one direction or the other” until it finds the position that yields the “peak or maximum” coupling. Ross at 12:33-63, 13:15-31.

85. The description of moving the coil “in one direction or the other,” while “monitor[ing] the change” in coupling to find the “peak or maximum” coupling conveys to a POSA a method of detecting the coupling at the current location, moving the coil in one direction, detecting the coupling at the new location, and moving or keeping the coil at the new position if it results in better coupling (i.e. if the inductively-received power signal has a higher amplitude)—repeating this process while continuing to move the coil until the peak coupling position is found. Ross at 12:33-63, 13:15-31. In this way, the system “sense[s] a degree of coupling” at the receiving antenna (vehicle coil) in the first position, then uses that sensed coupling to move the receiving antenna to a second position with better alignment, as claimed.

86. To the extent Dr. Horenstein suggests that the passages at column 12 of Ross are unrelated to, or distinct from, the passages at column 13 of Ross, I disagree. That is not how a POSA would read the reference. There is nothing in Ross to suggest that these two passages are separate embodiments or unrelated. In fact, the language confirms that they are related, as both relate to the “vehicle sensors” and the inductive coil monitoring that can occur “instead of” or “in combination with” those sensors. Ross at 12:33-63, 13:15-31.

CONCLUSION

All statements made herein of my own knowledge are true, and all statements made on information and belief are believed to be true. Further, I am aware that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. § 1001. I declare under penalty of perjury that the foregoing is true and correct.

Executed on Jan 27, 2025 (date), in Philadelphia, PA (city, state).


Mark Allen