

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 RESPONSE
(37 C.F.R. § 42.120)

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Regulations

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EXHIBIT LIST

Petitioner Exhibits

Ex. No.	Description
1001	US 7,151,430 Mattsson
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
1011	Declaration of June Ann Munford
1012	RFID Handbook 2 nd Ed. 2003
1013	Serway
1014	Ulaby
1015	Translation JP PCT EP 2005001515
1016	Excerpt Prosecution EP3567614
1017	WO 2004/0122213 Enzinger
1018	US6708880 Acher
1019	Excerpt ITC INV TA 1376 Claim Construction 3-13-2024
1020	ITC 337 TA 1300 Claim Construction 9-26-2022
1021	U6533178 Gaul
1022	US5345231 Koo
1023	US6,137,447 to Saitoh
1024	US6320491 Gevorgian
1025	US7088964 O
1026	US PUB 20020044058 Heinrich
1027	US6970088 Kovach
1028	US4724427Carroll
1029	US7057514 Mickle
1030	<i>Comprehensive Explanation On The High Quality Characteristics of Symmetrical Octagonal Spiral Inductor -- Ooi</i>
1031	<i>Design and Analysis of Symmetric Dual-Layer Spiral Inductors for RF Integrated Circuits -- Lee</i>

Ex. No.	Description
1032	<i>A Q-FACTOR ENHANCEMENT TECHNIQUE FOR MMIC INDUCTORS</i> -- Danesh
1033	PCT PUB WO9949513 Zhou
1034	US5583474 Mizoguchi
1035	RESERVED
1036	“A Single-Chip 900-MHz Spread-Spectrum Wireless Transceiver in 1-up CMOS – Part 1: Architecture and Transmitter Design” by Ahmadreza Rofougaran et al. , IEEE Journal of Solid-State Circuits, Vol. 33, No. 4 (April 1998)
1037	“A Single-Chip CMOS Transceiver for DCS-1800 Wireless Communication” by Michiel Steyaert, et al. ISSCC98, Session 3, Transceiver and Power Amplifiers (1998)
1038	“A 1.8-GHz Low-Phase-Noise CMOS VCO Using Optimized Hollow Spiral Inductors” by Craninckx, et al. (“Craninckx”)
1039	“Low-Phase-Noise LC Quadrature VCO Using Coupled Tank Resonators in a Ring Structure” by ElSayed, et al. (“ElSayed”)
1040	“A CMOS Frequency Synthesizer with an Injection-Locked Frequency Divider for a 5-GHz Wireless LAN Receiver” to Rategh, et al. (“Rategh”)
1041	“Illustrated Dictionary of Electronics” to Gibilisco, Eighth Edition
1042	“Class Definition for Class 343 Communications: Radio Wave Antennas,” U.S. Patent & Trademark Office (2001), https://web.archive.org/web/20011123183942/http://www.uspto.gov/web/patents/classification/uspc343/defs343.htm

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
2009	Supplemental Declaration of Dr. Paul Prucnal, Ph.D.
2010	Dr. Tentzeris Deposition Transcript

I. INTRODUCTION

Patent Owner Telefonaktiebolaget L M Ericsson (publ) (“Ericsson”) submits this Response to Intel Corporation’s (“Intel”) Petition for *Inter Partes* Review (“Petition”). Intel challenged Claims 1-21 of U.S. Patent 7,151,430 B2 (“‘430 Patent”), “METHOD OF AND INDUCTOR LAYOUT FOR REDUCED VCO COUPLING” dated December 19, 2006. Ericsson disclaimed claims 20-21 and does not address them in this Response. EX2001. Focusing on claim 1, the Patent Trial and Appeal Board (“Board”) instituted review of claims 1-19 (“Challenged Claims”). PAPER 10. Intel’s Petition fails to establish the Challenged Claims are invalid under 35 U.S.C. § 103. Ericsson requests the Board find that Intel failed to meet its burden of proving the Challenged Claims are obvious and that the Challenged Claims are patentable.

II. SUMMARY OF ARGUMENT

Intel relies on Taniguchi (EX1005) as the primary reference for Grounds 1, 2, 5 & 6. PAPER 2, pp. 2-53, 54-64, and 104-106. Intel relies on the combination of Midya and Raghavan as the primary references for Grounds 3, 4, 7 & 8. PAPER 2, at 65-101, 101-104, 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) (defining test for scope of analogous art) (citing *In re Bigio*, 381 F.3d 1320, 1325 (Fed. Cir. 2004)).

Ground 1 fails to establish the unpatentability of claims 1, 3-5, 7, 10-11, 13-15, 17 & 19. A person of ordinary skill (“POSITA”) would not have been motivated to modify Taniguchi. Taniguchi does not teach or disclose (1) inductors on semiconductors, (2) forming and orienting first and second loops so that magnetic fields from the second loop cancel magnetic fields from the first loop, (3) two closely spaced terminals, or (4) positioning the second conductor to reduce electromagnetic coupling between the first and second inductors.

Ground 2 combines Taniguchi with Rostoker (EX1006) but fails to establish claims 2, 8, 11, 13-15 & 17-19 are unpatentable. The deficiencies in Ground 1 apply to Ground 2. Rostoker does not fill the elements missing in Taniguchi. A POSITA would not have been motivated to combine these disparate references. Rostoker is directed to the formation of antennas, not inductors, on an integrated circuit (“IC”) chip. EX1006, Abstract. Rostoker does not express its antennas are suitable for use as inductors on a printed circuit board (“PCB”). EX2009, ¶ 19. Taniguchi does not express its PCB teachings apply to ICs. A POSITA would not have been motivated to combine Taniguchi’s PCB teachings with Rostoker’s IC teachings to arrive at the subject matter of claims 2, 8, 11, 13-15 & 17-19.

Ground 3 relies on the combination of Midya (EX1007) and Raghavan (EX1008) but fails to establish the unpatentability of claims 1, 3-6, 9, & 11-16. Midya discloses inductors implemented on a PCB that are orders of magnitude larger than inductors implemented on a semiconductor chip. Midya does not express its teachings can be applied to ICs. Midya uses four spiral inductors with long connections that create asymmetry and electromagnetic interference that the ‘430 Patent avoids. EX2009, ¶ 29. Midya does not disclose substantially 8-shaped or four-leaf clover shaped inductors. During prosecution of the ‘430 patent, the USPTO allowed the Challenged Claims over Midya. Raghavan (EX1008) is directed to inductors used in ICs. (EX1008, [0002]) Raghavan does not state its IC teachings apply equally to the field of PCBs like in Midya. Ground 3 fails.

Ground 4 adds Gardner (EX1009) to the Midya/Raghavan combination relating to the *two closely spaced terminals* limitations but fails to establish the unpatentability of claims 2, 11-16. 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. Ground 4 fails.

Ground 5 mirrors Ground 1 but combines Taniguchi with Brooks (EX1010) claiming the combination teaches the *two closely spaced terminals* limitation of claims 1, 3-5, 7, 10-11, 13-15, 17 & 19. Ground 5 fails.

Ground 6 mirrors Ground 2, adds Brooks to the Taniguchi/Rostoker combination, but fails to establish the unpatentability of claims 2, 8, 11, 13-15, & 17-19. The deficiencies in Taniguchi and Rostoker discussed in Ground 2 apply to Ground 6. Additionally, Brooks does not teach two closely spaced terminals for minimizing magnetic field contributions from the terminals. Ground 6 fails.

Ground 7 mirrors Ground 3, adds Brooks to the Midya/Raghavan combination, but fails to establish the unpatentability of claims 1, 3-6, 9, & 11-16. The deficiencies discussed for Ground 3 and of Brooks discussed in Ground 5 apply to Ground 7, which fails.

Ground 8 mirrors Ground 4, adds Brooks to the Midya/Raghavan/Gardner combination, but fails to establish the unpatentability of claims 2, 11-16. The deficiencies discussed for Ground 4 and of Brooks discussed in Ground 5 apply to Ground 8.

III. LEVEL OF ORDINARY SKILL AND CLAIM CONSTRUCTION

A. Level of Ordinary Skill

For the '430 Patent, 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 designing integrated radiofrequency circuits and inductors for semiconductors. EX2009, ¶ 7. This definition aligns with Intel's expert, who opined a POSITA would have had "years

of experience in designing integrated circuits or inductors.” EX1003, ¶ 58, EX2009, ¶ 8. PCBs differ from integrated circuits or semiconductors and broadly characterizing the field as “efficient circuit design” is incorrect for evaluating the prior art. Rather, the field should be limited to integrated circuits or inductors for semiconductors. EX2009, ¶ 9-10.

B. Claim Construction

The preamble to claim 11 recites a “method of reducing mutual electromagnetic coupling between a first inductor and a second inductor on a semiconductor die.” EX1001, 10:61-63. The phrase “semiconductor die” modifies the “first inductor” and “the second inductor” and requires both inductors to be formed on a single semiconductor die. EX1001, 2:13-15. A POSITA would understand that both the first inductor and the second inductor must be formed on the same, single semiconductor die. EX2009, ¶ 11.

The preamble of claim 11 is limiting because it provides antecedent basis for ensuing claim terms and because limiting the method to formation on a semiconductor die “is necessary to understand the subject matter encompassed by the claim.” *Deere & Co. v. Bush Hog, LLC*, 703 F. 3d 1349, 1357-58 (Fed. Cir. 2012). Claim 11’s preamble refers to concepts recited in the body of the claim:

11. A method of reducing mutual electromagnetic coupling between *a first inductor* and *a second inductor* on a semiconductor die, comprising:

forming **the first inductor** to reduce a far field, said step of forming **the first inductor** comprising:

...

positioning a second inductor at a predetermined distance from **the first inductor**, wherein the 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.

EX1001, claim 11 (emphasis added). Claim 11's preamble provides antecedent basis for terms in the body of the claim and is limiting. *See e.g., Catalina Mktg. Int'l. v. Coolsavings.com, Inc.*, 289 F.3d 801, 810-11 (Fed Cir. 2002).

The relationship between the preamble and body of claim 11 matches the relationship between the preamble and body of claim 2 in *In re Fought*, 941 F.3d 1175, 1177-78 (Fed. Cir. 2019).

2. **A travel trailer** having a front wall, rear wall, and two side walls with a first and a second compartment therein, those compartments being separated by a wall assembly, the wall assembly having a forward wall and at least one side member,

the side member being located adjacent to and movable in parallel with respect to a side wall of **the trailer**, and

the wall assembly being moved along the longitudinal length of **the trailer** by drive means positioned between the side member and the side wall.

(emphasis added). The entire preamble was found limiting, even though it had additional limitations not recited in the body of the claim. *In re Fought*, 941 F.3d at

1177-78 (“We have repeatedly held a preamble limiting when it serves as antecedent basis for a term appearing in the body of a claim.”) (citations omitted).

The limiting preamble, “a travel trailer,” in claim 2 from *In re Fought* is indistinguishable from claim 11’s preamble, “a first inductor and a second inductor on a semiconductor die.” The body of claim 11 refers to forming of “the first inductor,” while the preamble indicates the claim is directed to a method for forming “a first inductor and a second inductor on a semiconductor die.” The preamble’s recitation of “*a* first inductor” is the antecedent basis for “*the* first inductor” in the body of the claim:

11. A method of reducing mutual electromagnetic coupling between *a first inductor* and a second inductor on a semiconductor die, comprising:

forming *the first inductor* to reduce a far field, said step of forming *the first inductor* comprising:

...

positioning a second inductor at a predetermined distance from *the first inductor*, wherein the 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.

EX1001, claim 11.

The preamble’s recitation of “a first inductor and a second inductor on a semiconductor die” is also 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. *Deere & Co.*, 703 F.3d at 1358. In *Deere*, the claim preamble recited a “rotary cutter deck,” described as a “fundamental characteristic of the claimed invention” that informed a POSITA “as to the structure required by the claims.” *Id.* The body of the claim contained limitations concerning “torsional stiffness,” and the Federal Circuit stated the preamble therefore “informs the meaning of the ‘torsional stiffness’ limitation—the claimed structure must possess sufficient stiffness to withstand the torsional loads imposed by the operation of a rotary cutter.” *Id.*, at 1358. And the specification indicated the invention addressed a concern specific to decks for rotary cutters. *Id.*

The preamble of claim 11 is “necessary to give life, meaning, and vitality to the claim.” 703 F.3d at 1357 (citations omitted). The preamble’s requirement that the two inductors be “on a semiconductor die” is necessary to understand the subject matter and is a fundamental characteristic of the method recited in the claim. Whenever the specification refers to this method, it indicates implementation on a single semiconductor chip. The first sentence in the Summary of the Invention makes this clear: “An inductor design for reducing mutual EM coupling between VCO resonators and a method of implementing the same on a single semiconductor chip.” EX1001, 1:59-61.

