

Filed on behalf of: InductEV, Inc.

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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

PETITIONER'S REPLY

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1008	Chwei-Sen Wang, <i>Design Considerations for Inductively Coupled Power Transfer Systems</i> (2004) (Ph.D. dissertation, University of Auckland) (“Wang”)
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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”)
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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”)
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”)
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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”)
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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”)
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”)

I. Introduction

For the Odachi grounds, Patent Owner (“PO”) repeats its pre-institution arguments seeking overly narrow constructions of “transmitting antenna” and “receiving antenna.” The Board correctly rejected those constructions in its institution decision, and they remain unsupported for the reasons the Board already found. The remainder of PO’s arguments mischaracterize Odachi’s disclosure, treating Odachi as a transformer whose primary and secondary antenna are exclusively in physical contact, when in fact they are physically separated by a “spaced distance.” Odachi (Ex. 1005) at 2:32-37, 6:1-8.

For the Ross grounds, PO mischaracterizes Ross’s disclosure, arguing that Ross uses “optical sensors” to perform positioning, rather than positioning based on detecting coupling. In fact, Ross states that the system can detect coupling “instead of” or “in combination with using the sensors.” Ross (Ex. 1007) at 13:15-31.

II. The Board Properly Construed “transmitting antenna” and “receiving antenna”

PO proposes that “transmitting antenna” be construed as “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” and “receiving antenna” be construed as “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.” Paper 21 (“POR”) 8. PO proposed these same constructions in its Preliminary Response, which the Board rejected. Paper 12 (“ID”) 11.

As the Board correctly found, the plain meanings of “transmitting antenna” and “receiving antenna” are “an antenna that transmits energy” and “an antenna that receives energy.” ID 11. That is how the terms would be understood by a POSA, and how they are used in the ’654 Patent. Allen-Supp. ¶¶10-21; ’654 Patent (Ex. 1001) 2:26-39 (“transmit antenna ... provid[es] a means for energy transmission” and “receive antenna ... provid[es] a means for energy reception”).

The record evidence does not support a “near-field component of flux into free space” requirement. That phrase does not appear in the ’654 Patent’s claims, specification, prosecution history, or any of the dictionaries or publications offered by PO. Dr. Horenstein cites the Wiley Electrical Dictionary as support (Ex. 2001 ¶25), but that dictionary says nothing about near-field flux. Rather, consistent with the plain meaning, it defines “transmitting antenna” as “an antenna which emits electromagnetic radiation” and a “receiving antenna” as “an antenna which picks up electromagnetic radiation.” Ex. 2003 641, 801; Allen-Supp. ¶¶13-15.

PO’s attempt to limit the claimed antennas to the “near-field” is also overly narrow in view of the surrounding claim language. Claim 1, for example, recites “a transmitting antenna being configured to generate *a wireless field* for charging a

device including a receiving antenna.” ’654 Patent cl. 1.¹ PO does not provide any basis for narrowing the expressly claimed “wireless field” to only include the “near field.” Allen-Supp. ¶16.

PO argues that certain passages of the ’654 Patent describe near-field antennas, POR 8-12, but none of these passages limits the plain meaning of transmitting or receiving antennas. Allen-Supp. ¶¶19-21. Even if PO were correct that some or all of the specification embodiments produce a near-field component of flux, it would be error to import that limitation into the claims. *Evolution Concepts, Inc. v. HOC Events, Inc.*, 22 F.4th 1361, 1367 (Fed. Cir. 2022) (it is improper to “limit claims beyond their plain meaning” even where “the only embodiments, or all of the embodiments, contain a particular limitation”).

Regardless, PO’s description of the specification is incorrect. PO points to a statement that “energy from the transmitting antenna is generated in the near field and the far field, but ... is more efficient in the near field.” POR 9 (citing ’654 Patent 2:26-30). But the challenged claims do not recite any particular efficiency, and the ’654 Patent also describes “lower efficiency” solutions. Allen-Supp. ¶19; ’654 Patent 3:14-23, cls. 1, 13. Moreover, the ’654 Patent expressly states that its specification description is “exemplary,” intended only to “serv[e] as an example,

¹ All emphases added except where noted.

instance, or illustration” and “not necessarily to be construed as preferred or advantageous.” ’654 Patent 1:55-2:1, 3:43-45, Allen-Supp. ¶20.

PO’s attempt to inject an “into free space” requirement is similarly unsupported. In fact, the specification *contrasts* the claimed transfer of wireless energy with “propagating the energy from the transmitting antenna into free space.” ’654 Patent 3:14-23; Allen-Supp. ¶¶16-17. A POSA would therefore understand that “transmitting antenna” or “receiving antenna” specifically do not require near-field components of flux in free space. Allen-Supp. ¶¶16-17.

Finally, PO’s argument that a coil is only a “transmitting antenna” depending on the placement of the “receiving antenna” and the specific field the receiving antenna “intercepts” is entirely unsupported. Allen-Supp. ¶18; ID 11.

Accordingly the claims merely require, as the Board correctly found, “an antenna that transmits energy” and “an antenna that receives energy.” ID 11.

