

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MOMENTUM DYNAMICS CORPORATION,
Petitioner,

v.

WITRICITY CORPORATION,
Patent Owner.

IPR2021-01167
Patent 8,884,581 B2

Before JAMESON LEE, MIRIAM L. QUINN, and SCOTT RAEVSKY,
Administrative Patent Judges.

RAEVSKY, *Administrative Patent Judge.*

DECISION
Final Written Decision
Determining Some Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

Momentum Dynamics Corporation (“Petitioner”) filed a Petition (Paper 2, “Pet.”) requesting *inter partes* review of claims 1, 9, 10, 12, 13, 18, 36, 37, 43, 44, and 46–51 of U.S. Patent No. 8,884,581 B2 (Ex. 1001, “the ’581 patent”). WiTricity Corp. (“Patent Owner”) filed a Preliminary Response (Paper 6, “Prelim. Resp.”). Based on these and other preliminary submissions, we instituted an *inter partes* review of all challenged claims (Paper 7, “Decision” or “Dec.”). Subsequent filings include a Patent Owner Response (Paper 9, “PO Resp.”), a Petitioner Reply (Paper 18, “Reply”), and a Patent Owner Sur-reply (Paper 20, “Sur-reply”). An oral hearing was held on September 15, 2022, and a copy of the transcript was entered into the record. Paper 30 (“Tr.”).

We have jurisdiction over this proceeding under 35 U.S.C. § 6(b). After considering the evidence and arguments of the parties, we determine that Petitioner has proven by a preponderance of the evidence that claims 1, 9, 10, 12, 13, 18, 36, 37, 43, 44, and 49 of the ’581 patent are unpatentable. *See* 35 U.S.C. § 316(e). However, Petitioner has not proven by a preponderance of the evidence that claims 46–48, 50, and 51 are unpatentable.

II. BACKGROUND

A. The ’581 patent

The ’581 patent relates to systems for “wireless power transfer” for vehicle batteries. Ex. 1001, 1:20–25. Figure 1, below, illustrates an example of such a system:

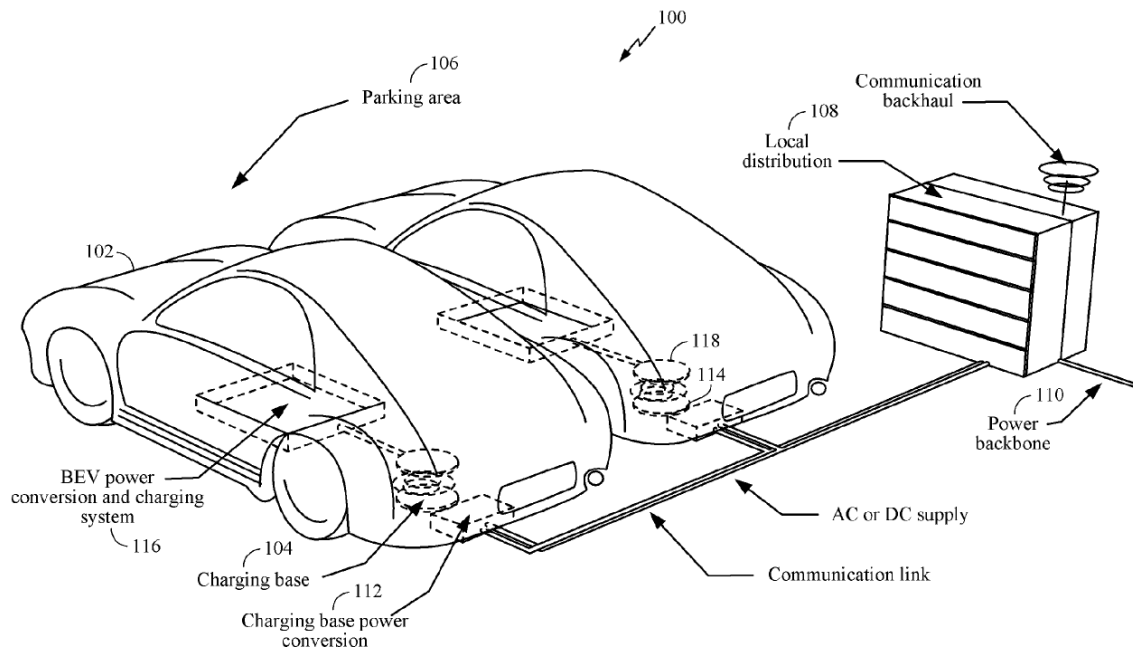


FIG. 1

Id. at 2:35–37. Figure 1 above illustrates a wireless charging system for wirelessly charging battery electric vehicles (BEV) 102 while the BEVs are parked over wireless charging base (CB) 103. *Id.* at 4:39–41. Two vehicles 102 are depicted in parking area 106, parked over corresponding CBs 104. CBs 104 include wireless power antennas 114 for generating a magnetic near field, and each BEV includes wireless power antenna 118 interacting with CB antenna 114 via the near field. *Id.* at 4:41–52.

Figure 2 below depicts the wireless power charging system of Figure 1 schematically:

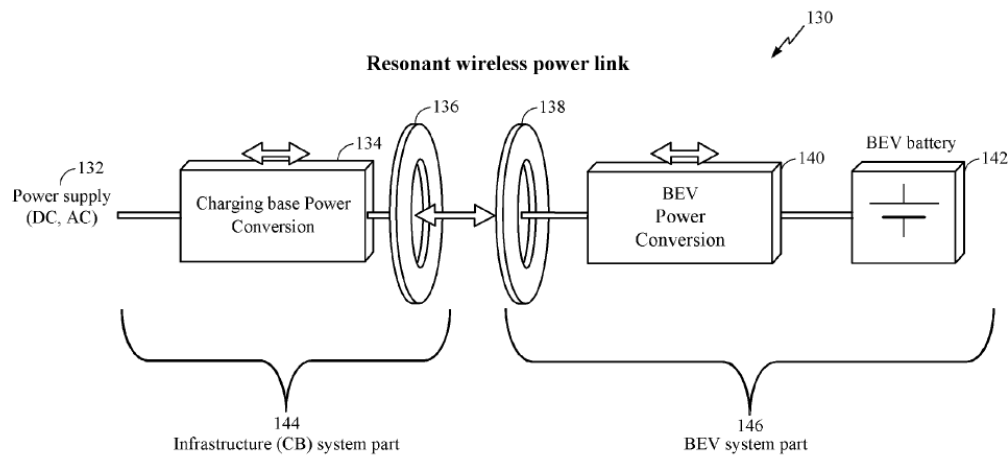


FIG. 2

Id. at 2:38–39. In Figure 2, CB antenna 136 couples with BEV antenna 138 to effectuate power transfer from the charging base to the BEV. *Id.* at 5:62–65, 2:13. A conventional power supply provides power to CB power conversion module 134, which drives CB antenna 136 to supply power to BEV antenna 138 in the vehicle. *Id.* at 5:56–65.

The maximum energy transfer rate between the two antennas depends on a coupling coefficient, k . *Id.* at 18:47–48. The coupling coefficient is a function of the distance between the two antennas. *Id.* at 16:6–10. The greater the distance between the antennas, the lower the energy transfer. *See id.* at 18:47–48. If a measured coupling coefficient between the two antennas changes, power conversion can change from one mode to another. *Id.* at 25:26–36. For example, the system can adapt to two different distances by changing the mode of power conversion, while attempting to maintain maximum efficiency and maximum power within regulatory constraints. *Id.* at 20:46–49.

To illustrate, if the coupling coefficient is above a threshold, power conversion is configured to a full-bridge mode. *Id.* Figure 19B below depicts this full-bridge mode:

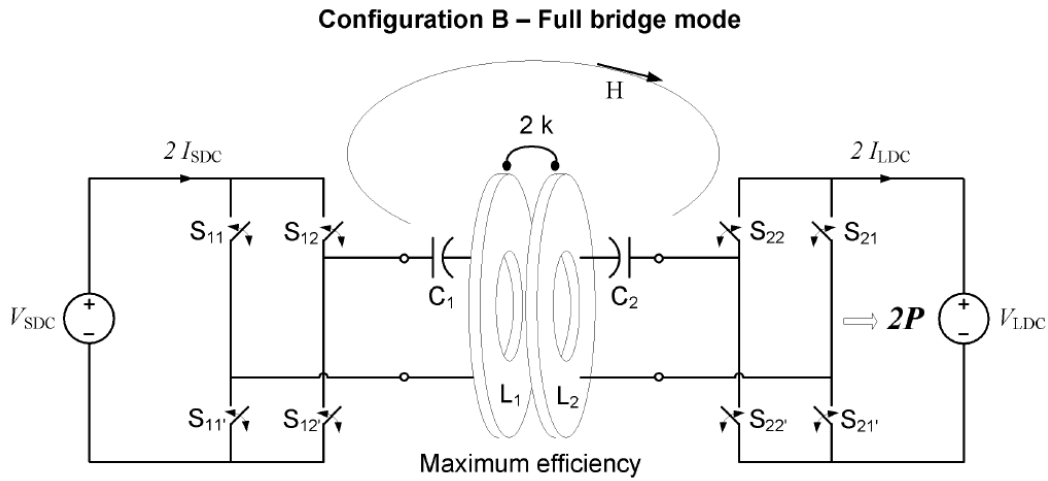


FIG. 19B

Id. at 3:30–32. In full-bridge mode in Figure 19B, all switches of power conversion are toggling in a manner such that switches S_{j1} and S_{j2} are closed at the same time. *Id.* at 19:51–55. That is, the two switches diagonal from each other are closed while the other two switches remain open. *See id.* Subsequently, the open switches are closed, and the previously closed switches are opened, and so on. *See id.*

If the coupling coefficient is equal to or below a threshold, power conversion is configured to half-bridge mode. *Id.* at 25:31–33. Figure 19A below illustrates half-bridge mode:

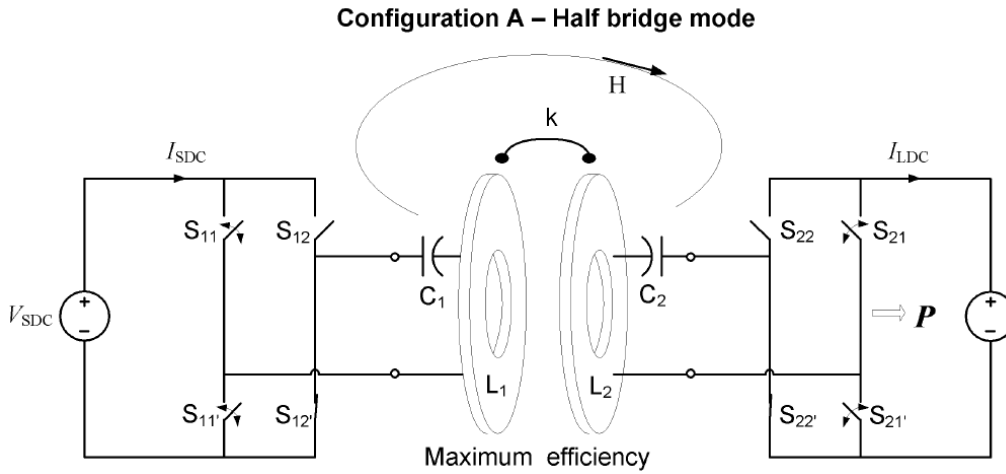


FIG. 19A

Id. at 3:30–32. In half-bridge mode in Figure 19A, only switches S_{11} and $S_{11'}$ are toggling (alternatingly), while switches $S_{12'}$ and S_{12} are static, resulting in lower energy transfer than in full-bridge mode. *See id.* at 19:56–58; *see also id.* at 20:52 (Table 1, reproduced below).

Table 1 below depicts the difference in energy transfer between these two modes:

TABLE 1

Example of a system that optimally adapts to two different distances				
Distance d	Coupling coefficient $k(d)$	Operating mode	Transformation ratio n_0	Energy transfer rate P_2 [kW]
4.8 cm	0.4	Full-bridge	$\frac{\sqrt{8}}{\pi}$	4
10 cm	0.2	Half-bridge	$\frac{\sqrt{2}}{\pi}$	2

Id. at 20:52. Table 1 illustrates full- and half-bridge modes for two different distances, resulting in two different energy transfer rates. *Id.* Table 1 also depicts a different “[t]ransformation ratio” for each operating mode. *Id.*

The transformation ratio of the power conversion represents the ratio of the DC input voltage to the r.m.s. (root mean square) voltage of the fundamental frequency at the output (of the fundamental frequency at LF (low frequency) output). *Id.* at 16:33–38.

This method of bridge reconfiguration may be combined with other methods of power control in order to adapt the link to any distance within a predefined range. *Id.* at 20:64–67. It is also the case that transmit power may have to be reduced while the system adjusts to a new distance/coupling coefficient. *Id.* at 24:54–55. Since power can be significantly reduced, efficiency is less of an issue in this mode of operation. *Id.* at 24:57–58. Finally, fine control to precisely adjust power to nominal power can be achieved by lowering or increasing coupling slightly or by another method that does not noticeably degrade efficiency. *Id.* at 25:45–48.

B. Illustrative Claim

Claims 1 and 46 are illustrative of the challenged claims:

1. A charging base, comprising:
 - a power converter configurable between first and second modes to convert power from a power supply system in a transmit mode;
 - and
 - a charging base antenna configured to be substantially resonant at an operating frequency and operably coupled to the power converter and configured to transfer wireless energy to a remote antenna,
 - the modes selectable based on a change in a coupling coefficient between the charging base antenna and the remote antenna.

Ex. 1001, 27:39–49.

46. An apparatus, comprising:
 - means for converting a power from a power supply system to a power at an operating frequency for transfer of wireless energy;

means for generating an electromagnetic field, the generating means substantially resonant within a first range of the operating frequency to transfer the wireless energy to a receive antenna positioned within a coupling-mode region, the coupling-mode region configured to be accessible by the receive antenna; and means for configuring the converting means to one of a first mode of operation to a second mode of operation based on a measurement indicative of a coupling coefficient between the generating means and the receive antenna.

Id. at 30:33–46.

