

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ADVANCED MICRO DEVICES INC.,
Petitioner,

v.

REALTEK SEMICONDUCTOR CORPORATION,
Patent Owner.

CASE: IPR2023-00788
U.S. PATENT NO. 9,590,582

PATENT OWNER'S RESPONSE

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EXHIBIT LISTING

Exhibit No.	Description
2001	<i>In the Matter of Certain Integrated Circuits, Components thereof, and Products Containing the Same</i> , Inv. No. 337-TA-1350, Order No. 21: Construing Terms of the Asserted Patents (July 25, 2023)
2002	Deposition Testimony of. Dr. Hall-Ellis (Aug. 10, 2023)
2003	Declaration of Dr. Joshua Phinney
2004	Excerpted ITC Trial Testimony of Dr. Prucnal and Dr. Hall-Ellis (Oct. 19, 2023 & Oct. 20, 2023) from Inv. No. 337-TA-1350
2005	Deposition Testimony of Dr. Prucnal (Jan. 25, 2024)
2006	Jri Lee, Ch. 5, Voltage-Controlled Oscillators and Frequency Dividers
2007	Cadence PCell Designer

I. INTRODUCTION

Patent Owner, Realtek Semiconductor Corporation (“Realtek”), submits this Patent Owner Response (“POR”) in response to Petitioner Advanced Micro Devices, Inc.’s (“Petitioner’s”) petition (“Petition”) for *Inter Partes* Review (“IPR”) (Paper 2) and the Board’s Institution Decision (“ID”) (Paper 12) regarding U.S. Patent No. 9,590,582 (“’582 Patent,” Ex.1001).

The ’582 Patent describes, and claims, a specific orientation of an LC circuit that is the result of countless hours of innovation at Realtek. The claimed orientation “reduc[es] generation of phase noise, arrangement of interconnecting wires, and an overall size.” Ex.1001, 1:63-2:3, 12:51-54 (noting the invention’s further benefit of reducing “parasitic RLC (Resistance-Inductance-Capacitance)”; Ex.2003, ¶¶51-53.

To accomplish these benefits, the inventors of the ’582 Patent identified a specific location—which Realtek’s expert Dr. Phinney¹ calls the “prime real estate”

¹ Dr. Phinney is an expert in the subject matter of the ’582 Patent and offers helpful opinions from the perspective of a POSITA. Ex.2002, ¶¶1-47; Appendix A (Dr. Phinney’s CV). As a Ph.D. with relevant publications in the subject matter of the ’582 Patent, his testimony regarding the prior art will assist the Board in understanding the references and subject matter. *Id.*

of the inductor—for locating the capacitor component of an inductor-capacitor (LC) circuit. Ex.1001, Cl. 1; Ex.2003, ¶54. The '582 Patent further teaches a specific orientation of the capacitor component, which together with the claimed placement, achieves the recited benefits. Ex.2003, ¶54. For example, as recited in independent Claim 1, the claimed capacitor component must be arranged “corresponding to [a] first region” that “is defined by the two extension-conductor segments and the coil-conductor segment” of the inductor and is “not substantially overlapped with the coil-conductor segment” of the inductor component. Ex.1001, Cl. 1; Ex.2003, ¶50. Accordingly, the claimed capacitor component, which comprises at least two connecting segments and at least two electrode segments, must be arranged corresponding to the first region. *Id.* The plurality of connecting segments of the capacitor components must extend corresponding to, and must be overlapped with, the extension-conductor segments of the inductor component. *Id.* The electrode segments of the capacitor component must extend laterally relative to the coupled connecting segment. *Id.*

The Petition appears to, incorrectly, suggest that because LC circuits were known, the claims of the '582 Patent must be obvious. Petition, 15-25. That argument is contrary to the Board's precedent. *Volkswagen Grp. of Am., Inc. v. Velocity Patent LLC*, IPR2015-00276, Paper 8, slip op. at 10 (PTAB Jun. 1, 2015)

(quoting *KSR Int'l Co. v. Teleflex, Inc.*, 550 U.S. 398, 418 (2007) (“An invention ‘composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art.’”)). The most that Petitioner accomplishes is to show that LC circuits existed in the prior art. Petition, 22-25. Petitioner has not identified *any* instance of an LC circuit having the claimed configuration, including the specific orientation and location of the claimed capacitor component relative the claimed inductor component.

Instead, Petitioner relies solely on the opinions of its expert, Dr. Prucnal, who, when given the opportunity to explain, testified only that, in hindsight, the claimed configuration was only *one way* of doing things in view of the art. Ex.2004 (1082:1-3). His opinions that the claimed configuration is “simple” or “most logical” are fraught with hindsight bias, and are contrary to the actual teachings in the record. Accordingly, Dr. Prucnal’s opinions should be given little weight.

Petitioner relies on a single reference, Gonzalez (Ex.1005), for its first ground. Petition at 34. The Petition improperly combines various disclosures of Gonzalez without any basis rooted in Gonzalez, and contrary to the actual teachings of Gonzalez. Further, Petitioner and its expert misconstrue the primary figure on which they rely, wrongly concluding that simple, current-conducting wires (expressly designed *not* to have capacitance) can satisfy the “electrode segment” requirement

of the claimed capacitor component. These improper interpretations of Gonzalez underscore the Petition's results-oriented, and totally incorrect, interpretation of Gonzalez.

Petitioner's second ground relies on the combination of Muh (Ex.1006) and Niknejad (Ex.1007). Petition at 76. Neither Muh nor Niknejad describe the claimed orientation of the claimed capacitor component. Instead, Petitioner and its expert rely on hindsight to conjure disclosures and suggestions that do not exist. Petitioner's arguments are contrary to the references themselves, and are inconsistent with the prevailing technological understanding at the time. Petitioner has not demonstrated any basis to support its theory that a POSITA would have modified Muh to arrive at the claimed capacitor component, a modification that requires not only changing the type of circuitry, but also the layout of the circuit, without any basis to do so. Indeed, Petitioner's own expert, Dr. Prucnal, has already conceded that the finger capacitor he identifies "could be oriented in various ways." Ex.2004, 1082:1-3. He offers no basis for placing and orienting the capacitor component in the inventive way, and he has recognized, in testimony, that the Niknejad reference explains why a POSITA would *not* have oriented the capacitor component as claimed. Thus, the only basis for his conclusion is impermissible hindsight.

Dr. Prucnal has no basis rooted in the prior art for why a POSITA would have altered the design of both Muh and Niknejad. As such, Petitioner has not, and cannot, establish why a POSITA would have made such a modification or that such a modification would be made with any expectation of success. Moreover, Petitioner has not established that Muh is actually prior art to the '582 Patent.

In sum, the Petition fails to demonstrate the alleged obviousness of the claims of the '582 Patent and the Challenged Claims should be found not unpatentable.

II. THE '582 PATENT

The '582 Patent describes and claims a novel configuration for components found within an inductor-capacitor (LC) resonant circuit. Ex.1001, 1:16-18, Cl.1. The '582 Patent describes how, in prior art circuits, “a signal may pass through the insulation layer and leak to the silicon substrate, resulting in transmission loss.” Ex.1001, 1:33-39. The claimed configuration, in contrast, “reduce[s] generation of phase noise, arrangement of interconnecting wires, and an overall size.” Ex.1001, 1:47-2:3. It also reduces “parasitic RLC (Resistance-Inductance-Capacitance).” Ex.1001, 12:47-54; Ex.2003, ¶42.

The '582 Patent claims priority to a Taiwanese application filed on April 16, 2014, and was filed in the United States as Application No. 14/338,904 on July 23, 2014. The '582 Patent issued on March 7, 2017 and contains two independent

claims. Independent Claim 1 (which the Petition treats as essentially identical as independent Claim 9) recites:

A semiconductor device with an inductor-capacitor (LC) resonant circuit, comprising:

a first insulation layer;

an inductor component, comprising:

a coil-conductor segment, located on a surface of the first insulation layer; and

two extension-conductor segments, located on the surface of the first insulation layer, coupled to two ends of the coil-conductor segment respectively, arranged at an interval, and extending outwards relative to the coil-conductor segment, wherein a first region is defined by the two extension-conductor segments and the coil-conductor segment; and

a capacitor component, arranged corresponding to the first region in an embedded manner on the other surface, opposite to the inductor component, of the first insulation layer, wherein the capacitor component is correspondingly configured outwards relative to the coil-conductor segment, and the capacitor component is not substantially overlapped with the coil-conductor segment,

wherein the capacitor component comprises:

a plurality of connecting segments, extending corresponding to the two extension-conductor segments in a same direction, wherein the plurality of connecting segments are respectively overlapped with the two extension-conductor segments in a vertical direction; and

a plurality of electrode segments, located below the first region,

wherein one end of each of the plurality of electrode segments is coupled to one of the plurality of connecting segments, and each of the plurality of electrode segments extends laterally relative to the respective coupled connecting segment of the plurality of connecting segments.

Ex.1001, cl. 1.

On July 25, 2023, the ITC issued Order No. 21 regarding claim construction of certain terms of the '582 Patent. Ex.2001. The order delayed construction of “two extension-conductor segments” and “coil conductor segment” until after the ITC’s evidentiary hearing. It construed “capacitor component” as “component that includes one or more capacitors.” It construed “plurality of connecting segments are respectively overlapped with the two extension-conductor segments in a vertical direction” as “at least a first connecting segment of the plurality of connecting segments overlaps one extension-conductor segment in a vertical direction, and at least a second connecting segment of the plurality of connecting segments overlaps the other extension-conductor segment in a vertical direction.” Ex.2001, 28-38.

These two terms should be construed in the matter set forth below, which is consistent with the ordinary and customary meaning of those terms to a POSITA, in view of the specification of the '582 Patent. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313 (Fed. Cir. 2005) (en banc); *In re Abbott Diabetes Care Inc.*, 696 F.3d 1142, 1149-50 (Fed. Cir. 2012) (construing the claims to be consistent with “the language

of the claims and the specification”).

A. The '582 Patent Overview

The '582 Patent generally relates to LC circuits. Ex.1001, Abstract. The specific design of the '582 Patent requires a certain location and orientation for the capacitor component relative to the inductor.

The '582 Patent explains that prior-art surface mounted components increase the “volume,” and therefore the size, of the chip. Ex.1001, 1:29-32. Using surface mounted components therefore thwarts the goals of making chips smaller and improving key performance indicators for these types of devices. Ex.1001, 1:24-32.

The '582 Patent discloses forming an LC circuit as part of the process of fabricating metal layers of an integrated circuit (and therefore with the inductor and capacitor on opposite surfaces of an insulation layer) and also orienting the capacitor component so that it is located below, and has connecting segments overlapped by, the extension-conductor segments in a vertical direction. Ex.1001, 3:48-55. The capacitor component is therefore “arranged corresponding to the first region **in an embedded manner**.²” Ex.1001, cls. 1, 9.

The orientation described in, and claimed by, the '582 Patent has important

² All emphasis added unless otherwise noted.

benefits. As the '582 Patent explains, “[a]t a high frequency, a signal may pass through the insulation layer and leak to the silicon substrate, resulting in transmission loss.” Ex.1001, 1:36-39. By requiring the extension conductor segments to overlap with a plurality of connecting segments, and by prohibiting the resonant portions of the capacitor from being under the coil-conductor segment, the claimed arrangement achieves the aims of “reduc[ing] generation of phase noise,” facilitating “arrangement of interconnecting wires,” reducing “overall size,” and limiting parasitic RLC. Ex.1001, 1:63-2:3, 12:51-54.

B. The '582 Patent's Prosecution History

The as-filed claims were rejected over U.S. Patent Publication No. 2009/0322447 to Daley et al. (“Daley”). Ex.1002, 342. However, the examiner stated that “Claim 5 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.” Ex.1002, 345. Then-pending Claim 5 recited, in part, the relative location of the connecting segments of the capacitor component to the extension conductor segments of the inductor component. Ex.1002, 327. The applicant responded by arguing that the specific orientation of the capacitor and inductor on respective sides of the insulation layer, including the lack of overlap

between the capacitor component and the coil-conductor segment, distinguished the then-amended claims from the cited prior art. *See* Ex.1002, 330-331.

The then-pending claims were again rejected over Daley. Ex.1002, 319. The examiner again stated that “Claim 5 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.” Ex.1002, 319. The applicant again argued that the specific orientation of the capacitor and inductor distinguished the then-amended claims from the cited prior art. *See* Ex.1002, 73-74.

The then-pending claims were rejected a third time over Daley. Ex.1002, 58-62. In the final rejection, the examiner again indicated that then-pending Claim 5 would be allowable if rewritten in independent form. Ex.1002, 61. The applicant then amended Claim 1 to reflect the subject matter deemed allowable by the examiner. Ex.1002, 27.

The Examiner identified U.S. Patent No. 9,270,247 to Jing (“Jing”) during an interview, which the examiner called “the closest prior art,” and substantively discussed Jing, for the first time, in the “Examiner’s Statement of Reasons for Allowance.” Ex.1002, 12. The applicant did not respond to the puzzling and incorrect statements that the examiner made when discussing the Jing reference because reasons for allowance do not limit the scope of a claim. *Salazar v. Procter*

& Gamble Co., 414 F.3d 1342, 1345 (Fed. Cir. 2005) (citing *ACCO Brands, Inc. v. Micro Sec. Devices, Inc.*, 346 F.3d 1075, 1079 (Fed.Cir.2003)). Jing is distinguishable on straightforward grounds that the examiner did not address, and the ITC ALJ, in Order No. 21, explained why the examiner misunderstood both Jing and the '582 Patent. Ex. 2001, 29-35; Ex.2003, ¶¶58-64. Jing, however, is not part of any Ground in this Petition, and the Examiner's incorrect statements are irrelevant.

C. The '582 Patent's Level of Skill in the Art

Petitioner suggests a POSITA in the subject matter of the '582 Patent is an individual with at least a bachelor's degree in electrical engineering or an equivalent field, and at least 3-4 years of professional experience in the field of integrated circuit design. Petitioner also suggests that a person with additional education but less professional experience, and vice versa, may qualify as a POSITA (e.g., suggesting that a POSITA would also include someone with a master's degree in electrical engineering and 1-2 years of professional experience in the field of integrated circuit design or someone with a Ph.D. in electrical engineering).