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

The Petition showed that claims 13 and 15 are anticipated by Odachi. Pet. 7-19. PO argues that Odachi 1) does not disclose a “transmitting antenna” or “receiving antenna,” and 2) does not move its antenna “responsive to detecting a degree of coupling in the first alignment position.” PO is wrong on both.

A. Odachi discloses a “transmitting antenna” and “receiving antenna”

PO's argument that Odachi does not disclose the claimed antennas hinges on its constructions of “transmitting antenna” and “receiving antenna.” Those constructions are wrong, as discussed above, and Odachi discloses the claimed antenna under their plain meaning. Moreover, Odachi discloses and renders obvious the claims even under PO's constructions.

1. Odachi discloses the claimed antennas under their plain and ordinary meaning

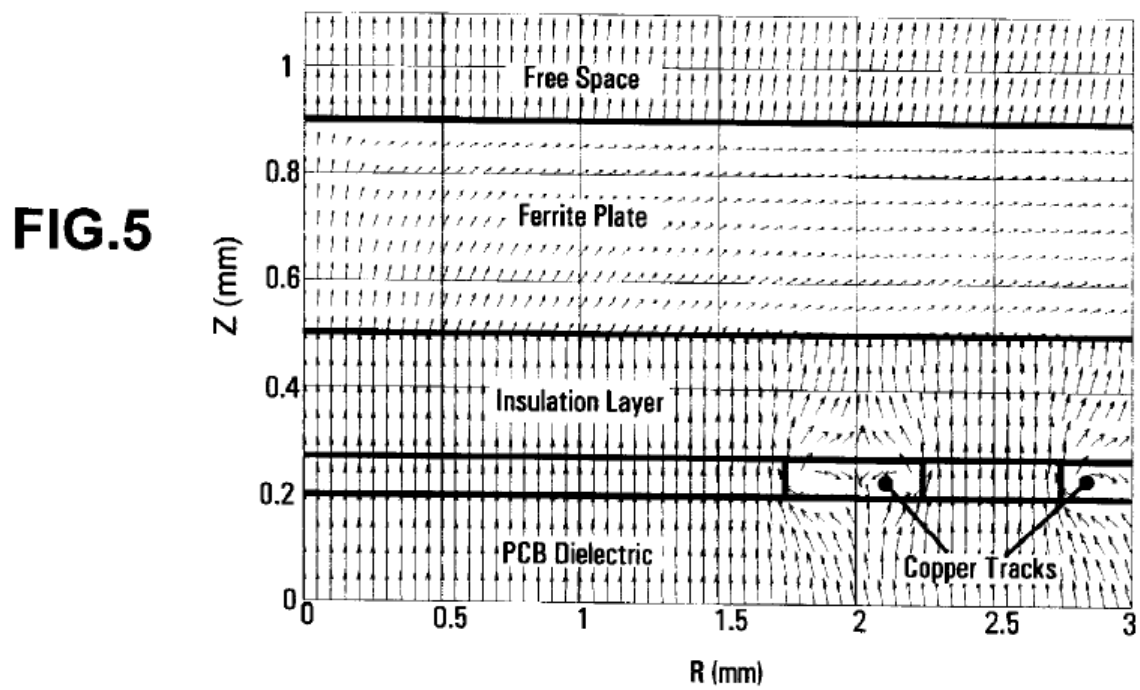
Odachi discloses the claimed transmitting and receiving antenna under their plain meanings of “an antenna that transmits energy” and “an antenna that receives energy” in substantially the same format as the '654 Patent. As the Petition explained, Odachi discloses (i) a transmitting antenna, referred to as the “primary inductive device or coupler,” that includes a “primary coil” wrapped around a “core”; and (ii) a receiving antenna, referred to as the “secondary inductive device or receptacle,” which has a separate “coil” wrapped around a separate “core”. Odachi 8:1-28; 4:6-15; *see* Pet. 7, 11-13, 25-26, Ex. 1003 ¶¶62-64, 103. Odachi's coils with magnetic cores are the same structure as the “loop antennas” disclosed in the '654 Patent: “a ‘loop’” wrapped around a “core such as a ferrite core,” also known as a “magnetic antenna.” '654 Patent 2:59-63; *see id.* 1:15-17, 1:36-37, Fig. 3; Allen-Supp. ¶¶22-26.

