

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

INTEL CORPORATION,
Petitioner,

v.

TELEFONAKTIEBOLAGET LM ERICSSON (publ),
Patent Owner.

IPR2024-00728
Patent 7,151,430 B2

Before SHARON FENICK, STEVEN M. AMUNDSON, and
RUSSELL E. CASS, *Administrative Patent Judges*.

CASS, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining Some Challenged Claims Unpatentable
Denying Patent Owner's Motion to Exclude
35 U.S.C. § 318(a)

I. INTRODUCTION

A. Background

In this *inter partes* review, Intel Corporation (“Petitioner”) challenges the patentability of claims 1–19 of U.S. Patent No. 7,151,430 B2 (Ex. 1001, “the ’430 patent”), which is assigned to Telefonaktiebolaget L M Ericsson.¹

We have jurisdiction under 35 U.S.C. § 6. This Final Written Decision, issued pursuant to 35 U.S.C. § 318(a), addresses issues and arguments raised during the trial in this *inter partes* review. For the reasons discussed below, Petitioner has proven by a preponderance of the evidence that claims 1–5, 7, 8, 10, 11, 12–15, and 17–19 are unpatentable. Petitioner has not proven by a preponderance of the evidence that any of claims 6, 9, and 16 are unpatentable.

B. Procedural History

In the Petition, Petitioner challenged claims 1–21 of the ’430 patent. Paper 2 (“Pet.”) 1. Following the Petition, Patent Owner filed a Preliminary Response that, among other things, disclaimed claims 20 and 21. Paper 7 (“Prelim Resp.”) 1. We instituted trial on all remaining challenged claims. Paper 10 (“Inst. Dec.”) 23. Following institution, Patent Owner filed a Response (Paper 16, “PO Resp.”), Petitioner filed a Reply (Paper 19, “Pet. Reply”), and Patent Owner filed a Sur-reply (Paper 25, “PO Sur-reply”).

Petitioner submitted a Declaration of Manos Tentzeris with its Petition (Ex. 1003, “Tentzeris Decl.”) and another Declaration from Dr. Tentzeris in opposition to the Patent Owner Response (Ex. 1043, “Reply Tentzeris Decl.”). Patent Owner submitted a Declaration of Paul R. Prucnal

¹ Petitioner initially challenged claims 1–21 (Pet. 1), but Patent Owner disclaimed claims 20 and 21 in its Preliminary Response (Prelim. Resp. 1).

(Ex. 2002, “Prucnal Decl.”) with its Preliminary Response, and another Declaration from Dr. Prucnal with its Patent Owner Response (Ex. 2009, “Supp. Prucnal Decl.”). An oral hearing was held on July 16, 2025, a transcript of which appears in the record. Paper 37, “Tr.”

C. Asserted Challenges to Patentability

Petitioner challenges the patentability of claims 1–19 of the '430 patent on the following grounds (Pet. 2):

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1, 3–5, 7, 10, 11, 13–15, 17, 19	103(a) ²	Taniguchi ³
2, 8, 11, 12–15, 17–19	103(a)	Taniguchi, Rostoker ⁴
1, 3–6, 9, 11–16	103(a)	Midya, ⁵ Raghavan ⁶
2, 11–16	103(a)	Midya, Raghavan, Gardner ⁷
1, 3–5, 7, 10, 11, 13–15, 17, 19	103(a)	Taniguchi, Brooks ⁸
2, 8, 11, 12–15, 17–19	103(a)	Taniguchi, Rostoker, Brooks
1, 3–6, 9, 11–16	103(a)	Midya, Raghavan, Brooks
2, 11–16	103(a)	Midya, Raghavan, Gardner, Brooks

² The '430 patent's earliest priority date falls before the Leahy-Smith America Invents Act ("AIA"), Pub. L. No. 112–29, 125 Stat. 284 (2011), took effect. Thus, we apply the pre-AIA version of § 103.

³ US 2003/0063034 A1; published Apr. 3, 2003. Ex. 1005.

⁴ US 6,373,447 B1; issued Apr. 16, 2002. Ex. 1006.

⁵ WO 98/05048; published Feb. 5, 1998. Ex. 1007.

⁶ US 2005/0077992 A1; published Apr. 14, 2005. Ex. 1008.

⁷ US 2001/0030591 A1; published Oct. 18, 2001. Ex. 1009.

⁸ Brooks, Douglas, "Signal Integrity Issues and Printed Circuit Board Design," Prentice Hall Modern Semiconductor Design Series (2003). Ex. 1010.

D. Real Parties in Interest

Petitioner states that the real parties in interest “include [Intel Corporation], as well as Lenovo (United States), Inc., Lenovo (Shanghai) Electronics Technology Co. Ltd., Lenovo Beijing, Ltd., Lenovo PC HK Limited, Lenovo Group, Ltd., Lenovo Information Productions (Shenzhen) Co., Ltd, Motorola (Wuhan) Mobility Technologies Communication Co., and Motorola Mobility LLC.”⁹ Paper 3, 1. Patent Owner states that Telefonaktiebolaget L M Ericsson, Ericsson AB, and Ericsson Inc. are the real parties in interest. Paper 22, 2.

E. Related Proceedings

The parties state that the ’430 patent is the subject of *Electronic Devices, Including Mobile Phones, Tablets, Laptops, Components Thereof, and Products Containing Same*, No. 337-TA-1376 (ITC) and *Telefonaktiebolaget LM Ericsson v. Lenovo (United States), Inc.*, No. 5:23-cv-00570 (E.D.N.C.). Pet. 108; Paper 22, 2.

F. The ’430 Patent (Ex. 1001)

Titled “Method of and Inductor Layout for Reduced VCO Coupling,” the ’430 patent describes “an improved inductor design” in voltage-controlled oscillators (“VCO”) of the type used in radio frequency (“RF”) transceivers. Ex. 1001, 1:19–22, code (54). Among other things, the ’430 patent describes using two inductors “that are substantially symmetrical about their horizontal and/or vertical axes and providing current to the

⁹ While Petitioner states that the real parties in interest “include” the listed entities, we assume that this list includes “*all* real parties in interest,” as per the statutory requirements for a petition to be considered. 35 U.S.C. § 312(a)(2) (emphasis added).

inductors in a way so that the resulting magnetic field components tend to cancel each other by virtue of the symmetry.” Ex. 1001, 1:61–66.

Copied below is Figure 2 of the ’430 patent, depicting a figure 8-shaped inductor.

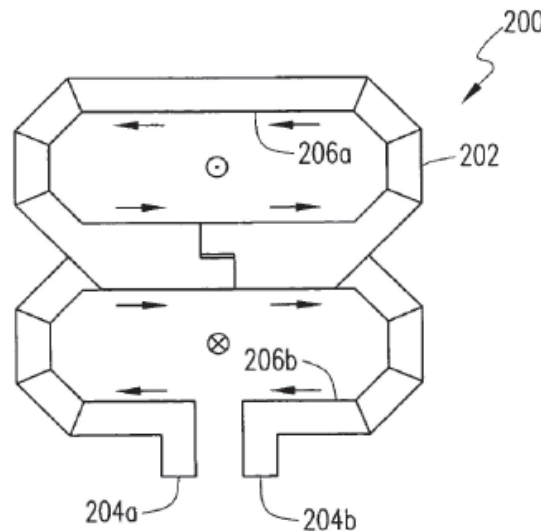


FIG. 2

Figure 2 depicts inductor 200 having inductor coil 202 in the form of a single-turn 8-shaped structure with upper loop 206a and lower loop 206b. Ex. 1001, 4:5–14. According to the ’430 patent, “[b]y virtue of the figure-8 shape, current in the upper loop 206a travels in a direction (e.g., counterclockwise, see arrows) that is opposite to current in the lower loop 206b (e.g., clockwise).” Ex. 1001, 4:10–14. “As a result, the EM field components emanating at a certain distance from the two substantially symmetrical loops 206a and 206b also have opposite directions and tend to counteract each other.” Ex. 1001, 4:14–17. “Consequently, the inductor 200 has been found to have a significantly reduced far field at a certain distance from the inductor coil 202” and, “by making the two loops 206a and 206b substantially symmetrical, cancellation of a significant amount of

far field on either side of the horizontal symmetry axis X may be achieved.” Ex. 1001, 4:19–25. The ’430 patent also explains that “the positioning of the terminals 204a and 204b may help minimize the far field,” for example, by “positioning the two terminals 204a and 204b as close to each other as possible,” which “helps make the field contributions from the two parts of the inductor 200 identical.” Ex. 1001, 4:28–32.

G. Representative Claim

Of the challenged claims remaining after the disclaimer, claims 1 and 11 are independent claims. Claim 1 is reproduced below with labels added corresponding to those referenced in the Petition.

- [1p]. An inductor layout having reduced mutual electromagnetic coupling, comprising:
 - [1A] a first inductor having a reduced far field, said first inductor comprising:
 - [1A.1] a first loop having a shape that is substantially symmetrical about a first predefined axis;
 - [1A.2a] a second loop connected to the first loop, [1A.2b] said second loop having a size and shape substantially identical to the first loop, [1A.2c] said second loop arranged such that a magnetic field emanating therefrom tends to cancel a magnetic field emanating from the first loop; and
 - [1A.3] two closely spaced terminals connected to the first loop for supplying electrical current to the first and second loops while minimizing magnetic field contributions from the terminals; and
 - [1B.1] a second inductor positioned at a predetermined distance from the first inductor, [1B.2] wherein a mutual electromagnetic coupling between the first inductor and the

second inductor is reduced as a result of the first inductor having a reduced electromagnetic field.

Ex. 1001, 10:11–30.

II. DISCUSSION

A. 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. In the Petition, Petitioner asserted that a person of ordinary skill would have had “a master’s degree in electrical engineering, physics, or similar discipline and at least two years’ experience in designing integrated circuits or inductors or a bachelor’s degree in electrical engineering, physics, or a similar discipline and at least four years’ experience in designing integrated circuits or inductors.” Pet. 2–3. Petitioner also stated that additional education might compensate for less experience and vice versa. Pet. 3 (citing Ex. 1003 ¶ 58).

In its Preliminary Response, Patent Owner disputed Petitioner’s description of the level of ordinary skill and stated that a person of ordinary skill “would have had a bachelor’s degree in electrical engineering, physics, or a similar discipline, and either a master’s degree in one of these fields of study or a minimum of two years of experience working in the wireless communications industry.” Prelim. Resp. 15–16 (citing Ex. 2002 ¶ 24).

In our Institution Decision, we applied Petitioner’s articulation of the level of ordinary skill in the art, but stated that our Decision would not change under Patent Owner’s articulation. Inst. Dec. 8. In doing so, we determined that Patent Owner’s reference to “experience working in the wireless communications industry” appeared potentially overbroad as compared to Petitioner’s reference to “experience in designing integrated

circuits or inductors,” which appeared to better reflect the subject of the ’430 patent and the prior art. *Id.* at 8.

Following the Institution Decision, Patent Owner set forth a new definition of the level of ordinary skill in the art, asserting that one of ordinary skill “would have a bachelor’s degree in electrical engineering, physics, or a similar discipline, and either a master’s degree in one of these fields of study or a minimum of two years of experience designing integrated radiofrequency circuits and inductors for semiconductors.” PO Resp. 4 (citing Ex. 2009 ¶ 7). Patent Owner argues that “[t]his definition aligns with [Petitioner’s] expert, who opined a POSITA would have had ‘years of experience in designing integrated circuits or inductors.’” *Id.* at 4–5 (citing Ex. 1003 ¶ 58; Ex. 2009 ¶¶ 9–10).

In response, Petitioner argues that Patent Owner’s new definition differs from the definition set forth by its expert, which provided that an alternative to a master’s degree was “a minimum of two years of experience designing integrated radiofrequency circuits *or* inductors for semiconductors.” Pet. Reply 5 –6 (citing PO Resp. 4–5).

