

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

INTEL CORPORATION,

Petitioner

v.

TELEFONAKTIEBOLAGET L M ERICSSON (publ),

Patent Owner.

Case No. IPR2024-00728

Patent No. 7,151,430 B2

Before Daveina B. Williams, *Trial Paralegal*

PATENT OWNER'S PRELIMINARY RESPONSE

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EXHIBIT LIST

Petitioner Exhibits

Ex. No.	Description
1001	US 7,151,430 Mattsson
1002	File History of US 7,151,430
1003	Declaration of Tentzeris
1005	US PUB 20030063034 A1 Taniguchi
1006	US 6,373,447 Rostoker
1007	PCT WO 9805048 Midya
1008	US PUB 20050077992 A1 Raghavan
1009	US PUB 2001/0030591 Gardner
1010	“Signal Integrity Issues and Printed Circuit Board Design” to Brooks
1017	WO 2004/0122213 Enzinger
1023	US 6,137,447 to Saitoh

Patent Owner Exhibits

Ex. No.	Description
2001	Statutory Disclaimer of claims 20 & 21 of U.S. Patent 7,151,430
2002	Declaration of Dr. Paul Prucnal In Support of Patent Owner Preliminary Response
2003	US 6,512,422 Dufour
2004	US 6,664,606 Estes
2005	US 6,891,444 Jacobson
2006	US 6,894,598 Heima
2007	WO 2003/084295 Bhailis
2008	US 6,194,987 Zhou

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I. INTRODUCTION

Patent Owner TELEFONAKTIEBOLAGET L M ERICSSON (publ) (“Ericsson”) submits its Preliminary Response to the Petition for *Inter Partes* Review (“Petition”) filed by Petitioner Intel Corporation (“Intel”). Intel challenges Claims 1-21 (“Challenged Claims”) of U.S. Patent 7,151,430 B2 (“‘430 Patent”), titled “METHOD OF AND INDUCTOR LAYOUT FOR REDUCED VCO COUPLING” and issued on December 19, 2006.

Ericsson maintains that claims 1-21 are patentable. To streamline this proceeding, pursuant to 35 U.S.C. § 253(a) and 37 C.F.R. § 1.321(a), Ericsson statutorily disclaimed claims 20 & 21. EX2001. The disclaimer does not affect remaining claims 1-19. *Consolidated Trial Practice Guide*, p. 52; *Vectra Fitness, Inc. v. TNWK Corp.*, 162 F.3d 1379, 1383 (Fed. Cir. 1998).

The Petition identifies eight Grounds against the Challenged Claims under 35 U.S.C. § 103 based on multiple references. PAPER 2 at 2. The cited references, alone or in combination, do not disclose or render obvious all the limitations of the Challenged Claims. Intel fails to show a reasonable likelihood that it would prevail on any of the Grounds asserted. Ericsson respectfully requests the Board deny institution.

II. SUMMARY OF ARGUMENT

The inventor of the ‘430 Patent sought to solve the problem of undesired altering of a signal generated by a circuit on a semiconductor chip due to mutual magnetic coupling between an inductor of the circuit and an inductor of another circuit on the same semiconductor chip. The ‘430 Patent discloses and claims an inductor design for reducing electromagnetic field coupling between inductors of voltage-controlled oscillators (“VCO”) resonators and a method for implementing the same on a single semiconductor chip. EX2002, VI(26).

The Petition identifies eight grounds, four relying on Taniguchi (EX1005) as the primary reference and four relying on Midya (EX1007) as the primary reference. Intel relies on Taniguchi as the primary reference for Grounds 1-2, 5-6. PAPER 2, pp. 2-53, 54-64, and 104-106. Taniguchi is not from “the same field of endeavor” as the ‘430 patent and is not “reasonably pertinent to the particular problem” the inventor sought to solve. *Innovention Toys, LLC v. MGA Entm’t, Inc.*, 637 F.3d 1314, 1321 (Fed. Cir. 2011) (citing *In re Brigio*, 381 F.3d 1320, 1325 (Fed. Cir. 2004)). Taniguchi is directed to antennas about one (1) meter long. EX2002, VII(27). The antennas are used in retail establishments as antitheft tools. EX1005 at [0084]. Taniguchi is not directed to inductors used on semiconductor chips having dimensions measured in microns. EX2002, VII(27).

Taniguchi is not reasonably pertinent to the particular problem the inventor of the '430 patent solved. Taniguchi is directed to solving the problem of too little mutual magnetic coupling between antennas in a retail setting. EX1005 at [0019-0020]. Taniguchi is not directed to solving the problem of too much mutual magnetic coupling between inductors on a semiconductor chip. EX2002, VII(28).

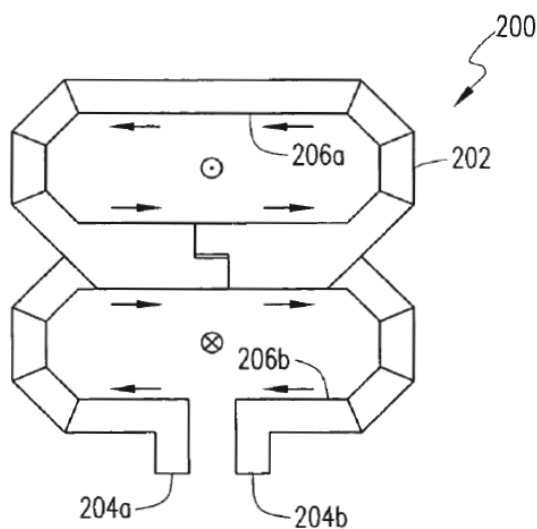
Taniguchi is less material than the references of record during prosecution of the '430 patent. *FMC Corp. v. Manitowoc Co.*, 835 F.2d 1411, 1415, (Fed. Cir. 1987) (holding that “prior art or information was not material . . . because it is less pertinent than or merely cumulative with prior art or information cited to or by the PTO”); 37 C.F.R. § 1.56(b) (1992) (“information is material to patentability when it is not cumulative to information already of record or being made of record in the application”).

Intel relies on Midya as the primary reference for Grounds 3, 4, 7 & 8. PAPER 2 at pp. 2, 65-101, 101-104, and 104-106. Midya discloses inductors implemented on a printed circuit board that are orders of magnitude larger than inductors implemented on a semiconductor chip. EX2002, XI(P)(89). During prosecution of the '430 patent, the USPTO considered Midya and allowed the Challenged Claims over Midya.

III. THE '430 PATENT

The '430 Patent describes the invention as “An inductor design for reducing mutual EM coupling between VCO (voltage-controlled oscillator) resonators and a method of implementing the same on a single semiconductor chip.” EX1001, 1:59-61. The inductors are structured and positioned so that the resulting magnetic fields tend to cancel each other by virtue of symmetry. *Id.*, 1:62-66. Two inductors may be positioned near each other and oriented so that the induced current in the second inductor due to the magnetic field from the first inductor is significantly reduced. *Id.*, 1:66-2:2.

FIG. 2 of the '430 Patent shows inductor 200. *Id.* at 4:5.

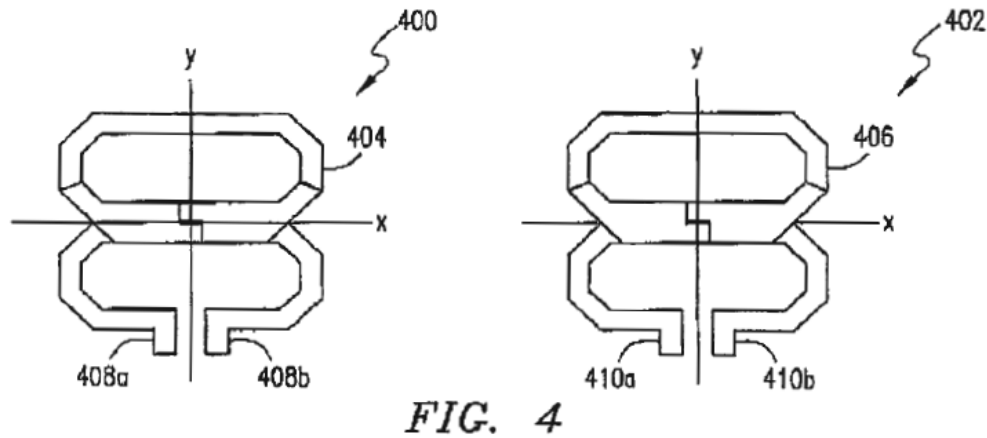


The inductor 200 has an inductor coil 202 and terminals 204a and 204b designed substantially symmetrical about a horizontal axis X. *Id.*, 4:5-8. The inductor coil

202 is a single-turn figure-8-shaped structure with an upper loop 206a and a lower loop 206b. *Id.*, 4:8-10. 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 the direction in which the current in the lower loop 206b (*e.g.*, clockwise) travels. *Id.*, 4:10-14.

The EM (electromagnetic) 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. *Id.*, 4:14-17. The directions of the EM field components are indicated by conventional notation in the middle of each loop 206a and 206b. *Id.*, FIG. 2 & 4:17-19. The inductor 200 has a significantly reduced far field at a certain distance from the inductor coil 202. *Id.*, 4:19-21. 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. *Id.*, 4:22-25. But perfect symmetry between the two loops 206a and 206b may be difficult to achieve given the presence of the terminals 204a and 204b. *Id.*, 4:25-27.

Referring to FIG. 4 of the '430 Patent, each individual inductor 400 and 402 has a reduced far field by virtue of the figure-8-shaped inductor coil 404 and 406, as explained with respect to FIG. 2. *Id.*, 5:4-7.