To the contrary, given the subject matter of the '582 Patent, a POSITA would have had at least a bachelor's degree in electrical engineering or an equivalent field. Ex.2003, ¶¶43-47. The additional professional experience is not essential given the

lab-work that accompanies a typical bachelors degree education in electrical engineering. However, there is not a substantial difference between the proposed levels of skill in the art. Ex.2003, ¶¶43-47.

III. CLAIM CONSTRUCTION

For the purposes of resolving this proceeding, only the terms “two extension-conductor segments”/“coil-conductor segment” need be construed.

A. Two Extension-Conductor Segments

The proper construction of “extension-conductor segments” is: “The two portions of the inductor that extend approximately perpendicular from where each joins the coil-conductor segment.” Ex.2003, ¶¶67-83.

The claims require that the extension-conductor segments “extend[] outwards relative to the coil-conductor segment,” (Ex.1001, Cl.1), and the specification expressly teaches how to determine where the extension-conductor segments begin and end:

The extension-conductor segment 133 is joined to a first end of the coil-conductor segment 131 and *is approximately perpendicular to a joining position* between the extension-conductor segment 133 and the coil-conductor segment 131.

Ex.1001, 4:1-5; Ex.2003, ¶67.

The claimed extension conductor segments (green in the below annotated

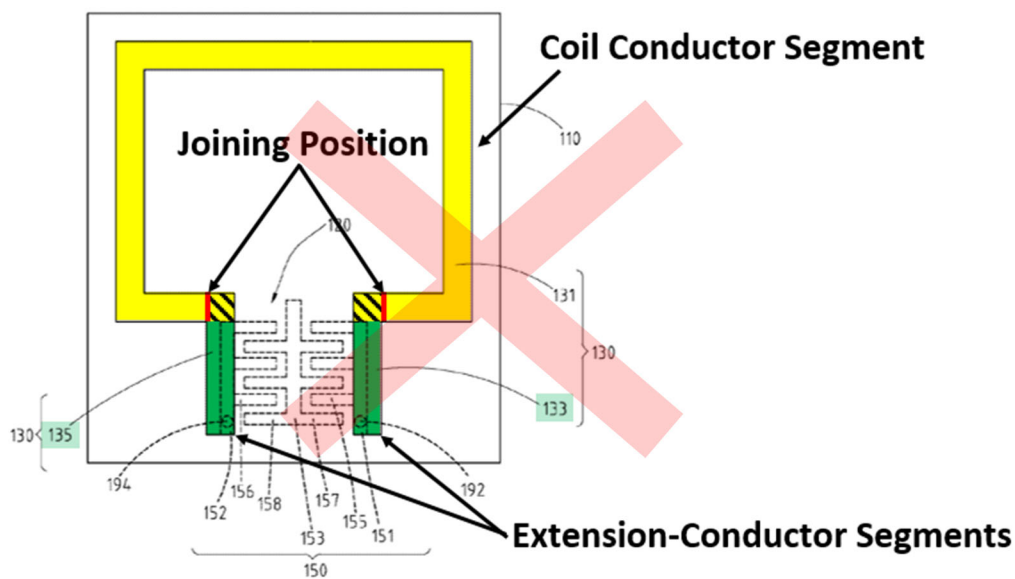
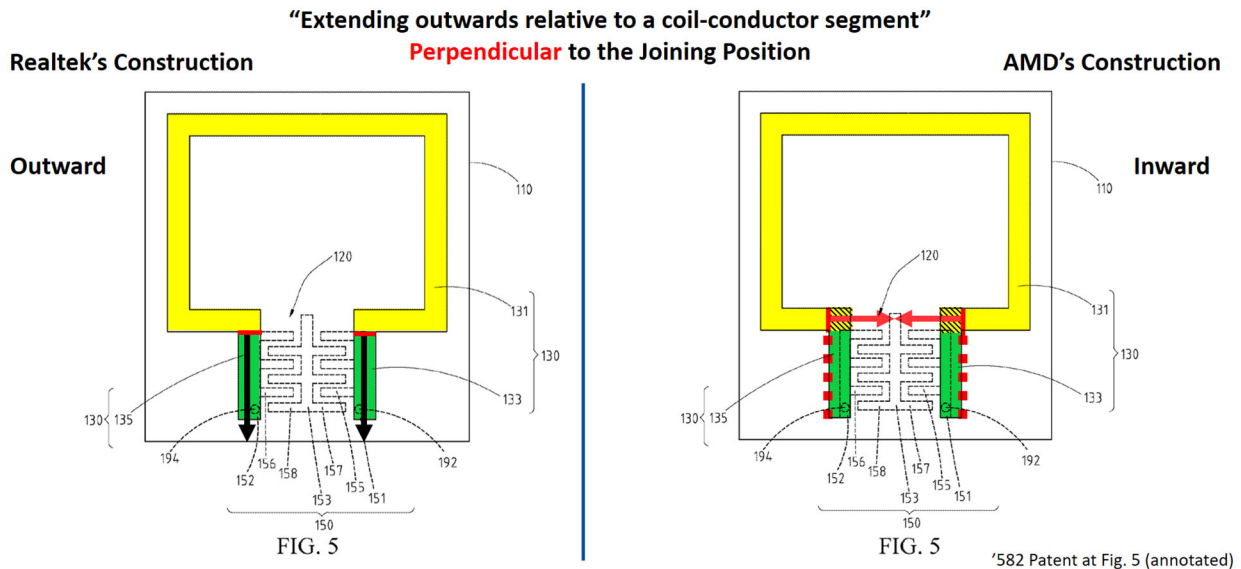


FIG. 5

Ex.2003, ¶¶71-72 (incorrectly showing a joining position parallel to the extension conductor segment, as Petitioner would include in its construction). Petitioner’s argument has two problems. First, it is contrary to the teaching in the ’582 Patent that the extension-conductor segments are “perpendicular to a joining position between the extension-conductor segment 133 and the coil-conductor segment 131.” Ex.1001, 4:1-13; Ex.2003, ¶73. Second, this improperly identifies a portion of the coil-conductor segment as being part of the extension conductor segment, and as a result, under this formulation, the extension-conductor segments do not “extend outward relative to the coil-conductor segment,” as the claims require. Ex.1001, 3:36-42; Ex.2003, ¶74.

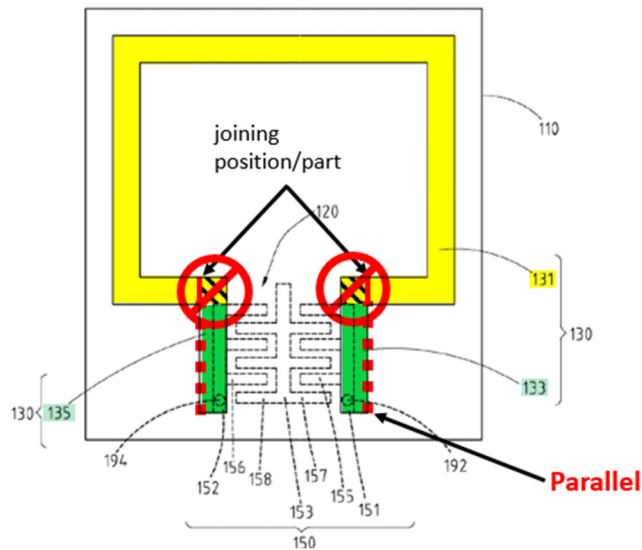
The figure below shows how Realtek’s construction ensures that the

extension-conductor segments extend outwards from the coil-conductor segment **and** are perpendicular to the respective joining portions:



Ex.2003, ¶75.

Conversely, Petitioner’s prior construction (by wrongly including the edge or corner of the coil-conductor segment in the extension-conductor segment) has the extension-conductor segments *parallel* to the joining portion:



Ex.2003, ¶76. Dr. Prucnal agreed that this joining position is parallel to the extension conductor segments. Ex.2005, 83:12-84:14. That type of a joining portion is inconsistent with the embodiments described in the '582 Patent.

Realtek's construction also reflects the requirement that the claimed first region (shaded in red below) is “*defined by* the two extension-conductor segments *and* the coil-conductor segment.” Ex.1001, cl. 1 (emphasis added).

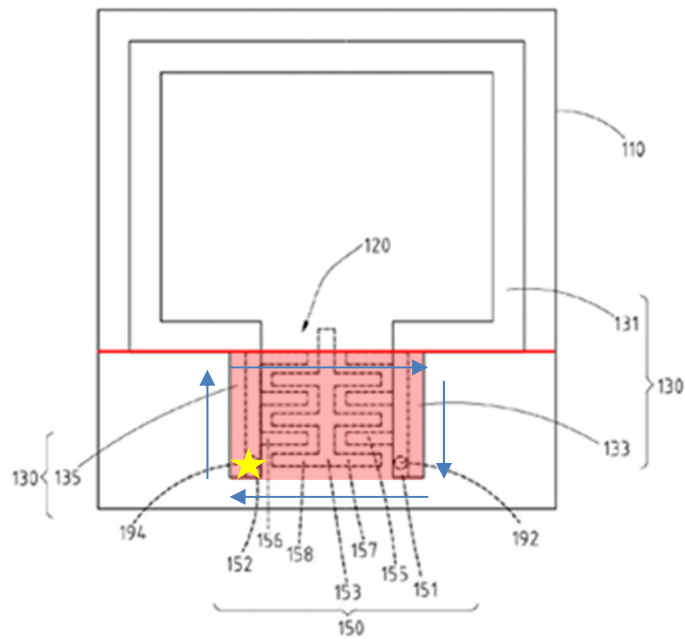


FIG. 5

Ex.2003, ¶77. The first region is defined by the two extension-conductor segments because they form the boundary of three sides of the first region. Beginning in the bottom left, at approximately 194 (indicated by the yellow star), the outer boundary of the first region is defined by the left extension-conductor segment until reaching the coil-conductor segment (at the red horizontal line), which as shown above, is the joining position. Because the first region is defined by *both* the extension-conductor segments and the coil-conductor segment(s), the first region ends when it reaches the coil-conductor segment. Its boundary thus turns right, across the space between the two extension conductor segments, until reaching the other extension-conductor segment, and the first region extends downward again, again defined by the

extension-conductor segment. Ex.2003, ¶78.

This proper identification of the first region is confirmed by examining a counterfactual. Ex.2003, ¶79. For example, if the joining positions were described in the specification to be diagonal (instead of perpendicular to the extension conductor segment, as is the case in the '582 Patent), the first region (shaded in red) would continue to have the same dimensions, because the first right-hand turn would still need to occur at the same location in both understandings because the first region is defined *by* the first contact with the coil-conductor segment:

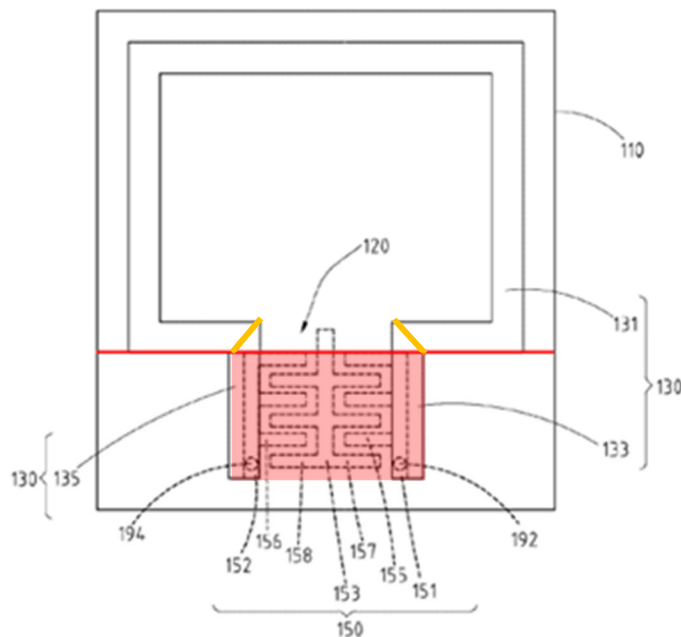


FIG. 5

Ex.2003, ¶80.