The Summary of the Invention describes the requirement for a method of forming both inductors “on the semiconductor die”:

In general, in another aspect, *a method* of reducing mutual electromagnetic coupling between *two inductors on a semiconductor die* comprises the step of *forming a first inductor on the semiconductor die* having a shape that is substantially symmetrical about a first predefined axis, the shape causing the first inductor to have a reduced far field, at least in some directions. *The method* further comprises the step of *forming a second inductor on the semiconductor die* at a predetermined 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 far field.

EX1001, 2:13-24 (emphasis added). The invention addresses a concern specific to implementing two inductors on a single semiconductor die:

Recent advances in wireless communication technology have allowed an entire RF transceiver to be implemented *on a single semiconductor die or chip*. However, integrating a complete RF transceiver *on a single chip* presents a number of challenges. For example, in wideband code division multiple access (WCDMA) transceivers, *a single-chip solution* requires two RF VCOs to be running on the chip at the same time.

EX1001, 1:26-33 (emphasis added).

The preamble limitations to a “semiconductor die” informs a POSITA of the meaning of other limitations in the body of the claim relating to physical dimensions. Claim 11 further requires the “far field” of the first inductor be reduced, the second inductor be positioned “at a predetermined distance from the first inductor,” and current be supplied using “two closely spaced terminals.” The preamble requirement that both inductors be on the same semiconductor die aids in understanding the meaning and boundaries of other limitations. Two inductors that

are on the same chip must be formed and positioned and supplied with current in a way that results in a reduced electromagnetic field and minimizes magnetic field contributions. EX2009, ¶ 13.

When it is clear the claim drafters intended to limit claimed methods to on-chip reactions using the preamble and body of the claim to define the invention, the preamble is limiting. *Bio-Rad Labs, Inc. v. 10X Genomics Inc.*, 967 F.3d 1353, 1371 (Fed. Cir. 2020). The recitation in the preamble of claim 11 that the method is implemented on a semiconductor die “informs one of skill in the art as to the structure required by the claim” and is not merely an intended use. EX2002, ¶ 88; *Deere*, 703 F.3d at 1358; *see also Invitrogen Corp. v. Biocrest Mfg., L.P.*, 327 F.3d 1364, 1370 (Fed. Cir. 2003); *In re Fought*, 941 F.3d at 1179.

Finally, the language used in the other patent claims informs a POSITA that the method of claim 11 is limited to forming both inductors on a semiconductor die. EX2009, ¶ 14. The '430 Patent includes ten apparatus claims directed at a two-inductor layout and nine method claims directed at forming two inductors on a die. EX1001, claims 1-19. Dependent method claims 12-19 have similar limitations to dependent apparatus claims 2-10, with the exception of dependent apparatus claim 2. Dependent claim 2 recites: “The inductor layout according to claim 1, wherein said first inductor and said second inductor are *formed on a single semiconductor die.*” EX1001, at claim 2 (emphasis added). There is no dependent method claim

that corresponds to claim 2 because independent method claim 11 (unlike independent apparatus claim 1) has a preamble that states the first inductor and second inductor are “on a semiconductor die.” A POSITA would conclude that the “semiconductor die” language in the preamble of method claim 11 is limiting and that the method claims require forming both inductors on a semiconductor die.

EX2009, ¶ 12.

Dependent claims 12-19 recite either or both of the first inductor and second inductor on a semiconductor die as positive limitations: claim 12 – “forming the first inductor;” *Id.*, 11:16-17; claim 13 – “positioning the second inductor;” *Id.*, 11:25; claim 14 – “orienting said first inductor and said second inductor;” *Id.*, 11:28-29; claim 15 – “placing said first inductor and said second inductor;” *Id.*, 11:31-33; claim 16 – “placing said first inductor and said second inductor;” *Id.*, 12:2-3; claim 17 – referring to first and second loops of first inductor; *Id.*, 12:6-8; claim 18 – “substantially 8-shaped first inductor;” *Id.*, 12:11; and claim 19 – “positioning said first inductor and said second inductor.” *Id.*, 12:13-14.

The specification supports interpreting the preamble of claim 11 as limiting. EX2009, ¶ 12. It describes an “inductor design for reducing mutual EM coupling between VCO resonators and a method of implementing the same on a single semiconductor die.” EX1001, 1:59-61, 2:13-24, 5:45-47. The specification does not identify any embodiment where the first inductor and the second inductor are

positioned on different semiconductor dies. The preamble of claim 11 differs from the preamble of independent claim 1 and disclaimed independent claim 20. *Id.*, 10:11-12 & 12:16. Claim 11's preamble is limiting and applies to dependent claims 12-19.

The claim term “reduced far field” (and variants) means “(reduced/reduce) the electromagnetic field at a certain distance from the first inductor (where the second inductor is positioned)”. EX1020, 19; EX2009, ¶ 15.

IV. THE ‘430 PATENT

The Abstract explains the field of endeavor as methods and systems for “reducing mutual EM coupling between VCO resonators and for implementing the same on a single semiconductor chip.” EX1001, Abstract. The SUMMARY OF THE INVENTION identifies the field of endeavor 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; EX2002, ¶¶ 32-35; EX2009, ¶ 16.

The method reduces mutual EM coupling between two inductors on a semiconductor die. *Id.*, 2:12-15; EX2009, ¶ 43. The first inductor on the semiconductor die has a shape that is substantially symmetrical about a first predefined axis thereby reducing the far field at some directions. *Id.*, 2:15-18. The second inductor on the semiconductor die is formed at a predetermined distance

from the first inductor, thereby reducing mutual EM coupling between the first inductor and the second inductor as a result of the first inductor having a reduced far field.” *Id.* 2:18-24; EX2009, ¶ 44-47. “Symmetrical” refers to symmetry relative to at least one axis. *Id.*, 3:10-11. A substantially symmetrical shape means a figure-8 or four-leaf clover shape. *Id.*, 3:19-20; EX2009, ¶ 18.

Intel alleges the field of endeavor is “inductor design.” PAPER 8, 1-2. The Board concluded the ‘430 Patent describes “an improved inductor design” in voltage-controlled oscillators (“VCO”). PAPER 10 at 3, 17. The Board stated: “neither the specification nor the claims are limited to such specific applications” (*i.e.*, semiconductor die applications). *Id.*, 17. Ericsson respectfully disagrees with the Board. The summary of the invention states the invention is focused on inductors for semiconductor chips. EX1001, 1:61, 2:14-17 & 2:20. The description reiterates the focus on semiconductors. *Id.*, 3:15, 5:45-48; EX2002, ¶ 32-33 & 36. Ericsson respectfully submits the field of endeavor of the ‘430 Patent is *inductor designs for semiconductors* and not as broad as *improved circuit design* as Intel argues. PAPER 8, 1-2.

Claim 1 is not representative of claims 2 & 11-19. Claims 12-19 depend from claim 11 and require reducing the EM field between the first and second inductors on a single semiconductor die. EX1001, 11:16-12:15. Like claims 11-19, claim 2 requires the first and second inductors to be formed on a single

semiconductor die. EX1001, 10:21-34. Claim 1 is not representative of the claims requiring the first and second inductors to be formed on a single semiconductor die.

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

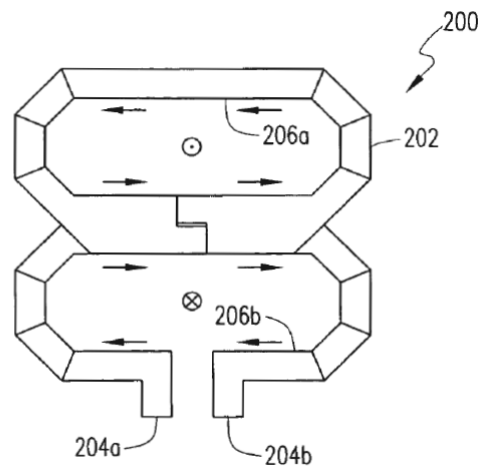


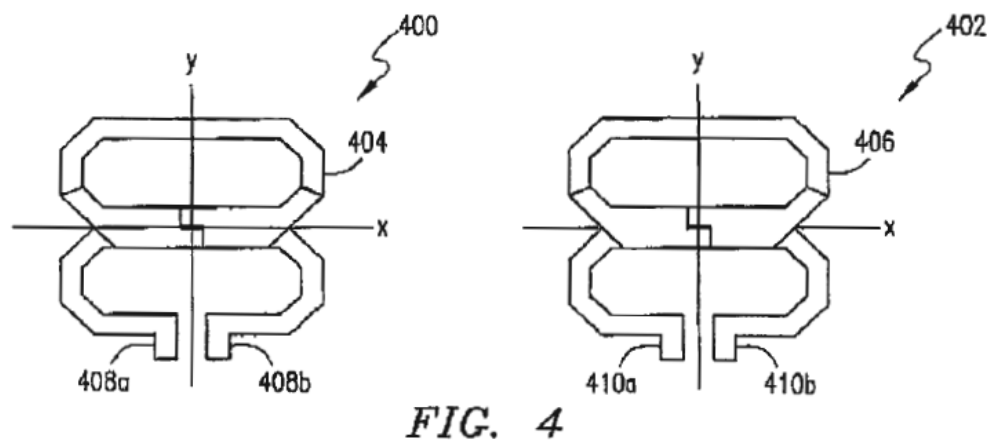
FIG. 2

The inductor 200 has an inductor coil 202 and terminals 204a and 204b designed substantially symmetrical about a horizontal axis X (not shown). *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. Current in the upper loop 206a travels in a counterclockwise direction that is opposite to the clockwise direction in which the current in the lower loop 206b travels. *Id.*, 4:10-14.

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. *Id.*, 4:14-17. EX2009, ¶ 46. The directions of the EM

field components are indicated by arrows in 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. Perfect symmetry between the two loops 206a and 206b is difficult to achieve given terminals 204a and 204b. *Id.*, 4:25-27.

FIG. 4 (below) shows inductors 400 and 402 have a reduced far field because of the figure-8-shaped inductor coil 404 and 406, as explained with respect to FIG. 2. *Id.*, 5:4-7.



The mutual coupling between inductors 400 and 402 is also reduced. *Id.*, 5:7-8.

The same mechanism that causes the radiated EM field from the first inductor to be reduced also reduces the “EM field receive sensitivity” of the second inductor. *Id.*,

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

Table 1 (below) summarizes 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. “[T]he 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; EX2009, ¶ 47. 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 90 degrees in opposite directions improved the isolation to nearly 40 dB. *Id.*, 7:16-18.

V. THE PRIOR ART

A. Taniguchi (EX1005)

Taniguchi does not relate to an inductor layout or to first and second inductors on a semiconductor die. EX2002, ¶ 27, 44. 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], EX2002, ¶ 44; EX2009, ¶ 22. The antennas, housed in an antenna gate, have a length of about 1 meter. EX2002, ¶ 27. The antennas work together to enhance the signal to better communicate with tags 211, 212, 213. EX2009, ¶ 22-23, 37.

The “mutual electromagnetic coupling between the first inductor and the second inductor” is not reduced “as a result of Taniguchi’s first antenna having a reduced electromagnetic field.” EX2009, ¶ 22, 37, 40-42. Taniguchi’s antenna 1 does not have a reduced magnetic field at antenna 2. *Id.* Antenna 1 has a strong magnetic field at antenna 2. *Id.* The reduced EM coupling between antennas 1 and

2 results from the strong magnetic field of antenna 1 inducing opposing currents in antenna 2. *Id.* Antenna 2 induces opposing currents in antenna 1, so the reduced EM field also is not reduced as a result of the second antenna having a reduced electromagnetic field. *Id.*

Taniguchi is less material than the references of record during prosecution of the '430 patent. EX2002, ¶ 29. 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. *Id.* & 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. *Id.* & EX2003. US 6,664,606 (Estes) disclosed a method for orienting inductors (not antennas) to minimize electromagnetic coupling. *Id.* & 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. *Id.* & 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). *Id.* & EX2006. WO 98/05048 (Midya) is directed to planar inductors (not antennas) for a printed circuit board. *Id.* & 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. *Id.* & EX2007. Last, WO 2004/012213 (Enzinger) disclosed a figure-eight inductor (not an antenna) that generates opposing magnetic fields that cancel and reduce interference. *Id.* & EX1017.