C. Asserted Grounds of Unpatentability

Petitioner asserts the following grounds of unpatentability (Pet. 1–2), supported by the declaration of Dr. Konrad Woronowicz (Ex. 1003):¹

Claim(s) Challenged	35 U.S.C. §	Reference(s)
1, 9, 13, 18, 36, 37, 43, 44, 46–51	102 ²	Sato ³
10, 12	103(a)	Sato
1, 9, 12, 13, 18, 36, 37, 43, 44, 46–51	102	Julstrom ⁴
10, 46–48, 50, 51	103(a)	Julstrom

¹ Patent Owner did not submit declaration testimony and did not cross-examine Dr. Woronowicz.

² The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112-29, 125 Stat. 284, 285–88 (2011), revised 35 U.S.C. §§ 102, 103, 112 effective March 16, 2013. Because the challenged patent was filed before March 16, 2013, we refer to the pre-AIA version of §§ 102, 103, 112.

³ U.S. Publication No. 2010/0259109 A1 to Sato (“Sato”) (Ex. 1005).

⁴ U.S. Patent No. 8,022,775 B2 to Julstrom (“Julstrom”) (Ex. 1006).

III. ANALYSIS

A. Principles of Law

Petitioner bears the burden to demonstrate unpatentability. *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015). Petitioner must demonstrate by a preponderance of the evidence that the claims are unpatentable. 35 U.S.C. § 316(e).

To show anticipation under 35 U.S.C. § 102, each and every claim element, arranged as in the claim, must be found in a single prior art reference. *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359 (Fed. Cir. 2008). The prior art need not, however, use the same words as the claims. *In re Gleave*, 560 F.3d 1331, 1334 (Fed. Cir. 2009). The anticipation inquiry takes into account the literal teachings of the prior art reference and inferences the ordinarily skilled person would draw from it. *Eli Lilly and Co. v. Los Angeles Biomedical Res. Inst. at Harbor-UCLA Med. Ctr.*, 849 F.3d 1073, 1074–75 (Fed. Cir. 2017).

A claim is unpatentable as obvious if “the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007) (quoting 35 U.S.C. § 103(a)). We resolve the question of obviousness based on underlying factual determinations, including: (1) the scope and content of the prior art; (2) any differences between the prior art and the claims; (3) the level of skill in the art; and (4) when in evidence, objective indicia of nonobviousness. *See Graham v. John Deere Co. of Kansas City*, 383 U.S. 1, 17–18 (1966).

We apply these principles to the Petition’s challenges.

B. Level of Ordinary Skill in the Art

We review the grounds of unpatentability in view of the understanding of a person of ordinary skill in the art at the time of the invention. *Graham*, 383 U.S. at 13, 17. Petitioner asserts that

[a] person of ordinary skill in the art (“POSA”) at the time of the purported invention would have had a Bachelor’s degree in electrical engineering or an equivalent field, and at least two years’ industry experience, or equivalent research.

Alternatively, a POSA could substitute directly relevant additional education for experience, e.g., an advanced degree relating to the design of circuits using inductive coupling, or an advance degree in electrical engineering or an equivalent field with at least one year of industry experience.

Pet. 10 (citing Ex. 1003 ¶¶ 8–12).

Patent Owner does not address the level of skill in the art. We are persuaded that Petitioner’s proposal is consistent with the problems and solutions addressed by the ’581 patent and prior art of record. We adopt Petitioner’s definition of the level of skill, except that we delete the phrase “at least” to avoid ambiguity.

C. Claim Construction

In *inter partes* review, we construe claims using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. § 282(b), including construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent. 37 C.F.R. § 42.100(b) (2020).

1. “means” terms

Petitioner proposes constructions for four means terms as follows:

Term	Proposed Construction
“means for <u>converting a power from a power supply system to a power at an operating frequency for transfer of wireless energy</u> ” (Claims 46, 50)	The corresponding structures for performing the claimed function of this term (underlined) are: an oscillator with amplifier; the half-bridge inverter in Figure 19A; or the full-bridge inverter in Figure 19B.
“means for <u>generating an electromagnetic field, the generating means substantially resonant within a first range of the operating frequency to transfer the wireless energy to a receive antenna positioned within a coupling-mode region, the coupling-mode region configured to be accessible by the receive antenna</u> ” (Claims 46, 50)	The corresponding structure for performing the claimed function of this term (underlined) is a transmit antenna configured as a resonant LC circuit.
“means for <u>configuring the converting means to one of a first mode of operation to a second mode of operation based on a measurement indicative of a coupling coefficient between the generating means and the receive antenna</u> ” (Claim 46)	The corresponding structure for performing the claimed function of this term (underlined) is a controller configured to control the output power mode of the power converting means based on a measurement indicative of a coupling coefficient between the generating means and the receive antenna.
“means for <u>configuring the power converter to one of a first mode of operation to a second mode of operation based on a distance between the transmit antenna and the receive antenna</u> ” (Claim 50)	The corresponding structure for performing the claimed function of this term (underlined) is the same as for the configuring means of claim 46—the controller configures the power converter to one of first and second output power modes based on the distance between the transmit antenna and receive antenna.

Pet. 11–16 (citing Ex. 1003 ¶¶ 48–60).

Prior to institution, Patent Owner did not challenge these constructions, and we adopted them for purposes of institution. Patent Owner also does not dispute these constructions in its Response.⁵ *See, e.g.*, PO Resp. 34–35. We adopt only one of Petitioner’s constructions, that for “means for generating,” although we add “and equivalents thereof.” *See* 35 U.S.C. § 112, para. 6 (“ . . . such claim shall be construed to cover the corresponding structure, material, or acts described in the specification *and equivalents thereof*.” (emphasis added)). Although Patent Owner did not dispute the meanings of the terms “means for converting” and “means for configuring” in claims 46 and 50, we find it necessary to construe these terms to resolve the disputes involving these terms. *See Intellectual Ventures II LLC v. Ericsson Inc.*, 686 F. App’x 900, 906 (Fed. Cir. 2017) (nonprecedential) (“The Board is not constrained by the parties’ proposed constructions and is free to adopt its own construction”) (citing *SAS Institute, Inc. v. ComplementSoft, LLC*, 825 F.3d 1341, 1351 (Fed. Cir. 2016), *overruled on other grounds by SAS Institute, Inc. v. Iancu*, 138 S. Ct. 1348 (2018)); Tr. 13:7–26 (Petitioner agreeing that the Board can independently consider Petitioner’s claim construction).

a. “means for converting a power from a power supply system to a power at an operating frequency for transfer of wireless energy”

Petitioner contends that the corresponding structures for performing the claimed function of the “means for converting” term (underlined) are: an oscillator with amplifier; the half-bridge inverter in Figure 19A; or the full-

⁵ Patent Owner raised a new argument about “means for converting” in its Sur-reply. Sur-reply 3. We address this issue below.

bridge inverter in Figure 19B. Pet. 11. Specifically, Petitioner asserts that “the converting means may be ‘an oscillator . . . configured to generate a desired frequency’ with ‘a power amplifier . . . with an amplification amount responsive to control signals’ to supply power for transfer of wireless energy.” *Id.* at 12 (citing Ex. 1001, 6:31–38). Petitioner next asserts that “[t]he converting means may alternatively be an H-bridge circuit configured as the half-bridge inverter shown in Fig. 19A.” *Id.* (citing Ex. 1001, 19:56–57). Further, Petitioner asserts that “[t]he converting means may alternatively be an H-bridge circuit configured as the full-bridge inverter . . . shown in Fig. 19B.” *Id.* at 12–13 (citing Ex. 1001, 19:51–54). Petitioner also discussed “means for converting” at the oral hearing, further explaining its position that this term encompasses at least an oscillator and amplifier. Tr. 15:1–16:12. As we noted above, Patent Owner does not dispute Petitioner’s constructions in its Response. *See* PO Resp. 34–35.

Turning to our analysis, we first note that means-plus-function claiming occurs when a claim term is drafted in a manner that invokes 35 U.S.C. § 112, para. 6, which states:

An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.⁶

Williamson v. Citrix Online, LLC, 792 F.3d 1339, 1347 (Fed. Cir. 2015). “[T]he use of the word ‘means’ in a claim element creates a rebuttable presumption that § 112, para. 6 applies.” *Id.* (citing *Personalized Media*

⁶ *See supra*, n.2 (explaining that the pre-AIA version of § 112 applies).

Commc 'ns, LLC v. Int'l Trade Comm'n, 161 F.3d 696, 703–04 (Fed. Cir. 1998)). That presumption is not rebutted here. Neither party disputes that 35 U.S.C. § 112, paragraph 6 applies to all of the “means” terms recited in the '581 patent claims. Pet. 11–16; PO Resp. 7–15, 34–35.

“Construing a means-plus-function claim term is a two-step process. The court must first identify the claimed function. . . . Then, the court must determine what structure, if any, disclosed in the specification corresponds to the claimed function.” *Williamson*, 792 F.3d at 1351 (citing *Noah Sys., Inc. v. Intuit Inc.*, 675 F.3d 1302, 1311 (Fed. Cir. 2012)). “Structure disclosed in the specification qualifies as ‘corresponding structure’ if the intrinsic evidence clearly links or associates that structure to the function recited in the claim.” *Id.* at 1352 (citing *B. Braun Med., Inc. v. Abbott Labs.*, 124 F.3d 1419, 1424 (Fed. Cir. 1997)).

We agree with Petitioner that the claimed function in the “means for converting” limitation is “converting a power from a power supply system to a power at an operating frequency for transfer of wireless energy.” Pet. 11. But we disagree with Petitioner that the corresponding structure is “an oscillator with amplifier; the half-bridge inverter in Figure 19A below; or the full-bridge inverter in Figure 19B.” *See id.* For the reasons below, we identify the disclosed structure corresponding to the “means for converting” limitation to be “a bridge circuit configurable between a full-bridge mode and a half-bridge mode, as shown in Figures 19A and 19B, and equivalents thereof.”

Power conversion in the '581 patent involves changing a transformation ratio when the distance between charging and battery antenna changes. Ex. 1001, 19:14–17, 25–27. As explained above, the

“transformation ratio” is the ratio of the DC input voltage to the r.m.s. (root mean square) output voltage (of the fundamental frequency at LF output). *Id.* at 16:33–38. Changing the transformation ratio in the ’581 patent entails configuring the mode of a bridge circuit from a full-bridge mode to a half-bridge mode or vice versa. *Id.* at 19:42–44. In more detail, the ’581 patent explains that to “ensure[] maximum efficiency and regulatory compliance,” the “transformation ratio . . . [is] adapted when distance [between antennas] is changed.” *Id.* at 19:14–17. The ’581 patent prescribes an “economical solution [that] may be achieved by using power conversion to provide the required variable transformation ratio.” *Id.* at 19:25–27. “One method to change transformation ratio and that is extremely low-loss,” the ’581 patent explains, “is to change the operational mode of the bridge (e.g., from full-bridge mode to half-bridge mode or vice versa).” *Id.* at 19:42–44.

Figures 19A and 19B, reproduced below, illustrate this “[h]alf-bridge power conversion configuration,” or half-bridge mode, and “[f]ull-bridge power conversion configuration,” or full-bridge mode:

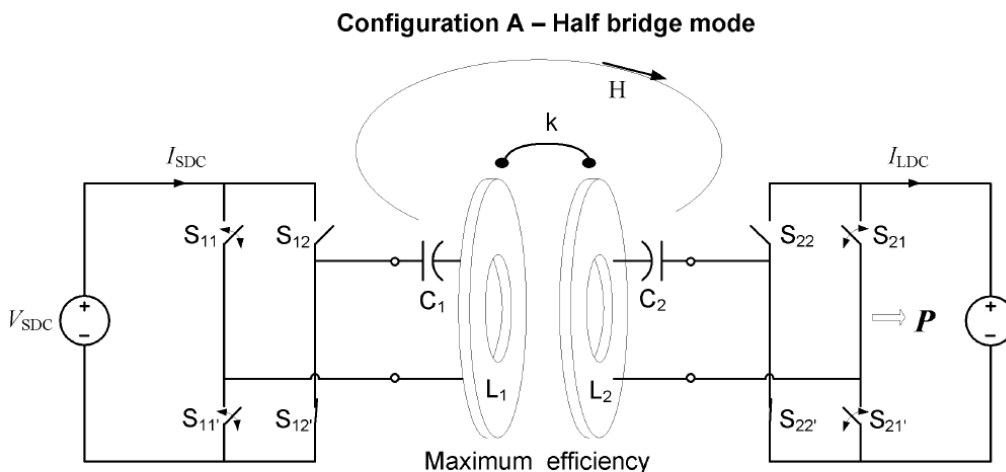


FIG. 19A

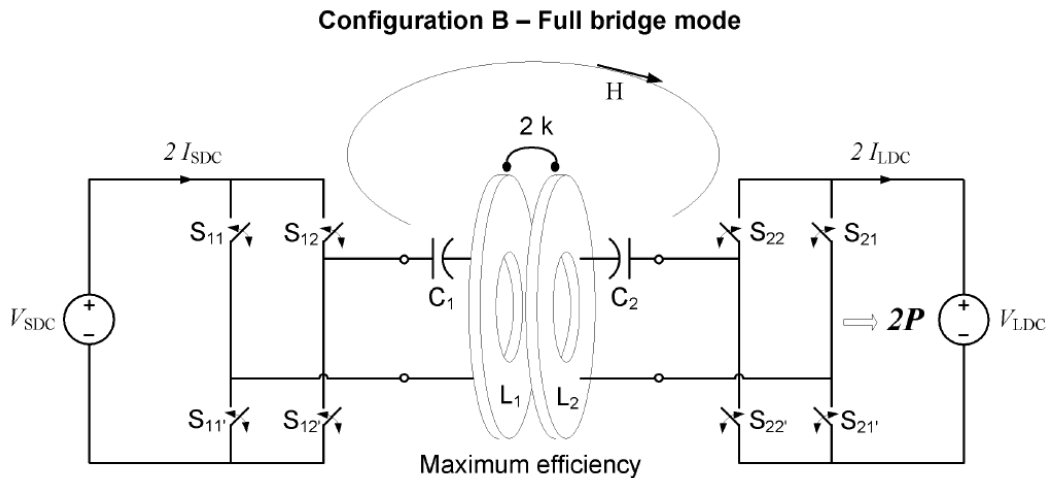


FIG. 19B

Id. at 3:30–33, 19:43. In the half-bridge mode depicted in Figure 19A, switches S_{11} and $S_{11'}$ toggle (alternatingly), while switches $S_{12'}$ and S_{12} are static. *Id.* at 19:56–58. In full-bridge mode in Figure 19B, all switches of power conversion toggle so that diagonally-placed switches S_{j1} and S_{j2} are opened and then closed together. *Id.* at 19:51–55.