In contrast, Petitioner's prior construction has the first region defined only by

what it contends are the extension-conductor segments, as shown in the figure below,

in which Petitioner's possible first region is identified:

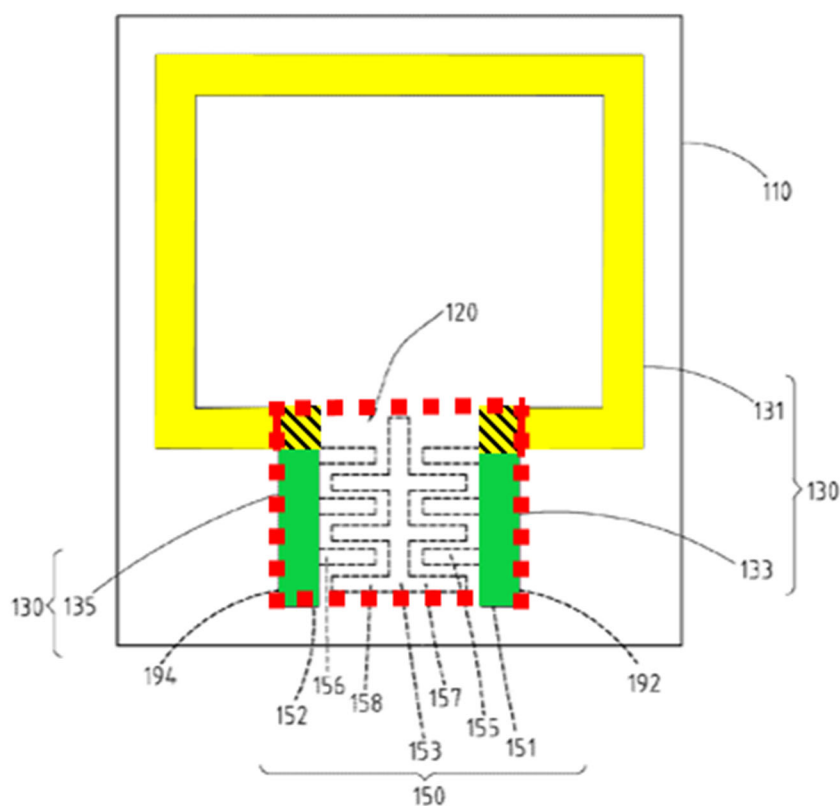


FIG. 5

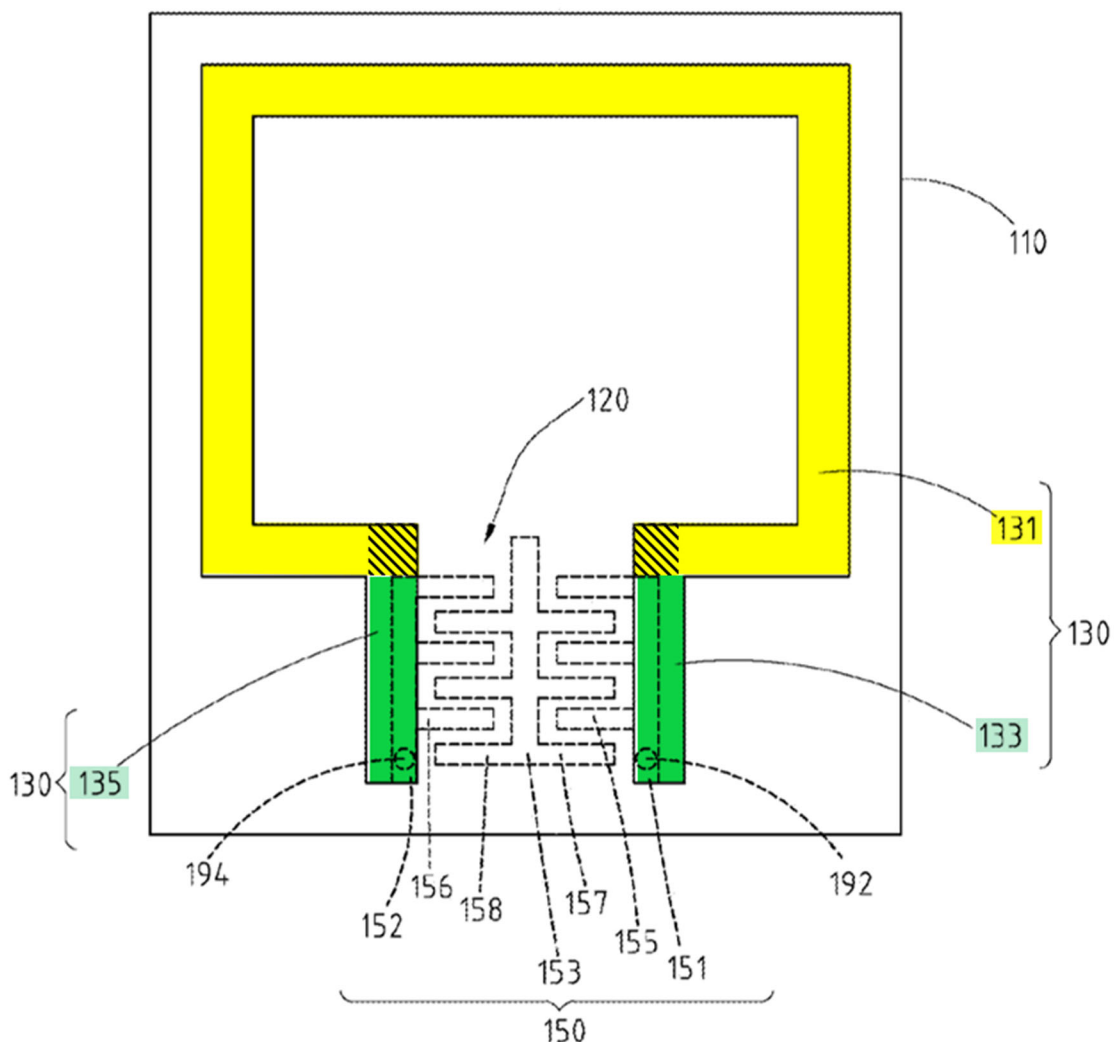
Ex.2003, ¶81.

Petitioner's first region follows only the outline of what Petitioner has identified as the two extension-conductor segments. The coil-conductor segment plays no role in defining the first region in Petitioner's incorrect drawing of the first region. In contrast, for Realtek, the first region is defined by both the coil-conductor segment and the extension-conductor segments, even if the extension-conductor

they extend approximately perpendicular to the joining position. It also satisfies Claim 1's requirement that the first region is defined by the extension-conductor segments and the coil-conductor segment, and Claim 4 is additionally defined between the extension-conductor segments. Accordingly, the proper construction of "extension-conductor segments" is: "The two portions of the inductor that extend approximately perpendicular from where each joins the coil conductor segment." Ex.2003, ¶83.

B. Coil-Conductor Segment

The '582 Patent teaches that parts of the inductor that are coil-shaped are coil-conductor segments, and extension-conductor segments extend *away* from coil-conductor segments approximately perpendicularly. Ex.1001, 4:1-5, 3:66-4:1, 3:22-27, Cl.1; Ex.2003, ¶84. A POSITA would therefore understand that the inductor coil includes the edges of the inductor coil, which are in cross-hatch in the image below, and which are separated from the extension-conductor segments at the joining position/part:



Ex.2003, ¶85. These portions of Figure 5 in cross-hatch above cannot be part of the extension conductor segments, as set forth above in Section III.A. Ex.2003, ¶86.

The constructions of these two terms are interlaced, and to resolve the dispute (which is pertinent to the location of the capacitor component in Ground 2, and whether the capacitor identified in Muh is, as the claims require, arranged corresponding to a first region and not substantially overlapped by the coil-

conductor segment), the Board need only construe extension-conductor segments, but if it chooses to construe “coil-conductor segment,” a proper construction is “inductor coil.” Ex.2003, ¶87.

IV. PRIOR ART

A. Gonzalez

Gonzalez is a research paper that analyzes certain microwave theories and techniques. Ex.1005. Gonzalez does not contain any circuit designs beyond a schematic and limited perspective views of a 3D model. Ex.1005, Figs. 2, 8. Gonzalez’s paper describes different aspects of an LC circuit, but never describes how the various aspects would fit together, and as a result, is inapposite to addressing the alleged unpatentability of the highly detailed structural Claims of the ’582 Patent. Moreover, Gonzalez makes clear that the wires that the Petition identifies as electrode segments of a capacitor component are deliberately designed to *minimize* capacitance and therefore cannot serve as the electrode segments of the claimed capacitor component. Ex.2003, ¶89.

B. Muh

Muh, a facially undated thesis (Ex.1006, 1), is purportedly obtainable from the University of California library system. Ex.1006, 1. The thesis is primarily directed towards a push-push VCO, although the Petition relies only on a small

portion of an appendix, and almost exclusively on Figure B-3. Ex.1006, 56-58. Figure B-3 depicts a HFSS (high-frequency three-dimensional field solver) model of an LC circuit but also fails to provide detail regarding the format, shape, or orientation of the capacitor. This shortcoming renders Muh inapposite to address the alleged unpatentability of the highly detailed structural claims of the '582 Patent. Ex.2003, ¶90.

C. Niknejad

The final prior art reference, Niknejad, is a textbook comprising almost 300 pages. Ex.1007, 12. As with Muh, the Petition relies on only a small subset of the pages of Niknejad: 26-28. Niknejad fails to provide any detail as to how its disclosed finger capacitor would be actually designed, positioned, or shaped and, more importantly, teaches that a POSITA would be motivated to orient a finger capacitor in an LC circuit contrary to the claims of the '582 Patent. Niknejad is inapposite to address the alleged unpatentability of the highly detailed structural claims of the '582 Patent. Ex.2003, ¶91.

V. THE PETITION FAILS TO DEMONSTRATE THE CHALLENGED CLAIMS OF THE '582 PATENT IS OBVIOUS

The Petition fails to identify any reference that actually discloses the claimed capacitor configuration. Instead, it attempts to alter the purported prior art references

to achieve the invention of the '582 Patent, based only on the teachings of the '582 Patent itself, and in doing so stretches the disclosures beyond the manner in which a POSITA would interpret those disclosures.

A. Ground 1, Based On Gonzalez, Fails⁴

Gonzalez, an academic article, lacks the requisite detail of the capacitors of its VCO to explain or suggest the specific configuration claimed in the '582 Patent. Ex.2003, 93. Gonzalez itself explains that for the research they were doing, “only pcells⁵ from the technology design kit were used.” Ex.1005, 5. Ultimately, for its research purposes a “middle ground” inductor PCell was selected because the author deemed it “as a good tradeoff between” having too low of a Q factor (albeit a wider selection of varactors available) and having too few varactor options (limited to varactors with largest capacitor ranges) but the highest Q factor. Ex.1005, 5; Ex.2003, ¶¶93-94. In this selected PCell, the inductor of the LC tank includes “two

⁴ Petitioner raised a similar challenge and subsequently dropped the challenge in the related ITC proceeding, indicative of the weakness of this ground.

⁵ A PCell is a pre-defined portion of a circuit used in circuit modeling and automated design processes that rely on certain software models of circuit behavior. Ex.2003, ¶93; Ex.2007.

upper copper metal layers, plus [an] aluminum metallization layer.” *Id.*

Gonzalez uses two types of varactors (i.e., voltage controlled or voltage tunable capacitors)—fine-tuning varactors and binary switched varactors—but they “are made from the same structure.” Ex.1005, 5; Ex.2003, ¶95; Ex.2005, 28:9-11. These varactors, Gonzalez explains, “are implemented using a thick gate-oxide available in the process that provides a capacitance ratio” of approximately 3 “for voltages between 0 and 1.8V.” Ex.1005, 6; Ex.2003, ¶95.

Gonzalez goes on to explain that these varactors are made “with N+poly/Nwell varactors” where the “N+poly gates are each connected to one of the two differential terminals (Out+ and Out-)” and are “placed in the same Nwell that is biased using a common voltage (V_c).” Ex.1005, 6; Ex.2003, ¶96. Because of their structure, these varactors are not, and cannot be, the capacitor component described and claimed in the ’582 Patent. Specifically, these varactors, as MOS capacitors, do not have electrode segments. Ex.2005, 37:3-11 (Dr. Prucnal explaining that there are no electrode segments that provide any capacitance in the varactor structure of Gonzalez, instead “it’s the source gate interface that is causing the capacitance”); 23:17-22:13 (Dr. Prucnal explaining that the only capacitor electrodes that he’s familiar with are in finger capacitors); Ex.2003, ¶97.

Moreover, Gonzalez explains that its varactor structure ensures that the

differential current path length (the length that current must travel from each differential terminal (Out+ and Out-)) is minimized. Ex.1005, 6; Ex.2003, ¶97. As part of Gonzalez's efforts to minimize the Out+ and Out- current lengths, it notes that when greater capacitive values are needed, an array of these varactors, with a waffle structure, is used (as shown in Gonzalez Fig. 5). *Id.* When this waffle structure of additional varactors is used, there are additional "wires" in place to ensure the voltage of the two differential terminals (Out+ and Out-) is provided where needed (as shown in, for example, figures 2 and 8) while maintaining the minimized differential current path. Ex.1005, Figs. 2, 8; Ex.2003, ¶97. Simply put, a POSITA would not interpret these yellow wires as capacitors because they are expressly designed to minimize incidental capacitance, as such incidental capacitance would frustrate the ability of the fine-tuning varactors to perform their tuning functions. Ex.2003, ¶97.

These varactors provide the capacitance of the LC Tank of Gonzalez and are the only capacitor structure identified in the Petition. Ex.1005, 6-7; Ex.2003, ¶¶98-99. It is undisputed however, that these varactors are not finger capacitors and lack the connecting segments and electrode segments required by the claims. Ex.2003, ¶¶98-99.

Because there is a mismatch between the claims and Gonzalez's varactors, the

Petition tries to map the claims onto components a POSITA would understand does not satisfy those claim limitations. For example, the structure that Petitioner identifies as the alleged “electrode segment” is nothing more than a wire designed to deliver power to the opposite side of the structure. That wire has no designed capacitance, and in fact, Gonzalez teaches that the capacitance of those wires is to be minimized. The identified wires are simply not capacitors, and the Petition’s interpretation is contrary to the express teaching of Gonzalez. The Petition also depends upon cobbling together different portions of Gonzalez that do not fit together and that are directly contrary to their disclosed structure.