Based on the full trial record, we continue to adopt Petitioner’s definition of the level of ordinary skill in the art, which is consistent with the ’430 patent and the prior art. In adopting this definition, we note that neither the title nor the “Field of the Invention” portions of the ’430 patent limit the invention to integrated circuits, and Patent Owner does not dispute that claim 1 encompasses inductors that are not provided on an integrated circuit. Ex. 1001, code (54), 1:16–22. Additionally, Dr. Prucnal’s definitions have shifted, and his latest definition purports to be based on Dr. Tentzeris’s characterization of the level of ordinary skill, but changes “experience

designing integrated circuits *or* inductors for semiconductors” to “experience designing integrated circuits *and* inductors for semiconductors” without sufficient explanation of the reasons for the change. Supp. Prucnal Decl. ¶ 8; Reply Tentzeris Decl. ¶ 56. However, our Decision in this case would not change under Patent Owner’s revised articulation. *See* Reply Tentzeris Decl. ¶ 57 (stating that his opinion would not change under Patent Owner’s revised definition of the level of ordinary skill).

B. Claim Construction

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) (2025).

The parties dispute the limiting effect of the preamble of claim 11, which recites “[a] method of reducing mutual electromagnetic coupling between a first inductor and a second inductor on a semiconductor die.” Petitioner argues that the language “on a semiconductor die” is not limiting, while Patent Owner disagrees.

More specifically, Patent Owner argues that this claim language is limiting because the phrase “semiconductor die” modifies the “first inductor” and “second inductor” in the preamble, and provides antecedent basis for the term “the first inductor” in the body of claim 11. PO Resp. 5–7. Patent Owner also argues that the language in the preamble is limiting because it is necessary to understand the subject matter encompassed by the claim, which is “a method of forming inductors on a single semiconductor

chip.” *Id.* at 7–8. Patent Owner further argues that the “Summary of the Invention” portion of the ’430 patent Specification describes the invention as forming both inductors on a semiconductor die, and that the Specification includes no embodiments where the first and second inductors are positioned on different semiconductor dies. *Id.* at 8–9, 11–12. Additionally, Patent Owner contends that the phrase “semiconductor die” in the preamble “informs the meaning of other limitations in the body of the claim relating to physical dimensions,” such as the “far field” of the first inductor, the “predetermined distance” between the first and second inductors, and the “two closely spaced terminals.” *Id.* at 9–10. Finally, Patent Owner argues that its position is supported by the fact that claim 2, which is dependent on claim 1, recites that the first and second inductors “are formed on a single semiconductor die,” and that there is no comparable claim that depends from claim 11. *Id.* at 10–11. Thus, according to Patent Owner, one of ordinary skill would understand the “semiconductor die” language in claim 11’s preamble as limiting because the inventors saw no need for a dependent claim that includes this limitation. *Id.*

Petitioner responds that the term “semiconductor die” only appears in the preamble and does not provide antecedent basis for any limitation in the body of claim 11. Pet. Reply 1. Petitioner also argues that the term “semiconductor die” in the preamble “does not recite essential structure or steps, or give necessary life, meaning, and vitality of the claim,” but rather merely describes a purpose or intended use. *Id.* at 2. Additionally, according to Petitioner, the phrase “on a semiconductor die” can be easily parsed from the remainder of the preamble without impacting the understandability or grammatical completeness of claim 11 and its

dependent claims. *Id.* Petitioner also contends that the '430 patent Specification's broad descriptions of the purported invention, and claim 1's recitation of similar limitations without reference to a "semiconductor die," confirm that claim 11 is not limited to a semiconductor die. *Id.*

Furthermore, according to Petitioner, the applicant did not amend the claims during prosecution to add the phrase "semiconductor die" or rely on this phrase to distinguish prior art, but instead broadened claim 11 by removing the phrase "said semiconductor die" when rewriting original claim 11 as new claim 26 (corresponding to issued claim 11). *Id.* at 3–4 (citing Ex. 1002, 23, 72). Finally, Petitioner argues that its position is consistent with the construction in a previous ITC decision, where the ALJ determined that the "first inductor" language in claim 11's preamble is limiting because it provides an antecedent basis for the phrase "the first inductor," in the body of the claim, but the separate preamble phrase "on a semiconductor die" was not limiting and did not provide antecedent basis for either "the first inductor" or any other language in the body of the claim. *Id.* at 4 (citing Ex. 1019, 2–3).

After considering the full trial record, we agree with Petitioner that the phrase "on a semiconductor die" in the preamble of claim 11 is not limiting. First, we determine that the phrase "on a semiconductor die" in claim 11 does not provide antecedent basis for terms in the body of the claim. The body of claim 11 does not refer to "the semiconductor die" or even mention the "semiconductor die" at all, and neither do any of the claims that depend from claim 11. We disagree with Patent Owner's argument that the phrase "on a semiconductor die" in the preamble of claim 11 provides antecedent basis for the term "the first inductor" in the body of the claim, because the

“first inductor” language in the preamble provides antecedent basis for “the first inductor” language in the claim’s body. The “on a semiconductor die” language in the preamble is presented separately and can be easily parsed from the preamble’s language reciting a “first inductor” without impacting the understandability or grammatical completeness of claim 11. Therefore, the “on a semiconductor die” language in claim 11’s preamble is not necessary to provide antecedent basis for the phrase “the first inductor” in the body of claim 11. This use of language in claim 11 is distinguishable from the Federal Circuit’s opinion in *Deere v. Bush Hog*, cited by Patent Owner, where the preamble term “rotary cutter deck” provided antecedent basis for the term “said deck” recited in the claim body, because in *Deere*, the words “rotary cutter” appeared directly before, directly modified, and were not easily parsed from the term “deck.” *See Deere & Co. v. Bush Hog, LLC*, 703 F.3d 1349, 1357–58 (Fed. Cir. 2012); PO Resp. 7–8.

The prosecution history supports our conclusion as well. As Petitioner points out, original claim 11 included not only the phrase “on a semiconductor die” in the preamble, but also recited in the body of the claim the steps of “forming a first inductor *on said semiconductor die*” and “forming a second inductor *on said semiconductor die*.” Ex. 1002, 23 (emphasis added). The fact that this language was removed from the body of issued claim 11 suggests that the applicant did not clearly intend for it to be limiting.

We also agree with Petitioner that the term “semiconductor die” in the preamble does not recite essential structure or steps, or give necessary life, meaning, and vitality of the claim, but rather merely describes a purpose or intended use. *See* Pet. Reply 2. The body of claim 11 is directed to the

design and positioning of the first and second inductors, rather than the substrate on which the inductors are formed. Indeed, as discussed above, the applicant removed references to the substrate from the body of the claim during prosecution, focusing the claim instead on the features of the inductors themselves rather than the substrate on which they were formed. Ex. 1002, 23, 72; Pet. 3–4. Claim 1’s recitation of very similar limitations without reference to a “semiconductor die” further suggests that the “semiconductor die” is not an essential part of the claimed invention, and is not necessary to give life, meaning, and vitality to the claim.

We disagree with Patent Owner’s argument that the ’430 patent Specification mandates that the phrase “on a semiconductor die” in claim 11’s preamble should be given patentable weight. Although some portions of the ’430 patent Specification describe inductors on a semiconductor die, others do not. As we explain further in Section II.D.1(a), the title and “Field of the Invention” portions of the ’430 patent indicate that the relevant field is inductor design, and neither limits the relevant field to inductors on a semiconductor chip. *See* § II.D.1(a), *infra*. The ’430 patent Specification goes on to describe the invention in broad terms, stating that “various embodiments of the invention provide an inductor design and method of implementing the same where mutual EM coupling is reversed” and that one of ordinary skill “will appreciate that the inductor design and method [of the invention] may be used to reduce coupling between two functional blocks *of any type* so long as each contains one or more inductors” Ex. 1001, 3:4–6, 3:36–40 (emphasis added); *see* § II.D.1(a), *infra*. Moreover, even though the ’430 patent describes embodiments on a semiconductor die, our reviewing court “has expressly rejected the contention that if a patent

describes only a single embodiment, the claims of the patent must be construed as being limited to that embodiment.” *Liebel-Flarsheim Co. v. Medrad, Inc.*, 358 F.3d 898, 906 (Fed. Cir. 2004). “Even when the specification describes only a single embodiment, the claims of the patent will not be read restrictively unless the patentee has demonstrated a clear intention to limit the claim scope using ‘words or expressions of manifest exclusion or restriction.’” *Id.* (quoting *Teleflex, Inc. v. Ficosa N. Am. Corp.*, 299 F.3d 1313, 1327 (Fed. Cir. 2002)). We see no such words of exclusion or restriction here.

Consequently, we determine that the phrase “on a semiconductor die” in the preamble of claim 11 does not have patentable weight.

We note that our conclusion is consistent with the International Trade Commission’s (ITC) analysis of the preamble of claim 11 in *In re: Certain Electronic Devices, Including Mobile Phones, Tablets, Laptops, Components Thereof, and Products Containing Same*, No. 337-TA-1376. Ex. 1019 (Claim Construction Order). In its Claim Construction Order issued on March 13, 2024, the ITC explained that, “for the 430 patent, the preamble of claim 11 provides antecedent basis for the term ‘first inductor,’” but it was not clear that the preamble was “otherwise limiting” because “it is not clear that the recitation of ‘on a semiconductor die’ in claim 11 of the 430 patent is properly understood as a limitation.” *Id.* at 16. This is consistent with our conclusion that the “first inductor” language in the preamble of claim 11 provides antecedent basis for “said first inductor” in the body of claim 11, but that the separate and distinct phrase “on a semiconductor die” in the preamble does not provide antecedent basis for the phrase “the first

inductor” in the body of the claim, or for any other language in the body of the claim.

To the extent the parties’ arguments touch on other claim construction issues, we address those issues in the context of our analysis of the claims in view of the prior art. *See* §§ II.D.1(b) (determining that the claims do not exclude concentric inductors), II.D.1(c) (discussing the “reduced far field” limitation); II.D.1(d) (discussing the “closely spaced terminals” limitation, II.G (also discussing the “closely spaced terminals” limitation). We determine no other claim terms require express construction for purposes of this Decision. *Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1375 (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)).

C. Obviousness

Under 35 U.S.C. § 103(a), a claim is unpatentable as obvious if “the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains.” *See KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). 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).

*D. Ground 1: Obviousness of Claims 1, 3–5, 7, 10, 11, 13–15, 17, and 19 over Taniguchi*¹⁰

1. Claims 1 and 11

With respect to claims 1 and 11, the parties dispute the following key issues: (1) whether Taniguchi is analogous art; (2) whether Taniguchi’s concentric conductors are positioned at a “predetermined distance” from each other; (3) whether Taniguchi’s first inductor has a “reduced far field” that reduces electromagnetic coupling with the second inductor; (4) whether Taniguchi discloses the “two closely spaced terminals” limitation; and (5) whether the “on a semiconductor die” language in the preamble of claim 11 distinguishes Taniguchi. These issues will be discussed below.

a) Whether Taniguchi is Analogous Art

A reference qualifies as prior art for obviousness purposes when it is analogous to the claimed invention. *Innovation Toys, LLC v. MGA Entm’t, Inc.*, 637 F.3d 1314, 1321 (Fed. Cir. 2011). “Two separate tests define the scope of analogous art: (1) whether the art is from the same field of endeavor, regardless of the problem addressed, and (2) if the reference is not within the field of the inventor’s endeavor, whether the reference still is reasonably pertinent to the particular problem with which the inventor is involved.” *Id.* “A reference is reasonably pertinent if . . . it is one which, because of the matter with which it deals, logically would have commended itself to an inventor’s attention in considering his problem.” *Id.*

¹⁰ The Petition’s discussion of claim 1 refers to and incorporates portions of the Petition’s discussion of now-disclaimed claim 20. Accordingly, our analysis of Petitioner’s showings for claim 1 also refers to portions of Petitioner’s showings for claim 20.

Patent Owner argues that Taniguchi is not analogous art because “[t]he ’430 Patent relates to an inductor layout on a semiconductor die,” and Taniguchi does not teach inductors on a semiconductor die but instead “focuses on solving the problem of too little mutual magnetic coupling between antennas for large, radio guidance antennas and tags for retail antitheft systems.” PO Resp. 28 (citing Ex. 2002 ¶¶ 27–28). More specifically, Patent Owner asserts that Taniguchi discloses antennas with dimensions on the order of about one meter facing each other in gates in order to generate a strong enough electromagnetic field to detect RFID tags. *Id.* at 29 (citing Ex. 1005 ¶¶ 81, 84, Figs. 13A–13B, 15A–15E, 21; Ex. 2002 ¶ 28; Ex. 2009 ¶ 39). Patent Owner also argues that Taniguchi involves “mutual inductance between two antennas positioned concentrically, not when they are in each other’s far field.” *Id.* at 30 (citing Ex. 2009 ¶¶ 20, 22, 39).