These two figures “illustrate . . . *power conversion configuration[s]*” and also “illustrate two circuit configurations of an adaptable series resonant *energy transfer system*,” or in other words, they illustrate the claimed function of “converting a power from a power supply system to a power at an operating frequency for transfer of wireless energy.” *Id.* at 3:30–32, 23:7–8 (emphasis added), 25:51-55; *see also id.* at 20:3–4 (“a full-bridge transforms a DC voltage level into a LF [low frequency, *id.* at 4:28] voltage level,” i.e., the claimed “from a power supply system to a power at an operating frequency”), 25:51-55, 20:12–18 (similar for half bridge), 19:45–46, 25:51-55 (“full-bridge-based . . . wireless energy transfer system,” i.e., the claimed “for transfer of wireless energy”).

Claim 46 specifically requires this full and half-bridge mode-switching concept from the specification by relating the “means for converting” to the “means for configuring,” namely reciting, “means for configuring *the converting means* to one of a first *mode* of operation to a second *mode* of operation based on a measurement indicative of a *coupling coefficient* between the generating means and the receive antenna.” *Id.* at 30:33–46 (emphasis added). In other words, the claimed converting means must be configurable between first and second modes based on a measurement indicative of a coupling coefficient. The ’581 patent explicitly discloses configuring the bridge system of Figures 19A and 19B—and only the bridge system—based on the coupling coefficient. *Id.* at 25:27–33, 23:7–16. If a measured coupling coefficient is above a threshold, “power conversion is configured to full-bridge mode.” *Id.* at 25:29–31. And if the coupling coefficient is at or below the threshold, “power conversion is configured to half-bridge mode.” *Id.* at 25:31–33. Thus, the only structure described in the ’581 patent specification both (1) as a converting means, and (2) which is configured by a configuring means based on a measurement indicative of a coupling coefficient, is the bridge circuit shown in Figures 19A and 19B. *See id.* at 25:27–33, 23:7–16.

Because the disclosed “coupling coefficient $k(d)$. . . is a function of distance,” *id.* at 15:67–16:1, the same disclosed structure for the “means for converting” applies to claim 50, which similarly recites “means for configuring the converting means to one of a first mode of operation to a second mode of operation based on a *distance* between the transmit antenna and the receive antenna,” *id.* at 31:11–14 (emphasis added).

Petitioner’s position that the “means for converting” can be *either* the half-bridge inverter in Figure 19A *or* the full-bridge inverter in Figure 19B overlooks the required configurability of the bridge, and is, therefore, incorrect. Pet. 11. Compounding this error is Petitioner’s construction of “means for configuring,” which asserts that the first and second modes of operation are simply “first and second voltage transformation ratios,” not the disclosed half- and full-bridge modes. *Id.* at 14–15 (citing Ex. 1001, 21:9–11). Collectively, Petitioner’s two constructions would result in (1) the “means for converting” including a half- or full-bridge inverter alone, which (2) in the “means for configuring” would be configured to have a different transformation ratio. But neither the half- or full-bridge inverter *alone* can be reconfigured to have a different transformation ratio—only configuring one type of inverter to the other type of inverter results in a different transformation ratio. *See* Ex. 1001, 20:51–61 (Table 1, reproduced below).⁷

Petitioner also does not explain why “transformation ratios” correspond to the claimed modes. Petitioner merely states, “[t]he controller configures the converting means to one of first and second output power modes (first and second voltage transformation ratios)” Pet. 15 (citing Ex. 1001, 21:9–11, 19:14–17, 19:27–29, 20:64–21:8, 26:28–43). Although Petitioner quotes the ’581 patent as describing, for example, “[c]hanging . . . transformation ratio . . . is equivalent to power control,” the specification

⁷ It would also be incorrect to find that “means for converting” includes a *generic* half bridge, unlike the one shown in Figure 19A. Some generic half bridges include just two switches, unlike the four-switch configuration shown in Figure 19A that is reconfigurable into the full bridge shown in Figure 19B. *See, e.g.,* Ex. 1006 (Julstrom), Fig. 17 (depicting half bridge with two switches, Q400 and Q402), 20:31–36; Ex. 1003 ¶ 210.

does not link “transformation ratio” to a “mode.” *See id.* (quoting, e.g., Ex. 1001, 19:27–29). To the contrary, Table 1 of the ’581 patent, reproduced again below, depicts two “Operating mode[s]” (half and full bridge) separately from the “Transformation ratio”:

TABLE 1

Example of a system that optimally adapts to two different distances

Distance d	Coupling coefficient k(d)	Operating mode	Transformation ratio n_o	Energy transfer rate P_2 [kW]
4.8 cm	0.4	Full-bridge	$\frac{\sqrt{8}}{\pi}$	4
10 cm	0.2	Half-bridge	$\frac{\sqrt{2}}{\pi}$	2

See Ex. 1001, 20:51–61. Table 1’s separation of “Operating mode” and “Transformation ratio” into two separate columns suggests that the transformation ratio is a separate concept from a mode. In fact, a transformation ratio is just a characteristic of power conversion, not a mode. *See id.* at 16:33–34 (“A transformation ratio $1:n_1$ can also be attributed to . . . power conversion[.]”).

Further, it would be incorrect to consider the “means for converting” as including both a half bridge and a full bridge inverter. At any given time, the bridge circuit is configured as one or the other, not both. *See id.* at 19:42–44 (“change the operational mode of the bridge (e.g., from full-bridge mode to half-bridge mode or vice versa)”); Sur-reply 3–9.⁸

⁸ Patent Owner argues for this interpretation for the first time in its Sur-reply. Sur-reply 3. Not only is this argument incorrect, but it is improper as non-responsive to Petitioner’s Reply, which did not newly construe “means for converting.” “Generally, a reply or sur-reply may only respond to

Further, the “means for converting” cannot be just an oscillator with amplifier, as Petitioner alleges. Pet. 11–12. The ’581 patent specification states that the “power conversion module may both include an oscillator, a power amplifier, a filter, and a matching circuit.” Ex. 1001, 6:31–33. But claim 46 requires the “converting means” to be configured from “one of a first mode of operation to a second mode of operation *based on a measurement indicative of a coupling coefficient*” (and similarly, “distance” in claim 50). Petitioner does not identify, nor can we find, any description in the ’581 patent of the oscillator with amplifier being configured from one mode to another based on a coupling coefficient or distance. *See id.* at 6:31–37.

Accordingly, in the “means for converting” limitation, we identify the structure corresponding to the claimed function as “a bridge circuit configurable between a full-bridge mode and a half-bridge mode, as shown in Figures 19A and 19B, and equivalents thereof.”

arguments raised in the preceding brief.” Consolidated Trial Practice Guide (November 2019), <https://www.uspto.gov/TrialPracticeGuideConsolidated>, 74. “The reason for limiting the scope of a sur-reply is simple—to promote procedural fairness and prevent sandbagging.” *Trane U.S., Inc. v. SEMCO, LLC*, IPR2018-00514, Paper 36 at 7 (PTAB Apr. 17, 2019).

b. “means for configuring the converting means to one of a first mode of operation to a second mode of operation based on a measurement indicative of a coupling coefficient between the generating means and the receive antenna” (claim 46)

“means for configuring the power converter to one of a first mode of operation to a second mode of operation based on a distance between the transmit antenna and the receive antenna” (claim 50)

As noted above, the “means for configuring” is similar in claims 46 and 50, except that claim 46’s means for configuring is based on a coupling coefficient, and claim 50’s means for configuring is based on distance. In view of the similarity of these limitations, we discuss them together.

Petitioner identifies the underlined text, reproduced in the heading above, as the recited function for each means term. Pet. 14–16. Petitioner then contends that the corresponding structure for performing the “means for configuring” of claims 46 and 50 is a controller. *Id.* at 15–16 (citing Ex. 1001, 21:9–11, 19:14–17, 19:27–29, 20:64–21:8, 26:28–43; Ex. 1003 ¶ 59). Further, Petitioner asserts that the first and second output modes recited in the “means for configuring” refer to “first and second voltage transformation ratios.” *Id.* (citing same). As we noted above, Patent Owner does not dispute Petitioner’s constructions in its Response. *See* PO Resp. 34–35.

Our construction for these terms flows from our above discussion of “means for converting.” First, we agree with Petitioner that the underlined portions of these terms in claims 46 and 50, reproduced above, is the correct recited function. We also agree with Petitioner that the corresponding structure for performing the “means for configuring” is a controller because

the embodiments of the '581 patent are “implemented or performed with . . . a controller.” Ex. 1001, 26:28–39. However, in the previous section, we disagreed with Petitioner that the first and second modes correspond with first and second voltage transformation ratios. These modes instead refer to either a full-bridge mode or a half-bridge mode, as explained above.

Thus, our construction of the “means for configuring” limitation in claim 46 that takes into account our discussion of “modes” in the previous section is, “a controller for configuring the converting means from one of a first mode of operation and a second mode of operation to the other, where one of the two modes of operation is a full-bridge mode and the other of the two modes of operation is a half-bridge mode, based on a measurement indicative of a coupling coefficient between the generating means and the receive antenna, and equivalents thereof.”

We construe claim 50 similarly, replacing the relevant different language from claim 46: “a controller for configuring the converting means from one of a first mode of operation and a second mode of operation to the other, where one of the two modes of operation is a full-bridge mode and the other of the two modes of operation is a half-bridge mode, based on a distance between the transmit antenna and the receive antenna, and equivalents thereof.”

2. “modes”

a. The parties’ arguments

Claim 1 recites, “a power converter configurable between first and second *modes* to convert power . . . ; the *modes* selectable based on a change in a coupling coefficient between the charging base antenna and the remote antenna.” Ex. 1001, 27:40–49 (emphasis added). Independent claims 36

and 49 also refer to configuring the power converter between first and second modes of operation. *Id.* at 29:64–65, 30:64–65. Patent Owner contends that “[t]he proper construction of this phrase is ‘discrete configurations.’” PO Resp. 8. By “this phrase,” we understand Patent Owner to be referring to the word “modes,” based on the remainder of Patent Owner’s arguments.

Patent Owner reasons that the ’581 patent “emphasizes its goal to maintain efficiency of wireless power transfer.” *Id.* (citing, e.g., Ex. 1001, 1:61–65, 2:5–7). And construing “modes” to broadly include “any adjustment” would run counter to this goal, Patent Owner argues. *Id.* at 9–10. In Patent Owner’s view, Petitioner’s construction also renders the term “modes” superfluous by effectively interpreting it to encompass “everything capable of being adjusted.” *Id.* at 10. But the ’581 patent, Patent Owner argues, makes clear that the claimed invention does not include continuous adjustment. *Id.* at 11.

Patent Owner refers to the following passage from the specification as supporting its contention that the claimed invention does not include continuous adjustment:

Several methods for power control and load adaptation have been proposed with some allowing for *continuous change* of transformation ratio, however sacrificing zero current switching (ZCS), thus leads to some increased switching loss and stress of switching devices. Others methods may maintain ZCS condition, but permit change of transformation ratio only in coarse steps.

PO Resp. 11–12 (citing Ex. 1001, 19:34–40 (emphasis added)).⁹ In other words, in Patent Owner’s view, the specification specifically dismissed those

⁹ The parties argue over whether Patent Owner misquoted this passage.

approaches that “allow[] for continuous change of transformation ratio.” *Id.* at 11–12. Patent Owner then points to the text that follows this passage, which describes “[o]ne method to change transformation ratio and that is *extremely low-loss*, is to *change the operational mode* of the bridge (e.g., from full-bridge mode to half-bridge mode or vice versa).” *Id.* at 12 (citing Ex. 1001, 19:41–44, 23:6–16, 25:41–48). Based on these passages, Patent Owner contends that the specification “specifically dismissed” continuous adjustments. *Id.* at 12–13 (citing Ex. 1001, 19:35–40). Finally, Patent Owner asserts that Petitioner’s reliance on another reference to “mode” in the specification is irrelevant, as it refers to just a single mode of operation. *Id.* at 14 (citing Ex. 1001, 24:54–59 (“in *this mode of operation*”), Pet. 20).

Patent Owner also cites dictionary evidence that it asserts “reinforces the discrete nature of the term ‘modes.’” *Id.* at 14–15 (citing Ex. 2001, 478 (defining “mode” as “[o]ne of *multiple available operational states* that can be selected from” and further noting that “mode” means “[a] manner, procedure, form, method, or way of using, operating, or functioning”)). In Patent Owner’s view, “[n]one of the definitions lend support to reading a continuum over a range into ‘modes.’” *Id.* at 15 (emphasis omitted).

In the Reply, Petitioner contends that the following specification passage, referred to above, does not constitute a disavowal of all forms of continuous adjustment:

Several methods for power control and load adaptation have been proposed with some allowing for continuous change of transformation ratio, however sacrificing zero current switching (ZCS), thus leads to some increased switching loss

Reply 3. We reproduce the entire paragraph here for immediate context and sidestep the parties’ quotation dispute.

and stress of switching devices. ***Others methods may maintain ZCS condition, but permit change of transformation ratio only in coarse steps.***

Reply 3 (quoting Ex. 1001, 19:34–40). Petitioner notes that this passage refers to “***some***” methods of continuous change and also criticizes other methods that “permit change of transformation ratio ***only in coarse steps.***” *Id.* In Petitioner’s view, these statements “merely indicate a preference” for a particular approach and “do not show that the patentee clearly and unmistakably disavowed claim scope.” *Id.* (quoting *Cont’l Circuits LLC v. Intel Corp.*, 915 F.3d 788, 797 (Fed. Cir. 2019)).