1. The identified wires do not satisfy the “electrode segment” requirement of the claimed “capacitor component”

The Petition misidentifies metal components that merely act as wires as the claimed “electrode segment.” However, the ’582 Patent is clear in describing the electrode segments: “The electrode segments 155 and 156 *serve as electrode plates of the capacitor*, capacitive induction is generated between the electrode segments.” Ex.1001, 4:41-43. The claimed electrode segments are not merely wires or metallic components that incidentally have a capacitance.⁶ The claimed electrode segments

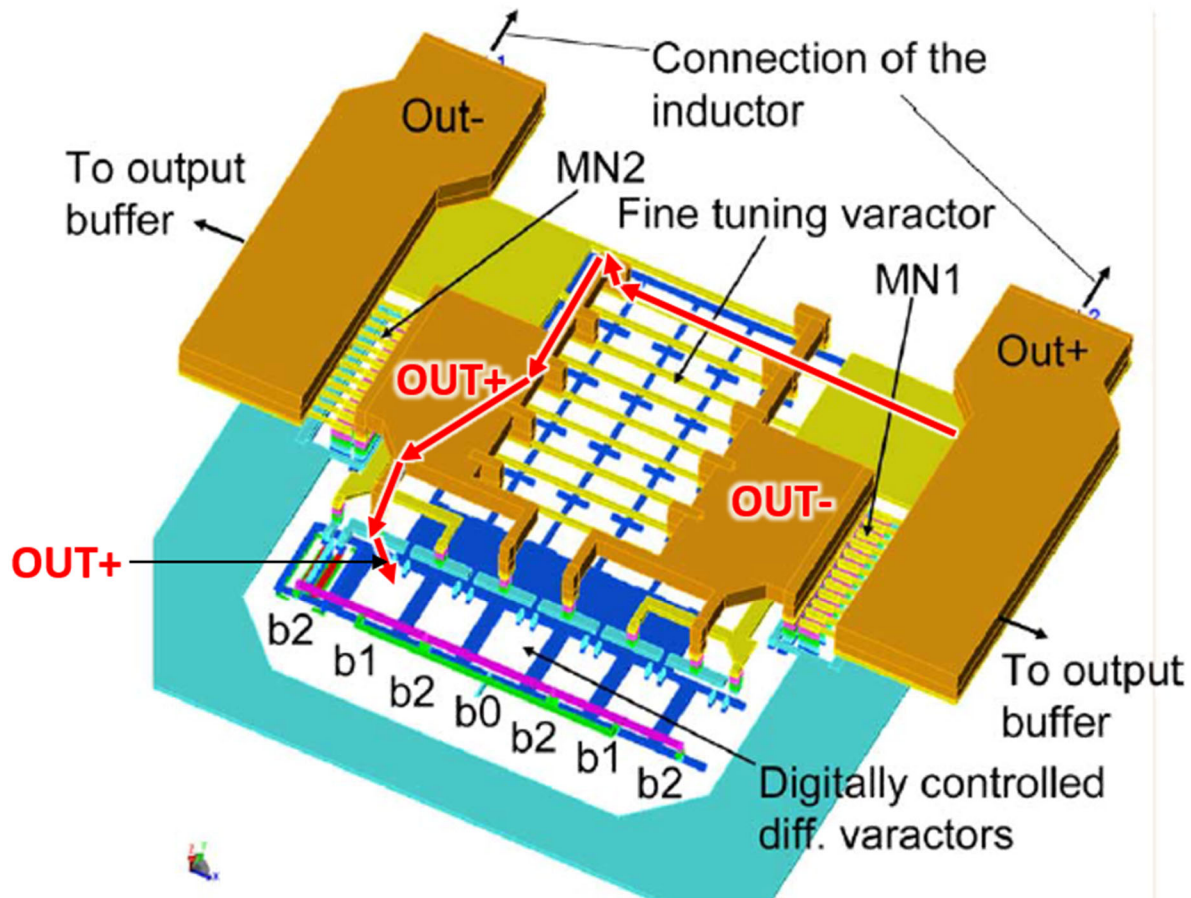
⁶ Any two conductive elements have a capacitance between them. Ex.2005, 40:23-41:3. In fact, an individual’s fingers have capacitance. Ex.2005, 41:9-12. However,

are electrode plates, of the claimed capacitor component of the claimed LC circuit, which have the designed capacitance for the LC circuit. Ex.2003, ¶¶100-101.

Gonzalez explains that there are three components in the LC circuit: 1) an inductor, 2) a continuous-tuning varactor, and 3) discrete tuning varactor. Ex.1005, 6. In other words, Gonzalez uses varactors to provide capacitance for its LC Tank. *Id.* Both experts agree that the varactors of Gonzalez themselves do not have any fingers (Ex.2003, ¶¶101-103; Ex.2005, 36:4-37:11, 22:17-23:7), and the Petition fails to provide any basis to modify the teachings of Gonzalez to use a different form of capacitor. The Petition misidentifies yellow wires that convey current from one side of the Figure 8 in Gonzalez, to the other side, as “electrode segments.” The Petition is wrong. Ex.2003, ¶102. These yellow wires are not electrode segments of any capacitor, do not provide any designed capacitance, and Gonzalez never teaches to use such kind of capacitor to form its LC tank. Ex.1005, Fig. 8; Ex.2003, ¶102. They cannot be the claimed electrode segments (as they are not providing

a POSITA would not interpret fingers, wires, or other non-intentional conductive elements as being electrodes, let alone the claimed electrode segments of a capacitor component, as the capacitor component of the '582 Patent is claimed. Ex.2005, 41:22-44:18.

capacitance) and, instead, are simply wires that carry charge from, for example, the Out+ terminal to the digitally controlled varactors:



Ex.2003, ¶¶102-104; Ex.1005, Fig. 8. These yellow wires are *not* part of the varactors disclosed in Gonzalez and do not supply any designed or meaningful capacitance. Ex.2003, ¶¶102-104; Ex.2005, 102:19-103:3.

Petitioner attempts to blur the line between these wires and the varactors, but Gonzalez teaches that these wires are located many metal layers above any actual varactor, and they therefore have no role in providing designed capacitance. *Id.*

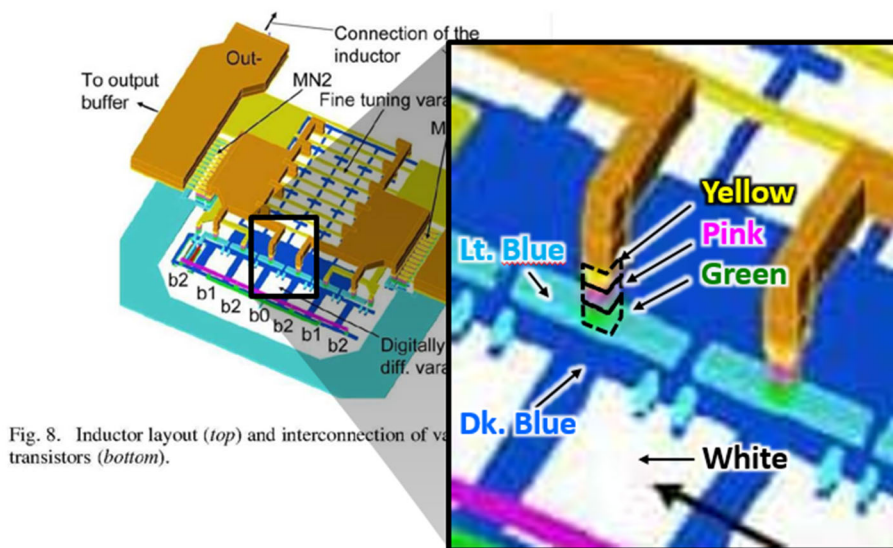


Fig. 8. Inductor layout (top) and interconnection of varactors (bottom).

Id. In particular, as shown above (and described below in Section V.A.2), these yellow wires are at least 5 metal layers above the silicon-based varactors that reside in the white squares depicted in Fig. 8. Ex.1005, Figs. 5, 8; Ex.2003, ¶¶103-105; Ex.2005, 54:5-56:8.

The placement of these wires—far above the varactors—confirms that they simply carry electrical charge from “Out-” and “Out+,” respectively, to the other side of the structure, in order to provide the varactors with charges necessary to operate the varactor. *Id.* For example, varactor b2 needs to have one lead having an Out+ voltage and one lead having an Out- voltage, and that is accomplished through these yellow fingers. *Id.* Dr. Prucnal alleges that there are un-depicted connections from the yellow fingers down at least 6 metal layers to the varactors located in the bottom silicon layer, and that therefore these yellow fingers are somehow related to

the varactors. Ex.2005, 57:13-20. This simply isn't shown and would be at odds with the design rules of Gonzalez, limiting it to 6 metal layers. Ex.2005, 23:14-26:17 (confirming Gonzalez's design rules permit 6 metal layers); Ex.2003, ¶105.

Notably, the Petition provides no evidence that these yellow wires provide any charge to any fine-tuning varactor. *Id.* The only power distribution shown from these wires is to the digital differential varactors at the bottom of the image. Indeed, neither the Petition nor Dr. Prucnal identifies any connection between these yellow fingers and the white "fine-tuning varactors" that sit in a 5x5 grid. Petitioner and Dr. Prucnal try to remedy this defect by pointing to Figure 2, which is the circuit schematic, but that schematic fails to show anything more than the existence of an electrical connection (from some unidentified source), not the specific path the connection takes. Thus, the yellow wires not only are not capacitors, but also have no demonstrated connection to the varactors that actually supply capacitance. Ex.2005, 57:13-20; Ex.2003, ¶¶103-105.

Moreover, Gonzalez expressly teaches a POSITA that the yellow wires are expressly designed *not* to have any substantial capacitance. Ex.2003, ¶¶106-107; Ex.1005, 5, *see also* 6 ("The differential current path length is thus minimized"). The Figure 2 layout shows a crossover structure—representing the yellow wires—which shows that Gonzalez configured those wires to convey charge in a manner

that minimizes any extra capacitance:

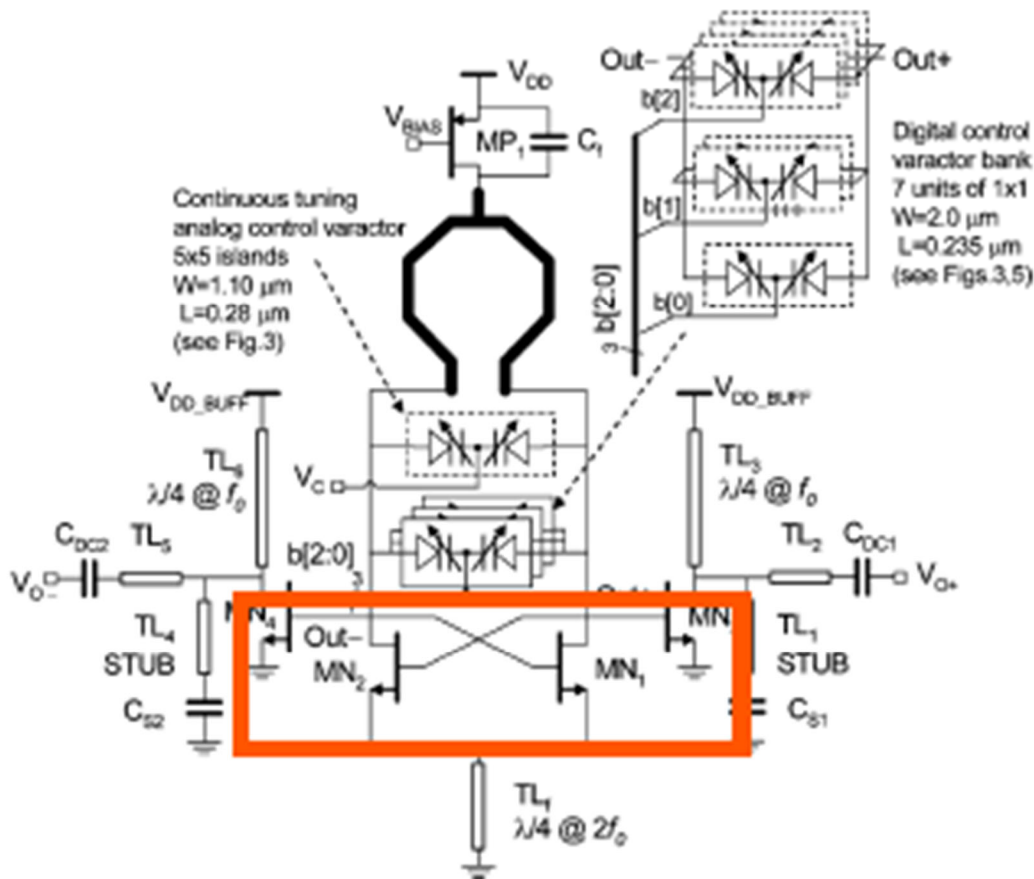
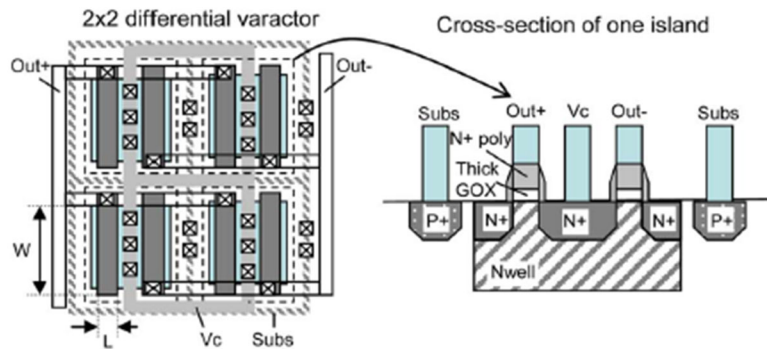


Fig. 2. VCO and output buffers schematic.

Ex.1005, 5 (Fig.2); Ex.2003, ¶106. Therefore, a POSITA would **not** interpret the yellow wires in Gonzalez as an “electrode segment” because Gonzalez itself teaches that it positions those in a manner that minimizes any incidental capacitance between the wires carrying Out+/Out-/V_c to the various gates. Ex.2003, ¶¶106-107. Indeed, any designed capacitance from these leads would impact the ability of the fine-

tuning varactors from performing their fine-tuning capabilities, which Gonzalez stresses is critical to its purpose, and a POSITA would therefore understand that uncontrollable capacitance from these wires is contrary to Gonzalez's teachings. *Id.*

Petitioner, in hopes of conflating the yellow wires that convey charge, and the varactors responsible for the designed capacitance, suggest that the yellow wires in Fig.8 (which are high above the varactors) are the same wires identified in Fig.5, which connect to the Varactors. In support of that sleight-of-hand, the Petition and Dr. Prucnal arbitrarily add yellow coloring to the "F-shaped" wires in Fig.5, in an effort to match Fig.8. Gonzalez, however, teaches that the yellow fingers in Fig. 8 are not the wires identified in Figure 5. Petition at 63-64; Ex.1005, Fig. 5. As shown above, the yellow fingers sit at least five metal layers above the varactors, and Figure 5 depicts the Out+ and Out- "fingers" at most two metal layers above the silicon. Ex.2003, ¶108; Ex.1005, Fig. 5. Gonzalez's figures are simply showing exemplary, stand-alone depictions of various aspects of its modeled design, and are not intended to depict a specific circuit drawing of the actual implementation of its VCO:



Id. In fact, Dr. Prucnal admitted that it’s hard to tell what Gonzalez is describing in the figures. Ex.2005, 45:25-46:12; Ex.2003, ¶109.

In sum, the Petition fails to demonstrate how Gonzalez would have rendered obvious independent Claims 1 and 9 of the ’582 Patent.

2. The images of Gonzalez do not show the relative orientation of the capacitor component as compared to the coil of the inductor.

The Petition improperly argues that the figures of Gonzalez show how the “capacitor component is not substantially overlapped with the coil-conductor segment.” *See* Petition at 55-59; Ex.2003, ¶110. However, the figures themselves do not have such a teaching. Specifically, the Petition cites to Figure 2—improperly alleging Figure 2 “illustrates spatial relationships” (Petition, 55), Figure 12—improperly including annotations of components not depicted in the image (Petition at 56-57), and Figure 8—improperly combining components in a specific manner without any basis to do so.