There is also a reduction in the mutual coupling between inductors 400 and 402.

Id., 5:7-8. 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. *Id.*, 5:8-11. The combined effect of the two inductors upon each other provides the desired coupling reduction. *Id.*, 5:11-13.

Table 1 (reproduced below) shows a summary of the simulation results for the mutual coupling between different coil shapes and orientations for two inductors at a center distance of 1 mm. *Id.*, 6:58-61. In Table 1, the notation “8_shape_90” represents a figure-8 shaped inductor that has been rotated 90 degrees, and the notation “8_shape_-90” represents a figure-8 shaped inductor that has been rotated by -90 degrees, “Q1” is the Q-factor for the Inductor 1, “Att” is the attenuation of the mutual EM coupling between the two inductors, and k is the estimated coupling coefficient. *Id.*, 6:61-67.

TABLE 1

Inductor 1	Inductor 2	L1 [nH]	Q1	Gvdd [dB]	Att [dB]	K
O-shape	O-shape	0.841	16.93	-54.0	reference	0.002077
8-shape	O-shape	1.216	15.20	-75.6	21.6	0.000173
8-shape_90	O-shape	1.218	15.63	-74.9	20.9	0.000187
8-shape	8-shape	1.216	15.84	-86.5	32.5	0.000049
8-shape_90	8-shape	1.216	15.19	-89.7	35.7	0.000034
8-shape_90	8-shape_-90	1.217	15.69	-92.8	38.8	0.000024

Id., 7:1-12.

Making one of the inductors figure-8-shaped reduced the mutual coupling by up to 20 dB. *Id.*, 7:13-14. Making both inductors figure-8-shaped improved the isolation by up to 30 dB. *Id.*, 7:15-16. Making both inductors figure-8-shaped and rotating them by 90 degrees in opposite directions improved the isolation nearly 40 dB. *Id.*, 7:16-18.

The '430 Patent has two independent claims 1 and 11. *Id.*, 10:12-31 and at 10:61-11:15. Claim 1 is directed to an inductor layout. *Id.*, 10:11. Claims 2-10 depend from claim 1. *Id.*, 10:32-60. Claim 11 is directed to a method of reducing mutual electromagnetic coupling between a first inductor and a second inductor on a semiconductor die. *Id.*, 10:61-63. Claims 12-19 depend from claim 11. *Id.*, 11:16 – 12:14. Ericsson disclaimed claims 20-21. EX2001.

IV. PRIOR ART

A. Taniguchi (EX1005)

Taniguchi does not relate to an inductor layout or to first and second inductors on a semiconductor die. EX2002, VII(27). Taniguchi relates to a radio guidance antenna, a data communication method, and a non-contact data communication apparatus, which make use of such an antenna, and to a radio guidance antenna for use in non-contact identification apparatus such as physical distribution systems, electronic coupon ticket systems, shop-lifting prevention systems, and the like, a data communication method, and a non-contact data communication apparatus. EX1005, [0001], [0084]. The antenna, which may be housed in an antenna gate, has dimensions measured in meters or a large fraction of a meter. EX2002 at VII(27).

Taniguchi is less material than the references of record during prosecution of the '430 patent. EX2002, VIII(29). For example, US 6,194,987 (Zhou), over which the patent examiner initially rejected the claims, disclosed an inductor (not an antenna) with counterpropagating currents in two loops such that the magnetic fields generated by the counterpropagating currents cancelled each other. EX2008. US 6,512,422 (Dufour) disclosed a method for reducing coupling between a VCO and external (to the VCO) magnetic interference by forming the VCO with two pairs of counterpropagating spiral inductors (not antennas), where the centers

between the pairs of inductors overlap so that the inductors appear to be symmetric from an external perspective. EX2003. US 6,664,606 (Estes) disclosed a method for orienting inductors (not antennas) to minimize electromagnetic coupling. EX2004. US 6,891,444 (Jacobsson) disclosed using mutual inductance, via a transformer-like structure, to magnetically couple inductors (not antennas) that are components of two different LC oscillators. EX2005. US 6,894,598 (Heima) disclosed an inductor (not an antenna) formed in multiple metal layers of a semiconductor and generating an inductor current that flows in opposite directions in each layer to reduce magnetic coupling between the inductor and the semiconductor substrate (not between two antennas). EX2006. WO 98/05048 (Midya) is directed to planar inductors (not antennas) for a printed circuit board. EX1007. WO 2003/084295 (Bhailis) is directed to a decoupling structure for reducing unwanted EM coupling between inductors (not antennas) on a printed circuit board. EX2007. Last, WO 2004/012213 (Enzinger) disclosed a figure-eight inductor (not an antenna) that generates opposing magnetic fields that cancel and reduce interference. EX1017.

Taniguchi's FIG. 3 (reproduced below) shows the first antenna 1 is divided into upper and lower halves by the antenna conductors 101, 102. EX1005, [0055]. The second antenna 2 is composed of an antenna conductor 103 formed on the same plane as, or a plane parallel to, the plane on which the first antenna 1 is

formed, but it is not connected to the first antenna 1. *Id.* The second antenna 2 is coupled in electromagnetic induction to the upper and lower halves of the first antenna 1 via regions S1 and S2. *Id.*

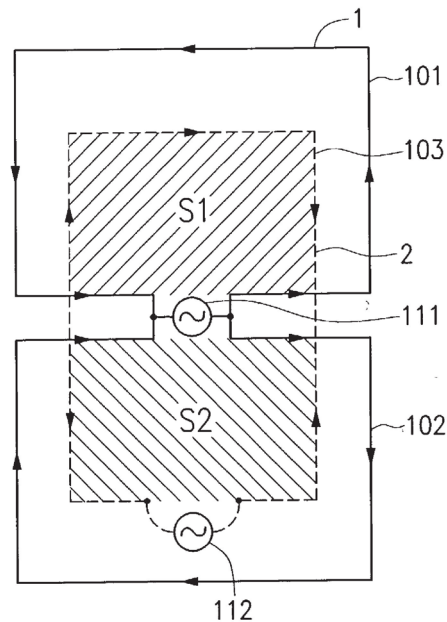
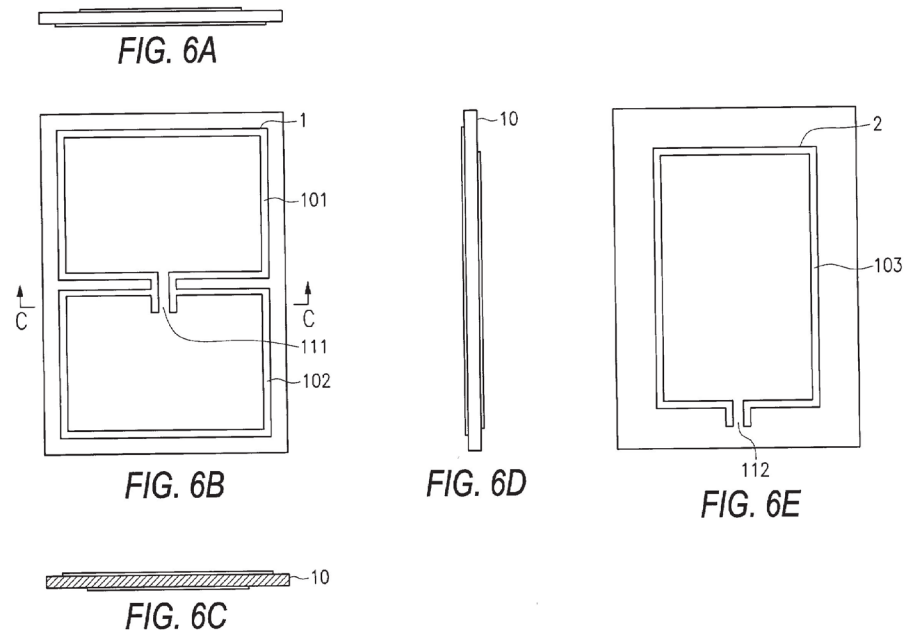


FIG. 3

In Taniguchi's FIGS. 6A to 6E (reproduced below), thin band-shaped antenna conductors 101, 102 are disposed on one of main surfaces of a plate-shaped insulation 10 in a rectangular configuration to form an antenna 1, and a feeding point 111 is provided at a connection of the antenna conductors 101, 102. EX1005, [0066]. A thin band-shaped antenna conductor 103 is disposed on the other of the main surfaces of the insulation 10 in a rectangular configuration to form an antenna 2, and a feeding point 112 is provided in a lower portion of the antenna. *Id.*, [0067].



B. Rostoker (EX1006)

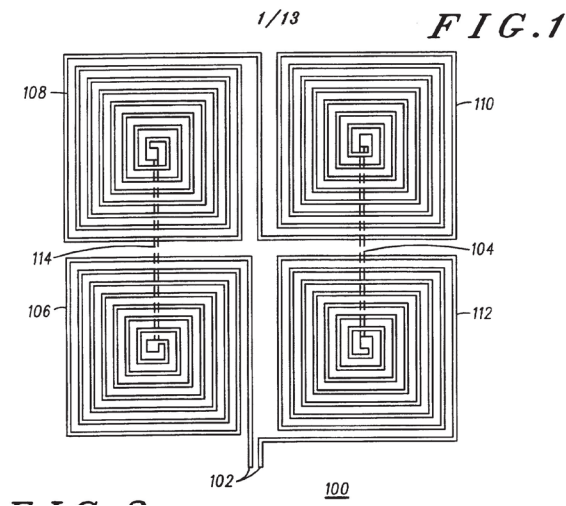
Rostoker relates to integrated circuit chips having an antenna formed thereon. EX1006, 1:5-7. Rostoker discloses antenna coils formed in conventional spiral or O-shaped configurations. *Id.*, FIGS. 2 & 6. Regarding inductors, Rostoker discloses only that inductors may be integrated on the chip along with antennas. *Id.*, 4:21-22, 14:1-3, 14:28-30. Therefore, Rostoker distinguishes inductors from antennas.