Taniguchi's FIG. 3 (below) shows antenna 1 with upper and lower antenna conductors 101, 102. EX1005, [0055]. Antenna 2 comprises antenna conductor 103 formed on the same plane as, or parallel to, antenna 1, but it is not connected to antenna 1. *Id.* Antenna 2 is coupled in electromagnetic induction to the upper and lower halves of antenna 1 via regions S1 and S2. *Id.*

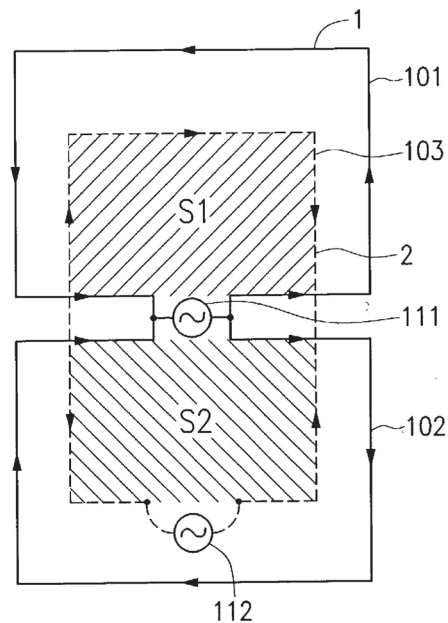
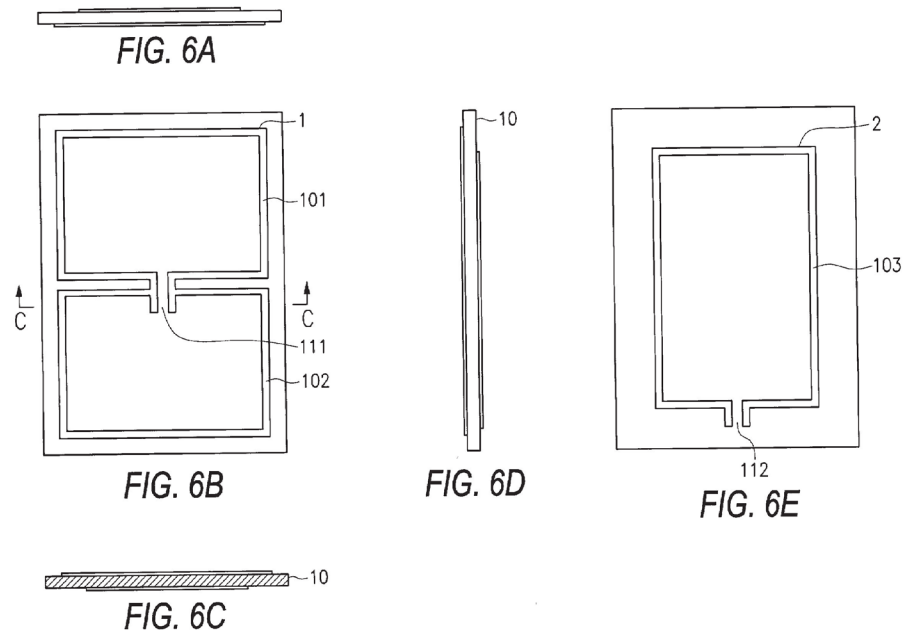


FIG. 3

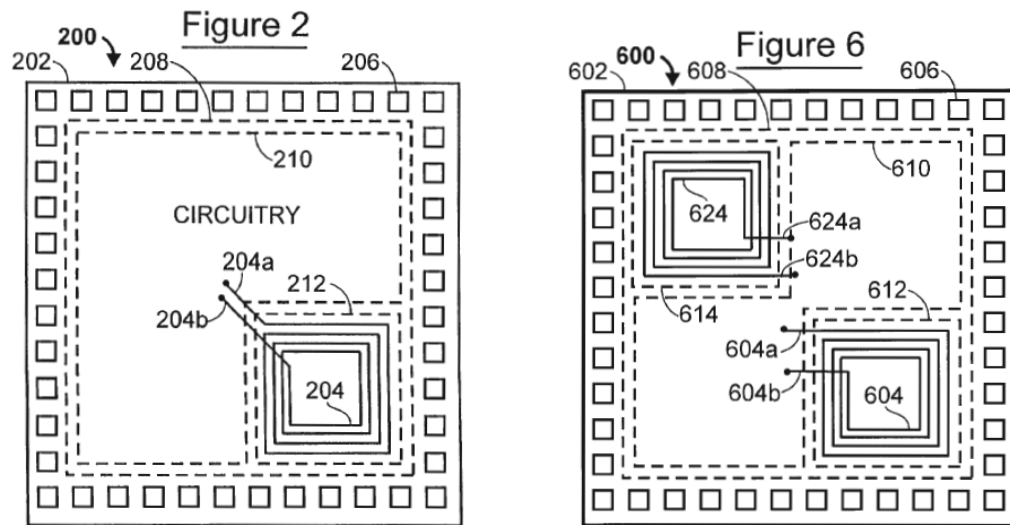
Taniguchi's FIGS. 6A to 6E (below) show antenna conductors 101, 102 on one surface of insulation 10 in a rectangular configuration to form an antenna 1 and feeding point 111 . EX1005, [0066]. Antenna conductor 103 is on the other surface of insulation 10 in a rectangular configuration to form antenna 2 with feeding point 112. *Id.*, [0067].



Antennas 1, 2 must be positioned concentrically. EX1005, Figs. 6A-6e, 7A-7D, 8A-8E, 10A-10E & EX1003, ¶ 107 (“Antenna 2 is placed within and concentric with antennas 1 such that the two antennas share common horizontal, vertical, and Z-axes.”), ¶ 163 (same), ¶¶ 166, 184-185. The concentric arrangement is necessary to achieve zero mutual inductance between the antennas. EX1003, ¶ 163, 190.

B. Rostoker (EX1006)

Rostoker discloses antennas formed on ICs in conventional spiral or O-shaped configurations. EX1006, 1:5-7; FIGS. 2 & 6 (below). Rostoker does not teach 8-shaped or clover-leaf shaped inductors. EX1006. EX2009, ¶ 24.

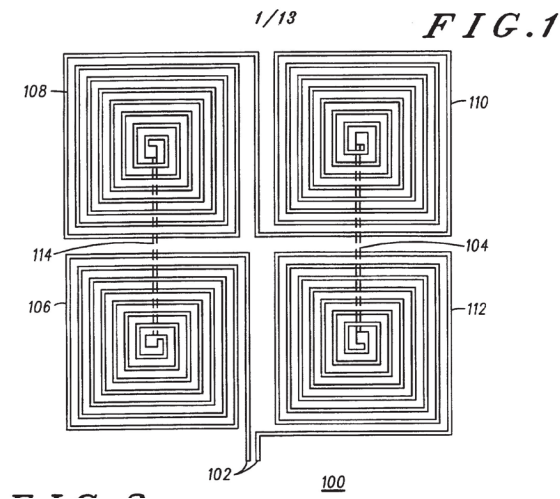


Rostoker discloses inductors may be integrated on the chip along with antennas. *Id.*, 4:21-22, 14:1-3, 14:28-30. Rostoker expressly distinguishes inductors from antennas.

C. Midya (EX1007)

Midya discloses a planar magnetic field inductor/transformer. EX1007, Abstract. 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 (“PCBs”) that are orders of magnitude larger than inductors implemented on a semiconductor chip. EX2002, ¶ 89.

Fig. 1 (below) shows electrical current is supplied to 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. EX2002, ¶ 93-94; EX1007, 11:1-6.



The USPTO considered Midya during prosecution of the '430 Patent and allowed all of the Challenged Claims over Midya. EX1001, Code (56) 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).

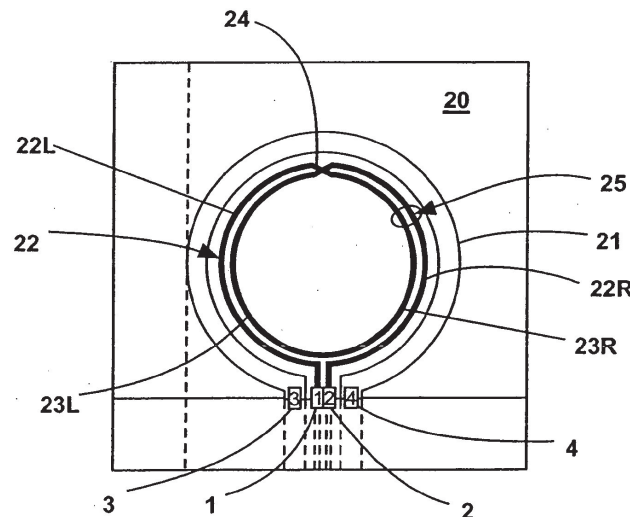
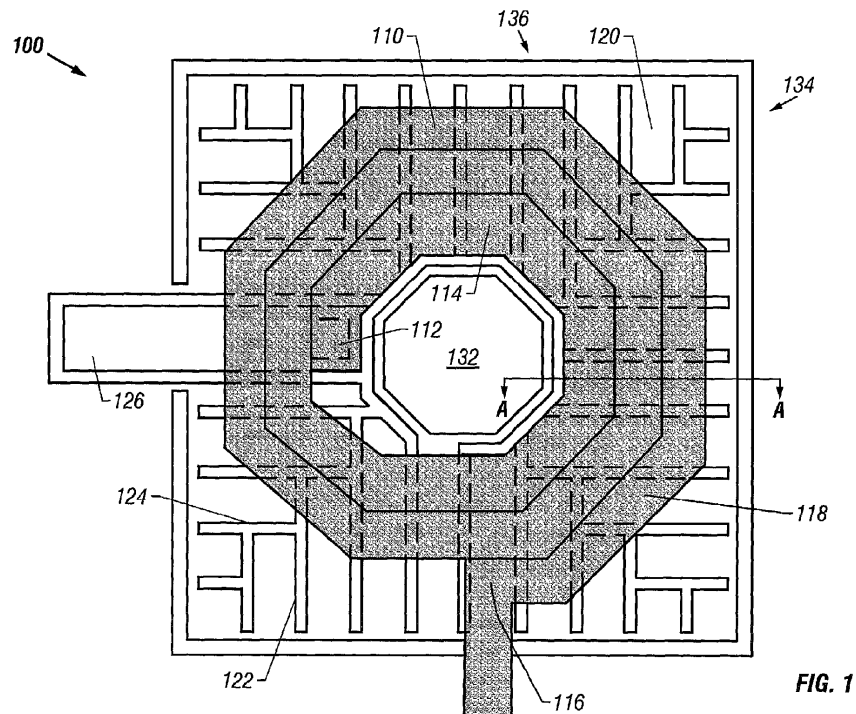


FIGURE 2

Raghavan also discloses a method of winding an inductor such that it 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.



Gardner's FIG. 1 illustrates an inductor 100 comprising a generally spiral-shaped conductor 110 defining a signal path along which current may flow to generate an electromagnetic field around conductor 110. Current may be induced to flow through conductor 110 by applying a voltage potential across an innermost node 112 near the beginning of an innermost turn 114 of conductor 110 and an outermost node 116 near the end of an outermost turn 118 of conductor 110. *Id.*, [0023]

F. Brooks (EX1010)

Brooks discloses PCB designs and teaches forming a “twisted pair of wires” to move two wires closer together to reduce the EMI radiations emitted by the

wires. EX2002, ¶¶ 42, 82; EX1010, Part 1 of 10, p.1 and Part 5 of 10, p. 157.

Brooks teaches that capacitively coupled crosstalk and inductively coupled crosstalk between traces on a PCB increase the closer the traces are to one another and that a technique for reducing crosstalk is to “spread the traces further apart.”

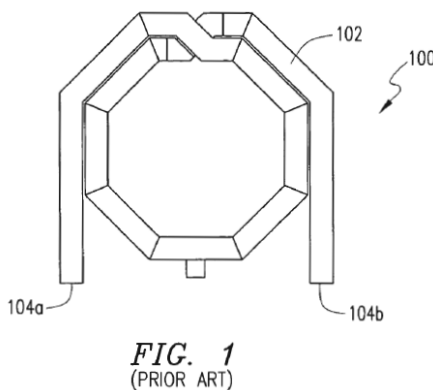
EX2002, ¶¶ 42 & 82; EX1010, Part 6 of 10, p. 222.

A POSITA would have understood 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, ¶¶ 42 & 82; EX1010 Part 6 of 10, p. 222.