These figures do not establish that, in Gonzalez, that the claimed “capacitor component is not substantially overlapped with the coil-conductor segment.” Figure 2 is a self-titled “schematic,” which a POSITA would understand does not show the relative position of any component, instead it shows the electrical connections between different circuit components. Ex.2003, ¶112; Ex.1005, Fig.2; Ex.2005, 44:22-24, 45:25-47:8. Contrary to Dr. Prucnal’s declaration, where he improperly alleges that Figure 2 “illustrates spatial relationships,” in deposition he confirmed that a schematic, such as Fig. 2, does *not* illustrate a spatial relationship. Ex.2005, 45:25-47:8 (“you can’t tell distances. And you can’t even tell exact locations”).⁷ This confirms that the schematic for an LC circuit having the capacitor below the inductor would look the same as an LC circuit having the capacitor located adjacent the inductor. *Id.*; see also 47:12-17; Ex.2003, ¶¶112-113. As such, it is undisputed that Figure 2 does not show any relative positioning of the varactors and inductor.

Similarly, Figure 12 of Gonzalez, reproduced below without any annotations, is a micrograph that does not depict any varactors. Ex.1005, Fig.12; Ex.2003, ¶114; Ex.2005, 48:20-24; 49:17-50:1. The description of Figure 12 is silent with regard to

⁷ Conversely, a circuit *layout* diagram, such as Figure 3-21 of Muh, does show the relative position of components. Ex.1006, 52 (Fig. 3-21).

any *positioning* of the two components (inductor and varactor). Ex.1005, 9; Ex.2003, ¶114; Ex.2005, 48:20-24; 49:17-50:1.

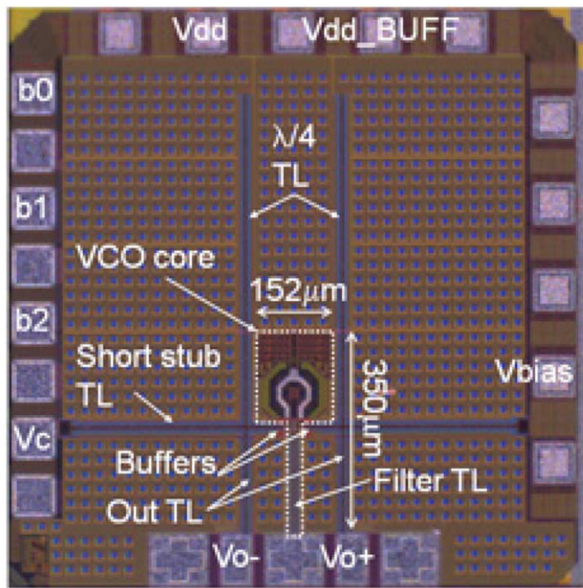
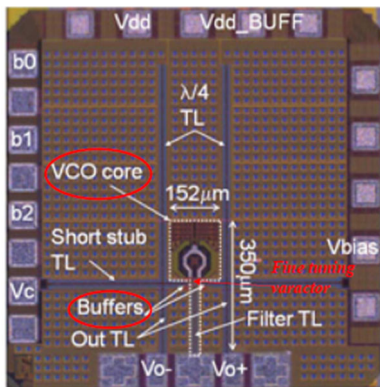


Fig. 12. VCO die micrograph.

Dr. Prucnal improperly added red arrows and circles, positing a location of fine-tuning varactors, without any basis to do so:

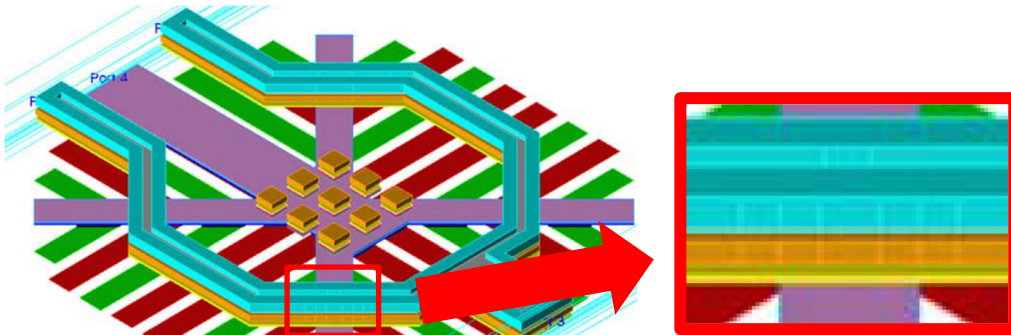


Petition at 57 citing Ex.1003 at ¶¶151-152. His attempted annotations are not rooted

in any actual disclosure of Gonzalez. Ex.2003, ¶115. As such, there is no basis for concluding that Figure 12 shows any relative positioning of the varactors and inductor. Ex.2005, 48:20-24; 49:17-50:1.

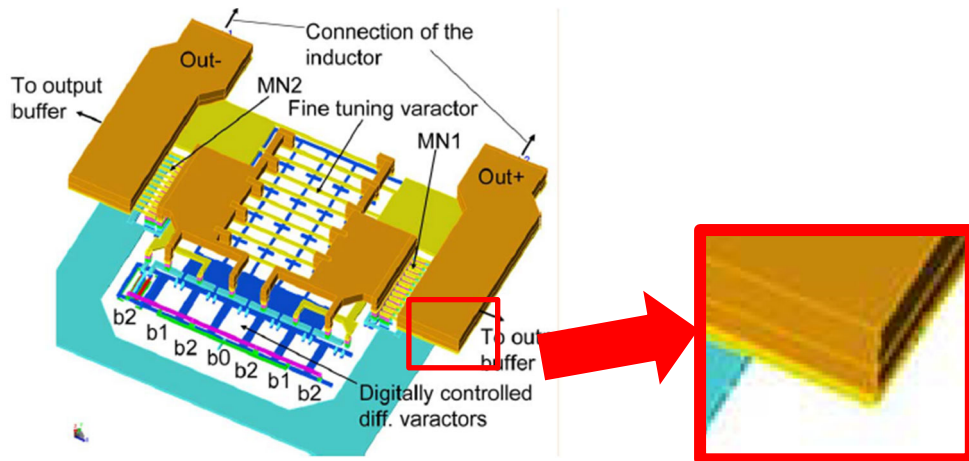
Figure 8, the only other source of information for the relative relationship between the capacitors and inductor of Gonzalez, as admitted by Petitioner, “does not show the VCO core in a combined view.” Petition at 58. Petitioner nonetheless suggests that it would have been obvious to combine the two parts of Figure 8 such that the purported capacitor component is not substantially overlapped with the coil-conductor segment.

Petitioner’s justification for its argument is not based on Gonzalez’s actual disclosures. The inductor of Gonzalez, depicted in the upper half of Fig.8, is made of three metal layers, depicted in blue, gold, and yellow.



Ex.1005, Fig.8, 6 (“two upper copper metal layers plus the aluminum metallization layer”); Ex.2003, ¶¶116-117. In contrast, the lower half of Gonzalez’s Figure 8 depicts the “[c]onnection of the inductor,” which has a double thick gold layer atop

a yellow.



Ex.1005, Fig.8; Ex.2003, ¶118.

Gonzalez says its design rules allow 6 metal layers (M1-M6). Ex.1005, 8, Fig. 9; Ex.2003, ¶119. These metal layers are built upon a silicon substrate and therefore sit above a silicon layer. Ex.2005, 28:20-22, 37:12-38:25. This teaching of Gonzalez—that there are 6 available metal layers—show that the two parts of Fig.8 cannot be combined as the Petition alleges because Petitioner’s combination requires *more* than the 6 metal layers allowed: one blue in the top image, one gold in the top image, one yellow in the top image, two gold in the bottom image, one yellow in the bottom image, one pink in the bottom image, one green in the bottom image, one light blue in the bottom image, and one blue in the bottom image. Ex.2003, ¶120. Even if the blue in the top image is intended to be the same metal layer as the top gold in the bottom image, the combination would still require more

metal layers than the design rules permit (two gold, yellow, pink, green, light blue, dark blue). Ex.2003, ¶120.

Gonzalez's description of Figure 8 explains that the top portion of Figure 8 shows the inductor layout, and the bottom portion of Figure 8 shows the interconnection of the varactors and the structure of the transistors. Ex.1005, 8; Ex.2003, ¶121. Neither picture is intended to demonstrate the relative positioning of the structures in the two pictures, and they do not (and cannot) show whether the varactors of the bottom portion of the image overlap with the coil-conductor segment of the top image. Ex.2003, ¶120.

The Petition suggests a way in which the two different portions of Fig.8 could be sandwiched together. Ex.2003, ¶121. But as shown above, the different portions of Fig.8 have different thicknesses and different numbers of layers, and a POSITA could not combine them as Petitioner suggests without violating the design rules. Ex.2003, ¶121. These two portions *could* be combined in a number of different ways that could satisfy the design rules, but many of those ways would have capacitors located below the inductor coil. The only explanation for Dr. Prucnal's conclusion to the contrary is the improper use of the '582 Patent as a roadmap to piece together the disclosures of Gonzalez.

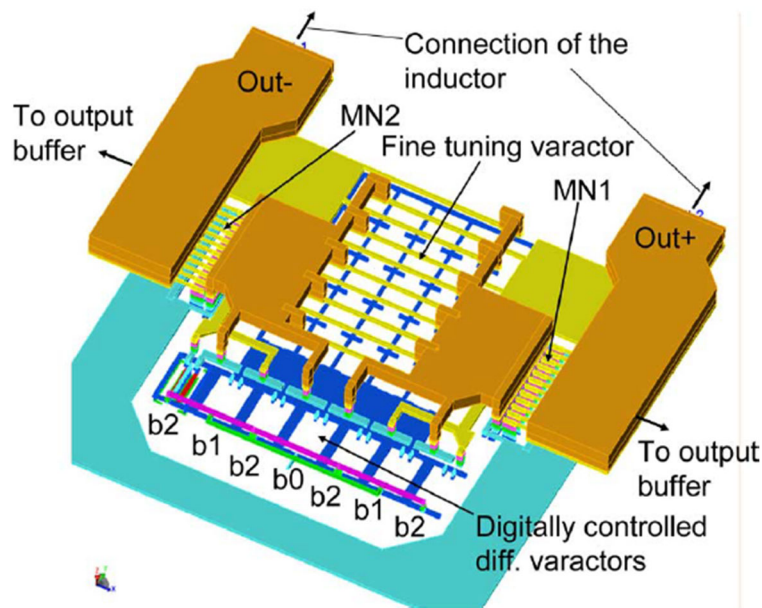
As a result, Gonzalez fails to show or suggest that the claimed capacitor

component “is correspondingly configured outwards relative to the coil-conductor segment, and the capacitor component is not substantially overlapped with the coil-conductor segment” of the independent claims 1. Ex.2003, ¶122.

3. No “connecting segment” of the claimed “capacitor component”

The Petition fails to identify any component that meets the requirements of the claimed connecting segments of the claimed capacitor component in Gonzalez. The claimed connecting segments must “extend[] corresponding to the two extension-conductor segments in a same direction” and be “respectively overlapped with the two extension-conductor segments in a vertical direction.” Ex.1001, Cl. 1; Ex.2003, ¶¶123-124.

The Out-/Out+ structures Petitioner identifies as the “extension-conductor segments” (in brown/gold) completely cover the yellow/green layers of Fig.8 of Gonzalez:



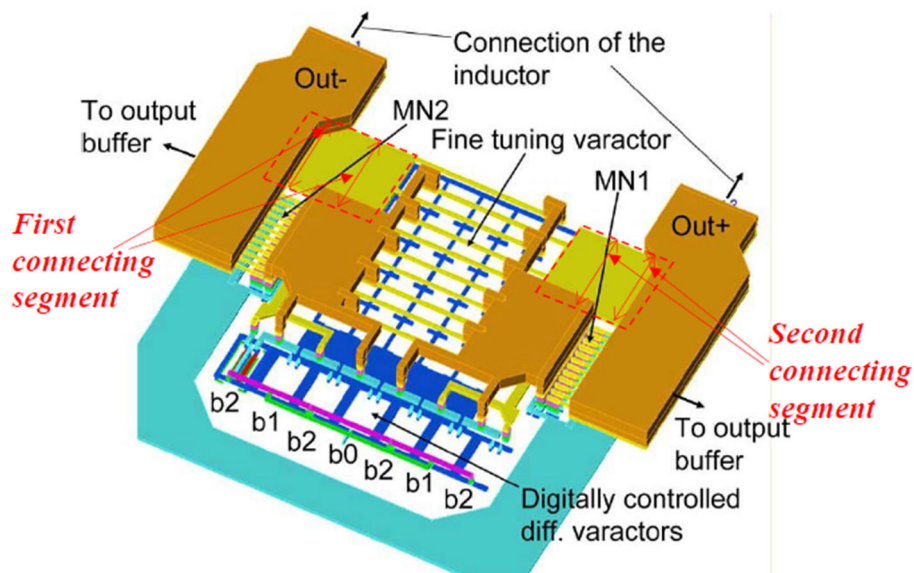
Ex.1005, Fig. 8; Ex.2003, ¶125.

The Petition and Dr. Prucnal speculate as to the form the hidden structure takes. *See* Ex.1003, ¶¶155, 159, 169; Petition, 60-61, 65; Ex.2003, ¶126. However, there is no indication in Gonzalez what form that layer takes, as it is irrelevant to the limited purpose Gonzalez serves. Ex.2003, ¶¶126-127.

It is undeniable that Figure 8 of Gonzalez contains many different metal layers. Ex.1005, Fig. 8; Ex.2003, ¶¶126-127. Neither Petitioner, nor Dr. Prucnal, has any evidence as to how the gold/brown layers connect to the yellow layers, as they are completely hidden. Ex.2003, ¶¶126-127; Ex.2005, 58:1-59:6 (“Whatever is going on under that brown extension segment isn’t shown, so I don’t know what the shape of it is.”).