C. Midya (EX1007)

Midya discloses a planar magnetic field inductor/transformer. EX1007, Abstract. A plurality of at least three planar loops/spiral conductor coils are arranged one after another in a simple/compound loop fashion. *Id.* The loops carry

a current from a signal source. *Id.* The plurality of planar conductor coils is arranged to maximize cancellation of a moment of the plurality of conductor coils over a predetermined range. *Id.* Midya is directed to inductors implemented on a printed circuit board that are orders of magnitude larger than inductors implemented on a semiconductor chip. EX2002 XI(P)(89).

In Midya, electrical current is supplied to the four loops 106, 108, 110, and 112 by a combination of terminals, wires, and crossovers that are spaced far apart, and which create an additional loop.



The limitations in claims 1 and 11 of the '430 Patent, “two closely spaced terminals connected to the first loop” and “connecting two closely spaced terminals to the first loop,” prevent the problem evident from what Midya discloses.

EX2002, XI(P)(94); EX1007, 11:1-6. The USPTO considered Midya during

prosecution of the '430 Patent and allowed all of the Challenged Claims over Midya. EX1001, FOREIGN PATENT DOCUMENT WO 98/05048.

D. Raghavan (EX1008)

Raghavan discloses a substantially symmetric inductor comprising a plurality of windings, at least one conductor crossover, and a peripheral conductor disposed at the periphery of the plurality of windings, the plurality of windings having a generally symmetric shape, each of the plurality of windings having a center and being of a different size from other ones of the plurality of windings, the peripheral conductor being generally symmetric and having a center, the plurality of windings and the peripheral conductor being substantially concentric, the conductor crossovers being disposed such that the symmetry of the inductor is substantially preserved. EX1008, Abstract, FIG. 2 (below).

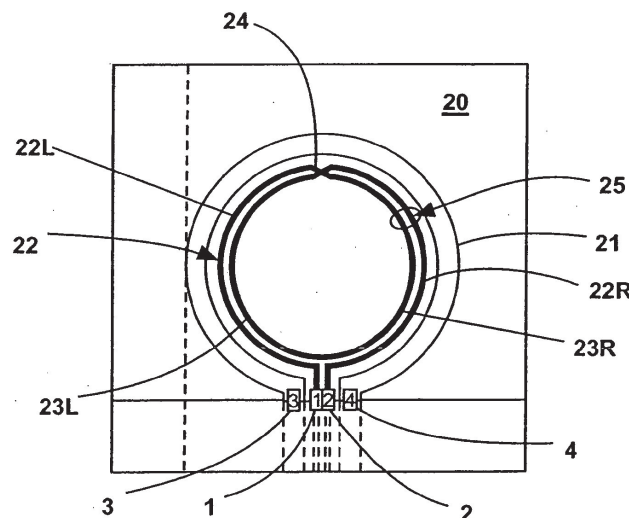


FIGURE 2

Raghavan also discloses a method of winding an inductor such that the inductor is substantially symmetric about a center of the inductor, whereby signal degradation due to asymmetry of the inductor is substantially minimized. *Id.*

E. Gardner (EX1009)

Gardner discloses an inductor comprising a substrate including a semiconductor material, a first dielectric layer over the substrate, a magnetic layer over the first dielectric layer, a second dielectric layer over the magnetic layer, and a conductor over the second dielectric layer. EX1009, Abstract.

F. Brooks (EX1010)

Brooks is limited to printed circuit board design and teaches forming a “twisted pair of wires” to move two wires closer together to reduce the EMI radiations emitted by the wires. EX2002, X(42) & XI(N)(82); EX1010, Part 1 of 10, p.1 and Part 5 of 10, p. 157. But Brooks also teaches that capacitively coupled crosstalk and inductively coupled crosstalk between traces on a printed circuit board increase the closer the traces are to one another and that a technique for reducing crosstalk is to “spread the traces further apart.” EX2002 at X(42) & XI(N)(82); EX1010, Part 6 of 10, p. 222. Consequently, a person of ordinary skill in the art (“POSITA”) would have understood, from Brooks, that for an inductor layout used in RF transceivers on a single semiconductor die at relatively high frequencies, there are problems with noise, capacitance, and complexity of the

conductive traces, such as crosstalk between the interconnect lines, the closer the interconnect lines are to each other, and that increased spacing, not reduced spacing, between the lines would have been prudent. EX2002, X(42) & XI(N)(82); EX1010 Part 6 of 10, p. 222. Indeed, before the priority date of the '430 Patent, CMOS technologies typically involved hundreds of layout design rules, including rules about minimum spacing, some designed to reduce crosstalk. EX2002, XI(N)(82).

V. CLAIM CONSTRUCTION

Patent claims shall be construed using the same claim construction standard 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; *see also Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (*en banc*).

VI. LEVEL OF ORDINARY SKILL

Ericsson disputes Intel's description of the qualifications of a POSITA. PAPER 2, Section III, p. 2-3. A POSITA 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 working in the wireless communications industry. EX2002, V(24).

VII. TANIGUCHI, ALONE OR IN COMBINATION WITH OTHER REFERENCES, DOES NOT DEMONSTRATE A REASONABLE LIKELIHOOD THAT AT LEAST ONE CHALLENGED CLAIM IS UNPATENTABLE.

Section VII discusses pertinent legal standards and then addresses Grounds 1, 2, 5 & 6 based on Taniguchi as the primary reference. Section VIII *supra* addresses Grounds 3, 4, 7 & 8 based on Midya as the primary reference.

A. Legal Standards

“The Director may not authorize an *inter partes* review to be instituted unless the Director determines that the information presented in the petition ... shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.” 35 U.S.C. § 314(a).

A claim is unpatentable under 35 U.S.C. § 103 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). The question of obviousness is resolved on the basis of underlying factual determinations, including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter

and the prior art; (3) the level of skill in the art; and (4) when in evidence, objective evidence of non-obviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17-18 (1966).

An obviousness determination based on a combination of references requires finding “both ‘that a skilled artisan would have been motivated to combine the teachings of the prior art references to achieve the claimed invention, and that the skilled artisan would have had a reasonable expectation of success in doing so.’” *KSR*, 550 U.S. at 418. An assertion of obviousness “cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *KSR*, 550 U.S. at 418; *In re NuVasive, Inc.*, 842 F.3d 1376, 1383 (Fed. Cir. 2016) (a finding of a motivation to combine “must be supported by a ‘reasoned explanation’” (citation omitted)).

“In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.” *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3)). This burden of persuasion never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) (discussing the burden of proof in *inter partes* review).

A reference qualifies as prior art for a determination under § 103 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.* (citing *In re Bigio*, 381 F.3d 1320, 1325 (Fed. Cir. 2004)). “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.* (citing *In re Clay*, 966 F.2d 656, 659 (Fed. Cir. 1991)). “If a reference disclosure has the same purpose as the claimed invention, the reference relates to the same problem, and that fact supports use of that reference in an obviousness rejection.” *Id.* Whether a prior art reference is “analogous” is a question of fact. *Id.*

B. Ground 1 (Claims 1, 3-5, 7, 10-11, 13-15, 17, 19, § 103 over Taniguchi)

Intel’s Petition focuses on Claim 20. PAPER 2, p. 5. Ericsson disclaimed claims 20 and 21. EX2001. Ericsson discusses limitations appearing in the inductor claims (1-10) and the method claims 11-19.

Claim 1 reads:¹

[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.

1. Taniguchi is non-analogous art that teaches away from the ‘430 Patent.

Because Taniguchi is not analogous to the claimed invention, it does not qualify as prior art for the purpose of determining whether the Challenged Claims

¹ Ericsson uses Intel’s nomenclature from the Independent Claim Appendix appended to the Petition.

of the '430 Patent are invalid under § 103. EX2002, VII(27-28), XI(46), *Innovention Toys*, 637 F.3d at 1321. Taniguchi is directed to a radio antenna system. EX1005, Abstract. It does not mention or teach a first “inductor,” a second “inductor,” or an inductor layout. EX2002, XI(46). Instead, it discloses a radio guidance antenna that includes antenna 1 and antenna 2. EX1005, FIGS. 6A-6E & 13A-13B, & [0081]. Taniguchi's antennas face each other as “gates” that detect the passing of a device that has an RFID tag. EX1005, FIGS. 13A-B & 15A-E, [0081], & [0084]. Taniguchi's antennas have dimensions on the order of a large fraction of a meter and greater than one meter. EX2002, VII(27-28). The RFID tags 201 and 202 that pass between the antenna gates 208 and 209 have coils 203 and 204. EX1005, FIG. 21 (reproduced below). The purpose of the antenna system in Taniguchi is to generate a strong enough electromagnetic field from the antennas to detect the tags at a distance from the antennas. EX1005, [0092].