G. Overview of the state of the art.

Before the priority date of the ‘430 Patent, IC technologies typically involved hundreds of layout design rules, including rules about spacing, some designed to reduce crosstalk. EX2002, ¶ 82. A POSITA designing a semiconductor chip would have been motivated to follow the CMOS layout design rules expressly for ICs, rather than Brooks’ PCB teachings. EX2009, ¶ 36. Existing inductor designs were optimized for maximum Q-factor due to inherent size constraints. EX2002, ¶ 34. Terminal positioning was dictated by the need to connect to other

circuits on the chip without regard to EM coupling. EX2002, ¶ 37. Fig. 1 (below) shows a typical prior art inductor. EX2002, ¶ 37.



Terminals 104a, 104b (Fig. 1) are not closely spaced. EX2002, ¶ 37. Spiral, O-shaped, and octagonal inductors having terminals spaced far apart were used in ASICs because they were easier to make and connect, required less space, and provided greater inductance through higher Q values. EX2002, ¶ 38.

VI. GROUND 1: Taniguchi, claims 1, 3-5, 7, 10-11, 13-15, 17 & 19

A. Overview

Intel's Petition focuses on Claim 20. PAPER 2, p. 5. Ericsson disclaimed claims 20 and 21. EX2001. After explaining why Taniguchi is not analogous art, Ericsson discusses the remaining claims.

B. Taniguchi is not analogous art.

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.*,

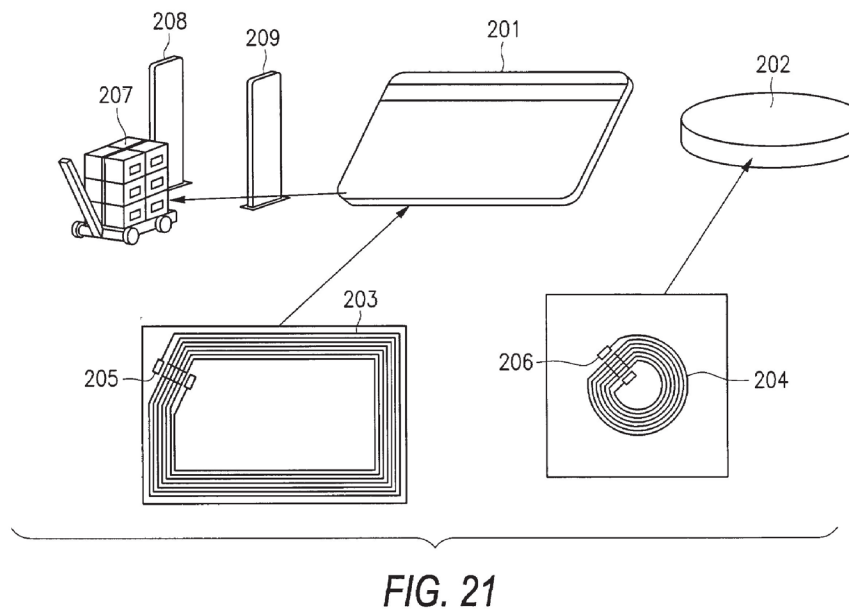
637 F.3d 1314, 1321 (Fed. Cir. 2011) “Two separate tests define the scope of analogous art: (1) whether the art is from the same field of endeavor, regardless of the problem addressed, and (2) if the reference is not within the field of the inventor’s endeavor, whether the reference still is reasonably pertinent to the particular problem with which the inventor is involved.” *Id.* “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.*

The ‘430 Patent relates to an inductor layout on a semiconductor die. See Section IV, *supra*. Taniguchi does not mention or teach a “first inductor and a second inductor on a semiconductor die.” EX2002, ¶ 27. Taniguchi is from a different field of endeavor than the ‘430 Patent. EX2002, ¶ 27. Taniguchi is not reasonably pertinent to the problem solved with the ‘430 Patent. *Id.*, ¶ 28.

Taniguchi focuses on solving the problem of too little mutual magnetic coupling between antennas for large, radio guidance antennas and tags for retail antitheft systems. *Id.*, ¶ 27-8. Taniguchi is not analogous to the ‘430 Patent, and it does not qualify as prior art for the purpose of determining whether the Challenged Claims are invalid under § 103; *Innovention Toys*, 637 F.3d at 1321.

Taniguchi discloses a radio guidance antenna having antennas 1 and 2. EX1005, FIGS. 6A-6E & 13A-13B, & [0081]. Taniguchi’s antennas face each

other as “gates” that detect the passing of an RFID device. EX1005, FIGS. 13A-B & 15A-E, [0081], & [0084]. Taniguchi’s antennas have dimensions of about one meter or greater. EX2002, ¶ 27. Fig. 21 (below) shows RFID tags 201 and 202 have coils 203, 204 and pass between the antenna gates 208 and 209. EX1005, Fig. 21. The purpose of Taniguchi’s antenna system is to generate a strong enough EM field from the antennas to detect the tags. EX1005, [0092]; EX2009, ¶ 37.



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 uses mutual inductance coupling between antennas for transmission

and reception and loop antennas 203, 204 formed in the tags 201, 202. *Id.* That is why Taniguchi refers to elements 1 and 2 as “antennas.” EX2002, ¶ 46-49.

The claimed inductors of the ‘430 Patent reduce mutual EM 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 EM field. EX1001, 10:26-30 and 11:11-15. 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.*, ¶ 49. Even though Taniguchi discusses mutual inductance, it does so in the context of mutual inductance between two antennas positioned concentrically, not when they are in each other’s far field. EX2009, ¶¶ 20, 22, 39.

C. No motivation to modify Taniguchi.

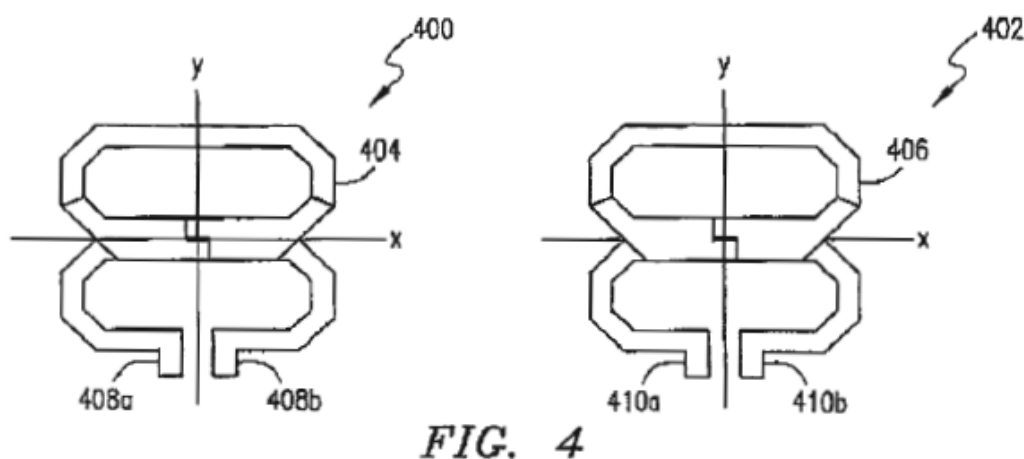
Intel must articulate a reason a person of ordinary skill in the art would have combined or modified the prior art references. *In re NuVasive, Inc.*, 842 F.3d 1376, 1382 (Fed. Cir. 2016); *Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1073 (Fed. Cir. 2015) (“[O]bviousness concerns whether a skilled artisan not only *could have made* but *would have been motivated to make* the combinations or modifications of prior art to arrive at the claimed invention.”) (emphasis original) (citing *InTouch Techs., Inc. v. VGO Commc'ns, Inc.*, 751 F.3d 1327, 1352 (Fed. Cir. 2014)). “A reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the

reference, or would be led in a direction divergent from the path that was taken by the applicant.” *Depuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 567 F.3d 1314, 1327 (Fed. Cir. 2009). Taniguchi meets the second test. On reading Taniguchi, a POSITA would be led in a direction divergent from the path taken in the ‘430 Patent. EX2009, ¶ 39. Taniguchi requires the antennas to be positioned concentrically, *i.e.*, their centers are not at a distance from each other. *Id.* That would lead a POSITA away from the ‘430 Patent’s teachings of positioning the two inductors adjacent one another on the same plane where the centers of the inductors are at distance from each other. *Id.*

Taniguchi is directed to antennas formed on PCBs. EX2009, ¶ 38. Taniguchi does not explain that its teachings apply equally or at all to semiconductors. *Id.* Conversely, the ‘430 Patent is focused on inductors for semiconductors. *Id.* Section 103 requires assessment of the invention as a whole, that is showing a POSITA art at the time of invention, confronted by the same problems as the inventor and with no knowledge of the claimed invention, would have selected the various elements from the prior art and combined them in the claimed manner. *Princeton Biochemicals, Inc. v. Beckman Coulter, Inc.*, 411 F.3d 1332, 1337 (Fed. Cir. 2005) (internal citations omitted). Section 103 requires some suggestion or motivation, before the invention itself, to make the new combination. *Id.* Intel impermissibly uses hindsight bias and *ex post* reasoning to use Taniguchi for teaching a figure-8

construction, rather than a motivation to modify teachings from the field of PCBs to semiconductors. *KSR v. Teleflex, Inc.*, 550 U.S. 398, 421 (2007).

Figs. 4-5, 6, 8, and 12 of the '430 Patent show the first and second inductors 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. EX1001, FIG. 6, FIG. 8, FIG. 12, 6:60-61, 7:20-21, 9:3-5 & EX2002, ¶ 50-51. The two inductors need not have the same size or shape as long as they are substantially symmetrical. EX1001, 3:27-31. The horizontal and vertical axes X and Y in Fig. 4 (below) and the electromagnetic data shown in Figures 6, 8, and 12 show a major factor in reducing the EM interference between the two inductors is the lateral distance between the X, Y center points of the two inductors (the “center distance” in Figs. 6, 8, & 12).



EX1001, Figs. 4, 6, 8, & 12. EX2009, ¶ 17. Taniguchi requires its antennas to be concentric, which means the distance (as understood by reference to Figures 6, 8,

and 12) is zero between the antennas' center points. *Id.* The “predetermined distance” language in the ‘430 Patent’s independent claims focuses on the lateral distance between the center points of the two inductors. *Id.*

TABLE 2

Offset [mm]	L1 [nH]	Q1	Gvdd [dB]	Att [dB]	Deg [dB]	k estim
0.0	1.216	15.19	−89.7	35.7	reference	0.000034
0.1	1.216	15.19	−85.3	31.3	4.4	0.000057
0.2	1.216	15.19	−82.5	28.5	7.2	0.000078
0.3	1.216	15.19	−81.0	27.0	8.7	0.000093
0.5	1.216	15.19	−81.8	27.8	7.9	0.000085
0.7	1.216	15.19	−85.8	31.8	3.9	0.000053
1.0	1.216	15.19	−103.4	49.4	−13.7	0.000007

Taniguchi works only because the second antenna 2 is “arranged so that the sum of mutual inductances between it and the first antenna is minimized.”

EX1005, [0057], [0058], [0061], & claims 1 and 8-10 & EX2002, ¶ 51.

Taniguchi’s antennas 1 and 2 are formed on the same plane or a parallel plane and must have concentric center points. *Id.* at FIGS. 6, 7, 8, 9, 10, 12 & EX2002, ¶ 51.

This concentricity positions antennas 1 and 2 in close proximity without EM coupling with each other while EM coupling with a tag. EX2002, ¶ 51. Taniguchi’s FIG. 4 (below) shows tags 211-213 are much further away than the antennas 1 and 2 are from one another and “makes interlinkage with many lines of magnetic flux” from antenna 1. *Id.*, [0064].

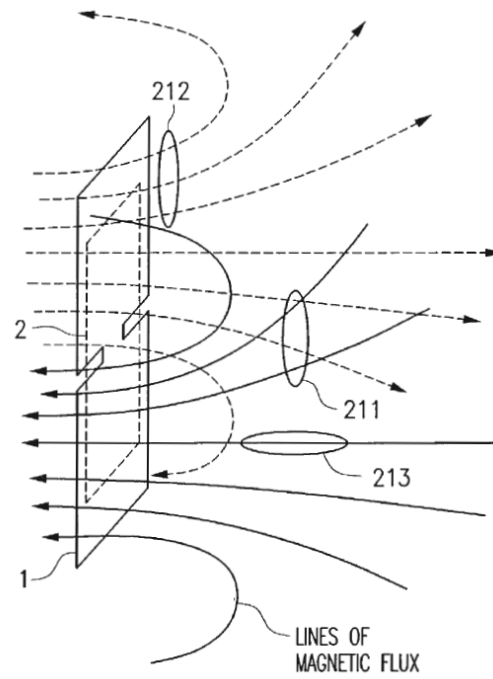


FIG. 4

Fig. 14A shows the 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) are sufficiently strong to communicate with the tags. EX1005. [0083]; EX2002, ¶ 51.