Petitioner argues that the relevant field of endeavor is “inductor design” and not “inductor design for semiconductors,” as Patent Owner proposes. Pet. Reply 4. Petitioner asserts that the portions of the ’430 patent Specification upon which Patent Owner relies “describe specific, non-limiting embodiments and simulations,” and that Patent Owner ignores other portions of the Specification indicating that the invention is not limited to use of inductors on semiconductor chips. *Id.* at 4–5. Petitioner also contends that Taniguchi’s loop antennas are “inductors,” and that “the electromagnetic fields produced by loop antennas and inductors of the same shape and carrying the same current are the same.” *Id.* at 6–7 (citing Ex. 1003 ¶ 25; Ex. 1043 ¶¶ 38, 41; Ex. 1044, 110:13–16; Ex. 1045, 203, 214; Ex. 2010, 12:8–13:12, 14:24–15:3, 31:24–42:4). Petitioner also argues

that Patent Owner improperly focuses on the coupling between Taniguchi's antennas and tags, because Petitioner's mapping does not rely on the tags but rather only points to the two inductors of Taniguchi's identification apparatus. *Id.* at 7–8 (citing Pet. 30–43; PO Resp. 28, 33; Ex. 1044, 139:13–18).

Based on the full trial record, we find that Taniguchi is in the same field of endeavor as the '430 patent and is therefore analogous art. First, we agree with Petitioner that the field of endeavor of the '430 patent is inductor design, and disagree with Patent Owner that the field of endeavor is limited to inductor design on a semiconductor chip. The title and "Field of the Invention" portions of the '430 patent indicate that the relevant field is inductor design, and neither limits the relevant field to inductors on a semiconductor chip. *See* §§ II.A, II.B, *supra*. More specifically, the title of '430 patent is "Method of and Inductor Layout for Reduced VCO Coupling," and the Field of the Invention states that "[t]he present invention relates to voltage-controlled oscillators (VCO) of the type used in radio frequency (RF) transceivers and, in particular, to an improved inductor design in a VCO," neither of which mentions semiconductor chips. Ex. 1001, code (12), 1:16–22.

The '430 patent Specification goes on to describe the invention in broad terms, stating that "various embodiments of the invention provide an inductor design and method of implementing the same where mutual EM coupling is reversed." Ex. 1001, 3:4–6. It further explains that:

[A] person having ordinary skill in the art will appreciate that the inductor design and method [of the invention] may be used to reduce coupling between two functional blocks *of any type* so long as each contains one or more inductors.

Id. at 3:36–40 (emphasis added). *See id.* at 3:4–16 (“The inductor design and method may also be used to reduce the coupling between an inductor and another on-chip or external structure”).

Additionally, neither independent claim 1 nor disclaimed independent claim 20 references the use of inductors on a semiconductor chip, indicating that the scope of the invention is not limited to use in semiconductor chips. *Id.* at 10:12–30, 12:16–28. And, of the claims depending from claims 1 and 20, only claim 2 mentions forming the inductors on a single semiconductor die, further indicating that the inventors considered their invention to be broader than inductors formed on a single semiconductor chip. *See id.* at 10:32–34.

We have reviewed the portions of the ’430 patent Specification cited by Patent Owner as supporting the proposition that the patent’s field of endeavor is limited to inductors on a semiconductor die, and find that they describe non-limiting embodiments and simulations. *See* PO Resp. 12–13; Ex. 1001, 1:59–6 (describing the invention as including “[a]n inductor design for reducing mutual EM coupling between VCO resonators”), 2:13–17 (referring to semiconductor die “in another aspect” of the invention), 2:19–20 (same), 3:14–15 (method “may also be used . . . on-chip”), 5:45–48 (describing exemplary simulations to determine the effectiveness of certain specific inductor designs in reducing mutual EM coupling). The field of endeavor is not limited to the use of inductors on semiconductor chips simply because the patent includes such embodiments or describes them as additional aspects of the invention. *See Unwired Planet LLC v. Google, Inc.*, 841 F.3d 995, 1001 (Fed. Cir. 2016) (The field of endeavor is “not limited to the specific point of novelty, the narrowest possible conception of

the field, or the particular focus within a given field.”). Therefore, Taniguchi is not outside the ’430 patent’s field of endeavor simply because it does not focus on the design of inductors on a semiconductor chip.

We also disagree with Patent Owner’s argument that Taniguchi is in a different field of endeavor because it uses large antennas and tags for retail antitheft systems, rather than small inductors on a semiconductor die. PO Resp. 28–29; PO Sur-reply 10–11. As discussed above, the field of endeavor of the ’430 patent is not limited to the use of inductors on a semiconductor chip, but rather is directed to inductor design more generally. We also find that Taniguchi’s antennas are inductors. Our conclusion is supported by Taniguchi itself, which describes its antennas as providing inductance, stating that “[t]he coupling of the antennas is composed of *inductive* coupling.” Ex. 1005 ¶ 16; *see id.* ¶ 15 (referring to “electromagnetic induction from the first antenna,” and the second antenna “being arranged so that the sum of mutual inductances between it and the first antenna is decreased”). We also find credible the detailed testimony of Dr. Tentzeris explaining that loop antennas like the ones disclosed in Taniguchi are inductors and use the principle of inductive coupling. Ex. 1003 ¶¶ 85–93; Ex. 1043 ¶¶ 38–43. And, as we noted in our Institution Decision, the ’430 patent attributes many of the characteristics of the EM field to the symmetrical, 8-shaped inductor having current flowing in opposite directions in each of the inductor’s loops (Ex. 1001, 4:5–32), which is structurally similar to the structures depicted in Taniguchi, such as Figures 3, 7, and 8. *See* Inst. Dec. 18. Indeed, Dr. Prucnal admitted at his deposition that the antennas in Taniguchi and the inductors in the ’430 patent “both have the same physics,” and Patent Owner’s counsel admitted at the hearing

that antennas are a species of inductor. Ex. 1044, 110:13–18; Tr. 40:23–41:19.

Additionally, Patent Owner’s focus on the facing gates and tags in Taniguchi is inapt in light of Petitioner’s mapping of Taniguchi to the claims. Petitioner’s mapping does not rely on the coupling of the antennas and tags, or the interaction of antennas on different gates with each other or with tags. *See* Pet. 30–43; Pet. Reply 7. Rather, Petitioner maps the two concentric antennas in one gate of Taniguchi’s system to the two inductors in the challenged claims. Pet. 30–43; Pet. Reply 7–8. As discussed above, Taniguchi’s figure-8 shaped antennas have the same relevant physics and magnetic field cancellations as the figure-8 shaped inductors in the ’430 patent.

Finally, we disagree with Patent Owner’s argument that Taniguchi is not in the same field of endeavor as the ’430 patent because Taniguchi involves “mutual inductance between two antennas positioned concentrically, not when they are in each other’s far field.” PO Resp. 30. As discussed in Section II.D.1(b) below, we do not find that the claims of the ’430 patent exclude inductors that are positioned concentrically. Additionally, as shown by the quotations from the ’430 patent cited above, the patent does not limit its relevant field to non-concentrically positioned antennas.

Consequently, we agree with Petitioner that the field of endeavor of the ’430 patent is “inductor design,” and that Taniguchi falls within this field of endeavor. We also find that, because Taniguchi deals with the design of a figure-8 inductor that reduces the far field of the inductor and reduces mutual electromagnetic coupling with a second inductor, that it is reasonably

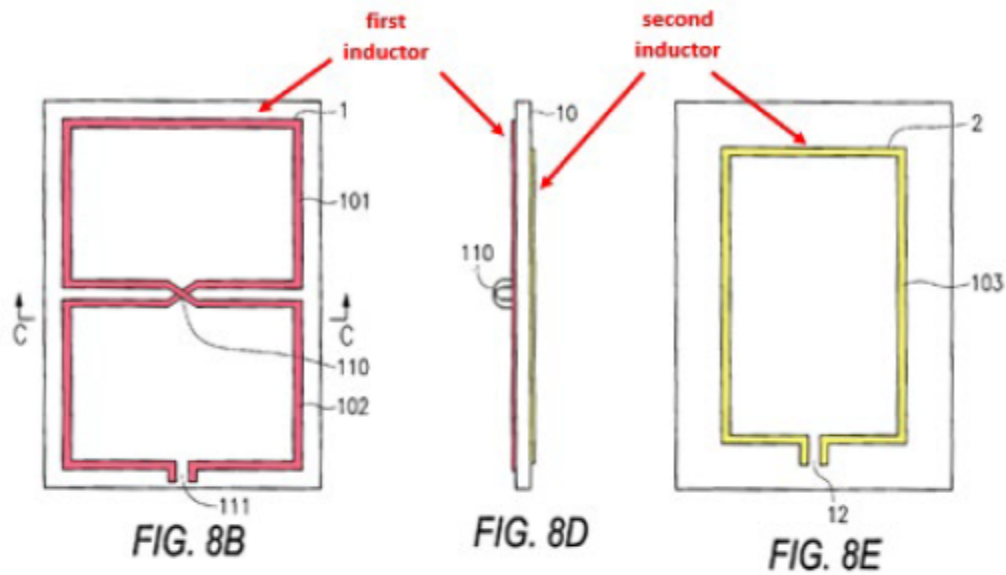
pertinent to the problem of designing an inductor with reduced electromagnetic coupling that the '430 patent inventors sought to address. *See* § II.D.1(c), *infra*; Ex. 1001, 1:41–42, 1:59–60.

b) Whether Taniguchi's Concentric Inductors Are Positioned at a "Predetermined Distance" from Each Other

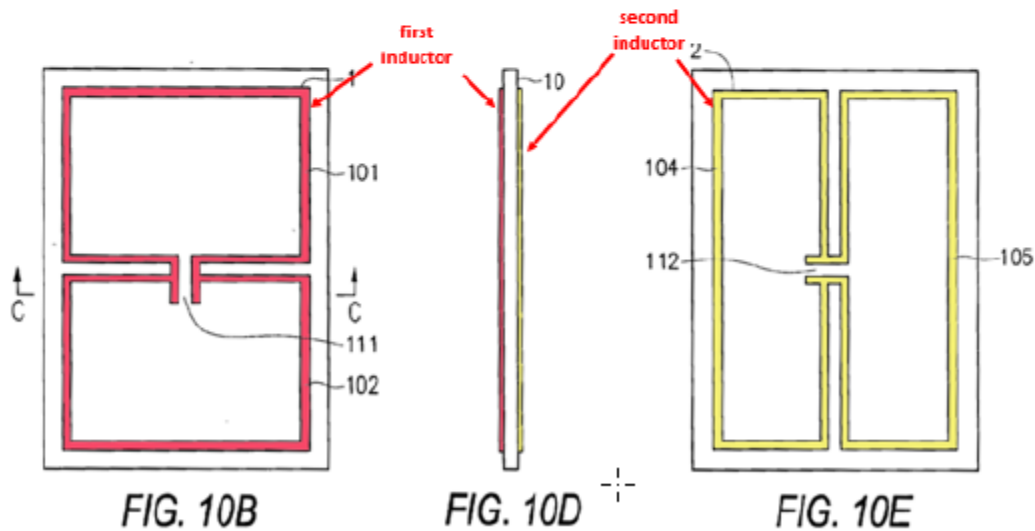
Claim 1 requires that the second inductor is "positioned at a predetermined distance from the first inductor." Ex. 1001, 10:26–27. Claim 11 similarly requires "positioning a second inductor at a predetermined distance from the first inductor." *Id.* at 11:11–12.

Citing the embodiments of Taniguchi's Figures 3, 7, 8, and 9/10, Petitioner argues that Taniguchi's "eight-shaped antenna 1" is the claimed "first inductor" and "rectangular antenna 2 (Figure 7–8 embodiments)" or "eight-shaped antenna 2 (Figure 9/10 embodiment)" is the claimed "second inductor." Pet. 31–32; *see* Pet. 36–38, 39–40. Petitioner contends that each of the embodiments of Taniguchi's Figures 7, 8, and 9/10 teaches that antenna/inductor 2 is formed on the opposite surface of insulation 10 and is thus separated from antenna/inductor 1 by the thickness of insulation 10, which is a "predetermined distance." Pet. 39–41 (citing Ex. 1003 ¶¶ 153, 158; Ex. 1005 ¶¶ 55, 68, 70–73, 76–77, 85–86, Figs. 7B, 8B, 8D, 8E, 10B, 10D, 10E).