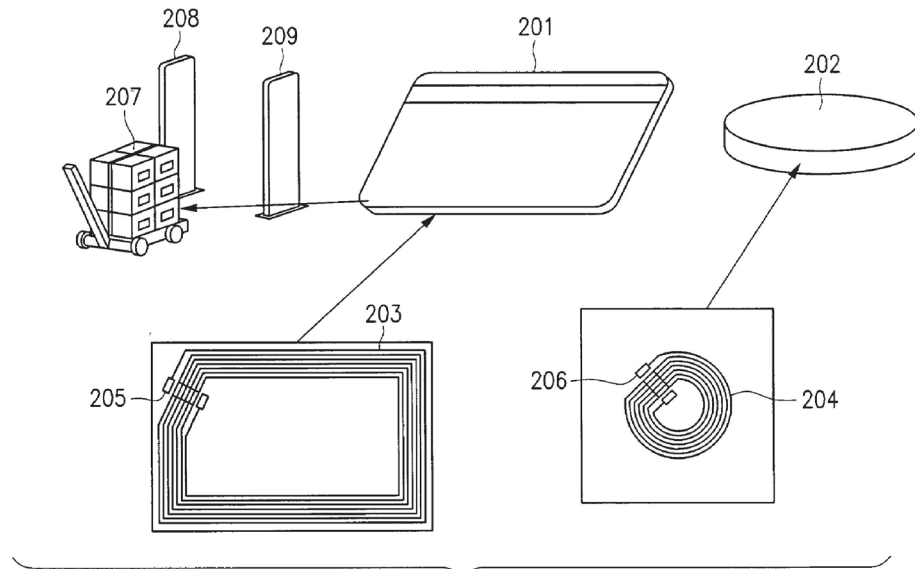


FIG. 21

EX1005, FIG. 21.

Such radio guidance antennas must ensure the magnetic-field intensity necessary for communication in all locations in a read area. EX1005, [0004]. Communication between a read and write device of the non-contact identification apparatus and the tags 201, 202 makes use of mutual inductance coupling between antennas for transmission and reception and loop antennas 203, 204 formed in the tags 201, 202. *Id.* That is why elements 1 and 2 in Taniguchi are always referred to as “antennas.” EX2002, XI(48-49). In contrast, the claimed inductors of the ‘430 Patent reduce mutual electromagnetic coupling between a first inductor and a second inductor (positioned at a predetermined distance from the first inductor) as a result of the first inductor having a reduced electromagnetic field. EX1001,

10:26-30 and 11:11-15. Therefore, the function of antennas 1 and 2 in Taniguchi is opposite to, and teaches away from, the claimed inductor layout of the ‘430 Patent. *Id.*; XI(49).

The Petition alleges a POSITA could substitute Taniguchi’s antennas for the inductors claimed in the ‘430 Patent. PAPER 2, pp. 31-32, 39. Taniguchi, viewed alone or in combination, would not have motivated a POSITA to substitute its radio guidance antenna, or any components thereof, for the claimed first or second inductors in the ‘430 Patent. EX2002, XI(52). Taniguchi teaches the radio guidance antennas promote, not reduce, electromagnetic coupling between radio guidance antennas or between a radio guidance antenna and another antenna. *Id.*; EX1005, FIGS. 14A – 14C, 20B, and 4.

Taniguchi would not have motivated a POSITA to substitute Taniguchi’s first antenna 1 for the claimed first inductor and Taniguchi’s second antenna 2 for the claimed second inductor in the ‘430 Patent. EX2002, XI(52). Taniguchi teaches a reduced coupling between first antenna 1 and second antenna 2 only when first and second antennas are aligned as shown, *e.g.*, in Taniguchi’s FIG. 3, and are on top of one another as shown, *e.g.*, in FIGS. 8A – 8E. *Id.*, (51 – 52); *see* EX1005, FIG. 3, FIGS. 8A – 8E, & [0057]-[0058]. Taniguchi would not have motivated a POSITA to substitute Taniguchi’s first antenna 1 for either or both the claimed first and second inductors. EX2002, XI(52); EX1005, FIG. 4, FIG. 5, & [0064]-[0065].

Taniguchi would not have motivated a POSITA to substitute its second antenna 2 for either or both the claimed first and second inductors. EX2002, XI(52); EX1005, FIG. 4, FIG. 5, & [0064]-[0065]. Taniguchi does not disclose or render obvious the coupling between two first antennas 1 spaced apart a predetermined distance or between two second antennas 2 spaced apart a predetermined distance. Taniguchi teaches away from using only antenna 1 and from using only antenna 2 because neither antenna 1 by itself nor antenna 2 by itself provides the desired level of coupling. EX2002, XI(52); EX1005, FIG. 4, FIG. 5, & [0064]-[0065].

Taniguchi is non-analogous art that teaches away from the inventions disclosed and claimed in the '430 Patent. *Innovention Toys*, 637 F.3d at 1321; EX2002, XI(46), XI(49), XI(52), & XI(F)(74). The Petition fails to establish a reasonable likelihood of success based on Taniguchi under § 103.

2. Taniguchi does not disclose or render obvious a first inductor having a reduced far field. [1A] and [11A]

Antenna 1 and antenna 2 of Taniguchi are not inductors designed for a semiconductor die. EX2002, XI(A)(55). The EM coupling between each antenna and the coils 203 and 204 in tags 201 and 202 is not reduced. *Id.* If a POSITA substituted the first antenna 1 of Taniguchi for the first inductor in the '430 Patent, the resulting device would not reduce the EM coupling as claimed in the '430 Patent. EX2002, XI(A)(57).

The first and second inductors in the '430 Patent have a different configuration, different function, and different results than Taniguchi's antennas 1 and 2. EX2002, XI(50). As shown in FIGS. 4-5, 6, 8, and 12 of the '430 Patent, the first and second inductors in the inductor layout on a semiconductor die 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 EM (electromagnetic) coupling between them. EX2002, XI(A)(69); EX1001, FIGS. 6, 8, 12, 6:60-61, 7:20-21, and 9:3-5.

In contrast, the non-contact identification apparatus in Taniguchi works because the second antenna is "arranged so that the sum of mutual inductances between it and the first antenna is minimized." EX2002, XI(A)(69); EX1005, [0057], [0058], [0061], and claims 1 and 8-10. This is accomplished because both of Taniguchi's antennas 1 and 2 are formed on the same plane or a parallel plane and must have their center points exactly coinciding and overlapping. EX2002, XI(A)(69); EX1005, FIGS. 6-10, 12, [0057], [0058], [0061], and claims 1 and 8-10. This complete overlap is the only way for Taniguchi's two antennas to be in close proximity without EM coupling with each other. EX2002, XI(A)(69). As shown in Taniguchi's Fig. 4, a tag 212 that is much further away than the antennas 1 and 2 are from one another "makes interlinkage with many lines of magnetic flux" from antenna 1. *Id.*

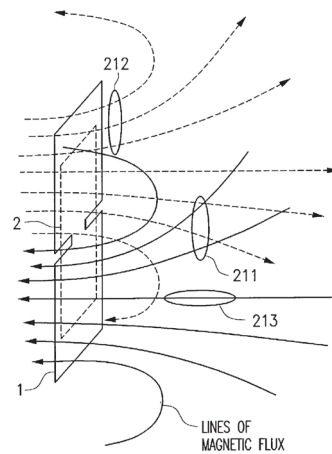


FIG. 4

FIGS. 14a-c show the electromagnetic fields from antennas 1 and 2 in the area between the two antenna gates (e.g., antenna gates 208 and 209 of Taniguchi's FIG. 21, *supra* VII(B)(1) is sufficiently strong to communicate with the tags. *Id.*; EX1005, [0083].

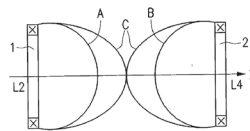


FIG. 14A

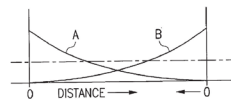


FIG. 14B

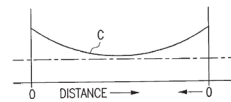


FIG. 14C

The Petition fails to establish that Taniguchi discloses or renders obvious the first and second inductor limitations of claims 1 and 11 in the '430 patent.

3. Taniguchi does not disclose or render obvious a second loop connected to first loop, having a substantially similar size and shape to the first loop, the second loop arranged such that a magnetic field emanating therefrom cancels the magnetic field emanating from the first loop. [1A2] and [11A2]

Taniguchi does not meet this claim element.

Taniguchi fails to show cancellation of the magnetic field emanating from the first antenna 1 at a predetermined distance away from the first antenna.

EX2002, XI(A)(60). Every embodiment of an antenna in the non-contact identification apparatus in Taniguchi provides the magnetic-field intensity necessary for mutual inductance coupling between antenna 1 and the coils 203, 204 in tags 201, 202. *Id.* For example, Taniguchi's FIG. 4 *supra* VII(B)(2)) shows a tag 211 that is relatively far away "makes interlinkage with many lines of magnetic flux" from antenna 1. *Id.* EX1005, [0064]. Similarly, Taniguchi's FIG. 14 (*supra* VII(B)(2)) shows electromagnetic field A emanating from antenna 1 in the area between the two gates is sufficiently strong to allow for communication with tags containing coils. EX2002, XI(A)(60); EX1005, [0083].

Furthermore, the opposing fields of Taniguchi's antenna 1 are not designed to cancel at a distance, but rather are designed to induce opposing currents in Taniguchi's antenna 2, which is concentric with antenna 1. EX2002, XI(A)(61);

EX1005, FIG. 3, [0015], [0019] - [0021], [0057], [0060], and [0095]. Taniguchi states that the opposing fields of antenna 1 inducing opposing currents in antenna 2 enables electric power to be efficiently converted to an electromagnetic field. EX2002, XI(A)(61); EX1005, [0095].

The Petition fails to establish obviousness of the second loop connected to first loop, having a substantially similar size and shape to the first loop, the second loop arranged such that a magnetic field emanating therefrom cancels the magnetic field emanating from the first loop limitations of claims 1 and 11 in the ‘430 patent.