Odachi teaches that its coils are antennas in that they transmit and/or receive energy wirelessly through radiating electromagnetic fields, using radio waves.² See Pet. 11-13. Specifically, Odachi teaches generating a wireless field by flowing “AC current” in the “primary coil,” which wirelessly transfers energy to the a secondary coil 4 by “induc[ing] a similar current in the secondary coil 4 under the effect of electromagnetic induction.” Odachi 5:18-25, 6:1-27, 7:27-50, 13:39-64; Allen-Supp. ¶¶27-30. By flowing AC current into it, Odachi’s primary coil produces radiating electromagnetic waves consistent with the understood mechanisms of a transmitting “loop antenna.” Allen-Supp. ¶31; Serway (Ex. 1043) 711 (explaining “fundamental mechanism” that “[e]lectromagnetic waves are radiated by *any* circuit carrying an alternating current”) (emphasis original); Terman (Ex. 1044) 813 (“The loop antenna is essentially a coil of any convenient cross section ... carrying a radio-frequency current”); ’654 Patent 2:59-63 (describing “loop antenna[s]”), 1:15-17, 1:36-37, Fig. 3; Horenstein Dep. (Ex. 1033) 16:7-12 (“Q. ... if a primary coil has AC current flowing through it, will it radiate energy? A. Yes.”). For the same reasons, as a loop antenna Odachi’s receiving coil can receive radio waves. Allen-Supp. ¶32.

² Thus, to the extent the Board believes an “antenna” must be “a device that radiates and/or receives radio waves,” ID at 8, this is met as well. Allen-Supp. ¶15

A POSA would understand that, as a loop antenna used to wirelessly transfer power, the waves radiated by Odachi's primary coil and received by its secondary coil would be in the radio-wave frequency spectrum. Allen-Supp. ¶¶32-33; Terman (Ex. 1044) 813; IEEE Dictionary (Ex. 1037) 915 (defining "radio transmission" as "transmission of signals by means of radiated electromagnetic waves other than light or heat waves"); Graf (Ex. 1042) 620 (defining radio waves as "electromagnetic wave at a frequency lower than 3000 GHz"); Wang (Ex. 1008) 38 (inductively coupled power transfer systems operate "between several kHz and many MHz").

PO argues that because Odachi's primary coil is adjacent to a magnetic core, the coil will not radiate waves. POR 21. PO is wrong. As was well understood in the art, magnetic core material adjacent to a coil can help shape the electromagnetic field, but it does not change the fundamental principle that a coil with AC current flowing through it will radiate energy, making it a transmitting antenna. Allen-Supp. ¶¶47-52; Hui (Ex. 1041) 3:28-29 ("ferrite material guides the magnetic field"); Serway 711; Terman 813. As a POSA would have known, and as shown in the Hui patent below, the presence of a "ferrite plate" can help guide a magnetic field, but does not prevent the magnetic flux from radiating into "free space." Allen-Supp. ¶47.



Hui Fig. 5; 4:8-10 (“the ferrite plate alone cannot completely guide the H-field”).

As a further example, the Dobbs patent below shows a similar arrangement to Odachi: coil “windings” surrounded by “core half-shells.” Dobbs (Ex. 1038) [0054].

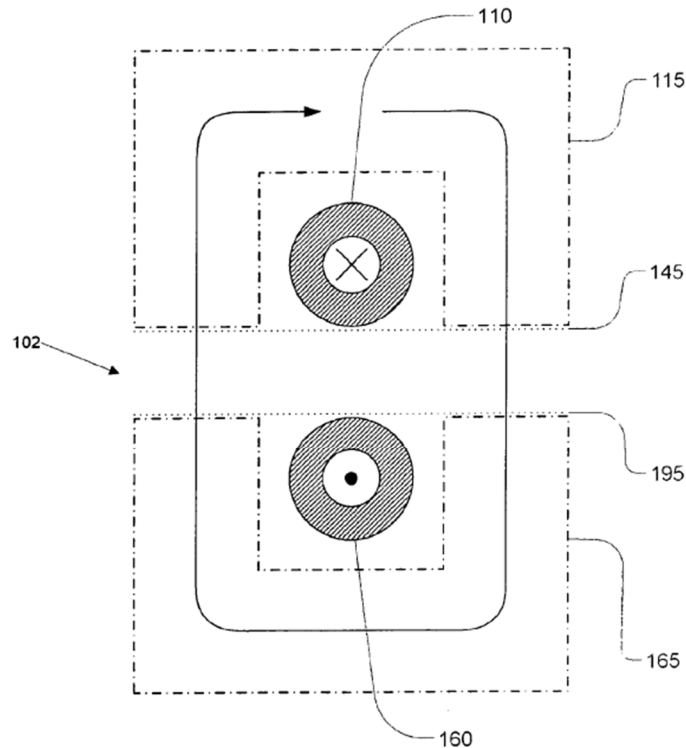


FIG. 2

Dobbs Fig. 2. Dobbs explains, as a POSA would have known, that “magnetic field lines escape ... in regions of core airgaps,” and as a result, “the power coupling devices ... *will radiate strongly* to the surrounding space.” Dobbs Abstract, [0054]. A POSA would have understood that the same occurs in Odachi: its primary coil/core is separated from the secondary coil/core and will radiate strongly to the surrounding space. Allen-Supp. ¶48-52.