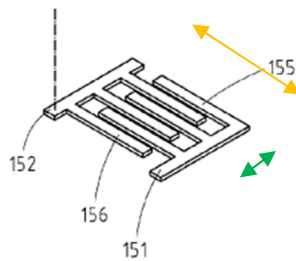
Because these components are hidden, there is no basis to conclude that they necessarily “extend[]corresponding to the two extension-conductor segments in a same direction,” or that they “are respectively overlapped with the two extension-conductor segments in a vertical direction,” as required by the claims. Ex.2003, ¶128.

In fact, Dr. Prucnal’s own annotations of how the connecting segment could be structure fails to meet the claimed limitations.



Ex.1003, ¶159; Ex.2003, ¶129. In this option (of the countless options for the “yellow portion”), the portions outlined in yellow do not “extend[] corresponding to the two extension conductor segments in the same direction” and are not “respectively overlapped with the two extension-conductor segments in a vertical direction.” Ex.2003, ¶130.

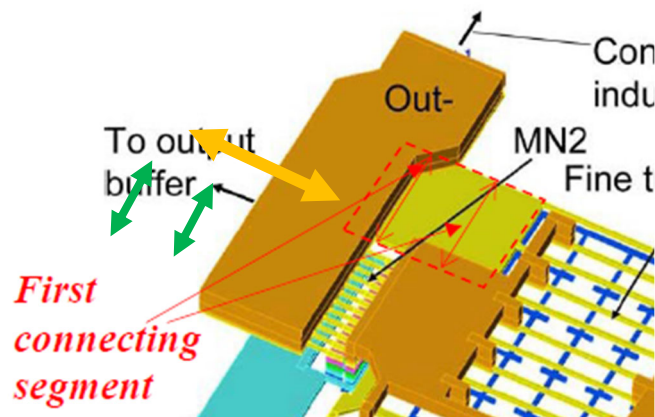
A POSITA would understand that, as the term is used in the '582 Patent, “extend” means the primary direction that the structure of the component exists in. Ex.2003, ¶131. For example, “the other end of the first electrode segment 155 extends laterally relative to the coupled first connecting segment 151.” Ex.1001, 5:8-10, Fig. 3.



Ex.2003, ¶132.

In Figure 3 of the '582 Patent (annotated above), electrode segment 155 has material that exists in both a direction extending away from 151 and, material that exists in the same direction as the direction 151 extends. Said otherwise, 155 has a length and a width. The length is traditionally the longer of the two dimensions and the width is traditionally the shorter of the two. In Figure 3, the length of 155 extends away from 151 (in a top left to bottom right direction in the above), as indicated by the orange arrow. The width of 155 exists parallel to the direction of 151 (in a top right to bottom left direction in the above), as indicated by the green arrow. Ex.2003, ¶133.

In this same vein, the red outlined “connecting segment” of Dr. Prucnal’s declaration actually extends in the direction of the orange arrow (as annotated below), which is the “length” of the red annotated box, rather than extending in the green annotated direction, which is the width.



Ex.1003, ¶159; Ex.2003, ¶134.

Even the above annotation, from paragraph 159 of Dr. Prucnal’s declaration, over-estimates what is actually depicted in Figure 8. Ex.2003, ¶135. Removing the “guess work” from the above annotation results in a portion of yellow metal that “extends” even more in the orange direction. Ex.2003, ¶135.

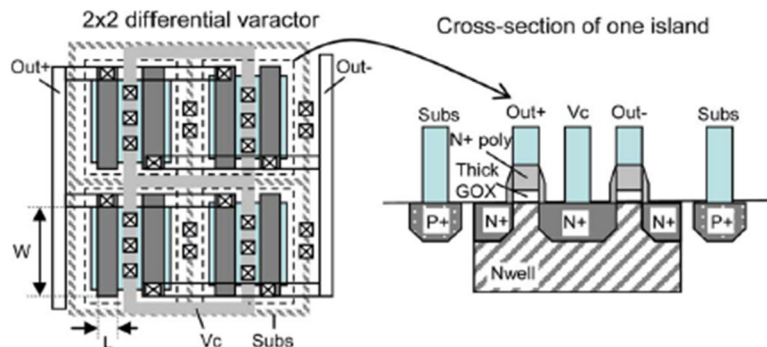
In short, the yellow structures are masked by the brown/gold Out-/Out+ structures, making it impossible to identify the structure that exists below the brown/gold layers. Petitioner’s “interpretation” is simply a guess as to what the hidden features of Gonzalez might look like, and this fails to render obvious the claimed connecting segments. Gonzalez never disclose the “connecting segment” of

claims 1 and 9. Ex.2003, ¶136.

4. No electronic component below the capacitor component of claims 2 and 3

Dependent Claim 2 requires “an electronic component, arranged corresponding to the first region in an embedded manner on a surface, opposite to the capacitor component, of the second insulation layer” and dependent Claim 3 specifies what form that component should take. The Petition fails to identify an insulation layer that meets the claimed second insulation layer or any component embedded opposite (e.g., below) the capacitor component. Ex.2003, ¶¶137-139.

The Petition appears to suggest that a second insulation layer, with an additional electrical component, would exist below the fine-tuning varactor. Petition at 69. However Figure 5 of Gonzalez establishes this is simply not the case. Ex.2003, ¶141. The fine-tuning varactor of Gonzalez is atop, and within, the silicon substrate:



Ex.2003, ¶¶141-143; Ex.1005, Fig. 5. The '582 Patent requires that the electronic

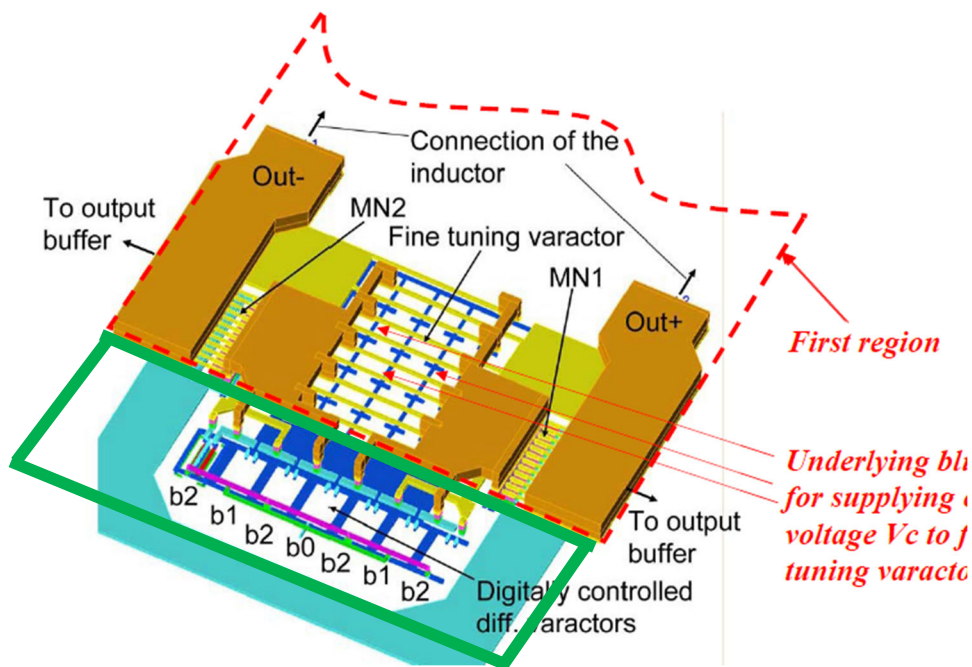
component of Claim 2 to be located below the capacitor component of Claim 1, specifically, there must be a layer of insulation between the capacitor component of Claim 1 and the electronic component of Claim 2. Ex.2003, ¶¶141-143; Ex.1001, Cls. 1-2. The Petition relies on the varactor as the capacitor component of claim 1, and has not identified any component below the varactor. Gonzalez does not disclose any electronic component below the varactor or any intervening insulation layer, nor could it, because such a structure would be contrary to the design of semiconductor devices. Ex.2003, ¶¶141-143.

Petitioner also suggests that digitally controlled differential varactors, which are at the *same* metal layer as the fine-tuning varactors,⁸ could be the claimed “Electronic component” of Claims 2 and 3. First, these digitally controlled differential varactors are not located below the fine-tuning varactors, and there is no showing of any insulation layer. Specifically, there is no “second insulation layer” below the fine-tuning varactors into which the differential varactors are embedded. Ex.2003, ¶¶144-145.

Moreover, the differential varactors are not “arranged corresponding to the

⁸ “The binary switched varactors are made from the same structure as the fine-tuning varactor.” Ex.1005, 5.

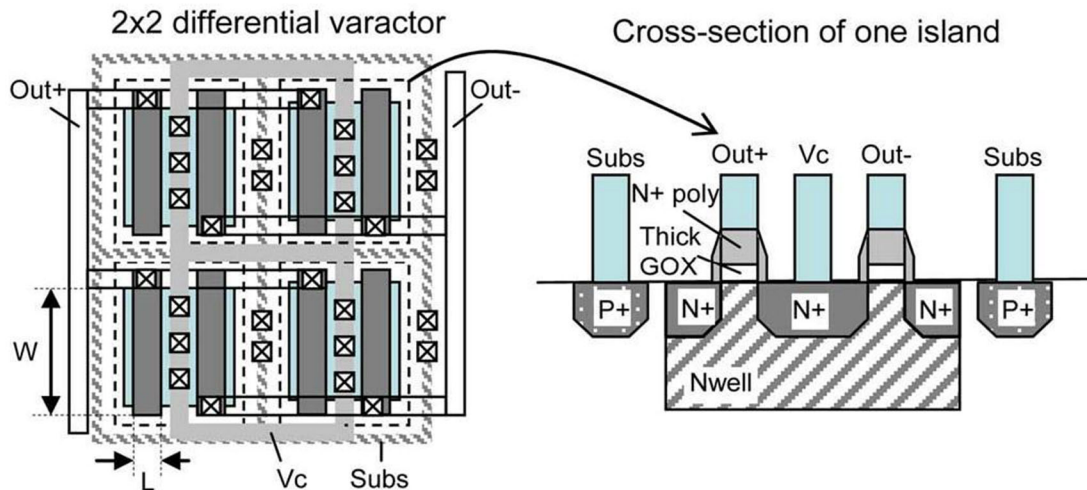
first region,” as is required by Claim 1. Instead, even as the Petition admits, they are located *outside* the first region:



Petition at 72; Ex.1005, Fig. 8; Ex.2005, 59:11-20 (confirming the digitally controlled differential varactors (in the green box) do not correspond to a first region identified by the Petition (red dotted line) above).

The failure of Petitioner’s arguments regarding Claim 2 further show that Claim 3 is not unpatentable. Claim 3 specifically identifies certain components as the claimed electronic component of Claim 2. The Petition identifies the “digitally controlled varactors” (which fail as set forth above) and “a common voltage V_c ” on the “blue metal layer,” as satisfying Claim 3. Petition at 73-74. However, Figure 5

confirms that the Vc that the Petition identifies, as well as the digitally controlled differential varactors, are not embedded on an opposite surface of a second insulation layer:



Ex.1005, Fig. 5; Ex.2003, ¶¶145-146. There is nothing below the varactors (which themselves include the Nwell) of Gonzalez, no insulation layer and no additional electrical components. Ex.2005, 28:15-22. The Petition fails to identify any capacitor, transistor, diode, or resistor that is found below the varactors of Gonzalez. The Petition fails to establish that any of Claims 1-5 or 9 are obvious in view of Gonzalez. Ex.2003, ¶147.

B. Ground 2, Based On Muh/Niknejad, Fails

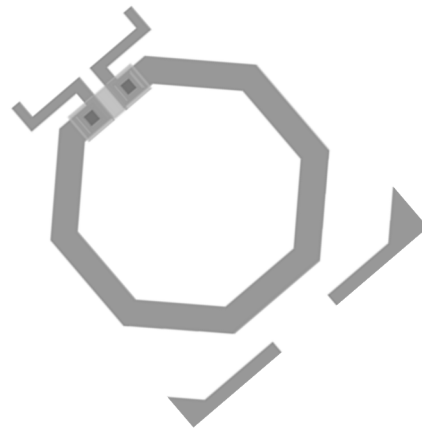
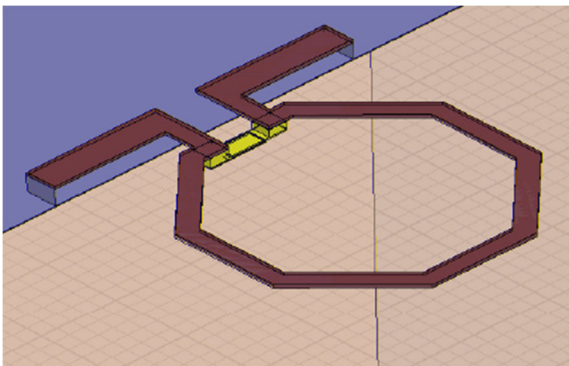
Muh, an undated thesis (Ex.1006, 1), purportedly was available prior to the invention of the '582 Patent from the University of California library system. Petitioner has not established that Muh qualifies as prior art, which dooms this

ground at the first step. Even if Muh were prior art, Ground 2 fails for two independent reasons.

First, a POSITA reviewing Muh and Niknejad would not have combined the two references to create an LC circuit with the claimed orientation. Muh and Niknejad—which refer to finger capacitors, but do not actually describe the use of a finger capacitor in an LC circuit in the claimed configuration—expressly teach that the fingers in such an LC circuit would be oriented in a manner contrary to that claimed by the '582 Patent. Muh and Niknejad teach that the fingers would be oriented as they were in the prior art, including in the Jing reference (Ex.1033) the examiner identified as most analogous in his notice of allowance. This prior art orientation is contrary to the claims and the teachings of the '582 Patent and is fatal to Petitioner's obviousness arguments. Ex.2003, ¶151.

Second, the combination of Muh's LC circuit and Niknejad's finger capacitor would result in an LC circuit where the coil-conductor segment substantially overlaps the capacitor component. In the Muh thesis, the author indicated that the capacitor of the LC circuit identified was attached to, and completely overlapped by, the coil-conductor, in order to improve the Quality or "Q" factor. *See e.g.*, Ex.1006, 31; Ex.2003, ¶152. The claims of the '582 Patent, in contrast, expressly require *no* substantial overlap of the coil-conductor segment and the capacitor component.