4. Taniguchi does not disclose or render 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. [1B] and [11B]

Antenna 1 of Taniguchi is not an inductor. EX2002 at XI(A)(57). Therefore, the electromagnetic field at a certain distance from a first inductor is not reduced. *Id.* Although there is some space between the ends of antenna conductor 102 at feeding point 111 in Taniguchi’s FIG. 8B, EX2002, XI(A)(63), Taniguchi does not disclose or suggest that these ends are closely spaced or minimize the magnetic field contributions from these ends. *Id.* EX1005, FIG. 8; EX2002. Because the dimensions of Taniguchi’s radio guidance antenna are on the order of a large fraction of a meter, or one or more meters, the ends of Taniguchi’s antenna

conductor 102 at feeding point 111 are not closely spaced relative to the semiconductor-die/chip environment described in the '430 Patent. EX2002, XI(A)(64).

Furthermore, Taniguchi fails to disclose or suggest that the spacing between the ends of antenna conductor 102 at feeding point 111 in FIG. 8B minimizes the magnetic field contributions from conductors at the feeding point. EX2002, XI(A)(65). Taniguchi indicates placement of feeding point 111 in FIG. 8B is at the lower side of insulation 10 so that the feeding point of the first antenna 1 will be near the separate feeding point 112 of second antenna 2. *Id.* The stated reason is “the two feeding points 111, 112 are nearer to each other, which is favorable in wiring.” *Id.* EX1005, [0072]. Taniguchi does not teach or suggest that placing separate feeding conductors for two separate antennas “nearer” to each other will minimize magnetic field contributions from the combination. EX2002, XI(A)(65).

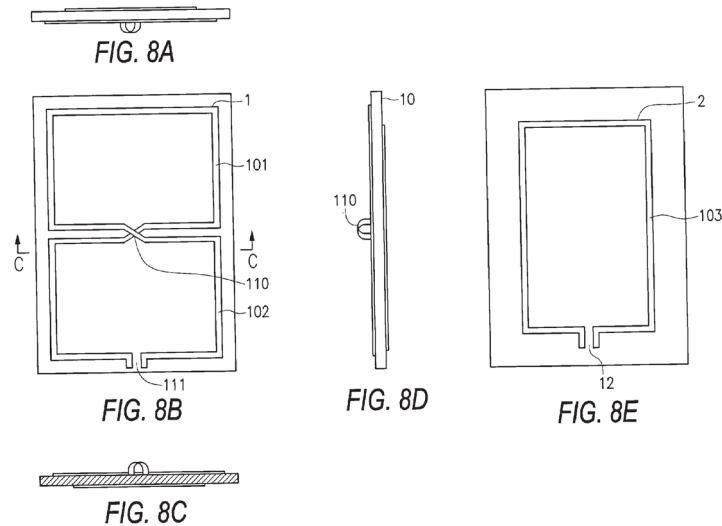
The Petition fails to establish obviousness of two closely spaced terminals connected to the first loop for supplying electrical current to the first and second loops while minimizing magnetic field contributions from the terminals limitations of claims 1 and 11 in the '430 Patent.

5. Taniguchi does not disclose or render obvious [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.

Antenna 2 of Taniguchi is not an inductor. EX2002, XI(A)(67); EX1005, [0055], & FIG. 8E. A second inductor is not positioned at a predetermined distance from a first inductor. EX2002, XI(A)(67). The electromagnetic field at a certain distance from a first inductor is not reduced. *Id.*, XI(A)(68). There is no reduction of mutual electromagnetic coupling between a first and second inductor as a result of a first inductor having a reduced electromagnetic field. *Id.*

In the '430 Patent, the first and second inductors in the inductor layout on a semiconductor die 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.*, XI(A)(69); EX1001, 2:19-24. In contrast, the non-contact identification apparatus in Taniguchi has a second antenna that is "arranged so that the sum of mutual inductances between it and the first antenna is minimized." EX2002, XI(A)(69); EX1005, claims 1 and 8-10. This is accomplished because both antennas are formed on the same plane or a parallel plane and must have their center points exactly coinciding or overlapping.

EX2002, XI(51) & XI(A)(69); EX1005, FIGS. 6, 7, 8, 9, 10, and 12. FIGS. 8A – 8E of the '430 Patent are exemplary:



This complete overlap is the only way for the two antennas to be in close proximity without electromagnetic coupling. EX2002, XI(51). A tag 212 that is much farther away “makes interlinkage with many lines of magnetic flux” from antenna 1. *Id.* EX1005, FIG. 4 & [0064]. And the electromagnetic fields from antennas 1 and 2 in the area between the two gates is sufficiently strong to communicate with the tags. EX2002, XI(51); EX1005, FIGS. 14A-14C, & [0083].

The Petition does not demonstrate a reasonable likelihood that Intel would prevail in establishing that claims 1 and 11 would have been obvious in view of Taniguchi.

6. Dependent claims 3-5, 7, 10 and 13-15, 17 and 19

Claims 3-5, 7 & 10 depend from independent claim 1. EX1001, 10:11-60.

Claims 13-15, 17 & 19 depend from independent claim 11. EX1001, 11:16-12:15.

For the reasons set forth above regarding independent claims 1 and 11, the Petition does not demonstrate a reasonable likelihood that Intel would prevail in establishing claims 3-5, 7, 10, 13-15, 17 and 19 would have been obvious of Taniguchi. EX2002, XI(C)(70) – XI(L).

C. Ground 2 (Claims 2, 8, 11, 13-15, 17-19, § 103 over Taniguchi and Rostoker).

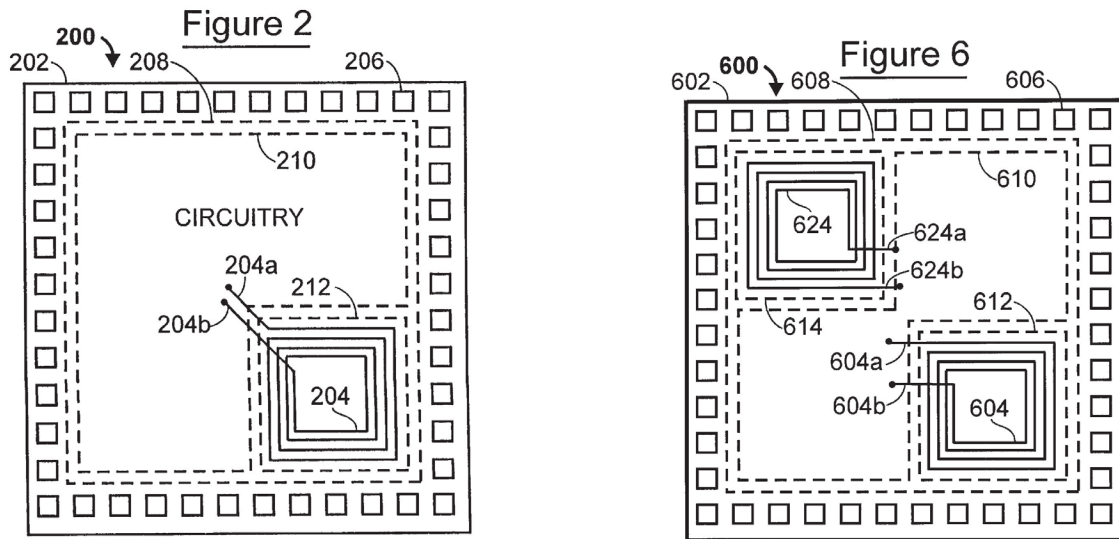
1. Lack of motivation to combine Taniguchi and Rostoker.

A POSITA would not have been motivated to combine or alter Taniguchi in view of Rostoker to obtain the claimed invention. EX2002, XI(M)(76). Claims 2 and 11 require the inductors to be formed on a semiconductor die. *Id.* EX1001, 10:31-33 & 61-63. Rostoker is directed to antennas, not inductors, and all of Rostoker's antenna coils implemented on a semiconductor die are formed in conventional spiral or O-shaped configurations. EX2002, XI(M)(77); EX1006, FIGS. 2 and 6. Rostoker mentions inductors that may be integrated on an IC chip along with his antennas, but it expressly distinguishes "antennas" from "inductors," and describes only antennas in any detail. EX2002, XI(M)(77); EX1006, 4:21-22, 14:1-3, and 14:28-30.

The purpose and function of the antennas in Rostoker differ from the purpose and function of the two inductors in the ‘430 Patent’s claimed inductor layout. EX2002, XI(M)(77). Rostoker states “[t]he invention has utility in communication applications such as pagers, cordless telephones, analog and digital cellular telephones and personal communication systems.” *Id.* EX1006, 4:24-26. If a POSITA substituted Rostoker’s FIG. 6 antenna layout for the claimed inductor layout in the ‘430 patent, the antennas would not function as inductors, and the circuitry connected to the antennas would not function as intended. EX2002, XI(M)(77).

A POSITA would not have had a reasonable expectation of success in combining or altering Taniguchi in view of Rostoker. EX2002, XI(M)(78). Art in the field when the ‘430 Patent was filed taught away from the inventions claimed in the ‘430 Patent. *Id.* References that described inductors formed on a semiconductor die taught spiral inductors or O-shaped inductors instead of inductors formed from a pair of loops. *Id.* See, e.g., EX1007, FIG. 1; EX1008, FIGS. 2-3. Generally, in references alleged by Intel to teach an inductor having two sections or “loops,” the terminals are not closely spaced because the actual points of contact on the “loop(s)” of the two conductors that supply electrical current are spaced apart. EX2002, XI(M)(78); EX1001, FIG. 1, 3:66-4:4; EX1007, FIG. 1.