2. Odachi discloses the claimed antennas under Patent Owner's constructions

Odachi also discloses (or renders obvious) transmitting and receiving antennas even under PO's incorrect constructions. PO asserts, for example, that a

“transmitting antenna may be formed by one coil of wire (i.e., a primary coil), and a receiving antenna may be formed by another coil of wire (i.e., a secondary coil), with the coils separated by air, without any intervening solid material.” POR 9. That is what Odachi discloses. While aligning, and even in the charging position, Odachi’s “primary coil 32” (a first coil of wire) and “secondary coil 4” (a second coil of wire) are not in contact and have no intervening solid material, i.e., “a space is formed between the primary and secondary coils on both sides thereof.” Odachi 8:50-54, 2:32-37 (describing “spaced distance” between the two devices), 6:1-27 (“spaced distance”), Fig. 12; Allen-Supp. ¶35. In this non-contact configuration “electromagnetic induction occurs between the coupler and the receptacle” (i.e. flux from the transmitting coil is transmitted through free space to the secondary coil) and “an electromotive force is induced in the secondary coil.” Odachi 6:6-8; Allen-Suppl. ¶¶31-37. Indeed, PO concedes Odachi’s primary coil generates “magnetic flux” that travels over a “gap between the cores” to induce current in the secondary coil. POR 29. A POSA would understand this to occur in the near field. Allen-Supp. ¶36; Horenstein Decl. (Ex. 2001) ¶24 (explaining that “localized wireless power transfer systems ... rely primarily on the near field component of the field produced by their primary antenna”); Chutorash (Ex. 1045) 2:60-66 (explaining that “magnetic field induction” is “near field communication”).

As an alternative to Odachi's express disclosure that energy transfer occurs over a "spaced distance," the Petition explained that it "would have been obvious to implement Odachi wirelessly," such that the primary and secondary devices never make physical contact. Pet. 23-25. In this case, too, electromagnetic induction will occur by radiating waves through the empty space between the separate primary and secondary devices (i.e. in the near field in free space), meeting the definition of antenna under any proposed construction. Allen-Supp. ¶37. PO does not dispute that a POSA would have and could have made such a modification to Odachi.

3. PO's Counterarguments Are Meritless

PO makes a series of scattershot arguments as to why Odachi's coils are supposedly not antennas, none of which have merit.

First, PO argues that "Odachi describes a traditional transformer, not an antenna." That is not correct. Allen-Supp. ¶¶38-42. PO contends a "traditional transformer" has (1) two or more coils of wire wrapped around the same magnetic core, and (2) no moving parts. POR 19-20; Ex. 2001 ¶27. Odachi's inductive devices have neither of these characteristics. Odachi's primary and secondary coil are each wrapped around *separate* cores, "core 31" and "core 3," which are expressly designed to move with respect to each other. Odachi 8:1-27, 11:6-59 (primary coil is affixed to a "move[able] ... support arm") 6:6-8 ("the spaced distance" between couplers "is reduced gradually ... when the former coupler comes close to the latter

receptacle”), Figs. 6, 11, 12 (showing separate cores), 14; Wang 13 (system with a secondary coil/core “allowed to move freely relative to the primary [coil/core]” is unlike a “traditional transformer” in which “the primary and secondary are fixed on a common core”), 82; Allen-Supp. ¶¶39-42; Pet. 7-11. Rather than disclosing a traditional transformer, Odachi’s primary coil 32 and receiving coil 3 match the ’654 Patent’s description—and commonly understood meaning—of a “loop antenna”: a “loop” of wire, also known as a “magnetic antenna,” which can include a “ferrite core.” ’654 Patent 1:15-17, 2:59-63; Odachi 8:1-54, Figs. 11, 12; Terman 813 (“The loop antenna is essentially a coil of any convenient cross section”); Allen-Suppl. ¶¶26, 31-33, 41.

PO’s “transformer” argument is further incorrect because it assumes that Odachi’s cores are always physically in contact. *See* POR 18-27. As the Board noted, PO’s myopic focus on when the cores are in contact is error. ID 16 (“we disagree with WiTricity that we should consider Odachi’s cores 3 and 31 to be in contact or nearly in contact for the purpose of our analysis”); *Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1076 (Fed. Cir. 2015) (“a reference must be considered for everything it teaches”). The challenged claims require analysis at the time of “test[ing] coupling,” “adjust[ing] an x-y alignment of the transmitting antenna,” “guiding a receiving antenna,” and “moving one of” the antennas. ’654 Patent cls. 1, 13; Allen-Suppl. ¶41. When these functions are occurring in Odachi, its primary

and secondary are a “spaced distance” apart. Odachi 6:1-40, 10:64-11:43, Fig. 6, Fig. 12, Fig. 14. Even across this distance, “electromagnetic induction occurs between the coupler and the receptacle” and “an electromotive force is induced in the secondary coil.” Odachi 6:6-8. That is all that is required.