Petitioner also disputes that the ’581 patent’s description of maintaining efficiency supports Patent Owner’s construction. *Id.* at 4. Petitioner contends that “Patent Owner cites nothing suggesting this adjustment of transformation ratio [to maintain efficiency] cannot be continuous.” *Id.* Further, Petitioner asserts that Patent Owner’s construction would exclude disclosed embodiments, including those where the power converter includes a “power amplifier” for continuously adjusting the power (transformation ratio) of the power converter. *Id.* (citing Ex. 1001, 6:31–38). These embodiments, Petitioner contends, permit “adapt[ing] the link to ***any distance*** within a predefined range.” *Id.* at 4–5 (citing, e.g., Ex. 1001, 20:64–21:1). Finally, Petitioner views Patent Owner’s supplied dictionary definitions of “mode” as supporting its position rather than Patent Owner’s. *Id.* (citing Ex. 2001, 478).

The Sur-reply largely reiterates the Patent Owner Response’s arguments. Sur-reply 9–14. We highlight the following. Patent Owner notes that Table 1 of the ’581 patent “show[s] changes of the transformation ratio in coarse steps between two modes.” *Id.* at 12. In the context of the

specification paragraph already quoted, Patent Owner argues that its “proposed construction for ‘modes’ comports with these ‘[o]ther methods’ (19:38–40) as well as the following ‘[o]ne method’ (19:41–44) because both change the transformation ratio in coarse steps when switching between the ‘discrete configurations.’” *Id.* at 13. Patent Owner concludes that “the specification has not criticized these ‘[o]ther methods’ because the allegedly ‘preferred embodiment’ of the ’581 specification is one such method that also changes the transformation ratio in coarse steps.” *Id.* (citing Ex. 1001, 19:38–40, 41–44, 20:3–18, 45–50, Table 1).

b. Analysis

Under the standard applied by district courts, claim terms are generally given their plain and ordinary meaning as would be understood by a person of ordinary skill in the art at the time of the invention and in the context of the entire patent disclosure. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313 (Fed. Cir. 2005) (en banc). “There are only two exceptions to this general rule: 1) when a patentee sets out a definition and acts as his own lexicographer, or 2) when the patentee disavows the full scope of a claim term either in the specification or during prosecution.” *Thorner v. Sony Computer Entm’t Am. LLC*, 669 F.3d 1362, 1365 (Fed. Cir. 2012).

For lexicography, “[e]ven when guidance is not provided in explicit definitional format, the specification may define claim terms by implication such that the meaning may be found in or ascertained by a reading of the patent documents.” *In re Abbott Diabetes Care Inc.*, 696 F.3d 1142, 1150 (Fed. Cir. 2012) (quoting *Irdeto Access, Inc. v. Echostar Satellite Corp.*, 383 F.3d 1295, 1300 (Fed. Cir. 2004)). For example, “a patent’s repeated and consistent description of a claim term may inform its construction.” *Groove*

Digital, Inc. v. United Bank, 825 Fed. App'x 852 (Fed. Cir. 2020) (nonprecedential) (citing *Abbott*, 696 F.3d at 1150). For disavowal to be applicable, “the specification must contain expressions of manifest exclusion or restriction, representing a clear disavowal of claim scope.” *Cont'l Circuits*, 915 F.3d at 797 (quotations and citations omitted).

Patent Owner's briefing relies heavily on the '581 patent specification to construe “modes,” but it does not clearly explain its legal theory for doing so. *See* PO Resp. 8–15; Sur-reply 9–15. It is unclear, for instance, whether Patent Owner's briefing advocates for lexicography (whether explicit or implied), or whether Patent Owner advocates for a disavowal. Complicating matters, Patent Owner's counsel stated in the hearing that Patent Owner is advocating only for the plain and ordinary meaning of “modes” and not for a disavowal. Tr. 21:2–11 (“So this disclaimer law . . . is inapplicable.”), 22:6 (“I agree there is no disavowal . . .”). Patent Owner's counsel was less clear on whether the specification implicitly defines the term, stating that “[p]erhaps there is an implicit construction or perhaps there is context to what the plain and ordinary meaning is,” but also that he is “not” “making a disavowal or implied construction argument.” *Id.* at 22:15–18, 30:8–10.

We agree with Patent Owner that the plain and ordinary meaning of “modes” applies, although we are not persuaded that Patent Owner's proposed construction is appropriate given the claim language, the specification, and the evidence of record. The plain language of the limitation, “a power converter configurable between first and second modes to convert power from a power supply system in a transmit mode,” indicates that there are *multiple* modes, namely, “first and second” modes (emphasis added). The last limitation of claim 1, “the modes *selectable* based on a

change in a coupling coefficient between the charging base antenna and the remote antenna,” indicates that the modes are *selectable*. Patent Owner points to a dictionary definition that captures these *multiple* and *selectable* concepts, defining “mode” as “[o]ne of *multiple* available operational states that can be *selected* from.” PO Resp. 15 (quoting Ex. 2001, 478) (emphasis changed). We find this dictionary definition compelling because it aligns so closely with the plain claim language. To be fair, Patent Owner only relies on this dictionary definition as supporting, not supplanting, its “discrete configurations” construction. *Id.* at 14–15. But we find that the dictionary definition explains the plain claim language more clearly than Patent Owner’s proffered “discrete configurations,” because unlike the concepts of *multiple* and *selectable*, no “discrete” concept appears in the claim. Petitioner also agrees that Patent Owner’s dictionary definition applies. Reply 5; Tr. 5:12–18.

Turning to the specification, we refer again to Patent Owner’s reliance on the following text as informing the meaning of “modes”:

Several methods for power control and load adaptation have been proposed with some allowing for continuous change of transformation ratio, however sacrificing zero current switching (ZCS), thus leads to some increased switching loss and stress of switching devices. Others methods may maintain ZCS condition, but permit change of transformation ratio only in coarse steps.

One method to change transformation ratio and that is extremely low-loss, is to change the operational mode of the bridge (e.g., from full-bridge mode to half-bridge mode or vice versa).

Ex. 1001, 19:34–44, *cited in* PO Resp. 11–12. In Patent Owner’s view, these passages “specifically dismissed” continuous adjustments. PO Resp.

12–13. We disagree. Petitioner correctly argues that Patent Owner reads the specification too narrowly, as the specification “merely indicate[s] a preference” for a particular approach. Reply 3 (quoting *Cont’l Circuits*, 915 F.3d 788 at 797). Elsewhere, the specification explains that “this method of bridge reconfiguration may be combined with other methods of power control . . . in order to adapt the link to *any distance* within a predefined range.” Ex. 1001, 20:64–67 (emphasis added). We find that one of ordinary skill in the art would have understood the disclosed “any distance” does not exclude continuous adjustments because the Specification is silent as to how the adjustment may be made to account for “any distance.” Thus, the specification does not specifically dismiss continuous adjustments, as Patent Owner alleges. PO Resp. 12–13.

Although we extensively discussed the specification’s full- and half-bridge mode examples above in the context of the means plus function claims, it is axiomatic that “a particular embodiment appearing in the written description may not be read into a claim when the claim language is broader than the embodiment.” *SuperGuide Corp. v. DirecTV Enter., Inc.*, 358 F.3d 870, 875 (Fed. Cir. 2004) (citing *Electro Med. Sys., S.A. v. Cooper Life Sci., Inc.*, 34 F.3d 1048, 1054 (Fed. Cir. 1994)). Claim 1’s “power converter configurable between first and second modes to convert power from a power supply system in a transmit mode” is broader than the disclosed embodiment captured by the “means for converting” in claims 46 and 50.

Neither party points to the prosecution history as relevant to the construction of “modes.”

As Patent Owner’s reliance on the specification does not support its proposed construction, we determine that the dictionary definition discussed

by the parties more closely aligns with the plain and ordinary meaning in light of the specification and the claim language. In other words, we construe “modes” in claim 1 (and similar claims 36 and 49) to mean “**one of multiple available operational states that can be selected from.**”

3. Summary

In summary, we construe these terms as follows:

Term	Our Construction
“means for <u>converting a power from a power supply system to a power at an operating frequency for transfer of wireless energy</u> ” (claims 46, 50)	The corresponding structure in the specification for performing the claimed function of this term (underlined) is a bridge circuit configurable between a full-bridge mode and a half-bridge mode, as shown in Figures 19A and 19B, and equivalents thereof.
“means for <u>generating an electromagnetic field, the generating means substantially resonant within a first range of the operating frequency to transfer the wireless energy to a receive antenna positioned within a coupling-mode region, the coupling-mode region configured to be accessible by the receive antenna</u> ” (claims 46, 50)	The corresponding structure in the specification for performing the claimed function of this term (underlined) is a transmit antenna configured as a resonant LC circuit, and equivalents thereof.

Term	Our Construction
“means for <u>configuring the converting means to one of a first mode of operation to a second mode of operation based on a measurement indicative of a coupling coefficient between the generating means and the receive antenna</u>” (claim 46)	The corresponding structure in the specification for performing the claimed function of this term (underlined) is a controller for configuring the converting means from one of a first mode of operation and a second mode of operation to the other, where one of the two modes of operation is a full-bridge mode and the other of the two modes of operation is a half-bridge mode, based on a measurement indicative of a coupling coefficient between the generating means and the receive antenna, and equivalents thereof.
“means for <u>configuring the power converter to one of a first mode of operation to a second mode of operation based on a distance between the transmit antenna and the receive antenna</u>” (claim 50)	The corresponding structure in the specification for performing the claimed function of this term (underlined) is a controller for configuring the converting means from one of a first mode of operation and a second mode of operation to the other, where one of the two modes of operation is a full-bridge mode and the other of the two modes of operation is a half-bridge mode, based on a distance between the transmit antenna and the receive antenna, and equivalents thereof.
“modes” (claims 1, 36, 49)	one of multiple available operational states that can be selected from

No other terms require construction at this stage. *See Realtime Data, LLC v. Iancu*, 912 F.3d 1368 (Fed. Cir. 2019) (“The Board is required to

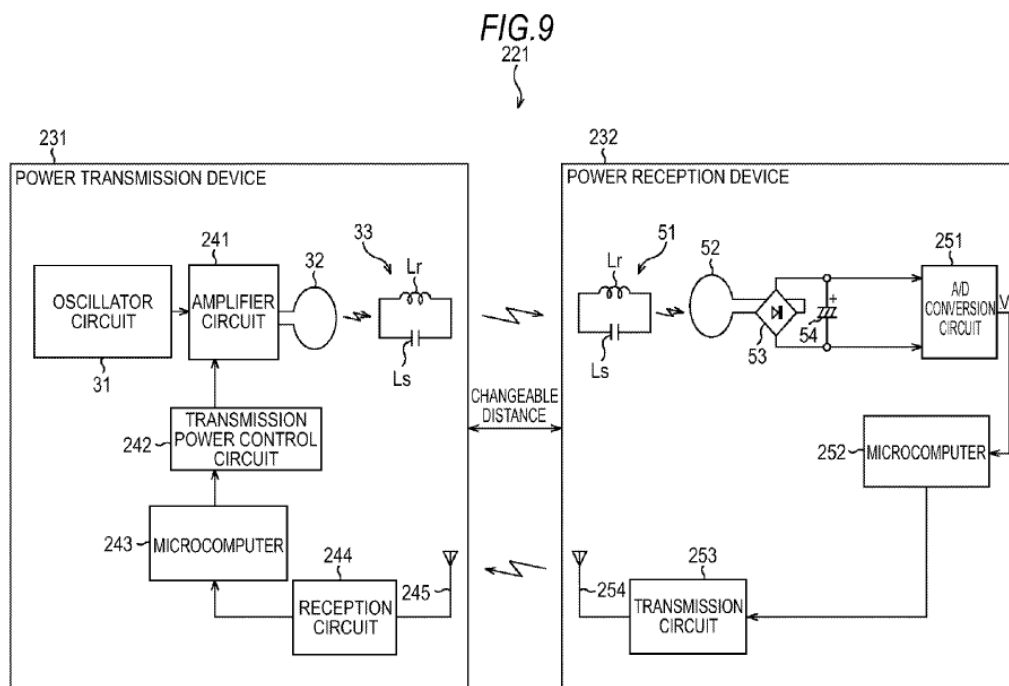
construe ‘only those terms . . . that are in controversy, and only to the extent necessary to resolve the controversy.’” (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)).

D. Asserted Anticipation by Sato (Ground 1)

Petitioner contends that claims 1, 9, 13, 18, 36, 37, 43, 44, and 46–51 are anticipated by Sato. Pet. 16–37.

1. Overview of Sato

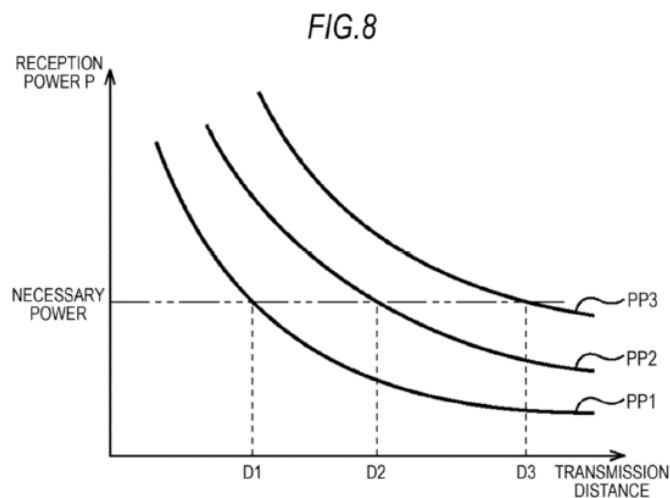
Sato describes a power transmission system that uses a “magnetic resonance-type power transmission technique” to wirelessly transfer power. Ex. 1005, code (57), ¶ 2. One example of this system is shown in Figure 9, reproduced below.