Several references relied on by Intel teach antennas instead of inductors, and these antennas perform a different function than the claimed inductor layout of the '430 Patent. EX2002, XI(M)(79). Taniguchi and Rostoker teach use of components designed to radiate an electromagnetic field for facilitating a more efficient antenna system. *Id.* EX1005, [0062]; EX1006, 1:25-27. Taniguchi and Rostoker are not relevant prior art and teach away from the '430 patent because they have nothing to do with reducing coupling between a pair of inductors in a layout on a semiconductor die. EX2002, XI(M)(79). Instead, Taniguchi and Rostoker describe coils that emit electromagnetic radiation in products designed, for example, for an RFID tag or other communication applications. *Id.* EX1005, FIG. 21, and [0084]; EX1006, 4:29-36. In view of the differing purpose, design, and applications for these antenna coils, a POSITA would not have been motivated to modify Taniguchi or Rostoker or combine them with different references to create a layout with reduced coupling between a pair of inductors on a semiconductor die. EX2002, XI(M)(79). And when a POSITA did implement an antenna coil on a semiconductor die, the antenna coils were formed in conventional spiral or O-shaped configurations. *Id.* EX1006, FIGS. 2 and 6 (reproduced below).



A POSITA would have applied the more relevant and precise design rules for analog integrated circuits. EX2002, XI(M)(80). The claimed inductor layout in the '430 patent is used in RF transceivers on a single semiconductor die, and an exemplary RF frequency referred to in the specification is 4 GHz. *Id.* EX1001, 10:31-33 and 8:37. A POSITA would understand that more spacing may be prudent between two terminals to address problems with noise, capacitance, and complexity of conductive traces. EX2002, XI(M)(80). As an example, capacitive crosstalk between the interconnect lines on a chip was a problem that engineers had to address. *Id.* A POSITA would have known that signal lines may have to be shielded from each other by putting ground lines between them or by allowing more space to reduce coupling. *Id.*

Contrary to Intel's contention, Saitoh would not have provided a POSITA motivation to combine or alter Taniguchi in view of Rostoker to obtain the claimed

invention. *Id.*, XI(M)(81). Like Taniguchi and Rostoker, Saitoh discloses an antenna, not an inductor. *Id.* Saitoh does not indicate that “adjusting the ‘number of turns’ in a transmitting antenna loop ensures that ‘magnetic field intensity is high enough inside the communication zone,’ . . . ‘decrease[s]’ the field ‘outside the communication zone,’ and helps zero out ‘mutual inductance’ between the two antennas.” *Id.* PAPER 2, p. 64, last paragraph. Saitoh indicates only that the number of turns of a loop coil of a transmitting antenna is one of many factors that may influence magnetic field intensity inside and outside of Saitoh’s communication zone. EX2002, XI(M)(81); EX1023, 12:9-12:22. Saitoh teaches the proper loop diameter of receiving antenna 3 and the position of that antenna relative to loop coils 2a and 2b of the transmitting antenna is what reduces the mutual inductance between receiving antenna 3 and internal loop coil 2a and external loop coil 2b, not the number of turns in the transmitting antenna loop. EX2002, XI(M)(81); EX1023, 5:4-11.

The Petition does not demonstrate a reasonable likelihood that Intel would prevail in establishing that claims 1 and 11 would have been obvious in view of Taniguchi and Rostoker. Claims 2 & 8 depend from independent claim 1. EX1001, 10:31-33 and 10:49-51. Claims 13-15, 17-19 from independent claim 11. EX1001, 11:24-11:33 and 12:5-14. For the reasons set forth above regarding independent claims 1 and 11, Intel does not demonstrate a reasonable likelihood that it would

prevail in establishing that dependent claims 2, 8, 11, 13-15 & 17-19 would have been obvious over Taniguchi in view of Rostoker.

D. Ground 5 - Claims 1, 3-5, 7, 10-11, 13-15, 17, 19-21, § 103 over Taniguchi and Brooks

Intel relies on the addition of Brooks to Ground 1 in an effort to show the “closely spaced” and “minimizing magnetic field contributions from the terminals” limitations. PAPER 2 at 104. Ericsson incorporates its prior analysis of why Taniguchi does not teach several limitations of claims 1 and 11 as if set forth verbatim here. Section VII(B) & VII(B)(1 – 5). Intel’s proposed combination in Ground 5 fails to correct the deficiencies in Ground 1 as discussed below. EX2002, XI(N)(82).

A POSITA would not have been motivated to combine or alter Taniguchi in view of Brooks to obtain the claimed invention. *Id.* Brooks is limited to printed circuit board design, and the section relied on by Intel teaches forming a “twisted pair of wires” to move two wires closer together to reduce the EMI radiations emitted by the wires. EX2002, X(42) & XI(N)(82); EX1010, p. 157. For an inductor layout used in RF transceivers on a single semiconductor die at relatively high frequencies, there are problems with noise, capacitance, and complexity of the conductive traces, such as capacitive crosstalk between the interconnect lines. EX2002, X(42) & XI(N)(82); EX1010, p. 222. As a result, a POSITA would be

motivated to increase the distance, not reduce the distance, between two signal lines to reduce coupling. EX2002, X(42) & XI(N)(82); EX1010, p. 222.

Claims 3-5, 7 & 10 depend from independent claim 1. EX1001, 10:34-42, 10:46-49, & 10:58-60. Claims 13-15, 17 & 19 depend from independent claim 11. *Id.*, 11:24-33, 12:5-7, & 12:11-14. For the reasons set forth above regarding independent claims 1 and 11, Intel does not demonstrate a reasonable likelihood that it would prevail in establishing that claims 1, 3-5, 7, 10-11, 13-15, 17 & 19 would have been obvious over Taniguchi in view of Brooks. EX2002, XI(N)(82).

E. Ground 6 (Claims 2, 8, 11, 13-15, 17-19, § 103 over Taniguchi, Rostoker, and Brooks)

Intel relies on the addition of Brooks to Ground 2 in an effort to show the “closely spaced” and “minimizing magnetic field contributions from the terminals” limitations of claims 1 and 11 of the ‘430 Patent. PAPER 2, 104. But as discussed above in Section VII(D) *supra*, Brooks does not show “closely spaced” or “minimizing magnetic field contributions from the terminals,” and, therefore, does not provide these teachings missing from Taniguchi and Rostoker. EX2002, XI(O)(83). Consequently, Intel’s proposed combination in Ground 6 fails to correct the deficiencies in Ground 2 for the reasons discussed above in Section VII(C) & VII(D) *supra. Id.*

Claims 2 & 8 depend from independent claim 1. EX1001, 10:34-42, 10:46-49, and 10:58-60. Claims 13-15, 17 & 19 depend from independent claim 11. EX1001, 11:24-33, 12:5-7, and 12:11-14. For the reasons set forth above in the preceding paragraph regarding independent claims 1 and 11, Intel does not demonstrate a reasonable likelihood that it would prevail in establishing that claims 2, 8, 11, 13-15, 17 and 19 would have been obvious of Taniguchi in view of Rostoker and Brooks.

VIII. MIDYA, ALONE OR IN COMBINATION WITH OTHER REFERENCES, DOES NOT DEMONSTRATE A REASONABLE LIKELIHOOD THAT AT LEAST ONE CHALLENGED CLAIM IS UNPATENTABLE.

A. Ground 3 (Claims 1, 3-6, 9, 11-16, 20-21, § 103 over Midya and Raghavan)

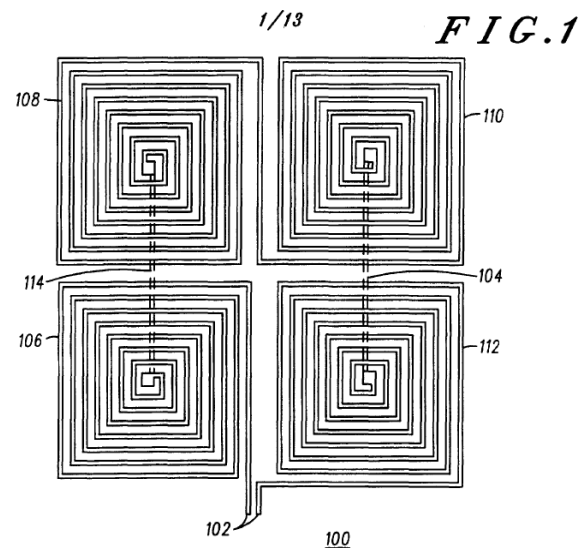
1. Two closely spaced terminals connected to the first loop . . . [1B] & Connecting two closely spaced terminals to the first loop . . . [11B].

The '430 Patent requires “two closely spaced terminals connected to the first loop,” in claims 1 and 11. EX1001, 10:22 and 11:7-8. These limitations in claims 1 and 11 require the two terminals be connected to the same loop. *Id.* But as discussed below, the combination of Midya and Raghavan does not disclose or suggest these claim limitations. EX2002, XI(P)(84).

Midya relates “generally to inductors and, more particularly, to substantially planar inductors.” EX2002, XI(P)(85); EX1007, 1:5-6. Midya was one of about a

dozen references that were cited on the face of the '430 Patent; therefore, the U.S. Patent Office considered Midya during prosecution of the '430 Patent. EX1001, Foreign Patent Documents; EX2002, XI(P)(85).