Ex.1001, Cl. 1, 1:47-2:9, 6:46-61, 8:54-64. In fact, Muh and Niknejad describe and depict the same structure, yet the Petition alleges a POSITA would have been motivated to modify these identical structures to arrive at the claimed circuit:



Ex.1006, 58 (left); Ex.1007, 26 (right, and rotated). These two references, if combinable, would result in an LC circuit that does not satisfy the claims of the '582 Patent. Ex.2003, ¶151.

The Petition's attempt to rectify these two shortcomings of the art demonstrate the hindsight bias that infects the analysis of Dr. Prucnal. Indeed, the only instance of the claimed configuration is found in the '582 Patent itself. No other reference shows a finger capacitor in the claimed manner, having an extension conductor segment overlapping a connecting segment that extends in the same direction as the extension conductor segment, and having electrode segments extending laterally relative to a connecting segment. Ex.2003, ¶153.

1. Muh is not prior art

Petitioner has not established that Muh is prior art. It relies on the testimony of Dr. Hall-Ellis, who herself is not a member of the relevant public, from whose perspective the public accessibility analysis is undertaken. *Blue Calypso, LLC v. Groupon, Inc.*, 815 F.3d 1331, 1348 (Fed. Cir. 2016) (explaining that prior art status is based on whether POSITAs are able to identify and locate the reference); Ex.2004 1188:13-1189:12. Most notably, Petitioner’s own expert admitted that even he, a person having greater than ordinary skill in the art, would not have relied upon MARC records to identify any reference as he has never heard of the term. Ex. 2004, 1153:7-11; *see also* Ex.2003, ¶149 (confirming a POSITA would not know how to use MARC records to located documents).

Dr. Hall-Ellis’s testimony does not, and cannot, establish that the Muh thesis was “disseminated or otherwise made available to the extent that ***persons interested and ordinarily skilled in the subject matter or art*** exercising reasonable diligence, can locate it,” as she is not such a person and does not offer opinions from such a position, noting that her opinions remain the same regardless of the subject matter of the patent. *Acceleration Bay, LLC v. Activision Blizzard Inc.*, 908 F.3d 765, 772 (Fed. Cir. 2018).

Dr. Hall-Ellis opines that a POSITA, using MARC data in the OCLC

database, would be able to find Muh. Ex.1036, 45-46. However, she performs her analysis from the perspective of a *librarian*, not a *person of ordinary skill in the art*, and not the perspective of *a person interested in the subject matter*. Ex.2002 at 29:15-31:5; Ex.2004, 1188:13-1189:12. Moreover, she received a copy of Muh from counsel in 2023, and used that as a roadmap to identify a copy of Muh at the Berkeley library. Ex.1036, 44; Ex.2004, 1192:3-10. There is no evidence that, without having this copy of Muh in-hand already, a person interested in the art would have been able to identify Muh. Instead, using the specialized librarian knowledge of her experience, she was able to use MARC data and the OCLC database (information there is no evidence a POSITA would be able to use) and the already in-hand copy of Muh, to find another copy of Muh. This is not the test for public availability.

A party seeking to introduce a reference “should produce sufficient proof of its dissemination or that it has otherwise been available and accessible to *persons concerned with the art* to which the document relates and thus most likely to avail themselves of its contents.” *In re Wyer*, 655 F.2d 221, 227 (CCPA 1981) (quoting *Philips Elec. & Pharm. Indus. Corp. v. Thermal & Elecs. Indus., Inc.*, 450 F.2d 1164, 1171 (3d Cir. 1971)). The Petition fails to explain any basis as to why or how the Muh thesis was “accessible to *persons concerned with the art* to which the

document relates and *thus most likely to avail themselves of its contents.*” *Id.* That Dr. Prucnal, opining as to a POSITA’s knowledge of the prior art, has no basis to identify Muh in the manner proposed by Petitioner, and as Petitioner has advanced no other theory, Petitioner has failed to establish Muh is prior art.

Dr. Hall-Ellis’s opinions are entirely based on indexing. While Federal Circuit law confirms that indexing is not the only way to establish prior art, according to Dr. Hall-Ellis, it is a necessary way (and indeed, it is the only way that she relies on). Ex.2004, 1189:13-1191:16.

Other than the indexing (which Petitioner’s evidence plainly establishes that a POSITA and a member of the *relevant* public would not have used and would be unable to use), Petitioner provides no other evidence that Muh was available to the relevant public. While indexing may not be the only way to establish a reference is prior art (*Voter Verified, Inc. v. Premier Election Sols., Inc.*, 698 F.3d 1374, 1380 (Fed. Cir. 2012)), it is the only theory advanced by the Petition. Also, while indexing may not be the only way in the eyes of the Federal Circuit, the library community—which oversees the storage and cataloging of a thesis like the Muh reference—believes that proper indexing by subject heading is *necessary* to perform a search using MARC data. Ex.2004, 1190:1-1191:16. Given the Petition only relies on this MARC indexing, and Dr. Prucnal confirms persons interested and ordinarily skilled

in the art would not be able to utilize this MARC indexing, and the Petition advances no other theory for why Muh is prior art, the Petition does not carry its burden.

Dr. Hall-Ellis's opinion fails to mention any other basis to conclude that Muh could be prior art. *See generally* Ex.1035, 44-46. Absent an additional theory as to why Muh constitutes prior art, the Petition's evidence is insufficient. The Federal Circuit has held that student theses indexed by name and title, and available "[i]n the main library," were "not accessible to the public because they had not been either cataloged or indexed in a meaningful way." *In re Cronyn*, 890 F.2d 1158, 1161 (Fed. Cir. 1989).

2. No basis to orient any finger capacitor as claimed

a. Overview

Muh and Niknejad teach orienting the fingers of the capacitor component (which the '582 Patent calls the "electrode segments") contrary to the requirements of the challenged claims. Specifically, Niknejad explains that when there is a need to "decrease finger resistance and inductance," as is the case in an LC circuit (as Petitioner's expert agrees⁹), a POSITA would be motivated to use "a large number

⁹ During the co-pending ITC proceedings, Dr. Prucnal testified: "If one could decrease finger resistance, that would be favorable." Ex.2004 at 1135:2-3.

of short fingers in parallel.” Ex.1007 at 73; Ex.2003, ¶¶154-155. This is precisely how the prior art (including that which the examiner of the ’582 Patent deemed most analogous) positioned its capacitors in an LC circuit:

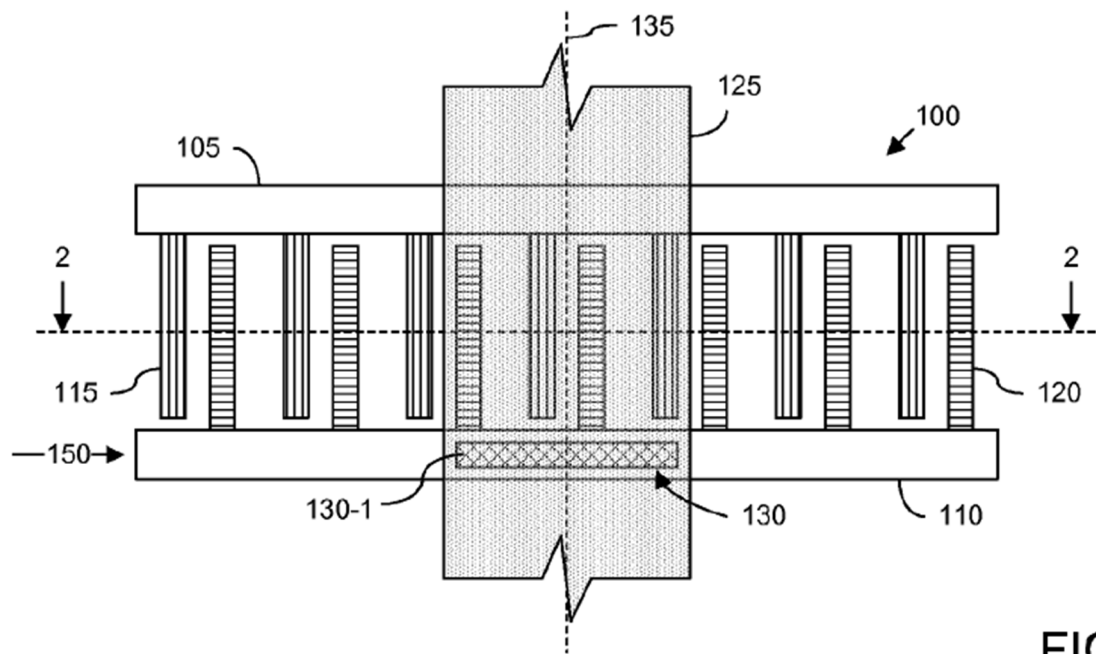


FIG. 1

Ex.1033 at Fig.1; *see also* Ex.1002, 12-13 (describing Jing as the “closest prior art”); Ex.2003, ¶155. In the structure that Niknejad teaches, and which Jing (above) illustrates, the connecting segments do not extend in the same direction as the extension-conductor segments, as the claims require. Ex.1001, Cl. 1. Instead, the electrode segments extend in the same direction as the extension-conductor segments, and the extension-conductor segments are perpendicular to the connecting segments.

b. Muh and Niknejad Do Not Teach the Claimed Orientation

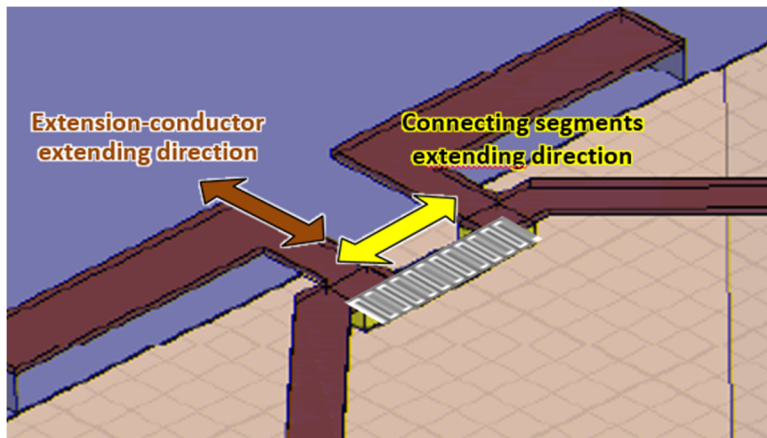
Niknejad confirms that there are two ways to design a finger capacitor: (1) with a larger number of short fingers or (2) a smaller number of long fingers. Ex.1007, 28; Ex.2003, ¶¶156-158. “The former structure results in smaller finger resistance and inductance but larger lead parasitics due to the transition from the signal lines to the capacitor plates. The latter structure exhibits the opposite tradeoff.” Ex.1007, 28; Ex.2003, ¶158.

In an LC circuit that uses finger capacitors, there are significant benefits to decreasing finger resistance and inductance. Ex.2003, ¶159. Petitioner’s own expert, Dr. Prucnal, has testified that “[i]f one could decrease the finger resistance, that would be favorable.” Ex.2004, 1135:2-5 (Dr. Prucnal’s Trial Testimony). That favorability arises, in substantial part, because decreasing the series resistance of the fingers increases the Q factor. *Id.* at 1134:15-24; Ex.2003, ¶¶159-160.

A POSITA would know that a greater number of shorter fingers is superior to a smaller number of longer fingers for several reasons. Ex.2003, ¶¶154-159. First, decreasing the series resistance increases the Q factor of the capacitor and the LC circuit. Ex.2003, ¶160. Second, as both Drs. Phinney and Prucnal agree, the designed inductance in an LC circuit is in the loop(s) of the inductor. Ex.2004, 1135:8-12; Ex.2003, ¶161. A POSITA is motivated to minimize what Dr. Prucnal

called the “ancillary inductance from the fingers.” Ex.2004, 1135:8-12; Ex.2003, ¶161.

A POSITA knows (and Niknejad explicitly says) that a greater number of shorter fingers is best to minimize the additional inductance within the capacitor component, and a POSITA would know that in an LC circuit, all of the necessary capacitance could be obtained from a larger number of shorter fingers. Ex.2003, ¶161. Accordingly, a POSITA using a finger capacitor in an LC circuit would choose a larger number of short fingers. Ex.1007, 28; Ex.2003, ¶161. As such, a POSITA who combined Muh and Niknejad, and replaced the “parallel-plate [MOM] capacitor” of Muh (Ex. 1006 at 57) with a finger capacitor, would utilize a design like this:



Ex.2003, ¶161. A POSITA would not orient the finger capacitor to have fewer and longer fingers, which is what would be required for the finger capacitor to be

oriented as Petitioner suggests. Ex.1003, ¶239; Ex.2003, ¶162.

Petitioner suggests that a POSITA (if using a finger capacitor) would depart from the structure and configuration of Muh, and extend the capacitor component away from the coil-conductor segment, but Muh and Niknejad teach the same shape and structure of an LC Circuit, which has the capacitor component completely overlapped by the coil-conductor segment:

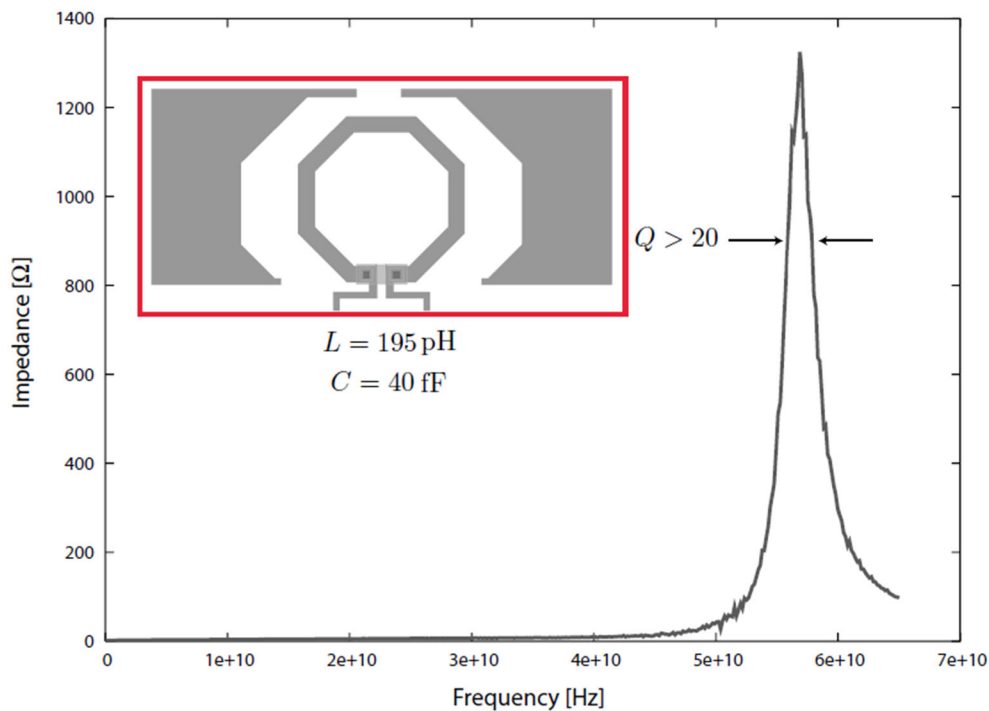


Fig. 3.10 Measured resonance of a mm-wave tank formed by a ring inductor and MIM capacitors.