Petitioner's annotated versions of Taniguchi's Figures 8 and 10 are copied below:



Taniguchi, Annotated Figures 8B and 8D-8E



Taniguchi, Annotated Figures 10B, 10D-10E

Pet. 40. Petitioner's annotated versions of Figures 8 and 10 depict a first inductor colored red and a second inductor colored yellow. The annotated versions of Figures 8D and 10D depict the first inductor connected to the left side of insulation 10 and the second inductor connected to the right side of insulation 10. According to Petitioner, as explained above, the two loops of

the figure-eight configuration of Taniguchi's antenna/inductor 1 generate repulsive magnetic flux that reduces the intensity of the remote EM field and also reduce the EM coupling between the first and second antenna/inductors. Pet. 42–43.

Patent Owner argues that Taniguchi's concentric inductors do not meet the “predetermined distance” limitation in claims 1 and 11. PO Resp. 31–36, 39–40; PO Sur-reply 15–17. Patent Owner argues that the '430 patent teaches “positioning the two inductors adjacent one another on the same plane where the centers of the inductors are at [a] distance from each other,” and that “[t]he ‘predetermined distance’ language in the '430 Patent's independent claims focuses on the lateral distance between the center points of the two inductors.” PO Resp. 31, 33. In support, Patent Owner argues that “Figs. 4–5, 6, 8, and 12 of the '430 Patent show the first and second inductors” are “‘positioned at a predetermined distance from’ each other, *i.e.*, the ‘center distance’ between the two inductors is far enough away to reduce the electromagnetic coupling between them.” *Id.* at 32 (citing Ex. 1001, Figs. 6, 8, 12, 6:60–61, 7:20–21, 9:3–5; Ex. 2002 ¶¶ 50–51). Patent Owner contends that the horizontal and vertical axes in Figure 4 of the '430 patent, the electromagnetic data from Figures 6, 8, and 12, and the data presented in Table 2, all show that the lateral distance between the center points of the two inductors is a major factor in reducing electromagnetic interference between the two inductors. *Id.* at 32–33 (citing Ex. 1001, Figs. 4, 6, 8, 12; Ex. 2009 ¶ 17).

Petitioner responds that claims 1 and 11 only require that the inductors are positioned at some predetermined distance at which there is reduced mutual electromagnetic coupling, and that Patent Owner “has

identified no lexicography, disclaimer, or disavowal that would justify requiring the inductors to be *laterally* displaced from one another.” Pet. Reply 13 (emphasis added). Petitioner also argues that none of the Patent Owner’s citations from the ’430 patent Specification define or even mention the term “predetermined distance,” or mandate that the claimed inductors must be arranged in a particular manner. *Id.* Thus, Petitioner contends, Patent Owner is improperly attempting to read a preferred embodiment into the claims. *Id.*

We agree with Petitioner that claims 1 and 11 do not require that the first and second inductor be laterally spaced, but instead merely require that the second inductor be positioned at a “predetermined distance” from the first inductor. Nothing in the claim language restricts this “predetermined distance” from being in the X, Y, or Z direction, or requires that the inductors be laterally spaced in the same plane. Moreover, the fact that the ’430 patent Specification describes embodiments where the inductors are laterally spaced in the same plane does not limit the claims to those embodiments. As explained previously, our reviewing court “has expressly rejected the contention that if a patent describes only a single embodiment, the claims of the patent must be construed as being limited to that embodiment.” *Liebel-Flarsheim*, 358 F.3d at 906. “Even when the specification describes only a single embodiment, the claims of the patent will not be read restrictively unless the patentee has demonstrated a clear intention to limit the claim scope using ‘words or expressions of manifest exclusion or restriction.’” *Id.* We see no such “words or expressions of manifest exclusion or restriction” here. Accordingly, we give the term

“predetermined distance” its ordinary meaning, which includes a distance in any direction.

The parties do not dispute that Taniguchi’s inductors are spaced apart with an insulation layer in between. Therefore, under the ordinary meaning of the claim language, Taniguchi’s second inductor is “positioned at a predetermined distance from the first inductor.”

c) Whether Taniguchi’s First Inductor Has a “Reduced Far Field” That Reduces Electromagnetic Coupling with the Second Inductor

Claim 1 of the ’430 patent requires “a first inductor having a reduced far field” wherein “a mutual electromagnetic coupling between the first inductor and the second inductor is reduced as a result of the first inductor having a reduced electromagnetic field.” Ex. 1001, 10:14, 10:27–30. Claim 11 includes a similar limitation. *Id.* at 10:64, 11:12–15.

Petitioner argues that in Taniguchi’s figure-8 inductor, the flux lines of the magnetic field generated by the two loops are equal and have opposite directions. Pet. 14–15 (citing Ex. 1005 ¶¶ 48, 63), 36, 38. As a result, according to Petitioner, the magnetic flux lines from the two loops cancel each other, reducing the electromagnetic field generated by the inductor, as Taniguchi explains. *Id.* at 15 (citing Ex. 1010, 157; Ex. 1003 ¶ 96; Ex. 1005 ¶¶ 57–59, 73–75). Petitioner asserts that this understanding is consistent with the ’430 patent, which states that its figure-8 inductor results in electromagnetic field components that “have opposite directions and tend to counteract each other,” resulting in “a significantly reduced far field at a certain distance from the inductor coil.” *Id.* at 16. Petitioner also offers simulations performed by Dr. Tentzeris that it argues demonstrate that Taniguchi’s figure-8 inductor produces an electromagnetic field that

decreases rapidly with increasing distance in both the lateral and vertical directions. Pet. Reply 17; Ex. 1043 ¶¶ 25–30.

In a similar vein, Petitioner argues that the reduced inductance from Taniguchi’s first figure-8 inductor causes a reduction of the induced inductance in Taniguchi’s second inductor. Pet. 32–36; Pet. Reply 16–18. This reduced inductance, according to Petitioner, reduces the mutual electromagnetic coupling between the first and second inductors as a result of the first inductor’s reduced electromagnetic field, as claims 1 and 11 require. Pet. 32–36; Pet. Reply 16–18. Petitioner also relies on Dr. Tentzeris’s simulations to support this argument. Pet. Reply 17; Ex. 25–30.

Patent Owner asserts that the term “reduced far field” means “(reduced/reduce) the electromagnetic field at a certain distance from the first inductor (where the second inductor is positioned),” as the ITC determined. PO Resp. 12 (citing Ex. 1020, 19; Ex. 2009 ¶ 15). Patent Owner argues that Taniguchi fails to disclose the “reduced far field” limitation because Taniguchi’s first antenna creates an electromagnetic field that is sufficiently strong to allow for communication with Taniguchi’s tags 211–213. PO Resp. 40, 42, 44–45; PO Sur-reply 17–20. Patent Owner also argues that Taniguchi teaches a reduced inductance coupling between the first and second inductors only when they are positioned concentrically. PO Resp. 38–40, 44–45. Patent Owner further contends that Dr. Tentzeris’s simulations should not be considered because they are “new evidence” and were not run “until after seeing Dr. Prucnal’s declarations and deposition.” PO Sur-reply 20.

Based on the full trial record, we find that Petitioner has sufficiently proven that Taniguchi discloses these limitations. With respect to the “reduced far field” limitation, we agree with the construction proposed by Patent Owner and adopted by the ITC, which is “(reduced/reduce) the electromagnetic field at a certain distance from the first inductor (where the second inductor is positioned).” PO Resp. 12; Ex. 1020, 19.

Both the ’430 patent and Taniguchi explain that the figure-8 inductor, by virtue of its shape, has magnetic fields in each loop that cancel each other out and result in a reduced electromagnetic field at a distance from the inductor. As the ’430 patent explains:

By virtue of the figure-8 shape, current in the upper loop 206a travels in a direction (e.g., counterclockwise, see arrows) that is opposite to current in the lower loop 206b (e.g., clockwise). As a result, the EM field components emanating at a certain distance from the two substantially symmetrical loops 206a and 206b also have opposite directions and tend to counteract each other. . . . Consequently, the inductor 200 has been found to have a significantly reduced far field at a certain distance from inductor coil 202.

Ex. 1001, 4:10–21. The ’430 patent goes on to explain that:

Each individual inductor 400 and 402 has a reduced far field by virtue of the 8-shaped inductor coil 404 and 406 In addition, there is also a reduction in the mutual coupling between the two inductors 400 and 402. This is because the same mechanism that causes the radiated EM field from the first inductor to be reduced also causes the “EM field receive sensitivity” of the second inductor to be reduced. Thus, the combined effect of the two inductors upon each other provides the desired coupling reduction.

Ex. 1001, 5:4–13.

Taniguchi includes similar disclosures explaining that a reduced far field is a natural result of the use of a figure-8 inductor. For example,

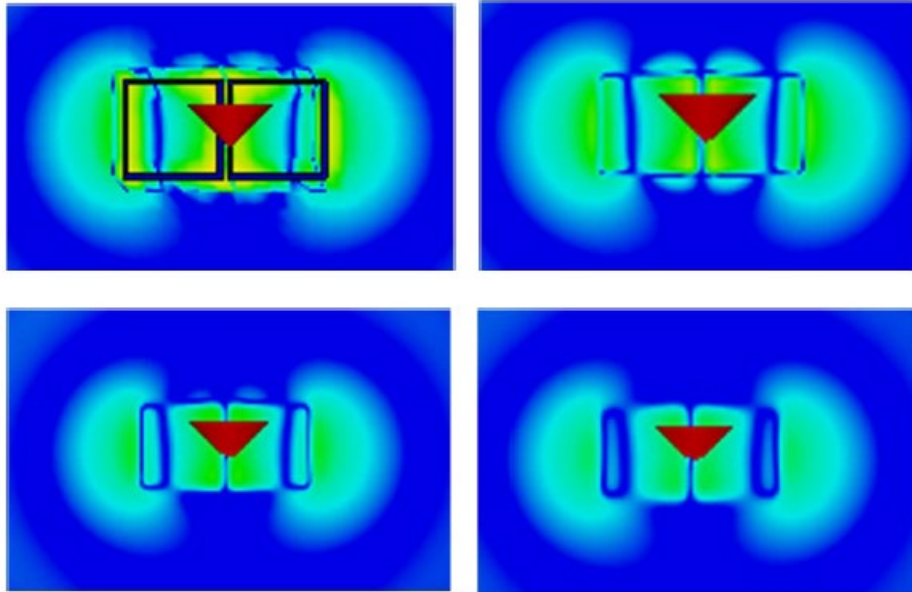
Taniguchi explains that “the first antenna 1 is provided by forming antenna conductors 101, 102 *in a substantially figure eight shape, which reduces a remote electromagnetic-field effect.*” Ex. 1005 ¶ 55 (emphasis added).

Taniguchi further explains that “the remote electromagnetic-field intensity is much suppressed by the figure eight-shaped antenna.” *Id.* ¶ 94. Both Dr. Prucnal and Dr. Tentzeris also agree that, in a figure 8-shaped inductor, the currents in the two loops of the figure 8 will flow in opposite directions and tend to cancel each other out, reducing the remote electromagnetic field. Ex. 1003 ¶ 116; Ex. 1044, 53:19–54:3.