Midya states “there is a need for a method and planar inductor/transformer that maximizes cancellation of a moment of the plurality of loops/spiral conductor coils over a predetermined range.” EX2002, XI(P)(86); EX1007, 1:23-26. Unlike the '430 Patent, Midya does not disclose a figure-8 inductor to achieve its stated goals. EX2002, XI(P)(86). Although Midya’s FIG. 12 “represents a radiation field pattern for a figure 8 shape” (EX1007 at 3:20-22), the actual inductor of Midya’s FIG. 1 (reproduced below) describes a “4-loop single layer planar inductor in accordance with the present invention.” EX2002, XI(P)(86); EX1007, 2:6-8.



Midya also states the “present invention provides a planar magnetic field inductor/transformer that has a plurality of at least three planar adjacent

loops/spiral conductor coils arranged one after another in a simple/compound loop fashion.” EX2002, XI(P)(87); EX1007, 7:14. Midya makes high-level reference to two terminals (*e.g.*, EX1007 at FIG. 1 item 102 (*see* reproduction of FIG. 1 above)) but does not describe the spacing of the terminals or much else about them.

EX2002, XI(P)(87); EX1007, 8:8-12, 11:1-16, and 16:1-25.

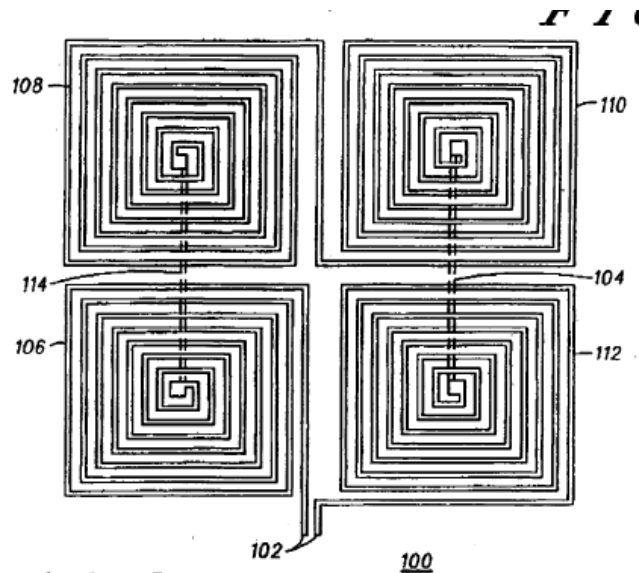
The ‘430 Patent explicitly recites “a second inductor” in claims 1 and 11. EX1001, 10:26 & 11:11. These limitations in claims 1 and 11 require the first and second inductors, which are planar inductors, to be part of the same “inductor layout” in claim 1 and on the same “semiconductor die” in claim 11. EX2002, XI(P)(88); EX1001, 10:11 and 10:61-62. Midya fails to disclose the required pair of planar inductors in a layout or on the same semiconductor die. EX2002, XI(P)(89). Midya teaches the so-called “second” inductor is directly above the “first” inductor” on a completely different layer of a printed circuit board: “two layers may [*sic*] utilized to construct two non-interacting inductors disposed concentrically (FIG. 26, numeral 2600).” EX2002, XI(P)(89); EX1007, 11:18-20.

Midya mentions a “transformer generally includes at least two windings disposed on top of each other in a semiconductor substrate and separated by an electrically insulating film,” (EX1007, p. 7, lines 15-18). But Midya’s detailed examples include inductors on a printed circuit board (EX1007, FIGS. 7, 8, and 10, 13:1-21, & 14:11-16). The dimensions of an inductor on a printed circuit board are

typically several orders of magnitude larger than the dimensions of an inductor on a semiconductor die. EX2002, XI(P)(89). A POSITA would understand this “concentric” or “stacked” configuration of inductors on different planes is clearly not within the scope of this claim limitation. *See id.* Every drawing, table, graph, embodiment, and description in the ‘430 patent specification makes clear that the two inductors must be on the same layer and that the distance measured between them is a lateral distance on the same semiconductor die. *Id.* EX1001, FIGS. 4-8 and 11-12, & Tables 1-3. A POSITA would not have looked to Midya for ways to position inductors on a semiconductor chip. *Id.*

Before allowing claims 1 and 11 of the ‘430 Patent to issue, the examiner considered the Midya reference and determined that the prior art did not teach these limitations. EX2002, XI(P)(90). In the Office Action of May 22, 2006 for the ‘430 Patent, where the examiner indicated that the claims corresponding to ‘430 patent claims 1 and 11 were allowable over the prior art, the examiner indicated, “[c]laims 25 and 26 recite, *inter alia*, a second inductor positioned at a distance from the first inductor, 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.” EX2002, XI(P)(90); EX1002, Page 113 of 162 ¶ 3. Midya does not disclose or suggest these limitations of independent claims 1 and 11 of the ‘430 patent. EX2002, XI(P)(90).

Midya also fails to disclose the two closely spaced terminals connected to the first loop. EX2002, XI(P)(91-92). According to Midya's description of FIG. 1 (reproduced below), "[t]he inductor has two terminals (102) and has two crossovers (104, 114) that connect the centers of each of the two pairs of spirals." EX2002, XI(P)(92); EX1007, 11:4-6.



Each of Midya's two terminals 102 is connected to a different loop, not the same loop, in the inductor, *i.e.*, one terminal is connected to loop 106 and the other terminal is connected to loop 112. EX2002, XI(P)(93). Midya results in two terminals that are connected to two different loops, not to the same loop, of the inductor as claims 1 and 11 require. *Id.*

Midya's FIG. 1 shows electrical current is supplied to the four loops 106, 108, 110, and 112 by a combination of terminals, wires, and crossovers that are

spaced far apart, and which create an “additional loop,” which is what the claim recitations (“two closely spaced terminals connected to the first loop” and “connecting two closely spaced terminals to the first loop,”) of claims 1 and 11 of the ’430 Patent are intended to prevent. EX2002, XI(P)(94). Electrical current is supplied to adjacent loops 106 and 108 by three long vertical conductive lines, *i.e.*, by crossover 114 in the center of these two loops and by two conductive lines between the set of inductors 106 and 108 and the set of inductors 110 and 112. *Id.* EX1007, 11:1-6. Electrical current is supplied to adjacent loops 110 and 112 by a different group of three long vertical conductive lines, *i.e.*, by crossover 104 in the center of loops 110 and 112 and by two conductive lines to the far right of the set of inductors 110 and 112. EX2002, XI(P)(94); EX1007, 11:1-6. Consequently, Midya shows sets of conductive lines for supplying current to individual loops that are spaced apart by a distance that is comparable in size to the individual loops. EX2002, XI(P)(95). Midya does not teach or suggest these recitations (“two closely spaced terminals connected to the first loop” and “connecting two closely spaced terminals to the first loop,”) of claims 1 and 11, and the PTO examiner agreed. EX2002, XI(P)(96).

The figure-8-shaped inductors described in the ’430 Patent contain two separate loops and require additional crossings between the conductive segments of the inductor. *Id.*, XI(P)(98). Consequently, the claimed inductors are more

complex, harder to manufacture, more expensive, and larger in size. *Id.* And if the claimed inductors do not provide the same inductance value L and Quality-Factor Q as prior-art inductors of the same size, their electrical performance would be worse and would be accompanied by undesired power consumption and heating.

Id.

A POSITA would have been motivated to select planar inductors having a design that is simple, easy to manufacture, used multiple times, small, and capable of being placed together with other components on an integrated circuit, not the complex inductors of the '430 Patent. EX2002, XI(P)(97). The prior-art inductors, whether circular, octagonal, or spiral (*e.g.*, as described in Midya) in geometry, meet these design goals because the design is simple, more compact, more commonly used, and provides the desired inductance with fewer crossings of metal layers. *Id.* The design goals of the prior-art inductors do not meet the design goals of the inductors of the '430 Patent as discussed above. *Id.*

A POSITA would not have been motivated by Midya (already considered by the examiner) alone, or to combine the teachings of Midya with Raghavan or with any of the other references that Intel used to challenge the claims, to implement the second inductor, much less one oriented in a different direction (dependent claims 4 and 14 of the '430 Patent (EX1001,10:38-40 & 11:27-29)) for the reasons discussed *supra*, including but not limited to the fact that it might not make sense.

EX2002, XI(P)(99). A POSITA would understand that there are many considerations when spacing chip components, and including a second inductor oriented in a different direction would not necessarily work in this particular context. *Id.* And there may be other considerations that may be more important than the orientation of the inductors *vis a vis* each other. *Id.*

Raghavan, considered in combination with Midya, does not disclose or render obvious any challenged claim of the '430 Patent. EX2002, XI(P)(100). Raghavan is typical of the prior art in that the inductors it describes are O-shaped inductors or spiral inductors instead of inductors formed from a pair of loops. *Id.*, XI(P)(101); EX1008, FIG. 2, FIG. 3, [0002], [0007], and [0008]. Raghavan points out that conventional spiral inductors, such as the inductors shown in the Midya reference relied on by Intel, are asymmetrical and can cause signal degradation. Raghavan states that “[p]lanar spiral inductors . . . have been designed with an intrinsic asymmetry since one terminal of the inductor is at the outside of the spiral, while the other terminal is on the inside. This asymmetry usually does not have any substantial effects on circuits using single-ended signals, *i.e.*, where the signal voltage is relative to ground or a fixed potential. However, many new circuits and systems use differential signals where the signal voltage is the difference between two terminals. Any asymmetry in circuits using differential signals (differential

circuits) has the effect of degrading the signal quality, and is thus very undesirable.” EX2002, XI(P)(101); EX1008, [0004].