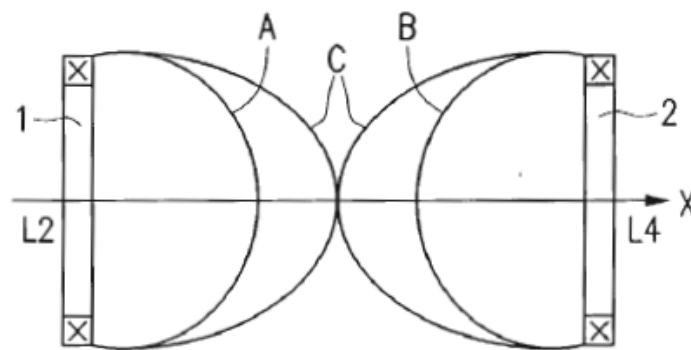


FIG. 14A

The figures below contrast the teachings of Taniguchi and the '430 Patent.

Fig. 7 of the '430 Patent (below left) depicts an embodiment that provides the best attenuation corresponding to Table 2, *i.e.*, inductors 700 and 702 are offset and rotated 90°. Fig. 3 of Taniguchi (below right) depicts the common embodiment showing antennas 1 and 2 positioned concentrically.

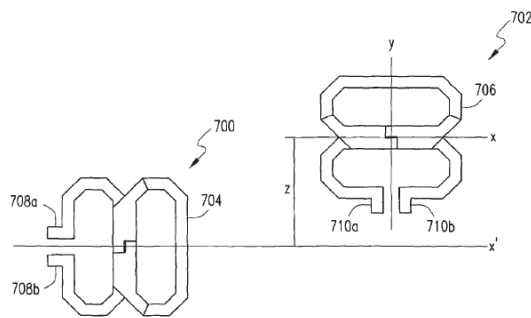


FIG. 7

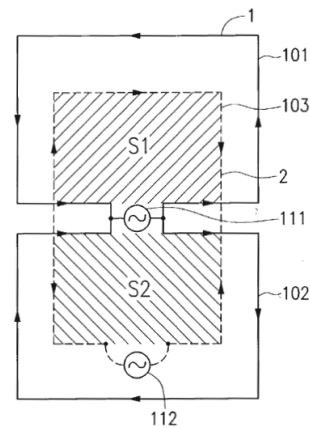


FIG. 3

Intel fails to show that Taniguchi discloses an antenna array other than the concentric positioning as shown in Fig. 3, 6, 7, 10. Intel fails to show Taniguchi would reduce magnetic coupling if its antennas 1 and 2 were positioned as shown in Fig. 4, 5, or 7 of the '430 Patent where the centers of the inductors are at a distance from each other. EX2009, ¶ 50. Taniguchi's requirement for

concentrically positioned antennas teaches away from the ‘430 Patent because the centers of the antennas are not at a distance from each other. EX2009, ¶ 39.¹

The ‘430 Patent teaches attenuating EM as the center distance between the two inductors increases. A POSITA would not have looked to Taniguchi’s concentrically arranged antennas when positioning inductors on a semiconductor die. EX2009, ¶ 50. It would be difficult, if not impossible, to make two inductors from different circuits at different locations on the semiconductor chip concentric with one another. EX2009, ¶¶ 48-50. Even if a POSITA could make the inductors concentric, the POSITA would have been unable to drive the two inductors as Taniguchi drives his antennas 1 and 2 to reduce coupling between the inductors because the inductors are each a component of a different circuit that, due to the function of the circuit (*e.g.*, VCO), would drive its inductor differently than taught by Taniguchi. *Id.* The inductors in the ‘430 patent necessarily need to be spaced from one another and cannot be concentric. *Id.*

Taniguchi would not have motivated a POSITA to substitute its radio guidance antenna, or any components thereof, for the claimed first and second inductors positioned on a semiconductor die in the ‘430 Patent. EX2002, ¶ 52.

¹ Ericsson’s products embodying the ‘430 Patent had commercial success. Due to word-limit constraints, Ericsson does not discuss those objective indicia here.

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, & 4. Taniguchi teaches reduced coupling between antennas 1, 2 only when the antennas are positioned concentrically. But such positioning is impossible to achieve with inductors comprising components of two separate circuits. Intel has not met its burden on the motivation to modify Taniguchi.

D. Independent Claims 1 and 11

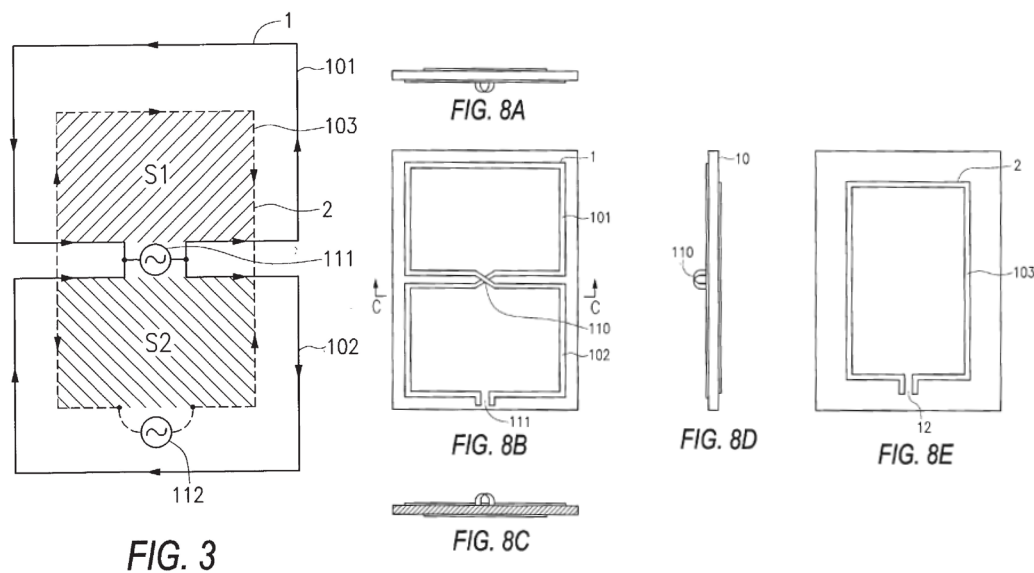
Claim 1 specifies a two-inductor layout. Claim 11 recites a method of reducing EM coupling between a first inductor and a second inductor on a semiconductor die.²

1. Taniguchi does not disclose “reducing mutual electromagnetic coupling between a first inductor and second inductor on a semiconductor die.” [11P]

The preamble in claim 11 is limiting. See III.B, *supra*. A POSITA would not have been motivated to modify Taniguchi’s antennas 1, 2 for the claimed first inductor and second inductor on a semiconductor die. EX2002, ¶ 53.

² Ericsson uses Intel’s labels from the Petition as the Board used in the Institution Decision. PAPERS 2 and 10.

Taniguchi teaches a reduced inductance coupling between first antenna 1 and second antenna 2 only when first and second antennas are positioned concentrically. EX1005, FIG. 3, FIGS. 8A – 8E, & [0057]-[0058], EX1003, ¶ 107, 163.



Taniguchi discusses reduced inductive coupling only in the context of two conductors forming one of the antennas when the antennas are positioned concentrically, not when they are in each other's far field. EX2009, ¶¶ 20-21. Those arrangements do not teach or suggest the first and second inductors on semiconductor dies. EX1001, 10:61-63.

Taniguchi's antenna 1 and antenna 2 are not "a first inductor and a second inductor on a semiconductor die." EX2002, ¶¶ 55, 57, 70-1. The EM coupling between each antenna and the coils 203 and 204 in tags 201 and 202 is not reduced. *Id.*, ¶ 55. The first and second inductors in the '430 Patent have a different

configuration, different function, and different result than Taniguchi's antennas 1 and 2. EX2002, ¶¶ 71, 78-79. As shown in FIGS. 4-5, 6, 8, and 12 of the '430 Patent, the first and second inductors 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 coupling between them. EX2002, ¶ 69; EX1001, Table 2, FIGS. 6, 8, 12, 6:60-61, 7:20-21, & 9:3-5.

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, ¶ 51; EX1005, [0057], [0058], [0061] & claims 1 and 8-10. This is accomplished because antennas 1 and 2 are formed concentrically on the same plane or a parallel plane. EX2002, ¶ 51; EX1005, FIGS. 6-10, 12, [0057], [0058], [0061] & claims 1 and 8-10. Taniguchi teaches this complete overlap is the only way for antennas 1 and 2 to be in close proximity without EM coupling with each other. *Id.* ¶¶ 52, 69. Taniguchi's Fig. 4 (below) shows tags 211-213 positioned much further away than the antennas 1 and 2 are from one another makes interlinkage with many lines of magnetic flux from antenna 1. EX1005, Fig. 4. Taniguchi does not teach positioning inductors having center distances spaced apart to reduce EM coupling between inductors as claimed in the '430 Patent. EX2002, ¶¶ 51-52.

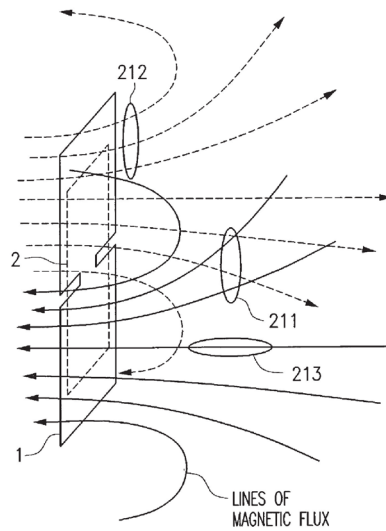


FIG. 4

Taniguchi's Figures 14A-C (below left) show the EM 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 (below right) is sufficiently strong to communicate with the tags. *Id.*; EX1005, [0083].

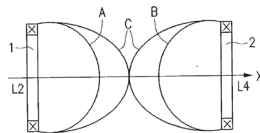


FIG. 14A

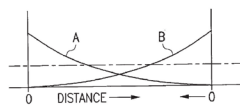


FIG. 14B

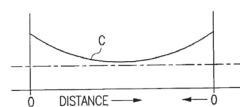


FIG. 14C

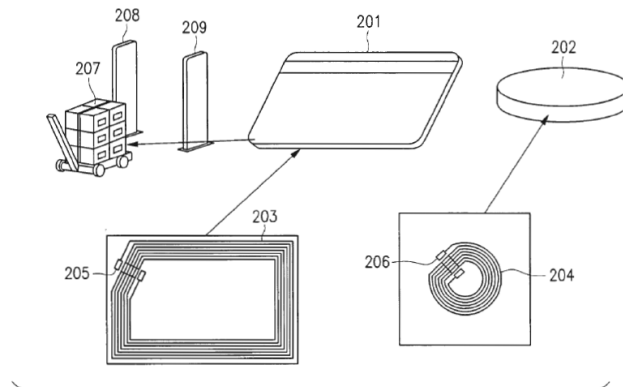


FIG. 21

The Petition fails to establish that Taniguchi discloses or renders obvious the first and second inductors on a semiconductor die having reduced EM coupling between them as claim 11's preamble requires.

2. **Taniguchi does not disclose or render obvious “forming the first inductor to reduce a far field, said step of forming the first inductor comprising: forming a first loop having a shape that is substantially symmetrical about a first predefined access; forming a second loop having a size and shape substantially identical to the first loop; orienting the second loop in relation to the first loop such that a magnetic field emanating from the second loop tends to cancel a magnetic field emanating from the first loop”. [1A1 & 2] and [11A1 & 2]**

Intel's expert states he could not obtain guidance from the '430 Patent regarding the bounds of the term “reduced far field.” EX.1003, ¶ 64.³ Yet, he states Taniguchi teaches this limitation. *Id.*, ¶ 83. Dr. Tentzeris provides no analysis, testing, or methodology explaining the underlying facts or how he arrived at the conclusion that Taniguchi met this limitation when he did not know the bounds of the limitation. Such testimony is inadmissible under Federal Rule of Evidence 702 and represents the type of conclusory statements that have little weight. *Xerox Corp. v. Bytemark, Inc.*, 2022 Pat. App. LEXIS 4317, * 16-17,

³ This was discussing claim 20, but Dr. Tentzeris incorporated the discussion of this claim term into his analyses of claims 1 and 11. PAPER 2, at 38.