Second, Patent Owner argues that when there is “a small gap between the cores in Odachi,” the system nonetheless “functions as a traditional transformer.” POR 29. PO wrongly presumes that if two coils function similarly to (or even are) a traditional transformer, they cannot be antennas. That is incorrect. Inductively coupled coils separated by a distance D and used to transfer energy wirelessly, as in Odachi, were commonly understood as antennas even if configured to function similarly to a transformer. Allen-Suppl. ¶¶43-56. Indeed, a similar patent from three inventors of the '654 Patent explained that “transmit and receiving antennas” can “react similarly to a loosely coupled transformer, with one antenna inducing power into the other.” Cook-765 (Ex. 1036) 1:38-45; *see id.* 3:21-23 (“resonator loop ... acts like a 1:1 transformer”); *see* Ross (Ex. 1007) 9:30-43 (“coupled coils [that] have an air gap between them” exhibit “the same type of coupling that occurs in a transformer”); Ex. 1016 (Partovi App) cl. 8 (“coils ... for inductively charging or supplying power ... also function as an antenna”); Chutorash 5:4-6 (“antennas ... may be ... configured to form an air-core transformer”).

PO does not cite any portion of Odachi, or any evidence other than the say-so of Dr. Horenstein, to support its argument that coils functioning similarly to a transformer are not antennas. POR 29. Dr. Horenstein asserts without citing any evidence 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. But they do not.” Horenstein Supp. (Ex. 2010) ¶69. That unexplained, unsupported, and conclusory assertion is not entitled to any weight.³ *Xerox Corp. v. Bytemark, Inc.*, IPR2022-00624, Paper 9, at 15 (PTAB Aug. 24, 2022) (precedential). In any event, Dr. Horenstein is incorrect. As explained above, a POSA would understand that flux will radiate from Odachi's primary core, escaping the core and entering free space. *Supra* 5-9. *See* Elliott (Ex. 1039) (“ferrite ... used to direct the magnetic flux” does not negate “radiated fields”); Gabrielson (Ex. 1044) (“any transformer ... radiate[s] magnetic fields”).

Third, PO argues that Odachi's coils are not antenna because they 1) have “a shared core material,” 2) “use a common magnetic core encircled by both of the coil windings,” and 3) form a “closed magnetic circuit.” POR 21-23. Each of these are

³ Notably, Dr. Horenstein took the opposition position in his first declaration, explaining that “in a practical transformer, a small amount of flux ... will escape the core.” Ex. 2001 ¶27.

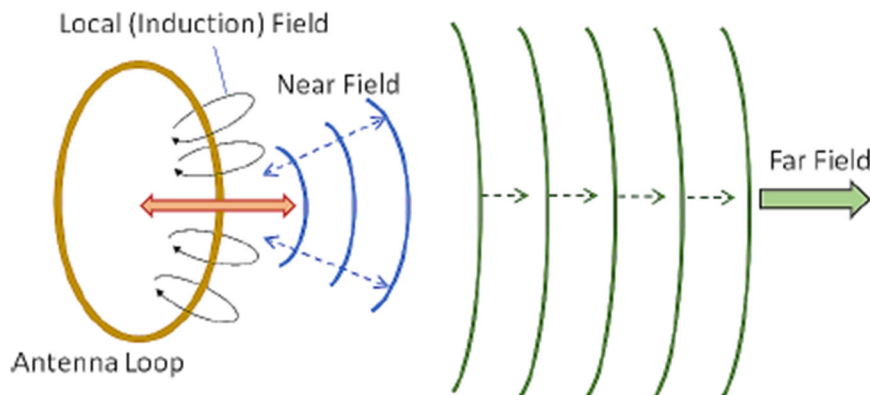
red herrings. Nothing in the claim language, or even Patent Owner's constructions, excludes shared cores, common magnetic cores or closed magnetic circuits. In any event, PO is incorrect on all three points. As discussed above, Odachi teaches separate primary and secondary coils with separate primary and secondary cores having a "spaced distance" between them—not "shared core material" or a "common magnetic core ... encircled by both of the coil windings" *See* Odachi 6:6-8; Pet. 23-25; Allen-Supp. ¶¶35, 42.⁴ Similarly, Odachi states that "a magnetic circuit is formed" when the primary and secondary devices "abut[]" each other. Odachi 4:34-47. Prior to that point, as a POSA would understand, the couplers are a "spaced distance" apart, and do not form a closed magnetic circuit. Odachi 6:1-45; Allen-Supp. ¶¶45, 55. Indeed, Odachi's positioning system requires that the circuit not be closed during positioning, because the system relies on detecting a variable amount of energy received by the secondary coil as the primary coil moves. Odachi 6:33-57, 7:51-58, 11:42-59, 13:53-64, Figs. 4-5; Allen-Suppl. ¶¶55.

Fourth, PO contends Odachi's primary coil "produces only the induction-field component, but no near field or far field." POR 24. Because the claims, as

⁴ To the extent PO contends that antennas cannot have *any* magnetic core, that is inconsistent with the '654 Patent, which states that "loop antennas," also called "magnetic antenna[s]," can include "a ferrite core." '654 Patent at 2:59-67.

properly construed, do not require the existence of or any distinction between “induction field,” “near field” or “far field” coupling, this is irrelevant. *Supra* 1-4. Regardless, PO is incorrect, for three reasons.