Id. ¶ 177. In Figure 9, power transmission system 221 includes power transmission device 231 and power reception device 232. *Id.* ¶ 179. Sato explains that there are cases where the transmission distance between the devices is changed. *Id.* ¶ 164. In such cases, the reception power changes in

inverse proportion to the transmission distance. *Id.* ¶ 165. Thus, when the transmission distance is short, the reception power may be greater than is needed on the reception side, and when the transmission distance is long, the reception power may be less than the necessary power. *Id.*

To address this issue, Sato’s system controls output power at the power transmission device. *Id.* ¶ 167. Figure 8, below, illustrates this transmission power variation technique:



Id. ¶ 168. In Figure 8, three levels of power are depicted—low, middle, and high. *Id.* ¶ 170. When the transmission distance changes to a relatively short distance (D1), the transmission power changes from middle to low. *Id.* ¶ 173. Conversely, when the reception distance changes to a relatively long distance (D3), the transmission power changes from low to high. *Id.*

2. Independent Claim 1

a. “A charging base, comprising:”

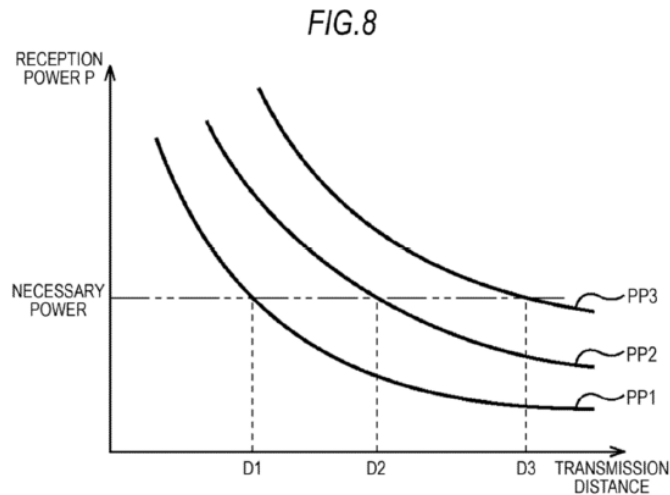
The preamble of claim 1 recites “A charging base.” Petitioner argues that Sato discloses a “power transmission device 231” that wirelessly charges a “power reception device 232” such as a “cellular phone or the

like.” Pet. 18 (citing Ex. 1005 ¶¶ 164, 180–181; Ex. 1003 ¶ 78–80). Patent Owner does not dispute that Sato discloses the preamble. We agree that Sato discloses the preamble, whether or not it is limiting.

b. [a] “a power converter configurable between first and second modes to convert power from a power supply system in a transmit mode”

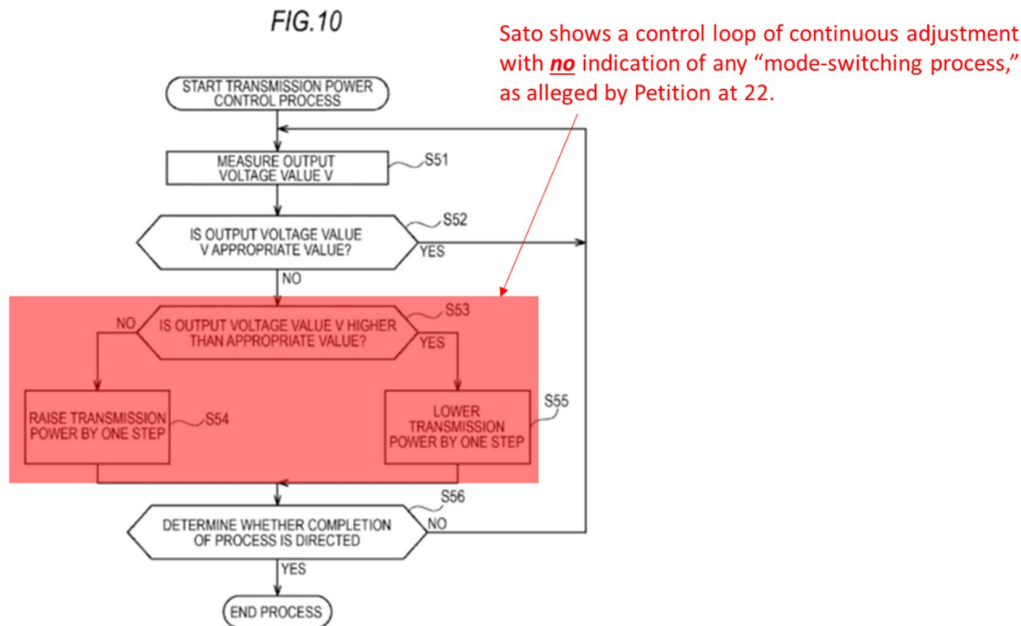
Claim 1 next recites “a power converter configurable between first and second modes to convert power from a power supply system in a transmit mode.” For this limitation, Petitioner argues that Sato’s power transmission device, including an oscillator circuit and amplifier circuit, discloses the “power converter.” Pet. 19. (citing Ex. 1005 ¶¶ 47–49, 177–180; Ex. 1003 ¶¶ 84–85). According to Petitioner, Sato’s oscillator circuit receives DC power from a power supply system and converts it into alternating current (AC) output power. *Id.* at 22 (citing Exs. 1014, 1015, 1016, 1003 ¶ 96). This power conversion happens in a transmit mode, Petitioner argues, because one resonant circuit 33 (in Figure 9, above) induces current in reception side resonant circuit 51 (Fig. 9). *Id.* at 24 (citing Ex. 1003 ¶ 98).

Regarding the claimed “configurable between first and second modes,” Petitioner argues that Sato Figure 8, reproduced below, shows the power converter switching between “low,” “middle,” and “high” power output modes depending on transmission distance.



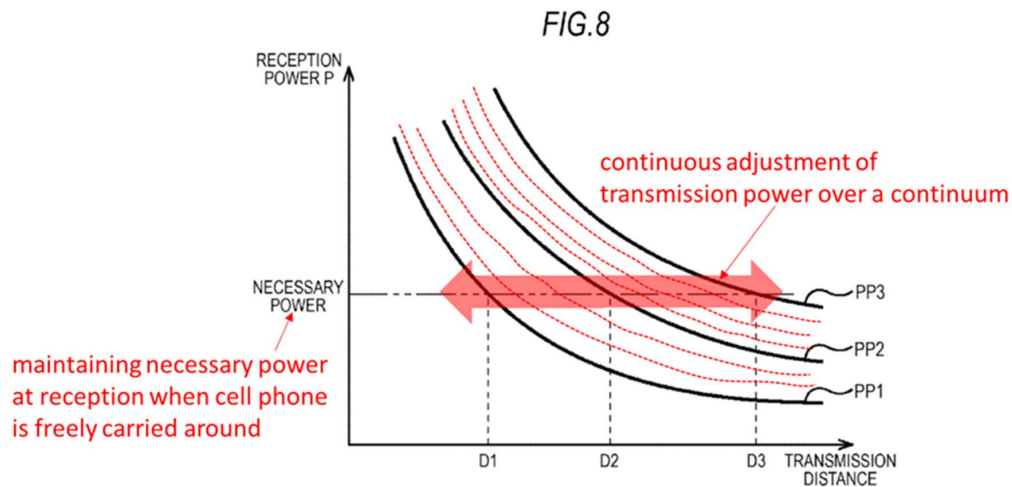
Pet. 20–21 (citing Ex. 1005 ¶¶ 170–172). In Sato’s Figure 8 above, three levels of power are depicted—low, middle, and high. Ex. 1005 ¶ 170. Petitioner contends, for example, that Sato discloses switching from a “middle” output power mode to a “low” output power mode so that “the reception power P can be maintained at the necessary power.” Pet. 20 (citing Ex. 1005 ¶¶ 171–172; Ex. 1003 ¶¶ 89–92).

Patent Owner contends that under its proposed construction of “modes” as “discrete configurations,” Sato does not disclose “a power converter that is configurable between first and second modes . . . because Sato merely discloses a continuous adjustment within one mode of operation.” PO Resp. 15–16. Patent Owner points to annotated Figure 10 of Sato, below, as showing continuous adjustment, rather than mode-switching:



Id. at 19 (annotated by Patent Owner). As shown above, Figure 10 depicts a flowchart of a transmission power control process. Ex. 1005 ¶ 192. Patent Owner argues that this flowchart depicts merely continuously adjusting transmit power to maintain the necessary reception power. PO Resp. 19–20 (citing, e.g., Ex. 1005 ¶¶ 187, 193–205).

Patent Owner also challenges Petitioner’s interpretation of Sato’s Figure 8. PO Resp. 21–22. With respect to Figure 8 of Sato, reproduced below as annotated by Patent Owner, Patent Owner argues that Sato teaches “a continuum of transmission power”:



Id. at 21. In Figure 8 above, Patent Owner contends that Sato depicts “a continuous adjustment of transmission power over a continuum.” *Id.* at 22. Patent Owner contends that the three depicted levels of low, middle, and high power are for “*simplification* of the description,” and do not actually disclose three separate power levels. *Id.* at 21 (quoting Ex. 1005 ¶ 170).

Finally, Patent Owner argues that “while Sato purports to increase transmission power when transmission distance increases so that ‘the reception power P can be maintained at necessary power,’ . . . the ’581 patent’s specification teaches the exact opposite.” *Id.* at 24 (citing Ex. 1005 ¶ 172, Fig. 8; Ex. 1001, 24:60–65 (“[I]f lower power (e.g., 2 kW) is desired, the systems adjusts to a weaker but defined coupling $k''=k/2$ at larger distance d'' .”)).

In the Reply, Petitioner contends that Sato discloses first and second modes because Sato disclose “low,” “middle,” and “high” power output modes. Reply 6. Petitioner also argues that Sato discloses configuring the power converter even under Patent Owner’s incorrect construction of modes as “discrete configurations” because Sato’s Figure 10 shows step-wise adjustment of the amplification factor. *Id.* at 8 (citing Ex. 1003 ¶¶ 94–95).

And regardless of whether throttling power constitutes one mode, Petitioner contends, Sato still discloses two modes—“a first mode when operating at maximum output power,” and “a second mode when throttling or reducing output power.” *Id.*

The Sur-reply asserts that Petitioner correctly acknowledged that Patent Owner’s construction excludes “conventional adjustments such as changing amplifier gain,” as in Sato. Sur-reply 23 (citing Reply 4–5 (arguing that Patent Owner’s construction would exclude disclosed embodiments, including the specification’s “power amplifier”)). Patent Owner also argues that even if we disagree with its claim construction, we should not accept Petitioner’s “implicit construction that renders the term ‘modes’ superfluous.” *Id.* at 24. Patent Owner contends that Sato only uses the term “output power,” not “mode” or “modes.” *Id.*

Turning to our analysis, we find Petitioner’s arguments more persuasive under the correct construction of “modes,” namely, “one of multiple available operational states that can be selected from.” We agree with Petitioner that Sato’s low, middle, and high power levels have been shown to constitute different modes. Pet. 20–21. In Sato, when the transmission distance changes to a relatively short distance (D1), for example, the transmission power changes from middle to low. Ex. 1005 ¶ 172. And when the reception distance changes to a relatively long distance (D3), the transmission power changes from low to high. *Id.* ¶ 173. Dr. Woronowicz testifies that this disclosure represents Sato’s power converter being configurable between multiple modes. Ex. 1003 ¶ 89–92. We agree with Petitioner that each of these power levels represents one of multiple available operation states that are selected from in Sato.

Patent Owner's arguments are unavailing largely because they are premised on a construction of "modes" that we did not adopt. They are also unpersuasive because they are based on an incorrect understanding of Sato. For instance, Patent Owner misinterprets Figure 10 of Sato as showing "continuous adjustment," but Figure 10 refers to raising and lowering transmission power "by one step" at a time. PO Resp. 19; Ex. 1005 ¶¶ 198–99. We find that one of ordinary skill in the art would have understood these steps to be discrete, not continuous, adjustments in Sato. Thus, we agree with Petitioner that even under Patent Owner's flawed construction, Sato discloses configuring the power converter between "discrete configurations" because Sato's Figure 10 shows step-wise adjustment of the amplification factor. Reply 8; *see also* Sur-reply 12–13 (emphasizing that the '581 patent's discrete configurations includes "coarse steps").

Patent Owner also errs by misinterpreting Sato's reference to a "simplification of the description" as implying a continuum of transmission power rather than three power levels. *See* PO Resp. 21 (citing Ex. 1005 ¶ 170). Sato describes that in Figure 8, "for simplification of the description, it is assumed that the transmission power can be changed to three levels of 'low', 'middle', and 'high'." Ex. 1005 ¶ 170. Patent Owner argues that because this example is "for *simplification* of the description," Sato actually discloses something else—"a continuous adjustment of transmission power over a continuum." PO Resp. 22. Patent Owner's attorney argument is not supported by Sato because Sato does not teach continuous adjustment of power, as we explained above.

It is also unpersuasive to argue that Sato discloses three power levels "for simplification of the description" because a reference may be relied

upon for all that it would have reasonably suggested to one having ordinary skill in the art, including nonpreferred embodiments. *Merck & Co., Inc. v. Biocraft Labs., Inc.*, 874 F.2d 804, 807 (Fed. Cir. 1989) (“But in a section 103 inquiry, ‘the fact that a specific [embodiment] is taught to be preferred is not controlling, since all disclosures of the prior art, including unpreferred embodiments, must be considered.’”) (quoting *In re Lamberti*, 545 F.2d 747, 750 (CCPA 1976)), *cert. denied.*, 493 U.S. 975 (1989). Thus, even if Sato’s “simplification of the description” embodiment is not preferred, it still discloses selecting among three power levels. See Ex. 1005 ¶ 170. We credit Dr. Woronowicz’s plain and un rebutted testimony that “Sato discloses switching between three output power modes: ‘low,’ ‘middle,’ and ‘high.’” Ex. 1003 ¶ 89. Accordingly, we find that one of ordinary skill in the art would have found Sato’s switching between three power levels to disclose the “power converter configurable between first and second modes” as claimed.

Lastly, we are unpersuaded by Patent Owner’s argument that “while Sato purports to increase transmission power when transmission distance increases so that ‘the reception power P can be maintained at necessary power,’ . . . the ’581 patent’s specification teaches the exact opposite.” PO Resp. 24 (citing Ex. 1005 ¶ 172, Fig. 8; Ex. 1001, 24:60–65 (“[I]f lower power (e.g., 2 kW) is desired, the system adjusts to a weaker but defined coupling $k''=k/2$ at larger distance d'' .”)). “[A] particular embodiment appearing in the written description may not be read into a claim when the claim language is broader than the embodiment.” *SuperGuide Corp. v. DirecTV Enter., Inc.*, 358 F.3d 870, 875 (Fed. Cir. 2004). Patent Owner’s attempt to distinguish Sato based on what the specification teaches

overlooks that the claim, not the specification, is what is compared with the prior art.