2022 Pat. App. LEXIS 4317 (PTAB 2022) (precedential); 37 C.F.R. § 42.65(a).

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, ¶ 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. & EX1005, Fig. 4. Taniguchi's FIG. 4 (*supra*) shows a tag 211 that is relatively far away "makes interlinkage with many lines of magnetic flux" from antenna 1. *Id.* & EX1005, [0064]. Taniguchi's FIG. 14 (*supra*) 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. *Id.* & EX1005, [0083].

The opposing fields of Taniguchi's antenna 1 are designed to induce opposing currents in Taniguchi's antenna 2, which is concentric with antenna 1. EX2002, ¶ 61; EX1005, FIG. 3, [0015], [0019] - [0021], [0057], [0060] & [0095]. The opposing fields of antenna 1 inducing opposing currents in antenna 2 enables electric power to be efficiently converted to an EM field strong enough to read tags 211-213. *Id.* & EX1005, [0095]. The field of antenna 2 induces opposing currents in antenna 1 to enable electric power to be efficiently converted to an EM field strong enough to read tags 211-213. *Id.* & EX2009, ¶ 48-49.

**3. Taniguchi does not disclose or render obvious
“connecting two closely spaced terminals to the first
loop for supplying electrical current to the first and
second loops while minimizing magnetic field
contributions from the terminals.” [1A.3] and [11A.3]**

Although there is some space between the ends of antenna conductor 102 at feeding point 111 in Taniguchi’s FIG. 8B, Taniguchi does not disclose or suggest that these ends are closely spaced to minimize the magnetic field contributions from these ends. EX2002, ¶ 63 & EX1005, FIG. 8. Taniguchi’s radio guidance antennas are about 1 meter long, and the ends of Taniguchi’s antenna conductor 102 at feeding point 111 are not closely spaced relative to the semiconductor chip described in the ‘430 Patent. EX2002, ¶ 64.

Taniguchi does not teach the spacing between the ends of antenna conductor 102 at feeding point 111 in Figure 8B minimizes the magnetic field contributions from the terminals. EX2002, ¶ 65. Taniguchi places feeding point 111 in FIG. 8B 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.* Taniguchi teaches “the two feeding points 111, 112 are nearer to each other, which is favorable in wiring.” 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. *Id.*

The Petition fails to establish that Taniguchi discloses or renders obvious the

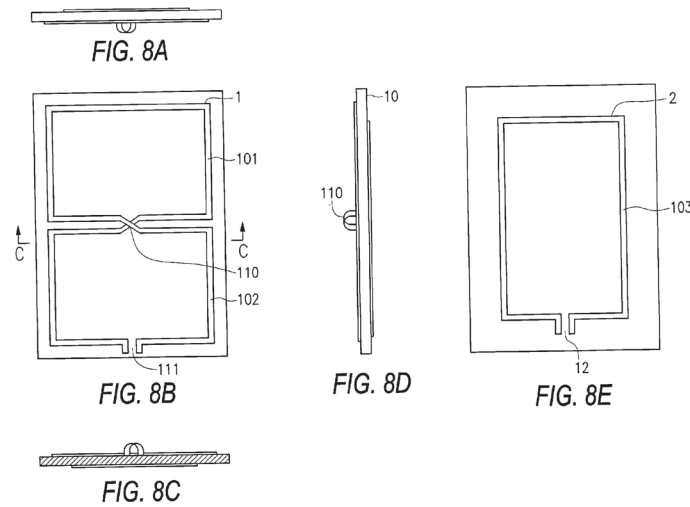
two closely spaced terminals connected to the first loop for supplying electrical current to the first and second loops while minimizing magnetic field contributions from the terminals limitations of claims 1 and 11 in the ‘430 Patent. EX2009, ¶ 51.

4. **Taniguchi does not disclose or render obvious “positioning a second inductor at a predetermined distance from the first inductor, wherein the 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.” [1B.1 & 1B.2], [11B.1 & 11B.2]**

Taniguchi’s antennas 1, 2 are not inductors, and antenna 2 is not positioned at a predetermined distance from antenna 1. EX2002, ¶ 67; EX1005, [0055], & FIG. 8E. The EM field at a certain distance from a first inductor is not reduced. EX2002, ¶ 68. There is no reduction of mutual EM 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 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 coupling between them. EX2002, ¶ 69; EX1001, 2:19-24. 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.” *Id.*; EX1005, claims 1 and 8-10. Both Taniguchi’s antennas are formed on the

same plane or a parallel plane and must have concentric center points to reduce EM coupling between antennas 1 and 2. EX2002, ¶ 69; EX1005, FIGS. 6, 7, 8, 9, 10, and 12. FIG. 8 is exemplary:



The Petition does not show Taniguchi discloses or renders obvious all the elements of independent claims 1 or 11. EX2009, ¶ 52.

E. Dependent Claims

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 same reasons provided above with respect to claims 1 and 11, Taniguchi does not disclose all the elements of dependent claims 3-5, 7, 10, 13-15, 17 & 19.

VII. GROUND 2: Taniguchi/Rostoker, claims 2, 8, 11, 13-15, 17-19

A. Summary

The deficiencies with Taniguchi explained in Section VI apply to Gound 2. A POSITA would not have been motivated to combine Taniguchi and Rostoker. For Ground 2, the Petition identifies claims 2, 8, 11, 13-15, 17-19. PAPER 2, at 54. The Petition discusses claim 2, 11, & 8/18. *Id.* at 60-65. The Petition does not discuss claims 13-15 or 17-19. Intel cannot prevail on Ground 2 as to claims 13-15 or 17-19. 35 U.S.C. § 312(a)(3).

B. No motivation to combine Taniguchi and Rostoker.

The rigid application of the teaching, suggestion, or motivation to combine (“TSM”) test has been rejected. *KSR Int’l. v. Teleflex, Inc.*, 550 U.S. 398, 419-420 (2007). “The prior art, skill, and knowledge of an ordinary artisan may also provide reasons not to combine which would likewise be a question of fact. For example, a reference may be found to teach away from a claimed combination, also a question of fact.” *Arctic Cat Inc. v. Bombardier Rec. Prods.*, 876 F.3d 1350, 1360 (Fed. Cir. 2017). “Prior art teaches away when “a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant.”” *Id.* Taniguchi does not expressly state its PCB teachings apply to ICs, nor does Rostoker suggest its IC teachings apply to PCBs.

A POSITA would not have been motivated to combine Taniguchi and Rostoker to obtain the claimed invention. EX2002, ¶ 76. Taniguchi teaches

antennas on a PCB but does not state that its teachings apply to semiconductor chips. EX2009, ¶ 38. Taniguchi's antennas must be positioned concentrically. *Id.*, ¶ 36. Rostoker teaches antennas on IC chips but does not state that its teachings apply to PCBs. EX2009, ¶ 24. A POSITA would not have found a reason to combine Taniguchi's PCB teachings with Rostoker's IC teachings from their respective disclosures. EX2009, ¶¶ 25, 53. The Petition fails to establish a sufficient motivation to combine Taniguchi and Rostoker. EX2002, ¶ 77.

Rostoker teaches using a shield to block antenna signals. EX1006, 4:18-20. That design teaches away from the '430 Patent's 8-shaped or four-leaf clover configurations to cancel the EM field. EX2009, ¶ 55. Rostoker teaches filling the loop with a core of ferrite, which increases the magnetic flux. EX1006, 6:33-5. One of the stated goals of Rostoker is moving the antenna from the periphery to the interior to avoid interfering with pinouts. *Id.* The connections to the antenna are located to avoid interference with pinouts. *Id.* The location of the connections was not determined by spacing them closely to cancel the magnetic field. *Id.* Another goal was to avoid EM interference when the circuitry is located within the antenna loop by relocating the antenna. *Id.* This teaches away from canceling the field generated by the antenna itself. Rostoker mentions locating both a transmit and receive antenna on the same chip without any concern of the transmit signal feeding back to the receive antenna and causing interference. EX1006, 4:14-21.

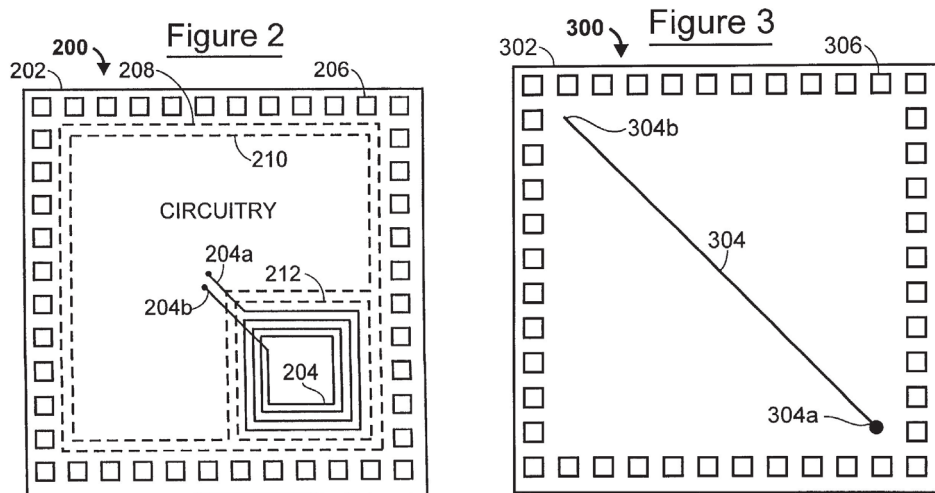
Intel has not presented substantial evidence demonstrating a motivation to combine Taniguchi and Rostoker.

Claims 2 and 11 require the first and second inductors to be formed on a semiconductor die. *Id.* and EX1001, 10:31-33 & 61-63. Rostoker is directed to antennas, not inductors, and Rostoker's antenna coils implemented on a semiconductor die are all formed in conventional spiral or O-shaped configurations. EX2002, ¶ 77 & EX1006, FIGS. 2 and 6. Rostoker mentions inductors may be integrated on an IC chip along with antennas, but it expressly distinguishes "antennas" from "inductors," and describes only antennas in any detail. *Id.* ¶ 77; EX1006, at 4:21-22, 14:1-3, & 14:28-30. Rostoker does not disclose 8-shaped or clover-leaf shaped inductors. EX1006.

The purpose and function of the antennas in Rostoker differ from the purpose and function of the first and second inductors claimed in the '430 Patent. EX2002, ¶ 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.* ¶ 77; 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. *Id.* A POSITA would not have been motivated to combine the teachings of Rostoker with the

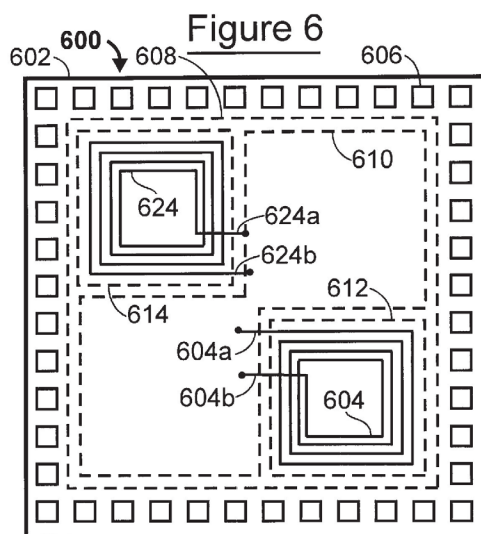
antennas of Taniguchi to arrive at the inductor layouts of the '430 Patent. EX2009, ¶ 56.

A POSITA would not have had a reasonable expectation of success in combining Taniguchi and Rostoker. EX2002, ¶ 78. Prior art taught away from the inventions claimed in the '430 Patent. *Id.* References that described inductors formed on a semiconductor die taught spiral or O-shaped inductors not inductors formed from a pair of loops. *Id.*, EX1006, FIG. 1 & EX1008, FIGS. 2-3 (below).



The terminals in Rostoker Fig. 2 are in a spiral, which lacks the required geometry to create the counter propagating magnetic fields required by the '430 Patent. EX2009, ¶ 26. Even if Rostoker's spiral was 8-shaped, one of Rostoker's endpoints is internal to the loops and needs to be brought outside by terminal 204b. *Id.* Terminals 204a and 204b are not symmetric, and even if their endpoints may appear close together, the magnetic fields would not cancel. *Id.* 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. *Id.*, EX1001, FIG. 1, 3:66-4:4; EX1006, FIG. 6.