We also find that one of ordinary skill would have understood that the mutual electromagnetic coupling between the first and second inductors is reduced as a result of the first inductor having a reduced electromagnetic field. As discussed above, Taniguchi discloses a first figure 8-shaped inductor and a second inductor, either figure 8 shaped or loop shaped, located concentrically and separated by an insulation layer. *See* § II.D.1(b). And, as discussed above, Taniguchi explains that its figure 8 antenna has a reduced electromagnetic field. Taniguchi further explains that, due to the currents flowing in opposite directions in each loop of its figure 8 antenna/inductor, the “residual mutual inductances of the antenna 1 and the antenna 2 are put in a state of zero.” Ex. 1005 ¶ 57; *see id.*, claim 1 (“the second antenna being arranged so that the sum of mutual inductances between it and the first antenna is minimized”); Ex. 1003 ¶¶ 154, 156, 161, 166. We agree with and find persuasive Dr. Tentzeris’s testimony that, “[b]ecause mutual inductance describes the coupling of two circuits by the medium of magnetic field . . . , the reduction in mutual inductance as a result of the electromagnetic field reduction is also a reduction on the mutual

electromagnetic coupling between antenna 1 and antenna 2.” Ex. 1003 ¶¶ 156, 161. We also credit Dr. Tentzeris’s testimony that “the eight-shaped antenna has a reduced electromagnetic field which necessarily results in the magnetic coupling of the field with the second inductor to be reduced.” *Id.* ¶¶ 142, 156, 161. Moreover, Patent Owner acknowledged in its Patent Owner Response that “Taniguchi teaches a reduced inductance coupling between first antenna 1 and second antenna 2 . . . when first and second antennas are positioned concentrically.” PO Resp. 38 (citing Ex. 1005 ¶¶ 57–58, Figs. 3, 8A–8E; Ex. 1003 ¶¶ 107, 163).

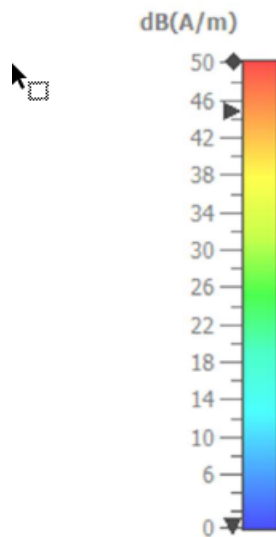
Dr. Tentzeris’s simulations also support our conclusion that Taniguchi’s concentric inductors meet the “reduced far field” and reduced “mutual electromagnetic coupling” limitations. *See* Pet. Reply 17; Ex. 1043 ¶¶ 25–30. Dr. Tentzeris’s first simulation shows the electromagnetic field at positions above a figure 8 shaped conducting loop on a PCB substrate, as shown in the figure below:



**Magnetic Field Measured in Plane of 8-Shaped Loop (top left)
and Above Loop: 1X (top right), 2X (bottom left) and
3X (bottom right) Substrate Thickness**

Ex. 1043 ¶ 28. The above figures show the magnetic field measured in the plane of the figure 8-shaped conducting loop in the top left, the magnetic field as measured a vertical distance equal to the thickness of a typical PCB substrate in the top right, the magnetic field as measured two times the thickness of a typical PCB substrate in the bottom left, and the magnetic field as measured three times the thickness of a typical PCB substrate in the bottom right. *Id.*

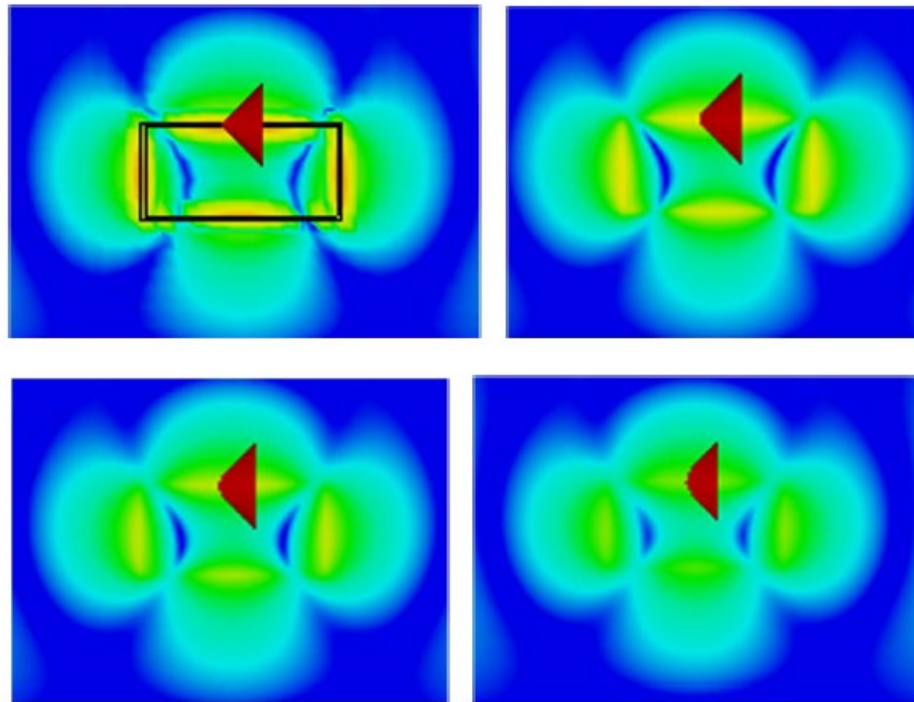
The colors in the above figure correspond to the following scale set forth in Dr. Tentzeris's declaration:



Magnetic Field Strength

Ex. 1043 ¶ 10. As Dr. Tentzeris explains, in this scale, the darkest blue represents zero field and the red represents where the field is largest. *Id.* Because the scale is in decibels, a magnetic field of 30 db (yellow-green) is 10 times greater than a field of 10 db (light blue). *Id.* Dr. Tentzeris explains, and we find credible, that, based on these simulations and figures, “the EM field produced by the eight-shaped conducting loop drops off rapidly with increasing vertical distance.” *Id.*

Dr. Tentzeris compares these results with a simulation of the electromagnetic field produced by a rectangular conducting loop on a PCB substrate, as shown in the figure below:



Magnetic Field Measured in the Plane of the Rectangular Conducting Loop (left) and Above the Conducting Loop: 1X (top right), 2X (bottom left) and 3X (bottom right) Substrate Thickness

Ex. 1043 ¶ 29. The above figures show the magnetic field measured in the plane of a rectangular shaped conducting loop in the top left, the magnetic field as measured a vertical distance equal to the thickness of a typical PCB substrate in the top right, the magnetic field as measured two times the thickness of a typical PCB substrate in the bottom left, and the magnetic field as measured three times the thickness of a typical PCB substrate in the bottom right. *Id.* Dr. Tentzeris explains that this EM field produced by the rectangular conducting loop “does not show this rapid decrease in magnitude with increasing vertical distance” demonstrated with the figure 8 loop, and we credit this testimony. *Id.*

Additionally, we agree with and find credible Dr. Tentzeris’s testimony that “[t]hese simulations demonstrate that the eight-shaped

antenna/inductor of Taniguchi and the '430 patent provides much better magnetic field containment than a rectangular shaped inductor, resulting in substantially reduced field at locations outside of the conducting loop, both laterally and vertically displaced from the conducting loop.” Ex. 1043 ¶ 30. This testimony is consistent with the above figures, which show: (1) a significant reduction in the amount of yellow when moving from the upper left hand figure to the upper right hand figure for the figure 8-shaped loop (equivalent to one substrate thickness), and (2) less reduction in the amount of yellow when moving from the upper left hand figure to the upper right hand figure for the rectangular-shaped loop (also equivalent to one substrate thickness). *See* Ex. 1043 ¶¶ 28–30.

We disagree with Patent Owner’s argument that Dr. Tentzeris’s simulations should not be considered because they are “new evidence” and were not run “until after seeing Dr. Prucnal’s declarations and deposition.” *See* PO Sur-reply 20. Dr. Tentzeris’s simulations expand on and further support the argument in the Petition that Taniguchi’s first inductor has a “reduced far field” and that the mutual electromagnetic coupling between the first and second inductors is reduced as a result of the first inductor’s reduced far field. Pet. 14–16, 32–36. The simulations also directly respond to our suggestion in the Institution Decision that, “[t]o the extent the parties’ declarants disagree regarding what a person of ordinary skill would have understood regarding the characteristics of the EM fields emanating from Taniguchi’s loop structure, the parties are encouraged to develop the record during trial.” Inst. Dec. 19. Additionally, the simulations constitute a permissible response to Patent Owner’s arguments that Taniguchi fails to disclose the “reduced far field” limitation, and Patent Owner’s argument that

Taniguchi's concentric inductors do not have a reduced mutual electromagnetic coupling between the first and second inductors. *See* PO Resp. 38–40, 42, 44–45. Moreover, Patent Owner did not depose Dr. Tentzeris on his simulations or request authorization to submit a response. *See* Tr. 63:20–22.

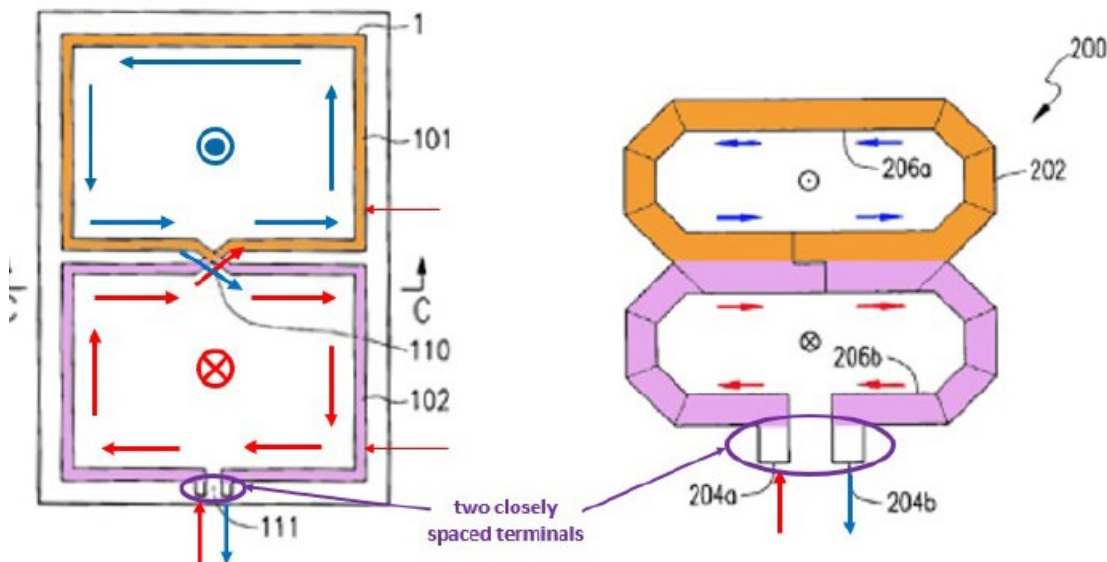
We also disagree with Patent Owner's argument that Taniguchi fails to disclose the "reduced far field" limitation because its first antenna creates an electromagnetic field that is sufficiently strong to allow for communication with Taniguchi's tags 211–213. *See* PO Resp. 40, 42, 44–45; PO Sur-reply 17–20. The claims of the '430 patent do not specify a particular amount that the far field must be reduced by, and therefore the fact that the electromagnetic field can activate Taniguchi's tags does not take Taniguchi outside the scope of the claims. Additionally, Dr. Tentzeris's simulations, discussed above, provide persuasive evidence that Taniguchi's Figure 8 design does reduce the far field of the first inductor.

We also disagree with Patent Owner's argument that Taniguchi teaches a reduced coupling between the first and second inductors only when they are positioned concentrically. *See* PO Resp. 38–40, 44–45. As discussed above in Section II.D.1(b), the challenged claims do not preclude the use of concentric inductors. And, as shown by Dr. Tentzeris's testimony and simulations, as well as the disclosures of Taniguchi, Taniguchi's first antenna/inductor has a reduced far field at the position of the second antenna/inductor, resulting in a reduced magnetic field coupling between the two inductors. *See* Ex. 1005 ¶ 57, claim 1; Ex. 1003 ¶¶ 154, 156, 161, 166; Ex. 1043 ¶¶ 25–30.

d) Whether Taniguchi Discloses the “Two Closely Spaced Terminals” Limitation

Claim 1 of the '430 patent requires “two closely spaced terminals connected to the first loop for supplying electrical current to the first and second loops while minimizing magnetic field contributions from the terminals.” Ex. 1001, 10:22–25. Claim 11 includes a similar limitation. *Id.* at 11:7–10.