Thus, on this record, we agree that Sato discloses limitation 1[a].

- c. *[b] “a charging base antenna configured to be substantially resonant at an operating frequency and operably coupled to the power converter and configured to transfer wireless energy to a remote antenna”*

Petitioner argues that Sato’s “[r]esonant circuit 33 generates ‘a vibrating electric field having a resonant frequency f33.’” Pet. 25 (citing Ex. 1005 ¶ 56). This resonant frequency is the same as an oscillation frequency f31, which Petitioner argues is the operating frequency. *Id.* (citing Ex. 1005 ¶¶ 60, 67; Ex. 1003 ¶¶ 102–103). According to Petitioner, “resonant circuit 33 transfers wireless (electromagnetic) energy to resonant circuit 51 (remote antenna) such that ‘power is supplied from the power transmission device 21 to the power reception device 22 in a non-contacting manner.’” *Id.* at 26 (citing Ex. 1005 ¶ 62; Ex. 1003 ¶ 105).

Patent Owner does not dispute that Sato discloses this limitation. We agree that Sato discloses limitation 1[b].

- d. *[c] “the modes selectable based on a change in a coupling coefficient between the charging base antenna and the remote antenna”*

For this limitation, Petitioner argues that “Sato discloses selecting the power output mode of the power converter based on a change in the transmission distance between the charging base antenna (resonant circuit 33) and the remote antenna (resonant circuit 51).” Pet. 27, 20 (“Sato discloses switching between different output power modes . . .”) (citing, e.g., Ex. 1005 ¶¶ 164–165). According to Petitioner, “[a] POSA would have

understood that when the transmission distance changes, the coupling coefficient changes.” *Id.* at 27 (citing, e.g., Ex. 1003 ¶¶ 108–110). Dr. Woronowicz testifies that “it was well known in the art that coupling coefficient is related to distance.” Ex. 1003 ¶ 108. In support, Dr. Woronowicz cites Ex. 1017 (Shimokawa), which states, “the larger the distance between the coils the smaller the coupling strength κ [i.e., coupling coefficient] becomes, and the smaller the distance between the coils the greater the coupling strength κ becomes.” *Id.* (quoting Ex. 1017, 6:57–67). Dr. Woronowicz also cites the ’581 patent’s statement that the “coupling coefficient $k(d)$. . . is a function of distance.” *Id.* (citing Ex. 1001, 16:6–10).

Dr. Woronowicz further cites the Wang thesis (Ex. 1010) for support, providing the following equation regarding the coupling coefficient (k):

$$k = \frac{M}{\sqrt{L_p L_s}}$$

Ex. 1003 ¶ 32 (citing Ex. 1010 at 171–172). In the above equation, Dr. Woronowicz testifies, “[t]he coupling coefficient (k) is a function of the coupling parameters M (mutual inductance), the primary self-inductance L_p , and the secondary self-inductance L_s .” *Id.* Dr. Woronowicz further testifies that “[a]s the air gap between the transmit and receive antenna increases, the mutual inductance M drops. Accordingly, the coupling coefficient is significantly influenced by ‘the relative position between the primary and secondary [coils].’” *Id.* ¶ 33 (citing Ex. 1010, 83, 191, 192, Fig. 7-21).

Petitioner’s arguments are persuasive and well-supported by evidence, including the detailed testimony of Dr. Woronowicz. In contrast, Patent Owner’s arguments are unsupported by record evidence. Patent Owner neither submitted expert testimony nor cross-examined Dr. Woronowicz.

Thus, Dr. Woronowicz's testimony stands unrebutted. For the reasons set forth below, Patent Owner's attorney argument does not undermine Petitioner's persuasive showing.

Patent Owner first contends that Sato "does not mention any coupling coefficient, let alone a change of the coupling coefficient." PO Resp. 25. Rather, Patent Owner contends, Petitioner effectively relies on inherency. *Id.* at 26. But this reliance on inherency is faulty, Patent Owner argues, "because Petitioner has failed to show that selecting a transmission power *based on* a change in transmission distance is necessarily the claimed mode selection '***based on a change in a coupling coefficient.***'" *Id.*

In support of this argument, Patent Owner asserts that Dr. Woronowicz's declaration does not support inherency. *Id.* at 27. Patent Owner disputes Dr. Woronowicz's assertion that "when distance increases, the M drops as well as the coupling coefficient." *Id.* (quoting Ex. 1003 ¶ 110). Patent Owner argues that this assertion does not follow from its premise because "the primary self-inductance L_p , and the secondary self-inductance L_s " also affect the coupling coefficient (k). *Id.* The quantities L_p and L_s are not necessarily constant, according to Patent Owner, because "the '581 patent discusses 'varying antenna inductance' as a possibility," although it should be avoided as complex. *Id.* at 27–28 (citing Ex. 1001, 19:17–24). Thus, Patent Owner charges Dr. Woronowicz with ignoring "the effect of varying capacitance or inductance on mutual inductance M and the coupling coefficient." *Id.* at 28.

Patent Owner next relies on the '581 patent's assertion that "the relationship between coupling coefficient and distance may differ to some degree, depending on local conditions." *Id.* (citing Ex. 1001, 24:64–25:2).

And Patent Owner relies on the Wang thesis (Ex. 1010) submitted by Petitioner, which states that “the coupling parameters (L_p , L_s , and M) vary due to misalignment”—such as offset and skew angle—“of the electromagnetic structure.” *Id.* at 28–29 (citing Ex. 1010, 164, 190, 191). Patent Owner therefore contends that Dr. Woronowicz “only considered the impact of distance, but not the impact of other factors (such as offset and skew angle), on the coupling coefficient.” *Id.* at 29.

Patent Owner further relies on the doctrine of claim differentiation, based on claim 9’s recitation, “wherein the power converter is reconfigured based on a distance between the charging base antenna and the remote antenna.” *Id.* at 29. Accordingly, Patent Owner argues that “[i]t would make little sense to include dependent claims directed to configuring the power converter based on transmission distance had the independent claims already required so, as alleged by the Petitioner in its inherency argument.” *Id.*

In the Reply, Petitioner largely cites to our Institution Decision’s reasoning against Patent Owner’s argument. Reply 8–12. Petitioner also confirmed in the hearing that it is not relying on inherency. Tr. 10:10–22. Rather, Petitioner relies on the explicit teachings of Sato. *Id.*

Patent Owner does not, in its Sur-reply, address Petitioner’s arguments in the Reply. However, Patent Owner does argue for the first time that we “should not accept Petitioner’s implicit construction that renders the term ‘modes’ superfluous.” Sur-reply 24. In particular, Patent Owner asserts, “[n]ot a single mention of ‘mode’ or ‘modes’ can be found in Sato.” *Id.*

Turning to our analysis, we agree with Petitioner that the Petition relies on what one of ordinary skill in the art would have understood from Sato's teachings, not inherency, by arguing that "[a] POSA would have understood that when the transmission distance changes, the coupling coefficient changes." Pet. 27 (citing, e.g., Ex. 1003 ¶¶ 108–110). Thus, Patent Owner's argument attacking Petitioner for relying on "inherency" misses the mark.

Not only that, but Patent Owner's attorney argument does not undermine Petitioner's persuasive showing, supported by the unrebutted testimony of Dr. Woronowicz. Sato discloses that when "transmission distance is changed," then "the reception power P changes in inverse proportion to the transmission distance." Ex. 1005 ¶¶ 164–165. Dr. Woronowicz testifies that "the coupling coefficient is significantly influenced by 'the relative position between the primary and secondary [coils],'" or in other words, the transmission distance, and this assertion is supported by record evidence. Ex. 1003 ¶ 33 (citing Ex. 1010, 83); *see also id.* ¶¶ 108, 110, 32 (citing Ex. 1017, Ex. 1001). Dr. Woronowicz's testimony is unrebutted and persuasive in light of the supporting evidence and no evidence to the contrary. Thus, based on the full trial record, we maintain our Institution Decision's position that Petitioner and Dr. Woronowicz are correct that "[a] POSA would have understood that when the transmission distance changes, the coupling coefficient also changes." *See id.* ¶ 110; Dec. 18.¹⁰

¹⁰ The '581 patent also uses distance and coupling coefficient interchangeably elsewhere, for example, by referring to reducing transmit power "while the system adjusts to a new distance/coupling coefficient."

Patent Owner's arguments are also unavailing because they misdirect attention to other, irrelevant parameters that can affect the coupling coefficient. For instance, Patent Owner's assertion that "the primary self-inductance L_p , and the secondary self-inductance L_s " also affect the coupling coefficient overlooks that Sato discloses a change in distance, not a change in primary or secondary self-inductances. PO Resp. 27; Ex. 1005 ¶¶ 164–165. Additionally, Patent Owner's reliance on the Wang thesis for the proposition that "the coupling parameters (L_p , L_s , and M) vary due to misalignment" overlooks that Sato does not disclose an alignment problem, but a change in distance. PO Resp. 28–29; Ex. 1005 ¶¶ 164–165.

Further, the '581 patent's disclosure that "the relationship between coupling coefficient and distance may differ to some degree, depending on local conditions," is irrelevant because elsewhere the '581 patent states that the "coupling coefficient $k(d)$. . . is a function of distance." *Compare* Ex. 1001, 24:66–25:2, *with* Ex. 1001, 16:6–10 (emphasis added). Although the specification teaches that the relationship between distance and the coupling coefficient "may differ," it does not state that the coupling coefficient would no longer be a function of distance. And Patent Owner's statement that "the '581 patent discusses 'varying antenna inductance' as a possibility" overlooks that Sato does *not* discuss varying antenna inductance, but rather, varying distance. *See* PO Resp. 27–28 (citing Ex. 1001, 19:17–24).

We also view Patent Owner's reliance on claim differentiation, based on claim 9's recitation, "wherein the power converter is reconfigured based on a distance between the charging base antenna and the remote antenna," as

Ex. 1001, 24:54–55.

misplaced. *Id.* at 29. The doctrine of claim differentiation does not apply here because dependent claim 9 does not modify limitation 1[c]. Claim 9 states that the “power converter is reconfigured based on distance,” but limitation 1[c] requires “the modes selectable based on a change in a coupling coefficient.” Claim 9 does not say, “the modes further selectable based on a distance” but instead modifies the “power converter” of limitation 1[a]. Thus, as a matter of logic, there is no claim differentiation here between limitation 1[c]’s coupling coefficient and distance. Not only that, but the specification affirmatively states that the “coupling coefficient $k(d)$. . . is a function of distance.” Ex. 1001, 15:67–16:1 (emphasis added). This clear statement in the specification overcomes any presumption of claim differentiation that might exist here. *Wi-LAN USA, Inc. v. Apple Inc.*, 830 F.3d 1374, 1391 (Fed. Cir. 2016) (“Claim differentiation cannot overcome . . . a contrary construction dictated by the written description or prosecution history.”) (internal quotation omitted).

Finally, Patent Owner’s Sur-reply argument that Sato does not explicitly mention the term “modes” is unpersuasive because it is a new argument, not responsive to the Petition. *See* Sur-reply 24; 37 C.F.R. § 42.23(b). Not only that, but the argument is unpersuasive because it overlooks that “it is not necessary that the limitations of a claim be set forth in haec verba.” *Indivior UK Ltd. v. Dr. Reddy’s Labs. S.A.*, 18 F.4th 1323, 1328 (Fed. Cir. 2021).

Thus, on this record, we agree that Sato discloses limitation 1[c].

e. Summary as to Claim 1

Based on the entire record, we find that Petitioner has demonstrated by a preponderance of the evidence that Sato anticipates claim 1.

3. Independent Claims 36, 46, 49, and 50

Petitioner provides a similar showing for claims 36 and 49 as with claim 1. Pet. 29–32, 37. Patent Owner raises similar “modes” and “coupling coefficient” arguments for independent claims 36 and 49 as with claim 1. PO Resp. 16, 30–31. Petitioner’s showing and evidence is similar for claims 36 and 49 as with claim 1, which we find persuasive. We reject Patent Owner’s arguments for claims 36 and 49 for similar reasons set forth above with respect to claim 1. Patent Owner raises similar arguments for claims 46 and 50, but we do not reach these arguments because we find, for other reasons, that Petitioner has not shown that these claims are unpatentable. *See* PO Resp. 31–39.

Petitioner’s arguments for means claims 46 and 50 differ from claim 1 in some respects. These claims recite, among other things, “means for converting” and “means for configuring,” which we have construed above. The “means for converting” are:

[claims 46, 50] means for converting a power from a power supply system to a power at an operating frequency for transfer of wireless energy.

For the underlined function above, we identified the corresponding structure in the specification as “a bridge circuit configurable between a full-bridge mode and a half-bridge mode, as shown in Figures 19A and 19B, and equivalents thereof.” The “means for configuring” are:

[claim 46] means for configuring the converting means to one of a first mode of operation to a second mode of operation based on a measurement indicative of a coupling coefficient between the generating means and the receive antenna.

[claim 50] means for configuring the power converter to one of a first mode of operation to a second mode of operation based

on a distance between the transmit antenna and the receive antenna.

For the underlined function in claim 46, we identified the corresponding structure in the specification as “a controller for configuring the converting means from one of a first mode of operation and a second mode of operation to the other, where one of the two modes of operation is a full-bridge mode and the other of the two modes of operation is a half-bridge mode, based on a measurement indicative of a coupling coefficient between the generating means and the receive antenna, and equivalents thereof.” We identified similar structure for claim 50, accounting for the slight differences in claim language (i.e., “based on a distance between the transmit antenna and the receive antenna”).

Petitioner argues that Sato discloses the “means for converting” in claims 46 and 50 by teaching “a power converter with an oscillator” and “an amplifier.” Pet. 33–34 (citing Ex. 1003 ¶¶ 151–52). For the “means for configuring,” Petitioner points to Sato’s controller, which “controls the output power mode of the power converter by changing the amplification factor (i.e., transformation ratio).” *Id.* at 35–36 (citing, e.g., Ex. 1005 ¶ 183, 186; ex. 1003 ¶¶ 162–65).