In Rostoker’s Fig. 6, ends 604a, 604b, 624a, 624b extend from the antenna 604, which is in the second portion 612 of the central area 608 of the chip 602 into the first portion 610 of the central area 608 of the 10 chip 602 so as to be connected to circuitry (not shown) disposed within the first portion 610 of the central area 608. EX1006, 9:19-35.

Antennas perform a different function than the claimed inductor layout of the ‘430 Patent. EX2002, ¶ 79. Taniguchi and Rostoker teach components designed to radiate an electromagnetic field for facilitating a more efficient antenna system. *Id.* & EX1005, [0062]; EX1006, 1:25-27. Taniguchi and Rostoker describe coils that emit EM radiation in products designed, for example, for an RFID tag or other

communication applications. *Id.* & EX1005, FIG. 21, & [0084]; EX1006, 4:29-36. Taniguchi and Rostoker are not analogous to, and teach away from, the '430 patent because they have nothing to do with reducing EM coupling between a pair of inductors in a layout on a semiconductor die. EX2002, ¶ 79. Because of the differing purpose, design, and applications for these antenna coils, a POSITA would not have been motivated to combine Taniguchi or Rostoker to create a layout with reduced coupling between a pair of inductors on a semiconductor die. *Id.*

For implementing the claimed inductor layout of claims 1-10 and the methods of claims 11-19, a POSITA would have applied the more relevant and precise design rules for ICs. EX2002, ¶ 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 & 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. *Id.* 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 Taniguchi and Rostoker to obtain the claimed invention. EX2002, ¶ 81. 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 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. *Id.* & EX1023, 12:9-12:22. Saitoh teaches the proper loop diameter of his antenna 3 and the position of that antenna relative to his coils 2a and 2b of the transmitting antenna reduce the mutual inductance between receiving antenna 3 and internal loop coil 2a and external loop coil 2b; the number of turns in the transmitting antenna loop is not mentioned. *Id.* & EX1023, 5:4-11. Intel's arguments fail to find support in the teachings of Saitoh. Intel has not met its burden of proof regarding motivation to combine Taniguchi and Rostoker. *In re NuVasive*, 842 F.3d at 1382.

C. Claim 11

Rostoker does not teach or disclose the first and second inductors formed on a single semiconductor die as claim 11 requires. EX2009, ¶ 53. Rostoker does not

overcome the deficiencies in Taniguchi discussed above regarding Ground 1 in Section VI. *Id.* Rostoker discloses antennas, not inductors, on an IC, and antennas are not inductors. EX2009, ¶¶ 53-54. Antennas are designed to emit or receive radiation for communication, not to produce magnetic fields that cancel. *Id.* The primary point of novelty of Rostoker’s antennas is to avoid crossing other circuitry on the chip, regardless of their size, geometry, or terminal spacing. *Id.* The ‘430 Patent’s inductors are designed to have a magnetic field that cancels and avoids communicating with other components on the chip. *Id.* The Petition fails to show Taniguchi combined with Rostoker renders claim 11 invalid.

D. Dependent Claims 2, 8, 13-15, 17-19

Claims 2 & 8 depend from independent claim 1. EX1001, 10:31-33 & 10:49-51. Intel does not challenge claim 1 with Taniguchi/Rostoker. Claims 13-15 & 17-19 depend from claim 11. For the same reasons discussed in Section VI, Taniguchi does not render these dependent claims obvious. For the reasons set forth below, Intel fails to establish claims 2, 8 & 18 are unpatentable over Taniguchi combined with Rostoker.

1. Claim 2

Claim 2 depends from claim 1 and further requires “said first inductor and said second inductor are formed on a single semiconductor die.” EX1001, 10:31-

33. For the reasons discussed in the preceding Section C regarding claim 11, the Taniguchi/Rostoker combination does not render claim 2 unpatentable.

2. Claims 8 & 18

Claims 8 recites the additional limitation “an inner loop within each of the two loops of said substantially 8-shaped first and second inductors. EX1001, 10:50-53. Claim 18 is similar and recites the additional limitation of “forming an inner loop within each of the two loops of said substantially 8-shaped first inductor. *Id.*, 12:8-11. As it depends from claim 11, claim 18 requires the first inductor to be on a single semiconductor die. For the reasons discussed in the preceding Section C regarding claim 11, the Taniguchi/Rostoker combination does not disclose or render obvious the first and second inductors formed on a single semiconductor die required in claims 8 & 18. The Petition fails to show claims 2, 8, 11, 13-15, or 17-19 are unpatentable.

VIII. GROUND 3: Midya (EX1007)/Raghavan (EX1008), claims 1, 3-6, 9, 11-16

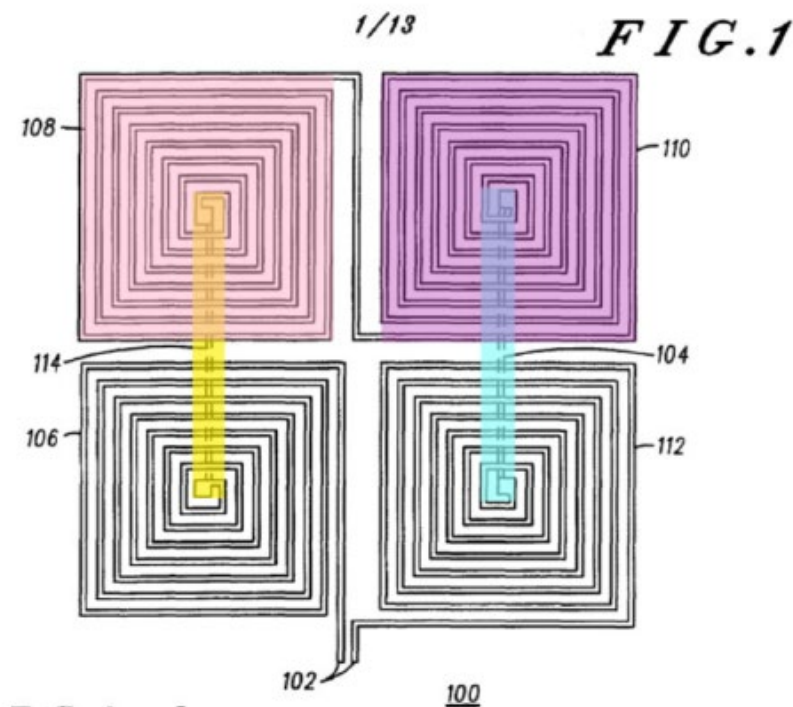
A. Summary

Intel fails to demonstrate a POSITA would have been motivated to combine Midya and Raghavan. The combination does not teach or disclose *forming first and second inductors on a semiconductor die* or the *two closely spaced terminals* limitations.

B. No Motivation to combine Midya and Raghavan.

Midya is directed to a planar magnetic field inductor having at least three planar loops/spiral conductor coils. EX1007, Abstract. Midya states its teachings are typically located on a PCB. *Id.*, at 13-14, & 20. Midya does not state that its teachings apply equally to inductors in IC chips. EX2009, ¶ 27.

Midya's FIG. 1 shows electrical current supplied to 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, ¶ 94; EX2009, ¶ 28. The additional loop generates an EM field that is not reduced or cancelled by any structure in Midya. EX2009, ¶ 28.



Midya's 4 spirals are not symmetric individually or collectively. EX1007, Fig. 1. Counter-propagating currents are produced by having the current in the first inductor travel from the outside of the spiral to the center, and the from the center of the next spiral to the outside. EX1007, 8. This requires the vertical lines shown that interconnect the center terminals of the first and second, and third and fourth inductors. *Id.*, Fig. 1. These vertical lines create additional asymmetry in both the individual inductors and their combination. EX2009, ¶¶ 30, 57.

Raghavan is directed to inductors used on IC. EX1008, [0002]. EX2009, ¶ 33. Raghavan does not state that its IC teachings apply equally to the field of PCBs

as is Midya. Raghavan does not disclose 8-shaped or clover shaped inductors. *Id.* Raghavan does not discuss reducing magnetic coupling between inductors. *Id.* A POSITA would not have been motivated to combine Midya and Raghavan.

C. Independent Claims 1 & 11

1. **The Midya/Raghavan combination does not teach or suggest “mutual electromagnetic coupling between the first inductor and the second inductor is reduced” [1A] or “reducing mutual electromagnetic coupling between a first inductor and a second inductor on a semiconductor die.” [11p]**

Midya does not disclose the required pair of planar inductors in a layout or on the same semiconductor die. EX2002, ¶ 89. Midya teaches a “second” inductor positioned above the “first” inductor” on a different layer of a PCB: “two layers may [sic] utilized to construct two non-interacting inductors disposed concentrically (FIG. 26, numeral 2600).” *Id.*, ¶ 89; EX1007, 11:18-20. Although Midya mentions in passing 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), Midya’s detailed examples include inductors on a PCB. EX1007, FIGS. 7, 8, and 10, 13:1-21 and 14:11-16; EX2002, ¶ 89. The dimensions of an inductor on a PCB are orders of magnitude larger than the dimensions of an inductor on a semiconductor die. EX2002, ¶ 89. A POSITA would understand Midya’s “concentric” or “stacked”

configuration of inductors on different planes is outside the scope of claim 11. *Id.* Every drawing, table, graph, embodiment, and description in the ‘430 Patent specification makes clear the two inductors must be side-by-side, not facing each other. *Id.*; EX1001, FIGS. 4-8 and 11-12 and Tables 1-3. A POSITA would not have looked to Midya for ways to position inductors on a semiconductor chip. EX2002, ¶¶ 89, 97-8.

Before allowing claims 1 and 11 of the ‘430 patent to issue, the examiner considered Midya and determined it did not teach these limitations. EX2002, ¶¶ 90, 96. In the May 22, 2006 Office Action, 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.” EX1002, p. 3. ¶ 3. Midya does not teach or suggest the inductor layout limitations of independent claims 1 and 11. EX2002, ¶¶ 90-93.

The configuration and function Raghavan’s symmetric spiral inductors shown in FIGS. 2 and 3 differ materially from the configuration and function of the inductors claimed in the ‘430 Patent. EX2002, ¶ 102. Raghavan’s inductors have a single “loop” with circular or square windings configured for “eliminating signal

degradation due to inductor asymmetry.” *Id.*; EX1008, [0018] & [0021]; EX2009, ¶ 34. Raghavan’s inductors avoid the asymmetry of conventional spirals by using crossovers and concentric loops such that the current travels only in one direction as it traverses the inductor from the input to the output terminal (a clockwise or counter-clockwise direction but not both). *Id.* Raghavan’s inductor cannot produce counter-propagating magnetic fields that cancel, as required by the ‘430 patent. *Id.* Raghavan does not cure the deficiencies in Midya relating to the inductor layouts for reducing EM coupling.

Raghavan attempts to correct the asymmetry of spiral inductors by using concentric loops with crossovers, making their terminals on the outside of the inductor, unlike the spirals. EX1008, [0007, 0015] Any attempt to insert four of Raghavan’s inductors into Midya would not repair the asymmetry produced by the interconnections required to connect the four inductors. EX2009, ¶ 54. The additional interconnection lines that would be required would produce just as much asymmetry, if not more, than Midya. EX2009, ¶ 57.

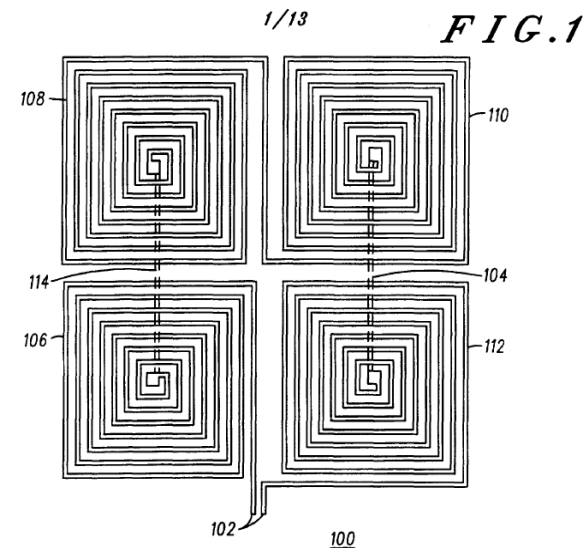
The Midya/Raghavan combination does not disclose or render obvious the reducing mutual EM coupling between the first and second inductors recitations of claims 1 and 11.

2. **The Midya/Raghavan combination does not teach or disclose “connecting 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.”
[1A.3] & [11A.3].**

Claims 1 and 11 require the two closely spaced terminals be connected to the same loop. *Id.* The combination of Midya and Raghavan does not disclose or suggest two closely spaced terminals.