In Raghavan, the configuration and function of the symmetric spiral inductors shown in FIGS. 2 and 3, which inductors are respectively formed from concentric circles or square windings, is completely different from the configuration and function of the inductors claimed in the ‘430 Patent. EX2002, XI(P)(102). These spiral inductors have only a single “loop” with circular or square windings that are configured for “eliminating signal degradation due to inductor asymmetry.” *Id.* EX1008, [0018] and [0021]. There is no mention made of mutual electromagnetic coupling between any two inductors and no attempt is made to reduce the electromagnetic field emanating at a certain distance from one inductor where a second inductor is positioned. EX2002, XI(P)(102).

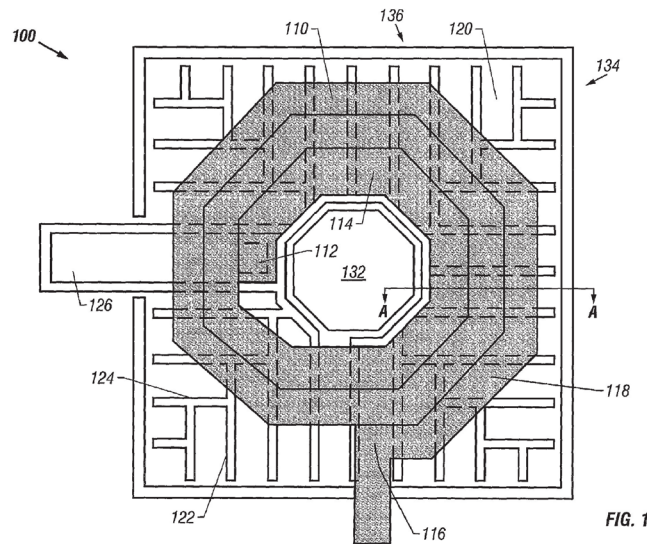
Raghavan teaches a particular design for a spiral inductor without mentioning any “inductor layout” or any configuration of “a first inductor and a second inductor on a semiconductor die.” *Id.*, XI(P)(103). If a POSITA designed an inductor layout on a semiconductor die using the symmetric spiral inductors shown in FIGS. 2 and 3 of Raghavan (EX1008, FIGS. 2 & 3), then there would be no reduction in mutual electromagnetic coupling between those inductors. EX2002, XI(P)(103).

Claims 3-6 & 9 depend from independent claim 1. EX1001, 10:35-45 and 10:53-57. Claims 12-16 depend from independent claim 11. EX1001, 11:16-12:4. For the reasons set forth above regarding independent claims 1 and 11, Intel does not demonstrate a reasonable likelihood that it would prevail in establishing claims 1, 3-6, 9, 11 & 12-16 would have been obvious over Midya in view of Raghavan. EX2002, XI(P)(104).

B. Ground 4 (Claims 2, 11-16, § 103 over Midya, Raghavan, and Gardner)

Ericsson incorporates its prior arguments regarding Midya and Raghavan. See Section VIII(A) *supra*. Gardner (EX1009) does not disclose or render obvious those elements from the Challenged Claims 2 and 11-16 missing from Midya and Raghavan. EX2002, XI(Q)(105).

Gardner teaches away from connecting two closely spaced terminals to a first loop for supplying electrical current to the first and second loops while minimizing magnetic field contributions from the terminals as recited in claims 1 and 11 of the '430 Patent. *Id.*, XI(Q)(106); EX1009, FIG. 1 and [0023]. As shown in Gardner's FIG. 1 (reproduced below), the only inductor disclosed in Gardner is implemented by a traditional spiral-shaped conductor 110. EX2002, XI(Q)(106); EX1009, FIG. 1 and [0023].



The terminals and connections for supplying electrical current to this spiral inductor are spaced far apart. EX2002, XI(Q)(107); EX1009, FIG. 1 and [0023]. As shown in Gardner's FIG. 1, one end of the spiral coil corresponding to innermost node 112 is provided with electrical current by a conductive underpass 126 extending to the left of the figure. Meanwhile, the other end of the spiral coil conductive corresponding to outermost node 116 has a conductive connection that extends to the bottom of the figure. EX2002, XI(Q)(107).

Claim 2 of the '430 Patent depends from independent claim 1. EX1001, 10:32. Claims 12-16 depend from independent claim 11. EX1001, 11:16-12:4. For the reasons set forth above regarding independent claims 1 and 11, combining Gardner with Midya and Raghavan does not render claims 2 and 11-16 obvious. EX2002, XI(Q)(108). The Petition does not demonstrate a reasonable likelihood

that Intel would prevail in establishing claims 1, 2, 11-16 obvious over Midya in view of Raghavan and Gardner.

C. Ground 7 (Claims 1, 3-6, 9, 11-16, § 103 over Midya, Raghavan, and Brooks)

Intel relies on the addition of Brooks to Ground 3 in an effort to show the “closely spaced” and “minimizing magnetic field contributions from the terminals” limitations. PAPER 2 at 104. But as discussed above in Section IV(F) *supra*, Brooks does not show “closely spaced” or “minimizing magnetic field contributions from the terminals,” and, therefore, does not provide these teachings missing from Midya and Raghavan. EX2002, XI(R)(109). Consequently, Intel’s proposed combination in Ground 7 fails to correct the deficiencies in Ground 3 for reasons similar to those discussed above in Section VIII(A) *supra*. *Id.*

Claim 3 & 9 of the ‘430 Patent depend from independent claim 1. EX1001, 10:32. Claims 12-16 depend from independent claim 11. EX1001, 11:16-12:4. For the reasons set forth above regarding independent claims 1 and 11, combining Brooks with Midya and Raghavan does not demonstrate a reasonable likelihood that Intel would prevail in establishing claims 1, 3-6, 9, and 11-16 obvious. EX2002, XI(R)(109).

D. Gound 8 - Claims 1, 11-16, § 103 over Midya, Raghavan, Gardner, and Brooks

Intel relies on the addition of Brooks to Ground 4 in an effort to show the “closely spaced terminals” and “minimizing magnetic field contributions from the terminals” limitations. PAPER 2 at 104. Intel’s proposed combination in Ground 8 fails to correct the deficiencies in Ground 4 as discussed below. EX2002, XI(S)(110).

Ericsson incorporates its prior arguments regarding Midya, Raghavan, and Gardner (*see* Sections VIII(A) & (B) *supra*) and incorporates its prior arguments regarding Brooks. IV(F) & VII(D) *supra*. As discussed above in Sections IV(F) & VII(D) *supra*, Brooks does not show “closely spaced terminals” or “minimizing magnetic field contributions from the terminals,” and, therefore, does not provide these teachings missing from Midya, Raghavan, and Gardner. EX2002, XI(S)(111). Consequently, the addition of Brooks to the references (Midya, Raghavan, and Gardner) in Ground 4 (to form Ground 8) fails to correct the deficiencies in Ground 8. *Id.*

IX. CONCLUSION

The Board should deny institution. Intel fails to show a reasonable likelihood of prevailing on Grounds One (1) through Eight (8). The cited references do not disclose or render obvious all of the limitations of independent claims 1 and 11. Intel failed to show that a POSITA would be motivated to combine their disparate references or that there would have been a reasonable

expectation of success in doing so. For the same reasons, Intel failed to demonstrate a reasonable likelihood of prevailing as to claims 2-10, which depend from claim 1, and claims 12-19, which depend from claims 11. Ericsson disclaimed claims 20-21 to streamline this proceeding, and they are no longer at issue.

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Respectfully submitted,

/Alastair J. Warr/

Alastair J. Warr, Reg. #47,166
FisherBroyles, LLP
203 North LaSalle Street, Suite 2100,
Chicago, IL 60601
Tel: 317.407.5270
alastair.warr@FisherBroyles.com

Bryan A. Santarelli, Reg. #37,560
FisherBroyles, LLP
701 Fifth Avenue, Suite 400
Seattle, WA 98104
Tel.: 206.338.8792
Bryan.santarelli@fisherbroyles.com

CERTIFICATE OF WORD COUNT

The undersigned hereby certifies that the portions of the above-captioned PATENT OWNER'S PRELIMINARY RESPONSE specified in 37 C.F.R. §42.24 has 9,873 words in compliance with the 14,000 word limit set forth in 37 C.F.R. §42.24. This word count was prepared using Microsoft Word.

Date: July 10, 2024

Respectfully submitted,

/Alastair J. Warr/

Alastair J. Warr, Reg. #47,166
FisherBroyles, LLP
203 North LaSalle Street, Suite 2100,
Chicago, IL 60601
Tel: 317.407.5270
alastair.warr@FisherBroyles.com

Bryan A. Santarelli, Reg. #37,560
FisherBroyles, LLP
701 Fifth Avenue, Suite 400
Seattle, WA 98104
Tel.: 206.338.8792
Bryan.santarelli@fisherbroyles.com

CERTIFICATE OF SERVICE

The undersigned hereby certifies that on Wednesday, July 10, 2024 a copy of the foregoing Patent Owner Preliminary Response and Patent Owner Exhibits 2001 through 2008 identified in the Table of Exhibits above were served via email on the following attorneys for the Petitioner:

Lori A. Gordon
Sanjeet K. Dutta
Christie L. Larochelle
Filippos Papadatos
Goodwin Procter LLP
gordon-ptab@goodwinlaw.com
sdutta@goodwinlaw.com
clarochelle@goodwinlaw.com
fpapadatos@goodwinlaw.com

Date: July 10, 2024

Respectfully submitted,

FisherBroyles, LLP

/s/Alastair J. Warr

Alastair J. Warr

Reg. No. 47,166