Petitioner argues that Taniguchi’s figure 8 antenna discloses two closely spaced terminals, using a comparison between Taniguchi’s Figure 8 and Figure 2 of the '430 patent illustrated in the Figure below:



Taniguchi, Annotated Fig. 8B (left); '430 Patent, Annotated Fig. 2 (right)

Pet. 26. Petitioner contends that the figure 8-shaped antenna/inductor 1 in Taniguchi’s Figure 8B, as shown in the above figure, includes two closely spaced terminals for supplying current in the form of the right and left portions of feeding point 111 on the lower side of conductor 102, with feeding point 111 having a left portion and a right portion for supplying electrical current to the loops. Pet. 27–28. Petitioner argues that this design

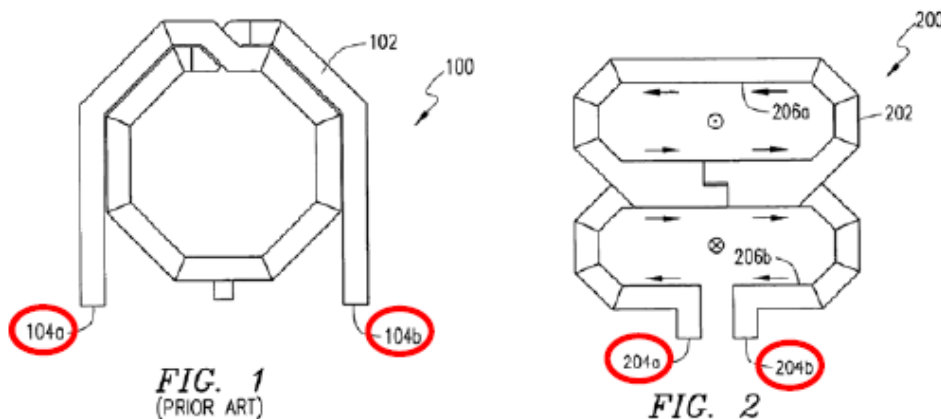
“is consistent with the ’430 patent, which discloses current enters the loop through terminal 204a and leaves through terminal 204b.” *Id.* at 26.

Further, Petitioner contends that the right and left portions of feeding point 111 in Taniguchi supply electrical current that a person of ordinary skill would understand to minimize magnetic field contributions relative to terminals that are placed farther apart. Pet. 28–30 (citing Ex. 1003 ¶¶ 127–131, 134; Ex. 1001, 4:29–32).

Patent Owner argues Taniguchi does not disclose or suggest two closely spaced terminals because Taniguchi does not state that the ends are closely spaced and because the dimensions of Taniguchi’s antenna 102 are about one meter long with ends at feeding point 111 that are not closely spaced relative to the semiconductor chip described in the ’430 patent. PO Resp. 43. Patent Owner also argues that Taniguchi fails to teach that the spacing between the ends of antenna conductor 102 at feeding point 111 minimizes the magnetic field contributions from the terminals. *Id.* Patent Owner argues that Taniguchi teaches that the purpose of placing feeding points 111, 112 nearer to each other is that this design is “favorable in wiring,” not to minimize magnetic field contributions from the combination. *Id.*

After considering the full trial record, we agree with Petitioner that Taniguchi teaches, including in its figure 8, an inductor with “two closely spaced terminals,” as recited in claims 1 and 11. *See* PO Resp. 43–44. The ’430 patent does not specify a particular spacing that must be achieved by the terminals, but rather explains that “positioning the two terminals 204a and 204b as close to each other as possible helps make the field contributions from the two parts of the inductor 200 identical.” Ex. 1001,

4:28–32. In its claim construction order in Case No. 337-TA-1300, the ITC construed the “two closely spaced terminals” limitation to have its “[p]lain and ordinary meaning,” which it found to be “two terminals in proximity to each other (such that the electromagnetic field at a certain distance from the first inductor (where the second inductor is positioned) is reduced.” Ex. 1020, 12. In reaching this conclusion, the ITC explained that the construction “is supported by figures of the ’430 patent, which provide examples and show that the spacing is relative to the proportions and locations of other claim elements.” *Id.* at 13. Specifically, the ITC explained that “Figure 1 of the ’430 patent depicts a prior art inductor 100 with terminals 104a and 104b that are clearly not spaced close to one another” but, “[b]y contrast, Figure 2 depicts an 8-shaped inductor 200 with terminals 204a and 204b that are closely spaced.” *Id.* Depicted below is Petitioner’s annotated version of Figures 1 and 2 of the ’430 patent with the terminals circled in red:



Figures 1 and 2 of the ’430 patent with the inductor terminals circled in red.
Pet. Reply 28.

Additionally, Dr. Prucnal submitted a declaration in the ITC investigation testifying that “the ‘closely spaced’ limitations in the claims are related to

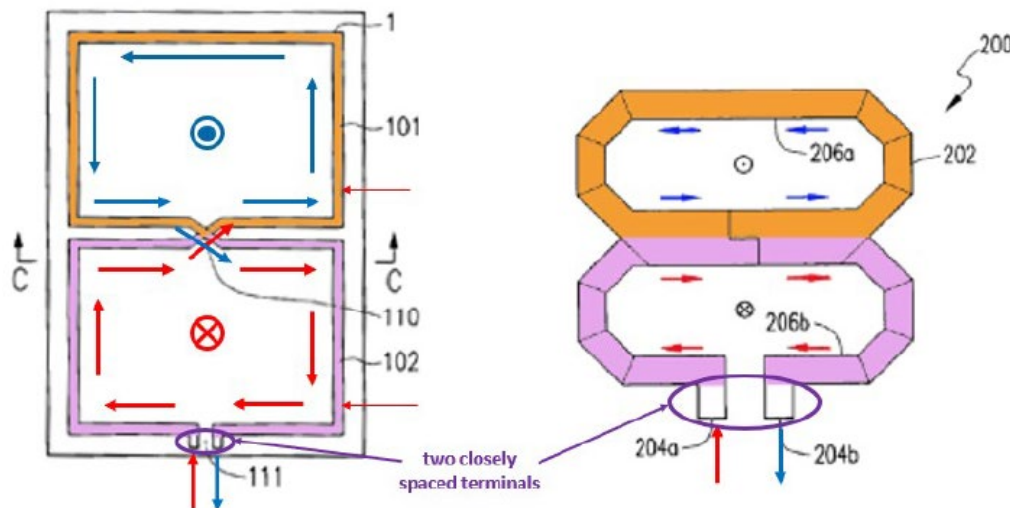
the functional limitations” and that “magnetic field contributions from these two terminals are minimized and mutual electromagnetic coupling between the two inductors is reduced as long as the spacing between the terminals is close enough that magnetic field contributions from each of the two terminals tend to cancel each other out in the vicinity of the second inductor.” Ex. 1051 ¶ 64.

We agree with and adopt the ITC’s construction of “closely spaced,” which is “two terminals in proximity to each other (such that the electromagnetic field at a certain distance from the first inductor (where the second inductor is positioned) is reduced.” Ex. 1020, 12. We find that this construction is supported by the intrinsic record, including the Specification of the ’430 patent, which shows terminals being “closely spaced” compared to the dimensions of the inductor itself, and explains that the purpose of the close spacing is to make the field contributions from the two parts of the inductor identical. *See* Ex. 1005, Figs. 1–2, 4:28–32. Claims 1 and 11 of the ’430 patent lack specific dimensions for either the inductor or the spacing between the terminals, and indicate that the purpose of the close spacing is to “minimiz[e] magnetic field contributions from the terminals.” Ex. 1001, 10:22–25, 11:7–10. Dr. Prucnal’s ITC declaration, although not intrinsic evidence, further supports our conclusion.

Although Patent Owner does not propose a construction for “closely spaced terminals,” it appears to argue that this term must be interpreted based on the dimensions of the semiconductor chip described in the ’430 patent. PO Resp. 43. We do not see any basis in the intrinsic or extrinsic evidence to impart such a narrow reading to the claim language, particularly because the ’430 patent Specification does not define the “closely spaced

terminals” in relation to a semiconductor chip, and claim 1 is not limited to inductors on a semiconductor chip.

Under the construction we have adopted, we find that Petitioner has sufficiently proven that the “closely spaced terminals” limitation is taught by Taniguchi. Like the terminals 204a and 204b in the ’430 patent, Taniguchi’s terminals 111 are in proximity to each other relative to the proportions and locations of the inductor as a whole, as shown by Petitioner’s annotated version of Taniguchi’s Figure 8B and Figure 2 of the ’430 patent, reproduced below.



Taniguchi, Annotated Fig. 8B (left); ’430 Patent, Annotated Fig. 2 (right)

Petitioner’s annotated Figure comparing Figure 8B Taniguchi with Figure 2 of the ’430 patent. Pet. 26.

Dr. Tentzeris also provides persuasive testimony that Taniguchi’s two terminals 111 minimize magnetic field contributions from the terminals due to the opposing currents flowing through the wires of the terminals.

Ex. 1003 ¶¶ 127–134. Dr. Tentzeris relies not only on his own experience, but also on a textbook by Douglas Brooks titled “Signal Integrity Issues and

Printed Circuit Board Design,” which explains that two wires carrying a signal and return current will have equal and opposite magnetic fields that will tend to cancel each other as they move closer together. *Id.* ¶¶ 127–128; Ex. 1010, 157. This testimony is confirmed by the deposition testimony of Dr. Prucnal, who explained that the Brooks textbook states that two wires carrying current in opposite directions create magnetic fields that “would tend to cancel” when they are physically close to each other. Ex. 1044, 132:7–12, 137:14–19. Further supporting this conclusion are simulations conducted by Dr. Tentzeris showing that magnetic fields produced by wires carrying current in opposite directions will tend to cancel each other, and that, in a figure 8-shaped inductor like that disclosed in Taniguchi, the magnetic fields produced by the two terminals cancel each other at locations away from the terminals. Ex. 1043 ¶¶ 34–36.

Consequently, we find that Petitioner has sufficiently proven that Taniguchi teaches two closely spaced terminals connected to the first loop for supplying electrical current to the first and second loops while minimizing magnetic field contributions from the terminals.

e) Whether the “On a Semiconductor Die” Language in the Preamble of Distinguishes Taniguchi

Patent Owner argues that Taniguchi does not disclose or suggest the “on a semiconductor die” limitation in claim 11 of the ’430 patent. PO Resp. 37–38. As discussed in Section II.B above, we have determined that the “on a semiconductor die” language in Claim 11 is not limiting. Therefore, we reject Patent Owner’s argument that Petitioner’s case against claim 11 fails because Taniguchi lacks this limitation.

f) Other Limitations of Claims 1 and 11

With respect to the other limitations of claims 1 and 11, which Patent Owner does not directly address, we have reviewed Petitioner's arguments and evidence concerning these limitations and find that they provide sufficient proof that these limitations are disclosed by or obvious over Taniguchi. *See* Pet. 3–53.

g) Conclusion for Claims 1 and 11

Weighing the record as a whole in view of the findings and analysis above, we conclude that Petitioner has met its burden to show, by a preponderance of the evidence, that claims 1 and 11 would have been obvious over Taniguchi.

2. Dependent Claims 3–5, 7, 10, 13–15, 17, and 19

Petitioner asserts that Taniguchi renders obvious the limitations of dependent claims 3–5, 7, 10, 13–15, and 19. Pet. 43–52. Patent Owner does not present arguments specifically directed to these dependent claims in this ground. PO Resp. 45. We have reviewed the arguments and evidence provided and conclude that Petitioner has met its burden to show, by a preponderance of the evidence, that claims 3–5, 7, 10, 13–15, and 19 would have been obvious over Taniguchi.