Midya relates to substantially planar inductors. EX2002, ¶ 85; EX1007, 1:5-6. 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, ¶ 86; EX1007, 1:23-26. Midya does not disclose a figure-8 inductor to achieve its stated goals. *Id.* 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 (below) describes a “4-loop single layer planar inductor in accordance with the present invention.” EX2002, ¶ 86; EX1007, 2:6-8. EX2009, ¶¶ 31-32.



Midya “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, ¶ 87; EX1007, 7:14. Midya makes passing reference to two terminals (*e.g.*, EX1007 at FIG. 1 item 102 (*see* reproduction of FIG. 1 above)) but does not describe the terminals as closely spaced and connected to the first loop. EX2002, ¶ 87; EX1007, 8:8-12, 11:1-16, & 16:1-25; EX2009, ¶ 30.

Midya also fails to disclose the two closely spaced terminals connected to the first loop. EX2002, ¶ 89; EX2009, ¶ 30. Fig. 1 shows terminals 102 connected to different loops 106, 112; both terminals are not connected to a first loop as claims 1 and 11 require. According to Midya’s description of FIG. 1, “[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, ¶ 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, ¶ 93. Midya's two terminals are not connected to the same loop 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, ¶ 94. The additional loop generates an EM field that is not reduced or cancelled by any structure in Midya. EX2009, ¶ 57. Electrical current is supplied to adjacent loops 106 and 108 by three 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.*, ¶ 28; EX1007, 11:1-6. Electrical current is supplied to adjacent loops 110 and 112 by a different group of three 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, ¶ 94; EX1007, 11:1-6. 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, ¶ 95.

Midya does not teach or suggest “two closely spaced terminals connected to the first loop” and “connecting two closely spaced terminals to the first loop,”), and the PTO examiner agreed. EX2002, ¶ 92.

Raghavan, considered in combination with Midya, does not disclose or render obvious claims 1, 3-6, 9, 11-16. EX2002, ¶ 100. Raghavan is typical of the prior art in that its inductors are O-shaped or spiral shaped, not inductors formed from a pair of loops. EX2002, ¶ 101; EX1008, FIG. 2, FIG. 3, [0002], [0007], & [0008]. Raghavan explains conventional spiral inductors, such as the inductors shown in the Midya, are asymmetrical and can cause signal degradation. EX2002, ¶ 101; EX1008, [0004].

In Raghavan, the configuration and function of the symmetric spiral inductors shown in FIGS. 2 and 3, are respectively formed from concentric circles or square windings, and differ materially from the configuration and function of the inductors claimed in the ‘430 Patent. EX2002, ¶ 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] & [0021]. Raghavan’s inductors avoid the asymmetry of conventional spirals by using crossovers and concentric loops such that the current travels only in one direction as it traverses the inductor from the input to the output terminal (a clockwise or counter-clockwise direction but not both). EX2009, ¶ 34. Raghavan’s inductor

cannot produce counter-propagating magnetic fields that cancel, as required by the ‘430 patent. *Id.* Raghavan does not discuss mutual EM coupling between two inductors and does not attempt to reduce the EM field emanating at a certain distance from one inductor where a second inductor is positioned. *Id.*

Raghavan teaches a 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.” EX2002, ¶ 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), there would be no reduction in mutual electromagnetic coupling between those inductors. *Id.*

D. Dependent Claims

Claims 3-6 & 9 depend from independent claim 1. EX1001, 10:35-45 & 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, the Petition fails to prove a POSITA would have been motivated to combine Midya and Raghavan to render obvious claims 3-6, 9, & 12-16. EX2002, ¶ 104.

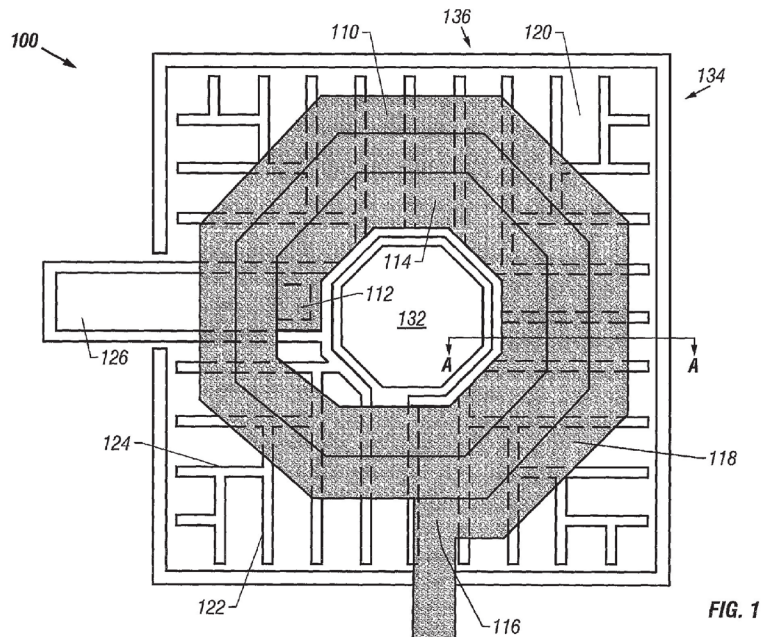
IX. GROUND 4: Midya/Raghavan/Gardner, claims 2, 11-16

A. Independent Claim 11

Ericsson’s arguments regarding Midya and Raghavan from Ground 3 apply to Ground 4. (Section VIII *supra*). Intel adds Gardner claiming it teaches the first

and second inductors formed on a semiconductor die. PAPER 2, at 101. Gardner (EX1009) does not disclose or render obvious those elements from the Challenged Claims 2 and 11-16 missing from Midya and Raghavan. EX2002, ¶ 105. Intel again combines the teachings of PCB applications with IC applications without pointing to any statements in the references suggesting they can be applied in that way. *Arctic Cat Inc.*, 876 F.3d at 1360. Intel relies impermissibly on conclusory statements from its expert using the benefit of hindsight, both of which the law forbids. *KSR*, 550 U.S. at 418.

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. EX2002, ¶ 106; EX1009, FIG. 1 & [0023]. FIG. 1 (below) shows inductor 110 is spiral-shaped. EX2002, ¶ 106; EX1009, FIG. 1 & [0023].



The terminals and connections for supplying electrical current to this spiral inductor are spaced far apart. EX2002, ¶ 107; EX1009, FIG. 1 & [0023]. 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. *Id.* 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. *Id.* Gardner's terminals are perpendicular to each other, and they cannot cancel each other's EM fields, because the generated EM fields would be orthogonal to one another. EX2009, ¶ 58. Combining Gardner with Midya and Raghavan does not teach or disclose the elements of claim 11. EX2002, ¶ 105.

B. Dependent Claims 2, 12-16

Claim 2 of the '430 Patent depends from independent claim 1. *Id.* at (136); EX1001 at 10:32. Claims 12-16 depend from independent claim 11. EX1001, 11:16-12:4. For the reasons set forth above regarding independent claim 11, combining Gardner with Midya and Raghavan does not render claims 2 and 11-16 obvious. EX2002, ¶ 108. The Petition does not establish claims 2, 12-16 are unpatentable.

X. GROUNDS 5-8

Grounds 5-8 mirror grounds 1-4 with the exception that Intel adds Brooks to the respective combinations.

A. Ground 5: Taniguchi & Brooks, claims 1, 3-5, 7, 10-11, 13-15, 17 & 19.

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. Grounds 5-8 mirror grounds 1-4 with the exception that Intel add Brooks to the combination. *Id.* Ericsson incorporates its prior discussion of Ground 1 showing the prior art does not teach or disclose “closely spaced” and “minimizing magnetic field contributions from the terminals” limitations. (Section VI, *supra*) Ericsson’s prior discussion of Brooks (Sections V(F) & X(A)) also applies.

The '430 Patent states “In addition, the positioning of the terminals 204a and 204b may help minimize the far field. For example, 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.” EX1001, 4:28-33.

Intel claims the terminals in Taniguchi are closely spaced because the distance between them is close relative to the width of the loops. EX1003, ¶ 126. Intel relies on Brooks to teach that if the wires were very close together, their EMI radiations would cancel and not be measurable. *Id.*, ¶¶ 127-8. But Dr. Tentzeris provides no testing or methodology to show that the terminals in Taniguchi are close enough to that the magnetic fields are minimized or cancelled. EX2009, ¶ 59. Such testimony is inadmissible under Federal Rule of Evidence 702 and represents the type of conclusory statements the Board ignores. *KSR*, 550 U.S. at 418; 37 C.F.R. § 42.65(a).

A POSITA would not have been motivated to combine Taniguchi and Brooks to obtain the claimed invention. EX2002, ¶ 82. Brooks is limited to PCB design, and the cited section teaches forming a “twisted pair of wires” to move two wires closer together to reduce the EMI radiations emitted by the wires. EX2002, ¶ 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, ¶ 82; EX1010, p. 222. A POSITA would have been motivated to increase the distance, not reduce the distance, between two signal lines to reduce coupling. EX2002, ¶ 82; EX1010, p. 222. A POSITA would have chosen CMOS IC design rules over Brooks' PCB teachings. EX2009, ¶ 60.

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 claim 11, Intel does not demonstrate claims 1, 3-5, 7, 10, 13-15, 17 & 19 are unpatentable.

B. Ground 6 Taniguchi, Rostoker & Brooks, claims 2, 8, 11, 13-15, 17-19

Ground 6 mirrors Ground 2 but adds Brooks to the combination in an effort to show the “closely spaced” and “minimizing magnetic field contributions from the terminals” limitations of claims 1 and 11. PAPER 2 at 104. Ericsson's arguments regarding Ground 2 (Section VII, *supra*) apply to Ground 6. The deficiencies of Brooks as described in Ground 5 (Section X(A), *supra*) apply to Ground 6. 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, ¶ 83. Intel's proposed combination

in Ground 6 fails to correct the deficiencies in Ground 2 for the reasons discussed above in Section VII(C) & (D) and X(A) *supra. Id.*

Claims 2 & 8 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. EX1001, 11:24-33, 12:5-7, & 12:11-14. Intel does not establish the Taniguchi/Rostoker/Brooks combination proves claims 2, 8, 11, 13-15, 17 & 19 unpatentable.

C. Ground 7: Midya, Raghavan & Brooks, claims 1, 3-6, 9, 11-16

Ground 7 mirrors Ground 3 but adds Brooks to the combination in an effort to show the “closely spaced” and “minimizing magnetic field contributions from the terminals” limitations. PAPER 2 at 104. Ericsson’s arguments regarding Ground 3 (Section VIII, *supra*) apply to Ground 7. The deficiencies of Brooks as described in Ground 5 (Section X(A), *supra*) also apply to Ground 7. 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, ¶ 110-111. Intel’s proposed combination in Ground 7 fails to correct the deficiencies in Ground 3. 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 teach or disclose the elements in claims 3-6, 9, and 12-16. *Id.* The Petition fails to show claims 1, 3-6, 9, 11-16 are unpatentable.

D. Ground 8: Midya, Raghavan, Gardner & Brooks, claims 1, 11-16

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. EX2002, ¶ 111. Ericsson incorporates its prior arguments regarding Ground 4 (*see* Sections IX(A) & (B) *supra*) and incorporates its prior arguments regarding Brooks from Ground 5 in Section X *supra*. *Id.* 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. *Id.* Consequently, the addition of Brooks to Midya/Raghavan/Gardner to form Ground 8 does not render claims 1, 11-16 unpatentable.

XIII. CONCLUSION

Intel has not established by a preponderance of the evidence that claims 1-19 of U.S. Patent 7,151,430 are unpatentable as 35 U.S.C. § 318(a) requires. Ericsson

respectfully requests the Board enter a final written decision that claims 1-19 are patentable and valid.

Date: January 13, 2025

Respectfully submitted,

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CERTIFICATE OF WORD COUNT

Pursuant to 37 C.F.R. §42.24(b), the undersigned certifies this PATENT OWNER'S RESPONSE complies with the type-volume limits of 37 C.F.R. §42.24(b) because it contains 13,974 words according to the word-processing system to prepare it, excluding words in the Table of Contents, Table of Authorities, List of Exhibits, Certification under 37 C.F.R. §42.24, and Certificate of Service, and any claims listing. This word count was prepared using Microsoft Word.

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CERTIFICATE OF SERVICE

The undersigned hereby certifies that on Monday, January 13, 2025 a copy of the foregoing Patent Owner Response was served via t email the following attorneys for the Petitioner:

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