First, Dr. Horenstein opines the induction field and the near field are exclusive, such that being in the induction field means not being in the near field. POR 11; Ex. 2010 ¶37. That is not correct. The Wiley IEEE dictionary defines the “near-field region” as “the electromagnetic field extending no further than a distance of $2D^2/\lambda$... beyond this distance, the far-field region begins.” Ex. 2006 498. In other words, the nearfield is the range from zero distance away up to $2D^2/\lambda$ away. *Id.*; Allen-Supp. ¶¶53-54. Thus, contrary to Dr. Horenstein’s diagram below, what he designates as “Local (Induction) Field” would *also* be the near field.



Ex. 2010 ¶37; Chutorash 5:4-7 (explaining “induction field” and “near field” are synonymous); Horenstein Dep. 59:3-20 (Dr. Horenstein admitting that he did not consult any sources in drawing this diagram), 60:12-67:1 (admitting that there are no discernable boundaries between the local field, near field, and far field).

Second, Dr. Horenstein admitted on cross examination that when a “primary coil receives an AC current” then it will necessarily generates energy in *each* of the “induction field,” “near field,” and “far field.” *Id.* 15:3-13.

Third, Dr. Horenstein asserts that Odachi's primary and secondary devices act similarly to a “transformer,” but it was well known that transformers operate through near-field coupling. Allen-Supp. ¶53; Holcombe (Ex. 1034) 7:3-6 (“transformers can be thought of as extreme near-field devices ... the near-fields are used to transfer or store energy); Kurs (Ex. 1035) 2:13-15 (“[e]lectric transformers ... are examples of devices that utilize this known short range, near-field energy transfer scheme”).

Accordingly, Odachi discloses transmitting antenna and receiving antenna under the plain meaning of those terms, and also under PO's proposed constructions.

B. Odachi discloses alignment “responsive to detecting a degree of coupling”

The Petition explained that Odachi teaches “responsive to detecting a degree of coupling in the first alignment position ... moving one of the receiving antenna and the transmitting antenna from the first alignment position to a second alignment position to improve alignment...” Pet. 13-18. Odachi's primary coil begins at “its operative home position” (first alignment position), then moves “leftward” while repeatedly measuring the coupling (voltage V_{RMS}) at each point. Odachi 11:43-59; 13:53-64; 6:34-45; Ex. 1003 ¶¶112-125. Odachi uses the measured V_{RMS} voltages to determine two positions X_1 and X_2 , calculates the midpoint between them, and

moves the primary coil to this midpoint “target position X_A ” for maximum coupling (second alignment position). Odachi 11:43-59; 13:53-64; 6:34-45; Ex. 1003. ¶¶112-125.

PO does not dispute how Odachi works, but argues that this amounts to “determin[ing] the point X_A of maximum coupling by detecting the positions X_1 and X_2 ”, and therefore is “not responsive to detecting a degree of coupling in the first alignment position.” POR 37-38. That is not correct. Odachi’s positioning system determines coupling (i.e., measures V_{RMS} or I_{RMS}) at every point along the sweep including the operative home position (the claimed first alignment position). Odachi 11:43-59; Allen-Supp. ¶¶57-58. It uses all of these measured coupling values—including the operative home position value—to determine points X_1 and X_2 , which are used to calculate and move the primary coil to the target position. Odachi 11:43-59; Allen-Supp. ¶¶57-58. The fact that numerous V_{RMS} values (including the home position value) are used to determine X_1 and X_2 , and that these values are in turn used to determine X_A and move the primary coil there, confirms to a POSA that the primary coil is moved in response to detecting a degree of coupling at, among other positions, the first operative home position. Allen-Supp. ¶¶57-58.

PO’s argument is further incorrect because it ignores that the operative home position can be the X_1 position. While Figure 11 shows a centrally-parked car with a centrally-parked coil, if the car were parked off-center to the right, or the vehicle

coil was mounted off-center on the car, the operative home position of the primary coil would be closer to the secondary coil. Allen-Supp. ¶¶59-63. In that case, X₁ could be the very first measurement taken, making the X₁ position the same as the operative home position. Allen-Supp. ¶¶59-63. In that scenario, this limitation would be met even under PO's narrow view of the phrase "responsive to".

IV. Ground 1b: Odachi and Wang Invalidate Claims 1, 7, and 18

The Petition showed that claims 1, 7, and 18 are obvious over Odachi and Wang. Pet. 19-38. PO's arguments otherwise are meritless.

A. A POSA would have combined Odachi with Wang

The Petition explained that it would have been obvious to add Wang's compensating capacitor to Odachi's coils. Pet. 25-31. This was an "often" used and "fundamental" technique known to increase voltage or current gain, yielding more efficient power transfer. *Id*; Ex. 1003 ¶¶145-155.