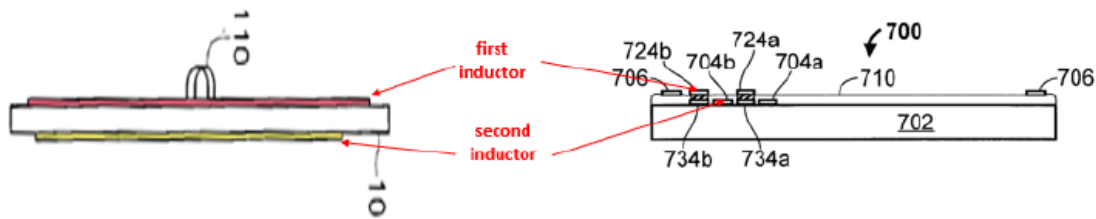
E. Ground 2: Obviousness of Claims 2, 8, 11, 12–15, and 17–19 over Taniguchi in View of Rostoker

1. Claims 2 and 11

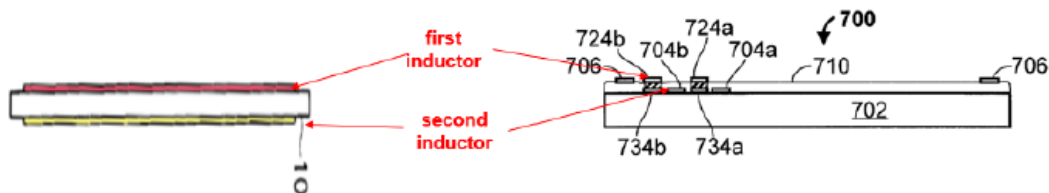
The key issue between the parties concerning claims 2 and 11 concerns the language stating that the first and second inductors are formed “on a semiconductor die.” As discussed above in Section II.B, we determine that the phrase “on a semiconductor die” in the preamble of claim 11 is not

limiting. Petitioner, however, argues that, even if this language in claim 11's preamble is limiting, it would have been obvious over the Taniguchi-Rostoker combination. Pet. 60–62. Petitioner also argues that claim 2 is obvious over this combination for the same reasons. *Id.* at 63.

Petitioner asserts that Taniguchi and Rostoker share the same field and are reasonably pertinent to the same problem as the '430 patent—efficient circuit design. Pet. 56. Petitioner argues that one of ordinary skill would have been motivated to implement Taniguchi's Figure 8 and Figure 9/10 embodiments using the stacked antenna teachings of Rostoker. Pet. 54. Petitioner uses the following figure, reproduced below, to illustrate this combination:



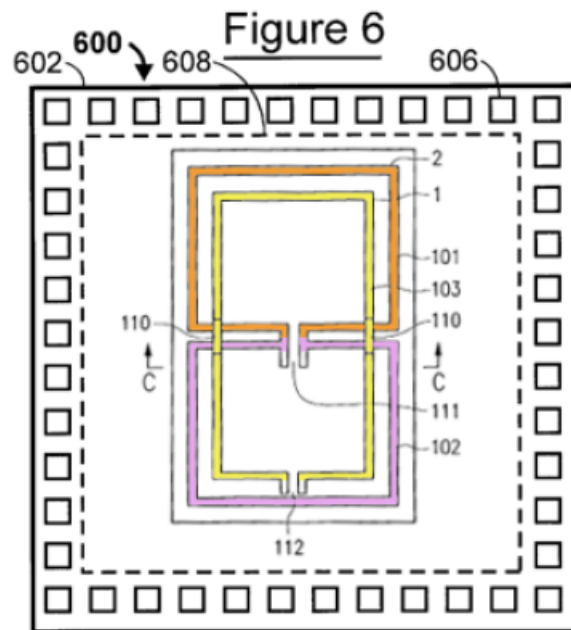
Taniguchi, Figure 8D (annotated/rotated); Rostoker, Figure 7B



Taniguchi, Figure 10D (annotated/rotated); Rostoker, Figure 7B

Id. at 55. Referring to the above combination, Petitioner argues that one of ordinary skill would have implemented Taniguchi's antenna/inductor (red) in a second metallization layer and Taniguchi's antenna/inductor 2 (yellow) in a first metallization layer with an insulating layer separating the two metallization layers. *Id.* at 55 (citing Ex. 1003 ¶ 201; Ex. 1005, Figs. 8D, 10D; Ex. 1006, Fig. 7B).

Petitioner also argues that one of ordinary skill would have implemented Taniguchi's Figure 7 embodiment using Rostoker's teachings of forming multiple antennas on the same plane, as shown in Petitioner's figure reproduced below.



Excerpts of Annotated Taniguchi, Figure 7B superimposed on Rostoker, Figure 6

Pet. 55–56. Petitioner explains that the above figure superimposes the antenna layout of Taniguchi's Figure 7B on the central area of Rostoker's Figure 6. *Id.*

Petitioner argues that one of ordinary skill would have pursued the above combination because Taniguchi states that one of its goals is “mak[ing] a data communication apparatus which is **small-sized**, lightweight and high in performance,” and “teaches use in alternative applications including ‘electronic coupon ticket systems.’” Pet. 56 (citing Ex. 1005 ¶¶ 1–2, 22, 86, 95; Ex. 1003 ¶ 203). Petitioner also points to Taniguchi's statement that the substrate need not be a printed circuit board

but instead “can be formed of an insulating film and an insulating material.” *Id.* at 58 (citing Ex. 1005 ¶ 86; Ex. 1003 ¶ 207).

Petitioner also argues that Rostoker suggests the combination because it teaches that a need exists in system having low power (range) requirements “to have an antenna structure integrated onto single semiconductor devices,” and “[n]on-contact identification systems using inductive coupling, like Taniguchi, were known to have low read/write ranges (e.g., less than 1 m).” Pet. 57. Petitioner further argues that Rostoker describes and incorporates by reference both U.S. Patent No. 5,345,231 to Koo (“Koo”) and U.S. Patent No. 4,724,427 to Carroll (“Carroll”), which are “directed to non-contact identification systems with one or more antennas integrated on a chip.” *Id.* (citing Ex. 1022, 1:6–32, 3:50–56, Fig. 7; Ex. 1028, 11:7–22).

Relying on the testimony of Dr. Tentzeris, Petitioner argues that, in light of these disclosures, the proposed combination is merely the application of a known technique (Rostoker’s forming antennas in metallization layers on a chip substrate) to a known device (Taniguchi’s antennas) ready for improvement to yield predictable results. Pet. 58 (citing Ex. 1003 ¶ 208). Specifically, according to Petitioner, “Taniguchi discloses a ‘base’ device with antennas formed on opposite sides or the same side of an insulating layer,” and one of ordinary skill “would have considered forming the stacked antennas in metallization layers of an IC chip substrate or on the surface of an IC substrate as an ‘improvement’ because it would have reduced the size of the interrogator, solving the known problem of making smaller form-factor devices, as Taniguchi seeks to do.” *Id.* at 58–59.

Petitioner also argues that the Taniguchi-Rostoker combination “represent[s] a straightforward and predictable substitution of one known element for another,” because one of ordinary skill “would have substituted Taniguchi’s PCB manufacturing technique with Rostoker’s semiconductor manufacturing technique to implement Taniguchi’s layouts.” Pet. 59 (citing Ex. 1003 ¶ 209). According to Petitioner, these techniques overlap, because “Taniguchi teaches forming antennas/inductors on two planes separated by an insulation layer” and “Rostoker similarly teaches forming antennas on metallization layers separated by an insulating layer.” *Id.* (citing Ex. 1005 ¶¶ 55, 77, 86; Ex. 1006, 10:23–29, Figure 7B).

Finally, relying on Dr. Tentzeris, Petitioner argues that one of ordinary skill “would have had a reasonable expectation of success of integrating Taniguchi’s antennas/inductors onto Rostoker’s chip and the results of the combinations would have been predictable.” Pet. 59 (citing Ex. 1003 ¶ 210). Petitioner asserts that “Rostoker describes fabrication of multiple antennas of various types on a chip using ‘well-known’ IC manufacturing processes,” and one of ordinary skill “would have understood that Rostoker would be used for its intended purpose when fabricating Taniguchi’s antennas.” *Id.* at 59–60 (citing Ex. 1006, 10:16-22; Ex. 1003 ¶ 210). According to Petitioner, “[i]t was known in the prior art how to fabricate antennas (including loops) on a single chip for various applications including non-contact identification applications, like that described in Taniguchi.” *Id.* at 60 (citing Ex. 1025, Abstract, 5:33–45, 8:48–49; Ex. 1022, 1:6–32, 3:50–56; Ex. 1029, Figs. 1, 3, 5:36–38).

Patent Owner disagrees, arguing that one of ordinary skill would have had no motivation to combine Taniguchi and Rostoker, and that Rostoker

discloses antennas, not inductors, on its integrated circuit. PO Resp. 46–54. Patent Owner argues that “Taniguchi teaches antennas on a PCB but does not state that its teachings apply to semiconductor chips,” and “Rostoker teaches antennas on IC chips but does not state that its teachings apply to PCBs.” *Id.* at 46–47. Patent Owner also argues that particular aspects of Rostoker’s design teach away from the combination, including: (1) the use of a shield to block antenna signals; (2) filling the loop with a core of ferrite to increase magnetic flux; (3) moving the location of the antenna from the periphery to the interior to avoid interfering with pinouts; and (4) locating both a transmit and receive antenna on the same chip. *Id.* at 47. Patent Owner further argues that Rostoker’s antenna coils are formed in spiral or O-shaped configurations, rather than a figure 8 configuration. *Id.* at 48.

Patent Owner also argues that one of ordinary skill would not have had a reasonable expectation of success in combining Taniguchi and Rostoker. PO Resp. 49. Patent Owner argues that Rostoker and other references describing inductors on a semiconductor die taught spiral or O-shaped inductors rather than inductors formed from a pair of loops. *Id.* Patent Owner also argues that Rostoker’s spiral antennas do not have terminals that are “closely spaced,” and that placing the terminals more closely together could cause issues, such as noise, capacitance, and complexity of conductive traces. *Id.* at 49–50 (citing Ex. 1001, 10:31–33, 8:37).

Petitioner responds that Patent Owner’s arguments directed at the particular configuration of Rostoker’s antennas are irrelevant because Petitioner’s combination uses Taniguchi’s antennas on Rostoker’s chip. Pet. Reply 21. Petitioner also argues that Rostoker’s loop antennas are inductors,

and are integrated on a chip. *Id.* Finally, Petitioner argues that Patent Owner’s reasonable-expectation-of-success argument lacks merit because Patent Owner fails to explain why a figure 8-shaped antenna presents any special challenge for integrating onto a chip. *Id.* at 22–23.

After considering the full trial record, we find that the weight of the evidence supports the conclusion that one of ordinary skill would have found it obvious to combine Taniguchi and Rostoker. As discussed above, we agree with Petitioner that the field of endeavor of the ’430 patent is inductor design, and we also agree that Rostoker (as well as Taniguchi) is in this field. *See* § II.D.1(a), *supra*; Pet. Reply 6–9. Additionally, as discussed previously in Section II.D.1(a), we find that Taniguchi’s loop antennas are inductors, and find the same for the loop antennas of Rostoker. *See* § II.D.1(a), *supra*; Pet. 6–11; Ex. 1003 ¶¶ 85–93; Ex. 1043 ¶¶ 38–48; Ex. 1006, Abstract, 8:64–9:42, 10:9–46. Patent Owner does not dispute that Rostoker’s loop antennas are integrated on a semiconductor chip. PO Resp. 53 (“Rostoker discloses antennas[] . . . on an IC”).

We find that Petitioner has sufficiently shown that one of ordinary skill would have been motivated to combine Taniguchi and Rostoker as Petitioner proposes. Petitioner sets forth sufficient argument and evidence, including the disclosures of Taniguchi and Rostoker and the testimony of Dr. Tentzeris, to support its obviousness arguments, and we adopt those arguments and evidence here. *See* Pet. 54–60; Pet. Reply 21–23; Ex. 1003 ¶¶ 201–210; Ex. 1043 ¶¶ 49–54. In particular, we agree with Petitioner that Taniguchi teaches that it is advantageous to make its device “small-sized” and form it on a substrate other than a printed circuit board, and Rostoker suggests integrating antennas/inductors for low power systems (such as

Taniguchi) on a semiconductor chip. Pet. 56–58; Ex. 1005 ¶¶ 1–2, 22, 86, 95; Ex. 1006, 1:10–14; Ex. 1003 ¶¶ 203, 206–207; Ex. 1012, 22–23, 26–27. We also find persuasive the fact that Rostoker describes and incorporates by reference the Koo and Carroll patents, which are directed to non-contact identification systems with one or more antennas integrated on a chip. Ex. 1006, 1:34–54; Ex. 1022, 1:6–32, 3:50–56, Fig. 7; Ex. 1028, 11:7–22; Ex. 1003 ¶ 206; Pet. 57.