Patent Owner raises additional arguments for claims 46 and 50. PO Resp. 31–39. For both claims, Patent Owner argues that Sato does not disclose “means for converting” or “means for configuring the converting means.” *Id.* With respect to “means for converting,” Patent Owner argues that Petitioner does not show that Sato teaches “a half-bridge inverter or a full-bridge inverter because Sato has neither.” PO Resp. 35. With respect to “means for configuring,” Patent Owner asserts that “Petitioner fails to explain how the *amplification factor* of Sato’s amplifier circuit 241 is

equated with a *transformation ratio* feature on the allegedly corresponding structure.” *Id.*

Petitioner does not persuade us that Sato discloses all the elements of claims 46 and 50. Petitioner’s arguments are facially incorrect due to being based on incorrect claim constructions for “means for converting” and “means for configuring.” Petitioner’s argument that Sato discloses an oscillator and amplifier, and hence “means for converting,” overlooks that the correct construction for this term does not encompass a mere oscillator and amplifier, but rather, “a bridge circuit configurable between a full-bridge mode and a half-bridge mode, as shown in Figures 19A and 19B, and equivalents thereof.” Nor does Petitioner argue that Sato’s oscillator and amplifier are equivalent to a bridge circuit configurable between a full-bridge mode and a half-bridge mode, as shown in Figures 19A and 19B. *See* Pet. 33–34.

Petitioner’s argument for “means for configuring” similarly fails. Although Petitioner identifies a controller in Sato, Petitioner’s assertion that this controller “controls the output power mode of the power converter by changing the amplification factor (i.e., transformation ratio)” does not address the correct claim construction. *Id.* at 36. The correct construction requires, among other things, that “one of the two modes of operation is a full-bridge mode and the other of the two modes of operation is a half-bridge mode, based on a measurement indicative of a coupling coefficient between the generating means and the receive antenna, and equivalents thereof.” As Petitioner does not argue that Sato discloses such modes of operation, or equivalents thereof, Petitioner does not persuade us that Sato discloses “means for configuring” in claim 46 (and similar claim 50).

Accordingly, we determine that Petitioner has proven by a preponderance of the evidence that Sato anticipates claims 36 and 49 but has not proven by a preponderance of the evidence that Sato anticipates claims 46 and 50.

4. Dependent Claims 9, 13, 18, 37, 43, 44, 47, 48, and 51

Petitioner contends that dependent claims 9, 13, 18, 37, 43, 44, 47, 48, and 51 are unpatentable as anticipated by Sato. Pet. 27–29, 32–33, 37. Petitioner provides a detailed analysis explaining where Sato discloses the limitations in dependent claims 9, 13, 18, 37, 43, and 44, which Patent Owner does not challenge. *Id.* We determine that Petitioner has proven by a preponderance of the evidence that Sato anticipates claims 9, 13, 18, 37, 43, and 44. But because Petitioner has not proven that Sato anticipates claims 46 and 50, we determine that Petitioner has also not proven by a preponderance of the evidence that Sato anticipates dependent claims 47, 48, and 51.

E. Asserted Obviousness over Sato (Ground 2)

Petitioner contends that dependent claims 10 and 12 would have been obvious over Sato. Pet. 37–44. Petitioner provides a detailed analysis, supported by record evidence, explaining where Sato teaches or suggests the limitations in dependent claims 10 and 12, which Patent Owner does not contest. *Id.* Based on the full record, we determine that Petitioner has shown by a preponderance of the evidence that claims 10 and 12 would have been obvious based on Sato.

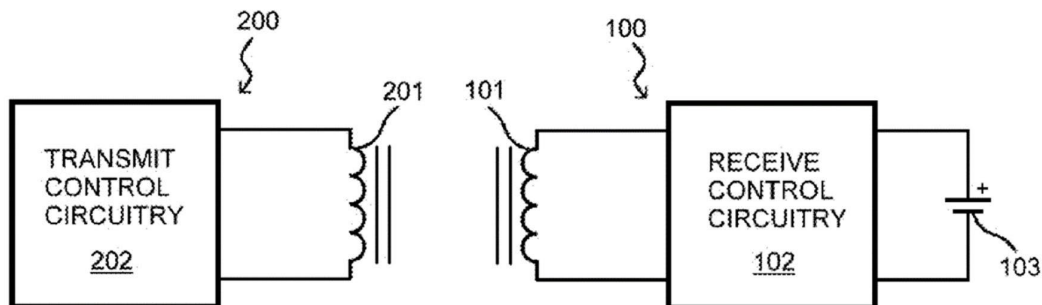
F. Asserted Anticipation by Julstrom (Ground 3)

Petitioner contends that claims 1, 9, 12, 13, 18, 36, 37, 43, 44, and 46–51 are anticipated by Julstrom. Pet. 44–74.

1. Overview of Julstrom

Julstrom describes inductively coupled battery charging systems. Ex. 1006, 2:65. Figure 1, reproduced below, shows an inductively coupled battery charging system with “transmit circuitry 200” and “rechargeable battery assembly 100.” *Id.* 11:46–48.

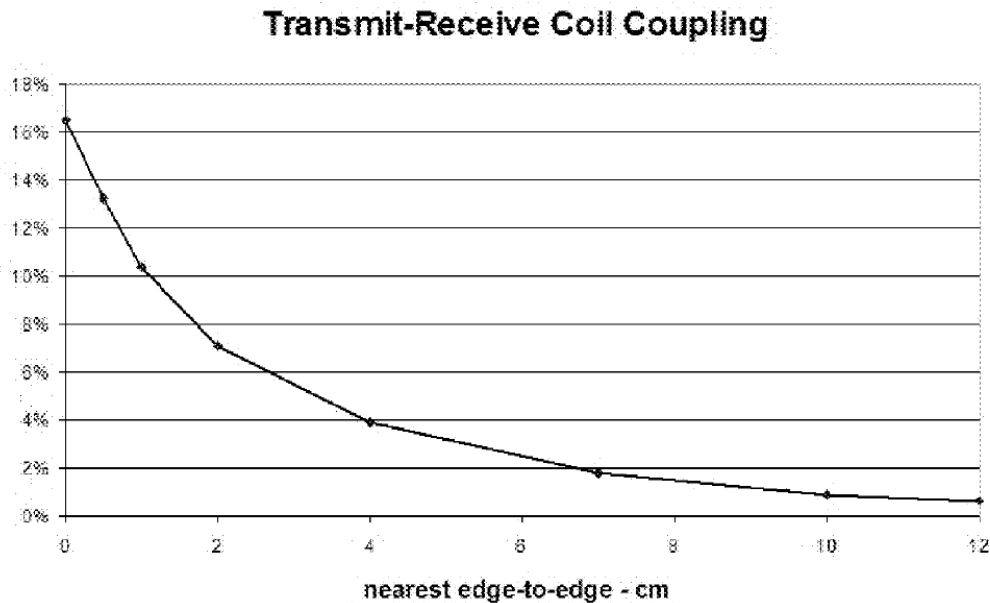
FIG. 1



In Figure 1, transmit circuitry 200 includes transmit coil 201 driven by transmit control circuitry 202. *Id.* at 11:48–50. Transmit coil 201 transmits a magnetic field, which couples to receive coil 101. *Id.* at 11:51–53. An induced current in coil 101 passes through receive control circuitry 102 and into storage cell 103, which may be a battery. *Id.* at 11:53–59.

Julstrom’s transmit and receive portions are linked by the coupling between inductors, “represented by a coupling factor k .” *Id.* at 24:47–50. At closer separations between coils, power transfer is more efficient. *Id.* at 24:65. Figure 9, reproduced below, depicts the percentage of transmit receive coil magnetic flux coupling versus separation distance:

FIG. 9



Id. at 10:27–28. As shown in Figure 9, if the coils are closer together, the coupled magnetic flux is greater than if the coils are spaced farther apart. *Id.* at 18:14–39.

2. Independent Claim 1

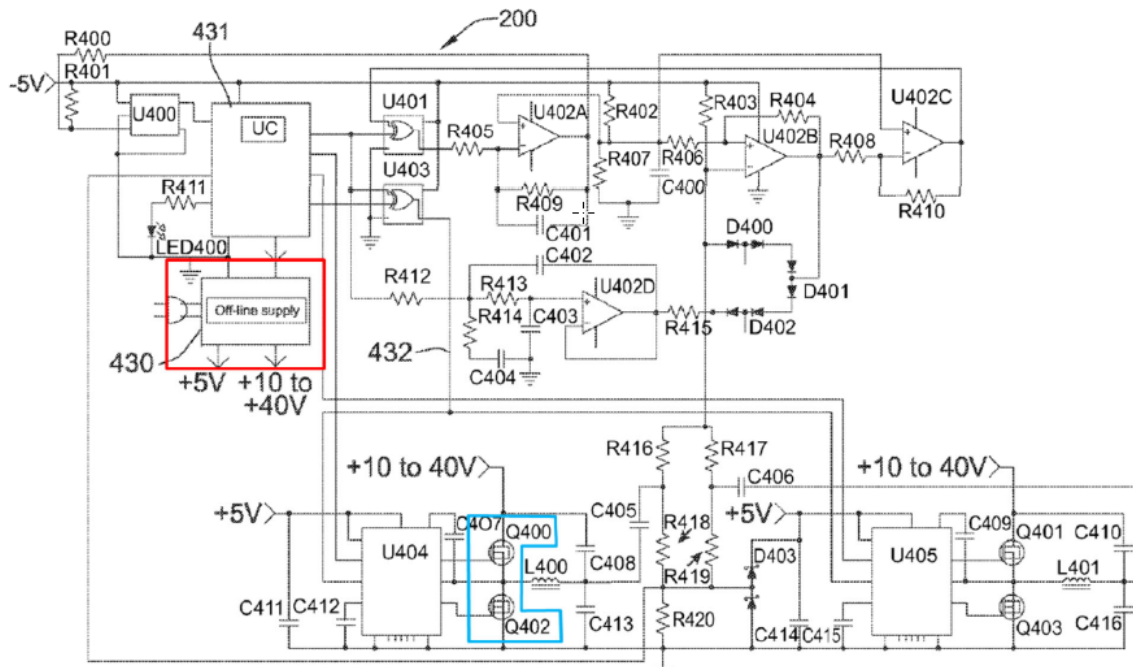
a. “A charging base, comprising:”

Petitioner argues that Julstrom discloses the preamble by teaching “an inductively coupled battery charging system” where “a device powered by one or more rechargeable battery assemblies is placed on [a] surface.” Pet. 46 (citing Ex. 1006, 18:46–50, Fig. 10; Ex. 1003 ¶ 205). Patent Owner does not dispute that Julstrom discloses the preamble. We agree that Julstrom discloses the preamble, whether or not it is limiting.

b. [a] “a power converter configurable between first and second modes to convert power from a power supply system in a transmit mode”

For this limitation, Petitioner points to Figure 17, reproduced below, which Petitioner argues depicts a half-bridge inverter (blue):

FIG. 17



Id. at 48–49 (annotations by Petitioner). In Figure 17, Petitioner contends, power supply 430 (red) supplies an adjustable DC voltage of 10–40V to the inverter (blue). *Id.* at 49 (citing Ex. 1006, 20:64–21:2, 21:13–16).

According to Petitioner, the power converter is configured between first and second modes because when the transmit and receive coils are close together, it “deliver[s] a full square wave” using pulse-width modulation (PWM). *Id.* at 49–50 (citing Ex. 1006, 27:19–23). As the receive coil moves farther from the transmit coil, Petitioner contends, the power converter “reduce[s] the drive voltage” first “down to 10 volts,” and then “from 4.5 Vrms (first mode) to 2.0 Vrms (second mode).” *Id.* at 50–51 (citing, e.g., Ex. 1006, 27:44–61, 49–53; Ex. 1003 ¶¶ 218–223).

Patent Owner disputes that Julstrom discloses “a power converter configurable between first and second modes.” PO Resp. 39–47. Patent Owner contends that “Petitioner mischaracterizes Julstrom in ways similar to

its mischaracterizations of Sato.” *Id.* at 42. In Patent Owner’s view, “Julstrom describes a continuous process ‘*to keep the drive current under the predetermined limit.*’” *Id.* (citing, e.g., Ex. 1006, 23:66–24:8, 27:50–53, 27:54–58, Figs. 26, 27). Similar to Sato, Patent Owner argues, “Julstrom teaches one mode of continuous regulation of the fundamental component of the drive voltage on the transmit coil.” *Id.* at 44.

Patent Owner further contends that Petitioner fails to demonstrate how Julstrom discloses “a power converter configurable between first and second modes that are selectable, as required by claim 1.” *Id.* at 44–45. Patent Owner interprets Julstrom as teaching “continuous adjustment over a continuum of fundamental drive voltages between ‘up to 18Vrms’ and ‘below 2Vrms.’” *Id.* at 45 (citing Ex. 1006, 27:8–61). That is, Patent Owner argues, “Julstrom does not purport to have separate modes for adjusting the fundamental component of the drive voltage,” but rather “performs, in one mode of operation, a regulation routine over a continuum of fundamental drive voltage possibilities.” *Id.* (citing same).