PO argues that a POSA would not have been motivated to add a compensating capacitor to Odachi because such capacitors benefit systems that transfer power "without contact," while Odachi's coils are "in abutment." POR 39-42. That is incorrect because, as described above, Odachi transfers energy across a "spaced distance" between the primary and secondary devices. *Supra* 9-13; Allen-Supp. ¶¶ 38, 33, 39-41, 66. Moreover, the Petition explained in the alternative that "it would have been obvious to implement Odachi wirelessly," without physical

contact, and that a POSA could and would have done so. Pet. 23-25. PO's argument that Wang is only relevant to systems that transfer power "without contact" fails because Odachi is such a system.⁵

PO further argues that nothing in Odachi "suggests that its transformer primary and secondary suffer from weak coupling that would necessitate" a compensating capacitor, but this is wrong as a matter of law. A POSA would have been motivated to add a capacitor to Odachi to increase its ability to efficiently transfer power, including at higher voltages or current. Ex. 1003 ¶¶152-155. The desire to make a product "more efficient" is an "implicit motivation to combine" that "exists ... even absent any hint of suggestion in the references themselves." *Dystar Textilfarben GmbH & Co. Deutschland KG v. C.H. Patrick Co.*, 464 F.3d 1356, 1368 (Fed. Cir. 2006). The desire to make Odachi more efficient—which PO does not dispute would occur when adding a compensated capacitor—is sufficient motivation regardless of whether precisely laid out in Wang itself. Moreover, a POSA would understand that Odachi's less-than-perfect coupling would have benefited from the increased efficiency of a compensating capacitor. Allen-Supp. ¶¶65-67.

⁵ For the same reason, PO's argument that Odachi "already provides strong coupling" fails. POR 41-42. This incorrectly treats Odachi as a traditional transformer with tight coupling via physical connection. Allen-Supp. ¶¶65-66.

B. Odachi and Wang Render Obvious An Alignment Controller to Test Coupling and Adjust an X-Y Alignment

The Petition explained that Odachi and Wang render obvious the claimed alignment controller in the form of Odachi's "controller" that moves the primary coupler in the X, Y, and Z directions. Pet. 34-37. PO first repeats its argument from Section III(B) above, which is wrong for the reasons previously explained. Allen-Supp. ¶¶68; Odachi 11:6-59.

PO further argues that Odachi does not teach "basing the y-axis adjustment on a degree of coupling," because "the y-axis adjustment is fixed." POR 44. That is incorrect. Odachi teaches "positioning ... in the vehicle longitudinal direction ... in the same method as in the positioning along the X-axis." Odachi 14:29-32; *see id.* 4:65-5:4 ("longitudinal direction" means "Y-axis"). Thus, the Y-axis adjustment is based on degree of coupling, just like the X-axis adjustment. Allen-Supp. ¶¶69-70. Moreover, this limitation would be met even if the y-axis adjustment were fixed, because adjustment responsive to a degree of coupling in the X-axis direction, and in a fixed amount in the Y-axis direction, would still constitute "adjust[ing] an X-Y alignment" based on degree of coupling. Allen-Supp. ¶71.

C. Odachi teaches a "remote receiving antenna"

PO argues that Odachi does not teach a "remote receiving antenna" because Odachi's primary and secondary "touch each other." POR 45. That is incorrect. As previously described, Odachi's coils operate with a "spaced distance" between them,

making the receiving antenna remote. *Supra* 9-13; Allen-Supp. ¶¶72-74. Moreover, it would have been obvious to modify Odachi to operate with a distance between the coils, again making the receiver remote. Pet. 23-25.

D. Odachi teaches “a measurement of the amount of power”

PO argues that Odachi does not teach “the coupling test comprises a measurement of the amount of power that is transferred” because it performs this test “with a check current,” not “actual power transfer.” POR 46. PO misunderstands claim 18, which requires “wherein *the coupling test comprises a measurement of the amount of power that is transferred.*” ’654 Patent cl. 18. All that is required is to measure the amount of power that is transferred *during the coupling test*, which PO does not dispute is accomplished by measuring I_{RMS} or V_{RMS} using the check current.

V. Ground 1c: A POSA would have combined Odachi, Wang, and Partovi

PO argues that a POSA would not have combined Odachi, Wang, and Partovi because “[a] POSA would not have considered it feasible to use the pancake coils of Partovi to couple to the 3-D core-based secondary coils of Odachi.” POR 48. That is incorrect. PO argues “physical incompatibility” (POR 51), but “[i]t is well-established that a determination of obviousness ... does not require an actual, physical substitution of elements,” and “whether the references could be physically combined” is “basically irrelevant.” *In re Mouttet*, 686 F.3d 1322, 1332 (Fed. Cir.

2012). Regardless, PO is incorrect because it was a POSA would have implemented Partovi's coil-array concept with "coils sized like Odachi's original coil." Pet. 44; Ex. 1004 ¶185. An array of coils each shaped and sized like Odachi's original coil would resolve any supposed incompatibility. Allen-Supp. ¶¶75-76.

PO further argues that an array of coils in Odachi's original shape would lead to "limited charging locations" because "the primary windings would not be able to move relative to the vehicle's secondary coil." POR 53-54. Dr. Horenstein conceded at his deposition that this is not true: the windings are movable in this combination. Horenstein Dep. 102:2-10. The Petition explained the same. Pet. 41-44. PO argues that there may have been "simpler" or "less expensive" approaches available, but that does not defeat obviousness. "[T]hat better alternatives exist in the prior art does not mean that an inferior combination is inapt for obviousness purposes." *Bayer Pharma AG v. Watson Labs., Inc.*, 874 F.3d 1316,1327 (Fed. Cir. 2017).