Based on this evidence, we agree with Petitioner that the proposed combination is merely the application of a known technique (Rostoker’s forming antennas in metallization layers on a chip substrate) to a known device (Taniguchi’s concentric antennas) ready for improvement to yield predictable results. Pet. 58–59; Ex. 1003 ¶ 208. We also agree with Petitioner that the Taniguchi-Rostoker combination represents a straightforward and predictable substitution of one known element for another because one of ordinary skill would have substituted Taniguchi’s PCB manufacturing technique with Rostoker’s semiconductor manufacturing technique to implement Taniguchi’s layouts. Pet. 59; Ex. 1003 ¶ 209. Additionally, we agree with Petitioner that one of ordinary skill would have had a reasonable expectation of success in integrating Taniguchi’s antennas/inductors onto Rostoker’s chip because forming loop antennas on a chip was a well-known integrated circuit manufacturing process. Pet. 59–60; Ex. 1003 ¶ 210; Ex. 1006, 10:16–22; *see also* Ex. 1025, Abstract, 5:33–45, 8:48–49; Ex. 1022, 1:6–32, 3:50–56; Ex. 1029, Figs. 1, 3, 5:36–38.

We do not agree with Patent Owner’s arguments to the contrary. In arguing that Taniguchi does not teach antennas on a semiconductor chip and

Rostoker does not teach antennas on a printed circuit board, Patent Owner appears to address the references individually, rather than Petitioner's combination. *See* PO Resp. 46–47. Patent Owner's arguments that Rostoker's antenna design and configuration teaches away from the Taniguchi-Rostoker combination (PO Resp. 47) is not persuasive because Petitioner relies on Taniguchi's antennas in the combination, not Rostoker's antennas or antenna design. Pet. 60–62; Pet Reply 21. Petitioner relies on Rostoker for its teaching of fabricating antennas on a semiconductor chip, not for the shape and design of the antennas themselves. *Id.* Moreover, we do not see anything in the portions of Rostoker cited by Patent Owner that would discourage or disparage the use of figure 8 loop antennas like those in Taniguchi. PO Resp. 47–48; Ex. 1006, 4:14–21, 6:33–35, Figs. 2, 6.

We also are not persuaded by Patent Owner's argument that one of ordinary skill would not have had a reasonable expectation of success in combining Taniguchi and Rostoker as Petitioner proposes. *See* PO Resp. 49. Patent Owner argues that Rostoker and other prior art taught spiral or O-shaped inductors, but does not explain why one of ordinary skill in the art would have had difficulty implementing figure 8 inductors like those of Taniguchi on a semiconductor chip like Rostoker's. *Id.* Dr. Tentzeris testifies that, prior to the '430 patent, it was known in the art to fabricate loop antennas on a single chip for various applications, and we find this testimony credible. Ex. 1003 ¶ 210. Additionally, although Patent Owner and Dr. Prucnal state that more spacing between two terminals on the antenna “may be prudent . . . to address problems with noise, capacitance, and complexity of conductive trances,” and that signal lines on a chip “may” have to be shielded from each other, neither Patent Owner nor Dr. Prucnal

explain with any specificity why this would have posed a technical obstacle to implementing Taniguchi's inductors with closely spaced terminals on a semiconductor chip like Rostoker's. PO Resp. 51; Ex. 2002 ¶ 80.

Consequently, we find that Petitioner has sufficiently proven that one of ordinary skill would have been motivated to combine Taniguchi and Rostoker as Petitioner proposes. The parties' arguments as to the remaining limitations of claims 2 and 11 are similar to those discussed in Ground 1 for claims 1 and 11, and we find Petitioner's arguments persuasive for the reasons explained above with respect to Ground 1. *See* § II.D.1, *supra*.

2. Dependent Claims 8, 12–15, and 17–19

Petitioner asserts that Taniguchi and Rostoker render obvious the limitations of dependent claims 8, 12–15, and 17–19. Pet. 62–65. Patent Owner does not present arguments specifically directed to these dependent claims in this ground. PO Resp. 53–54. We have reviewed the arguments and evidence provided and conclude that Petitioner has met its burden to show, by a preponderance of the evidence, that claims 8, 12–15, and 17–19 would have been obvious over Taniguchi and Rostoker.

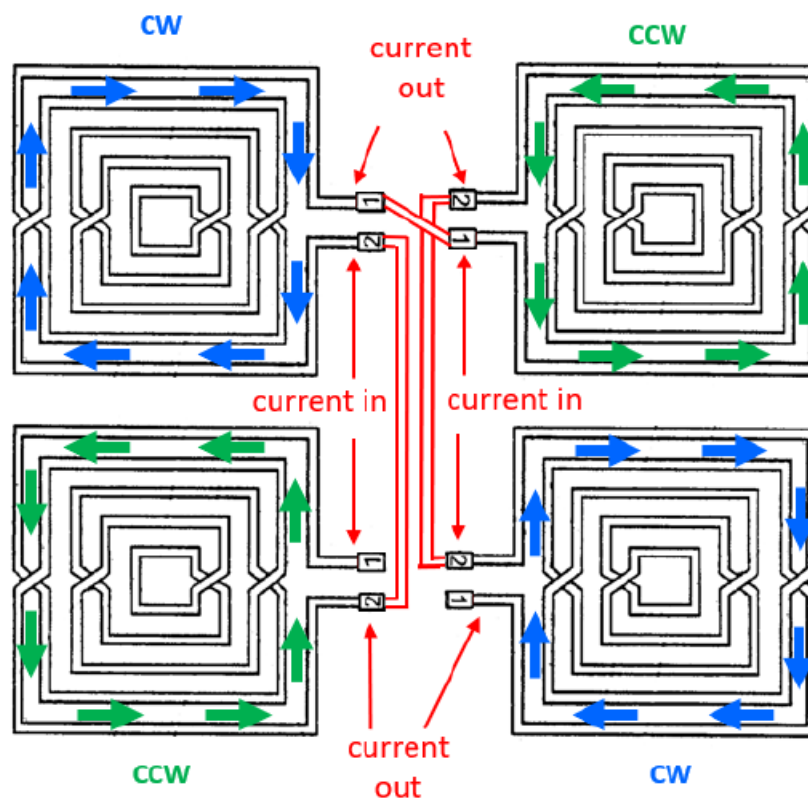
F. Grounds 5 and 6: Obviousness Based on Taniguchi and Brooks (Ground 5) and Taniguchi, Rostoker, and Brooks (Ground 6)

Petitioner presents Grounds 5 and 6, in the event the Board finds that Grounds 1 and 2 “do not disclose ‘closely spaced’ or ‘minimizing magnetic field contributions from the terminals’” of claims 1 and 11. Pet. 104. Because we find that Grounds 1 and 2 teach these limitations, we also find that they are taught by Grounds 5 and 6, which include the same references and arguments as Grounds 1 and 2.

G. Midya-Based Grounds (Grounds 3, 4, 7, and 8)

The parties dispute numerous issues concerning Petitioner’s Midya-based Grounds. However, as discussed below, we find that Petitioner’s Grounds are deficient because they fail to sufficiently show that the proposed combinations teach or make obvious “two closely spaced terminals connected to the first loop for supplying electrical current to the first and second loops while minimizing magnetic field contributions from the terminals,” as recited in claim 1, and the similar limitation recited in claim 11. This issue is dispositive of these Grounds.

Petitioner combines Midya and Raghavan to form the combination set forth in Petitioner’s figure below:



Midya-Raghavan Combination

Pet. 71. In this combination, as shown in the figure above, the inductor includes four loops, each with two terminals, one in which the current goes into the loop, and the other in which the current goes out of the loop. *Id.* at 69–71.

Claim 1 of the '430 patent requires a “first inductor comprising . . . two closely spaced terminals connected to the first loop for supplying electrical current to the first and second loops,” and claim 11 includes a comparable limitation. By its plain language, this limitation requires that the “two closely spaced terminals” of *the first inductor* (i.e., the inductor as a whole) are connected to “the first loop,” not merely that two terminals of a particular loop of the first inductor are closely spaced. In Petitioner’s combination, the “first inductor” includes all four of the loops, as shown in Petitioner’s figure above. As Patent Owner points out, in the above figure, the two terminals of *the first inductor* are terminal 1 of the lower left hand loop (where the current enters the inductor) and terminal 1 of the lower right hand loop (where the current exits the inductor). *See* Pet. Sur-reply 24. Therefore, the two terminals of *the first inductor* in Petitioner’s combination are not attached to the same first loop of the inductor; instead, one terminal of the inductor is connected to one loop of the inductor and the second terminal of the inductor is connected to a different loop of the inductor.

Consequently, Petitioner has failed to demonstrate that the combination of Midya and Raghavan teaches claims 1 and 11 of the '430 patent. Petitioner’s arguments for the remaining claims and grounds based on Midya and Raghavan do not cure this deficiency, and also fail on this basis. *See* Pet. 94–106.

H. Patent Owner's Motion to Exclude

Patent Owner filed a motion to exclude portions of Dr. Tentzeris's Reply Declaration discussing simulations performed on various conducting loops, such as figure-8 shaped and rectangular-shaped loops, as well as on closely spaced current-carrying wires. Paper 28 (Mot.); *see* Ex. 1043 ¶¶ 6–36 (the “Simulation Evidence”). Patent Owner argues that Petitioner did not submit the Simulation Evidence with the Petition, and that this evidence exceeds the bounds of the arguments presented in the Patent Owner Response. Paper 28, 1, 4–6.

We disagree that the Simulation Evidence is improper. As discussed previously in Section II.D.1(c), Dr. Tentzeris's simulations expand on and further support the argument in the Petition that Taniguchi's first inductor has a “reduced far field” and that the mutual electromagnetic coupling between the first and second inductors is reduced as a result of the first inductor's reduced far field. *See* Pet. 14–16, 32–36. The simulations also directly respond to our suggestion in the Institution Decision that, “[t]o the extent the parties' declarants disagree regarding what a person of ordinary skill would have understood regarding the characteristics of the EM fields emanating from Taniguchi's loop structure, the parties are encouraged to develop the record during trial.” Inst. Dec. 19. The Simulation Evidence provides additional information about the characteristics of the EM fields emanating from Taniguchi's loop structure and supports Dr. Tentzeris's opinions about what one of ordinary skill would have understood about those characteristics. Additionally, the Simulation Evidence constitutes a permissible response to Patent Owner's arguments that Taniguchi fails to disclose the “reduced far field” limitation, and Patent Owner's argument that

Taniguchi's concentric inductors do not have a reduced mutual electromagnetic coupling between the first and second inductors. *See* PO Resp. 38–40, 42, 44–45. Moreover, Patent Owner had the opportunity to Dr. Tentzeris on his simulations or request authorization to submit a response. *See* Tr. 63:20–22.

For these reasons, Patent Owner's Motion to Exclude is denied.

III. CONCLUSION¹¹

The outcome for the challenged claims of this Final Written Decision follows. In summary:

Claim(s)	35 U.S.C. §	Reference(s) /Basis	Claim(s) Shown Unpatentable	Claim(s) Not Shown Unpatentable
1, 3–5, 7, 10, 11, 13–15, 17, 19	103(a)	Taniguchi	1, 3–5, 7, 10, 11, 13–15, 17, 19	
2, 8, 11, 12–15, 17–19	103(a)	Taniguchi, Rostoker	2, 8, 11, 12– 15, 17–19	
1, 3–6, 9, 11–16	103(a)	Midya, Raghavan		1, 3–6, 9, 11– 16
2, 11–16	103(a)	Midya, Raghavan, Gardner		2, 11–16
1, 3–5, 7, 10, 11, 13–15, 17, 19	103(a)	Taniguchi, Brooks	1, 3–5, 7, 10, 11, 13–15, 17, 19	
2, 8, 11, 12–15, 17–19	103(a)	Taniguchi, Rostoker, Brooks	2, 8, 11, 12– 15, 17–19	
1, 3–6, 9, 11–16	103(a)	Midya, Raghavan, Brooks		1, 3–6, 9, 11– 16
2, 11–16	103(a)	Midya, Raghavan, Gardner, Brooks		2, 11–16
Overall Outcome			1–5, 7, 8, 10, 11, 12–15, 17–19	6, 9, 16

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

ORDER

Accordingly, it is:

ORDERED that claims 1–5, 7, 8, 10, 11, 12–15, and 17–19 of the '430 patent have been shown to be unpatentable and claims 6, 9, and 16 of the '430 patent have not been shown to be unpatentable;

FURTHER ORDERED that Patent Owner's Motion to Exclude is denied; and

FURTHER ORDERED that, because this is a Final Written Decision, the 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.

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).

IPR2024-00728
Patent 7,151,430 B2

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