In the Reply, Petitioner disputes that Julstrom discloses a “continuous adjustment,” but rather avers that Julstrom’s controller is a computer processor that “makes discrete, step-wise adjustments to the PWM.” Reply 17. Specifically, Petitioner asserts, Julstrom’s “drive invert threshold is ‘stepped from a count’ between 0 and 42.” *Id.* (citing, e.g., Ex. 1006, 26:20–22). Because this threshold is “stepped” through a range of discrete values, Petitioner argues, Julstrom discloses controlling the PWM in discrete, step-wise adjustments. *Id.* Petitioner therefore concludes that Julstrom discloses “the claimed ‘modes’ even under Patent Owner’s flawed construction.” *Id.*

Patent Owner argues in the Sur-reply that Petitioner “relies on Julstrom’s adjustment of the duty cycle on its half-bridge *only* inverter to meet the claimed mode switching operation.” Sur-reply 26 (citing Reply 16). Patent Owner further asserts that because Petitioner relies on this configuration, which is excluded by Patent Owner’s claim construction, Petitioner has not demonstrated anticipation (or obviousness in Ground 4). *Id.* at 26–27. But even if we do not agree with Patent Owner’s construction, Patent Owner argues (for the first time), we “should not accept Petitioner’s implicit construction that renders the term ‘modes’ superfluous.” *Id.* at 27. As with Sato, Patent Owner asserts, “Julstrom does not contain a single mention of ‘mode’ or ‘modes.’” *Id.*

Turning to our analysis, we agree with Petitioner that Julstrom’s different voltage levels constitute different modes. In Julstrom, as “coupling becomes looser, . . . [f]irst the supply voltage is reduced down to 10 volts.” Ex. 1006, 27:47–50. Then drive voltage may then be set at 4.5 Vrms and eventually “reduced below, for example, 2.0 Vrms.” *Id.* at 27:23, 55–56. Dr. Woronowicz testifies that these disclosures represent Julstrom’s power converter being configurable between multiple modes. Ex. 1003 ¶¶ 218–224. Patent Owner’s arguments do not undermine Petitioner’s arguments because they rely on an incorrect construction of “modes.” And to the extent that Patent Owner raises a new argument in the Sur-reply that “Julstrom does not contain a single mention of ‘mode’ or ‘modes,’” this late argument is also unpersuasive. Sur-reply 27. Patent Owner again ignores that “it is not necessary that the limitations of a claim be set forth in haec verba.” *Indivior*, 18 F.4th at 1328.

We also agree with Petitioner that Julstrom discloses modes under Patent Owner’s incorrect construction of modes by teaching that its “drive invert threshold is ‘stepped from a count’ between 0 and 42.” Reply 17 (citing, e.g., Ex. 1006, 26:20–22). In other words, we agree that because this threshold is “stepped” through a range of discrete values, Julstrom discloses controlling the PWM in discrete configurations. *Id.*; *see also* Sur-reply 12–13 (emphasizing that the ’581 patent’s discrete configurations include changing the transformation ratio in “coarse steps”).

Accordingly, we agree with Petitioner that Julstrom discloses limitation 1[a].

- c. [b] “a charging base antenna configured to be substantially resonant at an operating frequency and operably coupled to the power converter and configured to transfer wireless energy to a remote antenna”*

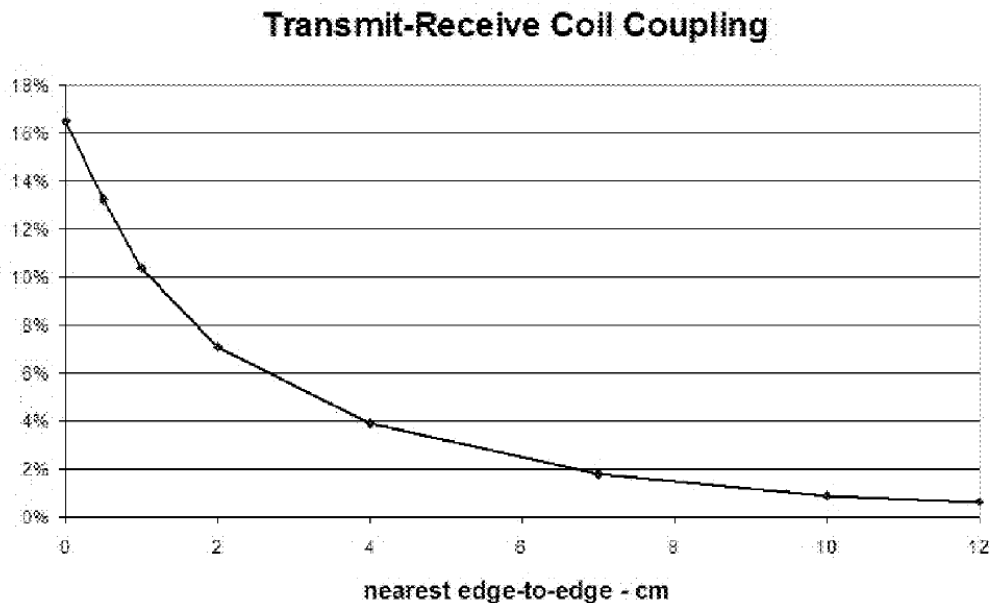
Petitioner argues that Julstrom discloses a “transmit LC resonant circuit” that “resonates at 23 kHz” (the operating frequency). Pet. 51–52 (citing Ex. 1006, 20:36–38). Petitioner further argues that the “charging base antenna (transmit LC resonant circuit) is operably coupled to the power converter.” *Id.* at 53–54 (citing Ex. 1006, 20:29, 20:64–21:2, Fig. 17; Ex. 1003 ¶¶ 234–235). And Petitioner asserts that Julstrom further discloses a “receive LC resonant circuit” or “remote antenna” that receives power wirelessly from the transmit LC resonant circuit. *Id.* at 54–55 (citing Ex. 1006, Fig. 3, 11:60–63, 26:10–12; Ex. 1003 ¶¶ 236–237).

Patent Owner does not dispute that Julstrom discloses this limitation. We agree with Petitioner that Julstrom discloses limitation 1[b].

d. [c] “the modes selectable based on a change in a coupling coefficient between the charging base antenna and the remote antenna”

Petitioner argues that Julstrom discloses a “coupling factor k,” which “represents a flux coupling, as graphed in FIG. 9.” Pet. 56. Figure 9 of Julstrom, reproduced below, depicts the percentage of transmit receive coil magnetic flux coupling versus separation distance:

FIG. 9



Ex. 1006, 10:27–28. Petitioner contends that “Figure 9 shows that the coupling coefficient decreases as transmission distance between antennas increases.” Pet. 56 (citing Ex. 1006, 24:47–50). Petitioner contends that “[w]hen the transmission distance (and thus the coupling coefficient) between antennas changes, the uComputer controller 431 selects between first and second power output modes for the power converter,” examples of which are described above with respect to limitation 1[a]. *Id.*; *see also id.* at 57 (citing Ex. 1003 ¶¶ 242–243).

Patent Owner does not dispute that Julstrom discloses this limitation. We agree with Petitioner that Julstrom discloses limitation 1[c].

e. Summary as to Claim 1

We determine that Petitioner has proven by a preponderance of the evidence that Julstrom anticipates claim 1.

3. Independent Claims 36, 46, 49, and 50

Petitioner provides a similar showing for claims 36 and 49 as with claim 1. Pet. 59–64, 74. Patent Owner raises similar arguments for independent claims 36 and 49 as with claim 1. PO Resp. 39–47. Petitioner’s showing and evidence is similar for claims 36 and 49 as with claim 1, which we find persuasive. We reject Patent Owner’s arguments for claims 36 and 49 for similar reasons set forth above with respect to claim 1. Patent Owner also raises similar arguments for claims 46 and 50, but we do not reach these arguments because we find, for other reasons, that Petitioner has not shown that these claims are unpatentable. *See id.*

Petitioner’s arguments for means claims 46 and 50 differ from claim 1 in some respects due to their “means” recitations. For instance, Petitioner relies on Julstrom’s disclosure of a half-bridge inverter for the “means for converting” in each of these claims. Pet. 66–68, 74. Petitioner further contends that Julstrom’s two-switch half-bridge inverter is equivalent to the ’581 patent’s Figure 19A half-bridge inverter:

This is equivalent to the H-bridge circuit configured as a half-bridge inverter shown in Figure 19A below of the ’581 patent. Although the H-bridge circuit of Figure 19A includes four switches, two of them are inactive in the half-bridge configuration. . . . The half-bridge inverter of Julstrom therefore performs the same function (*see also* limitation 1[a] above) and operates in substantially the same way (alternately

toggling two switches on and off) to achieve substantially the same result (output an AC waveform with a maximum voltage that is approximately half the input voltage).

Id. at 67 (citing Ex. 1003 ¶¶ 298–301).

Petitioner does not persuade us that Julstrom discloses all the elements of claims 46 and 50. Petitioner’s arguments are again incorrect due to being based on an incorrect claim construction for “means for converting.”

Petitioner’s argument that Julstrom discloses a half-bridge inverter, and hence “means for converting,” overlooks that the correct construction for this term does not encompass a simple half-bridge inverter, but rather, “a bridge circuit configurable between a full-bridge mode and a half-bridge mode, as shown in Figures 19A and 19B, and equivalents thereof.”

Although Petitioner argues that Julstrom’s half-bridge inverter is equivalent to the ’581 patent’s half-bridge, Pet. 67, Petitioner does *not* contend that Julstrom’s half bridge is equivalent to a bridge circuit configurable between a full-bridge mode and a half-bridge mode, as shown in Figures 19A and 19B.

For the “means for configuring” in claims 46 and 50, Petitioner argues that Julstrom discloses a controller that “configures the power converter to first and second modes of operation (low and high output power modes).” Pet. 71 (citing Ex. 1003 ¶ 317). But this argument also fails because Petitioner’s assertion does not address the correct claim construction. The correct construction requires, among other things, that “configuring the converting means from one of a first mode of operation and a second mode of operation to the other, where one of the two modes of operation is a full-bridge mode and the other of the two modes of operation is a half-bridge mode, based on a measurement indicative of a coupling coefficient between

the generating means and the receive antenna, and equivalents thereof.” As Petitioner does not argue that Julstrom discloses such modes of operation, or equivalents thereof, Petitioner does not persuade us that Julstrom discloses “means for configuring” in claim 46 (and similar claim 50).

Accordingly, we determine that Petitioner has proven by a preponderance of the evidence that Julstrom anticipates claims 36 and 49 but has not proven by a preponderance of the evidence that Julstrom anticipates claims 46 and 50.

4. Dependent Claims 9, 12, 13, 18, 37, 43, 44, 47, 48, and 51

Petitioner contends that dependent claims 9, 12, 13, 18, 37, 43, 44, 47, 48, and 51 are unpatentable as anticipated by Julstrom. Pet. 57–59, 64–65, 73–74. Petitioner provides a detailed analysis explaining where Julstrom discloses the limitations in dependent claims 9, 12, 13, 18, 37, 43, and 44, *id.*, which Patent Owner does not challenge. We determine that Petitioner has proven by a preponderance of the evidence that Julstrom anticipates claims 9, 12, 13, 18, 37, 43, and 44. But because Petitioner has not proven that Julstrom anticipates claims 46 and 50, we determine that Petitioner has also not proven by a preponderance of the evidence that Julstrom anticipates dependent claims 47, 48, and 51.

G. Asserted Obviousness over Julstrom (Ground 4)

Petitioner contends that claims 10, 46–48, 50, and 51 would have been obvious over Julstrom. Pet. 74–78.

1. Dependent Claim 10

Petitioner contends that dependent claim 10 would have been obvious over Julstrom. Pet. 74–75. Petitioner provides a detailed analysis explaining where Julstrom discloses or suggests the limitations in dependent

claim 10, which Patent Owner does not challenge. *See* PO Resp. 47–48 (resting its argument for claim 10 on its lack of anticipation argument for claim 1). We determine that Petitioner has proven by a preponderance of the evidence that claim 10 would have been obvious over Julstrom.

2. *Independent Claims 46 and 50*

Petitioner argues that to the extent Patent Owner asserts that the “means for converting” limitation of these claims requires a “full-bridge inverter,” it would have been obvious to implement one in Julstrom. Pet. 75. As we noted above, Petitioner argues that Julstrom uses a half-bridge inverter to drive a transmit antenna. *Id.* at 75–76 (citing Ex. 1006, Fig. 17; Ex. 1003 ¶ 344). Petitioner reasons that one of ordinary skill would have modified this half-bridge inverter to be a full-bridge inverter because it was one of only a few “identified, predictable solutions.” *Id.* at 76 (citing *KSR*, 550 U.S. at 421; Ex. 1019, 1320; Ex. 1010, 25). It was well-known in the art, Petitioner asserts, that “[m]ost proposed topologies are based on a half-bridge or a full-bridge high-frequency inverter.” *Id.* (citing Ex. 1019, 1320; Ex. 1010, 25). In addition, Petitioner argues that one of ordinary skill would have known that a full-bridge inverter was more suitable for higher-power applications. *Id.* at 77 (citing Ex. 1018, 123; Ex. 1010, 25; Ex. 1003 ¶¶ 345–346).

Significantly, Petitioner asserts that “a POSA would have had a reasonable expectation of success in implementing a full-bridge *rather than* half-bridge inverter.” *Id.* (emphasis added). This argument is problematic because the correct construction of “means for converting” requires “a bridge circuit configurable between a full-bridge mode and a half-bridge mode, as shown in Figures 19A and 19B, and equivalents thereof.” Thus,

Petitioner's position that it would have been obvious to implement a full-bridge *rather than* a half-bridge inverter fails to show that it would have been obvious to modify Julstrom to include a bridge circuit *configurable between* a full-bridge mode and a half-bridge mode, as shown in Figures 19A and 19B, or equivalents thereof.

Thus, Petitioner has not proven by a preponderance of the evidence that independent claims 46 and 50, or their respective dependent claims 47–48 and 51, would have been obvious based on Julstrom.

IV. CONCLUSION¹¹

In summary:

Claims	35 U.S.C. §	Reference(s)/ Basis	Claims Shown Unpatentable	Claims Not shown Unpatentable
1, 9, 13, 18, 36, 37, 43, 44, 46– 51	102	Sato	1, 9, 13, 18, 36, 37, 43, 44, 49	46–48, 50, 51
10, 12	103(a)	Sato	10, 12	
1, 9, 12, 13, 18, 36, 37, 43, 44, 46–51	102	Julstrom	1, 9, 12, 13, 18, 36, 37, 43, 44, 49	46–48, 50, 51
10, 46–48, 50, 51	103(a)	Julstrom	10	46–48, 50, 51
Overall Outcome			1, 9, 10, 12, 13, 18, 36, 37, 43, 44, 49	46–48, 50, 51

¹¹ Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner’s attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. See 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. See 37 C.F.R. § 42.8(a)(3), (b)(2).

V. ORDER

It is, therefore,

ORDERED that Petitioner has shown by a preponderance of the evidence that claims 1, 9, 10, 12, 13, 18, 36, 37, 43, 44, and 49 of the '581 patent are unpatentable;

FURTHER ORDERED that Petitioner has not shown by a preponderance of the evidence that claims 46–48, 50, and 51 of the '581 patent are unpatentable; and

FURTHER ORDERED that, because this is a Final Written Decision, parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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