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

The Petition showed that claims 8-10, 12-14, 16, and 19 are obvious over Ross, alone or in view of Wang. Pet. 47-72.

A. A POSA would have combined Ross with Wang

PO argues that a POSA would not have combined Ross and Wang because of an alleged incompatibility in their frequencies. POR 58-60. That is incorrect. Ross

teaches frequencies “in the 1-10 kHz range,” while Wang states that “it is often necessary to increase the frequency to between several kHz and many mHz, depending on application requirements.” Ross 5:40-43; Wang 38. Those ranges are compatible: a POSA would have recognized, as Wang teaches, that Ross’s system could remain at “several kHz” (within 1-10), or could have its frequency increased by “several kHz” or as much as “many mHz” to achieve the desired level of power transfer. Allen-Supp. ¶¶77-78.

PO next argues that a POSA would not modify Ross because Ross “already addresses the issue of increased efficiency.” POR 59. The fact that a device already functions well does not negate the motivation to “make further improvements.” *Transtex Inc. v. Laydon Composites*, 848 F. App’x 901, 907 (Fed. Cir. 2021). As a POSA would have understood, compensating Ross’s capacitors would yield even further efficiency.⁶ Allen-Supp. ¶¶79-80. Finally, PO argues that Ross states a preference for “low intensity” magnetic fields as a “safety issue.” POR 60. But Wang confirms that inductive charging systems remain “intrinsically safe and reliable” at its described frequencies. Wang i, 1.

⁶ PO’s claim that Ross is “95%” efficient is misleading. This quote refers to the efficiency of Ross’s battery, not the efficiency of its wireless power transfer. Ross 5:29-39.

B. Ross teaches moving the receiving antenna for better alignment**1. Claims 8-10, 12, and 19**

PO argues that Ross “does not disclose moving the receiving antenna to a second alignment position to achieve an alignment that is better than the alignment detected based on the degree of coupling measured at the receiving antenna.” POR 61-62. That is incorrect. Ross’s vehicle is initially brought to rest “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.” Ross 9:60-66. Ross then “further controls the lateral position” of the vehicle coil, moving the coil assembly until it is “more closely aligned” with the “optimum lateral position.” Ross 12:33-62.

In the following column, Ross explains how the system determines the movement of the receiving coil from the “rough[ly]” aligned position to the “more closely aligned” position: “by *monitoring the change* in the amplitude of the inductively received power signal *as the coil 42 is laterally moved in one direction or the other*,” to find the “peak or maximum level.” Ross 13:15-32. The phrase “monitoring *the change*” conveys to a POSA that Ross is taking an initial measurement of the inductively-received amplitude (which indicates the strength of coupling), then moving the coil and measuring again, and comparing the two. Allen-Supp. ¶¶81-86; Ross 13:15-32. If the comparison indicates a positive change (i.e.,

a higher amplitude inductively-received power signal), that indicates better alignment such that the system can move the coil to the “more closely aligned” position where the higher measurement was taken, repeating this process as necessary to find the “peak or maximum level.” Allen-Supp. ¶¶84-85; Ross 13:15-32.

PO's argument that Ross will use “optical sensors,” POR at 62-63, is contradicted by Ross's statement that the coupling detection technique (“monitoring the change in the amplitude of the inductively received power signal”) is utilized “*instead of* using the sensors ... or *in combination with* the sensors,” Ross at 13:15-31. For the same reason, PO's attempt to divorce the teachings of column 13 from the teachings of column 12 is unsupported. Ross expressly states that the coupling-detection can be performed as part of the lateral alignment described in column 12, including both “when the vehicle is stopped” and when it is “being driven.” Ross at 13:5-31; Allen-Supp. ¶82.

2. Claims 13, 14, and 16

PO argues that Ross does not disclose “mov[ing] from the ‘rough tolerance’ position (i.e. first alignment position) to the more closely aligned position (i.e. the second alignment position) ‘responsive to detecting a degree of coupling in the [rough tolerance] position.’” POR 65. This appears to be substantively the same as PO's prior argument, and is wrong for the same reasons. Allen-Supp. ¶¶81-86.

VII. Conclusion

The Board should hold all challenged claims unpatentable.

Respectfully submitted,

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CERTIFICATE OF COMPLIANCE WITH 37 C.F.R. § 42.24

I hereby certify that this Petitioner's Reply complies with the word count limitation of 37 C.F.R. § 42.24(c)(1) because it contains 5,597 words using Microsoft Word's counting feature, excluding the cover page, signature block, and the parts of the Petitioner's Reply exempted by 37 C.F.R. § 42.24(c).

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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.6(e), I certify that on this 27th day of January, 2025, a true and correct copy of the foregoing **Petitioner's Reply and all Exhibits** were served by electronic mail on Patent Owner's lead and backup counsel at the following email addresses:

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