Ex.1007 at 26 Fig.3.10 (red box added to show structure of LC circuit and use of MIM (plate) capacitors). This location and use of the capacitor is the same as Muh. Ex.1006, 58; Ex.2003, ¶163.

As discussed in more detail below, Muh (and Niknejad) deliberately position the capacitor of the LC circuit in the area under the coil-conductor segment. They do so because that orientation improves the Q factor of the LC Circuit. Ex.2003, ¶164. In contrast, the '582 Patent accepts the lower Q factor in exchange for significant benefits in reducing parasitics and phase noise, and the stated benefit of achieving a beneficial size and arrangement of interconnecting wires. Ex.1001, 1:63-2:3, 12:51-54.

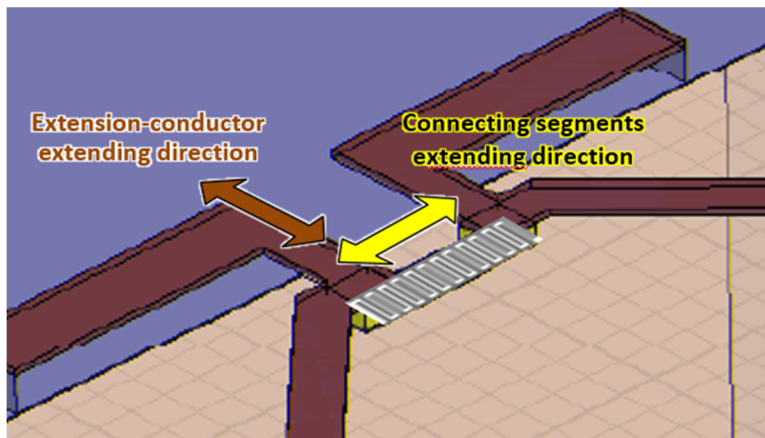
Petitioner's only response is to argue—contrary to the teachings of Muh and Niknejad—that the finger capacitor of Niknejad “would naturally extend further away from the core-segment of the inductor than Muh's parallel-plate capacitor.” Petition at 102. That argument is contrary to the teachings of both Muh and Niknejad. Those two references show *only* LC circuits with capacitors that are overlapped by, and connected to, the coil-conductor segment, which is a design choice made explicitly to improve the Q factor. Ex.1006, 58; Ex.1007, 26; Ex.2003, ¶165. The two references only teach the use of a larger number of shorter fingers. Together those teachings show that a POSITA would not be motivated to modify Muh and Niknejad to have a capacitor component that extends beyond the area they identified for such capacitors and would not select finger lengths that are longer, which is what would be required in Petitioner's proposed configuration.

Petitioner, recognizing the weakness of its argument, suggests that the inventive orientation of the '582 Patent (which is directly contrary to the orientation above used in Muh and Niknejad) is nonetheless “an obvious design choice.” Petition at 103. This is a particularly troubling use of hindsight bias because the invention of the '582 Patent is the specific orientation and location of its capacitor component in relation to the coil-conductor segment and extension-conductor segments, none of which is taught by either Muh or Niknejad. *McGinley v. Franklin Sports, Inc.*, 262 F.3d 1339, 1351 (Fed. Cir. 2001) (“When the art in question is relatively simple, as is the case here, the opportunity to judge by hindsight is particularly tempting.”).

Indeed, the prior art, including Jing (as well as Muh and Niknejad), taught different orientations in order to achieve other goals, such as higher Q. Ex.2003, ¶166. The insight, and a key inventive concept of the '582 Patent, is that orienting the capacitor component in a specific manner, in “the prime real estate” of the first region of the inductor, would achieve significant benefits. *Id.*

By separating its argument from any specific teaching of the prior art, Petitioner’s efforts to try to explain away the inventive concept of the '582 Patent are improper and riddled with hindsight bias. For example, the Petition, at 103, simply states that the finger capacitor “would be placed such that its two connecting

segments extend corresponding to the two extension-conductor segments of Muh's inductor in a same direction." This is not rooted in any disclosure of Muh or of Niknejad, and instead only cites to Dr. Prucnal's declaration at ¶239. The Petition alleges this "would have been an obvious design choice" based on the use of vias. Petition at 103. However, contrary to the Petition's representation (Petition at 103-104), a POSITA would have instead been motivated to connect a finger capacitor to the coil-conductor segment in the orientation and footprint that Muh and Niknejad teach:



Ex.2003, ¶169.

A POSITA would have used vias to connect one end of the coil-conductor segment to one of the connecting segments, and the other end of the coil-conductor segment to the other connecting segment. The Jing reference on which the examiner relied shows how this was done using either a "trench" via or "standard sized" vias.

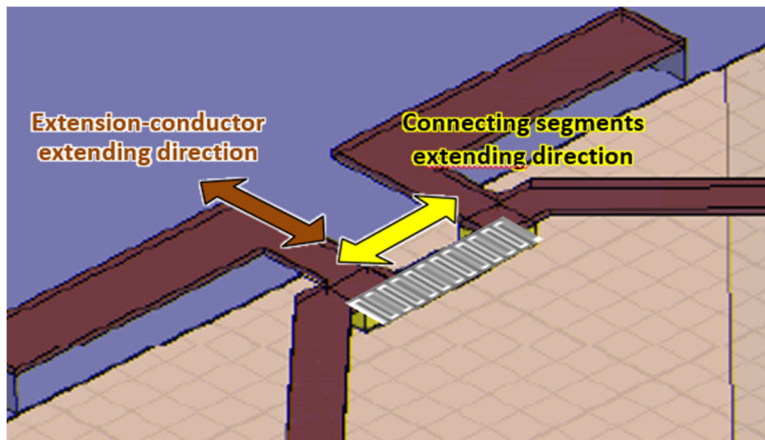
Ex.1033 at 5:19-28, Fig.1; Ex.2003, ¶168.

The Petition incorrectly alleges that “Muh already discloses vias.” Petition at 103. It does not. *See generally* Ex.1006; Ex.2003, ¶168. The Petition also alleges “it would have been obvious that the same or similar vias [of Muh] would be used to connect the finger capacitor to the inductor.” Petition at 103-104. Muh does not identify or discuss any “same or similar” vias and provides no basis for the inclusion of undisclosed vias. *See generally* Ex.1006; Ex.2003, ¶168. Petitioner’s arguments regarding the orientation of the finger capacitors is made up out of whole cloth, with no grounding in the references. Ex.2003, ¶169.

Indeed, Dr. Prucnal added certain annotations without any basis in the references he was analyzing. *See* Ex.1003, ¶239. Contrary to what he concluded, Muh’s B-3 does not disclose a via.

In sum, even if the combination of Muh and Niknejad were proper (which, as discussed below in Section V.B.4 is not the case), there is no basis for concluding that any alleged extension conductor segment of Niknejad would be oriented as the Petition alleges as opposed to spanning the space between the two ends of the coil segment. There is no basis to orient the alleged combination in the manner the Petition alleges. Nothing in either Muh, or Niknejad provides a reason to position the alleged connecting segment from Niknejad’s capacitor component in the claimed

configuration. *Id.* Instead, the actual designs used in the prior art show that the “connecting segments” of Niknejad’s capacitor would be positioned in the other, 90 degree rotated, position:



In this position, the capacitors match the prior art reference Jing (Ex.1033). Ex.1033, Figs. 1, 3, 4. The orientation of Jing’s “extension conductor segment” 125 and “connecting segment” 105/110 is unaddressed by Dr. Prucnal and the Petition. Ex.2003, ¶169. The Petition disregards that the orientation of Jing, the only actual orientation that exists in the prior art references of record. *Id.* Doing so, without any basis in the prior art, is only further evidence of the hindsight bias that infects Ground 2 (as discussed in greater detail in Section V.B.4). *Id.*

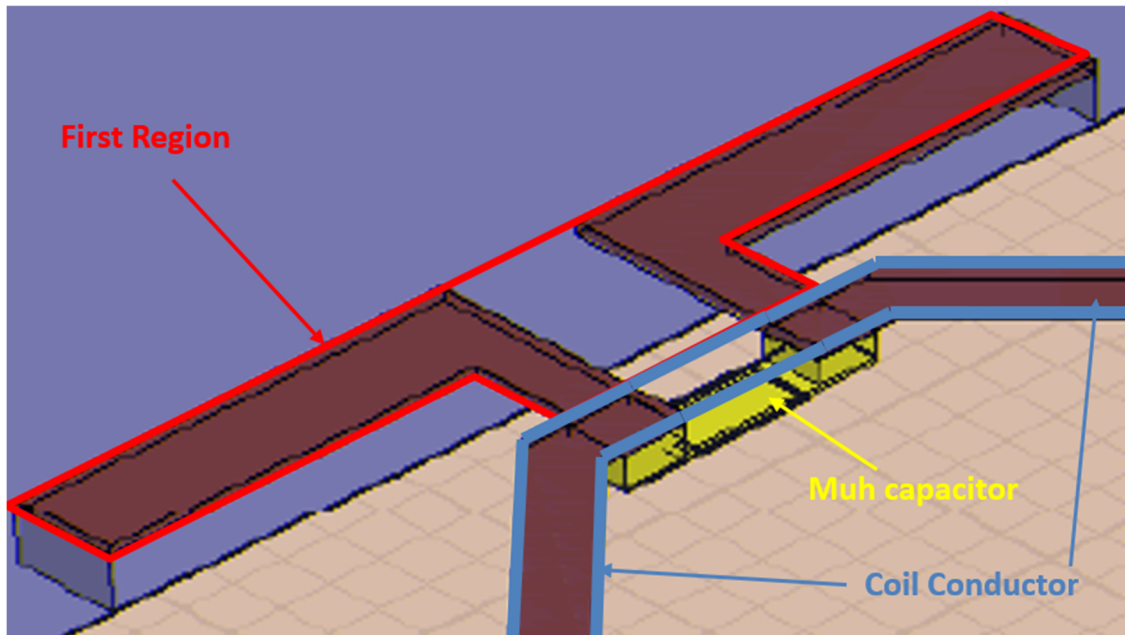
The orientation of Jing is far more likely and, contrary to the Petition’s unsupported conclusions, the simplest and most reliable design choice, as it was already proven to exist. *Id.*

The Petition fails to explain any basis to orient the “connecting segments” of Niknejad in the manner required by the claims. The only reference that includes a finger capacitor oriented in the claimed manner in this proceeding is the ’582 Patent itself. Muh and Niknejad each discloses the use of a plate capacitor in an LC circuit, and while Niknejad discloses finger capacitors in the abstract, it explains that a POSITA—when considering the benefits of a finger capacitor—would choose to orient it contrary to the teachings of the ’582 Patent, which is how such finger capacitors were used in the prior art. There is no support—other than rank hindsight bias—for Petitioner’s arguments.

3. The capacitors of Muh and Niknejad are substantially overlapped with the coil-conductor segment

There is a second, independent reason that Muh and Niknejad do not render the claims of the ’582 Patent obvious. The capacitor of Muh and Niknejad is substantially overlapped with the coil-conductor segment as the term is properly construed. The basis for the Realtek’s construction is set forth in Section III.

Under the construction that Realtek advances for “extension-conductor segments” and “coil-conductor segment,” Muh’s capacitor is completely overlapped by the coil conductor segment:



Ex.1006, 58; Ex.2003, ¶170. Because of this overlap, Muh also fails to teach or suggest any electrodes “located below the first region.”

The Petition attempts to use an annotated version of ’582 Patent Figure 8—an unclaimed embodiment of the ’582 Patent—in an effort to demonstrate that some substantial overlap is allowed, so-long as there isn’t complete overlap. Petition at 100; Ex.2003, ¶171. The Petition ignores the fact that the ’582 Patent describes and depicts a number of embodiments. *See generally* Ex.1001, 2:13-58. Not all of these embodiments are claimed nor do the claims necessarily apply to all disclosed embodiments. That certain figures depict a resonant portion of the capacitor component below the inductor coil confirms that those depict embodiments not claimed by Claim 1. There are numerous claimed embodiments illustrated in the

figures of the '582 Patent, but patents notably do not need to include drawings of particular embodiments in order to claim them. *See CCS Fitness, Inc. v. Brunswick Corp.*, 288 F.3d 1359, 1367 (Fed. Cir. 2003) (refusing to limit the scope of patent claims in view of figures). Accordingly, a claim is not limited to inventions looking like those in the figures. *MBO Labs., Inc. v. Becton, Dickinson & Co.*, 474 F.3d 1323, 1333 (Fed. Cir. 2007). This guidance is especially apt here because the '582 Patent repeatedly uses phrases like “first embodiment” (Ex.1001, 2:19), and “in some embodiments” (*see e.g.*, Ex.1001, 2:3, 4:34). The text of the '582 Patent clarifies that there are many embodiments, not all of which are claimed. Figures 2 and 5 for example, depict a “capacitor component is not substantially overlapped with the coil-conductor segment.” Petitioner’s attempt to supplant the actual claim language by reference to a figure is improper. *CCS Fitness*, 288 F.3d 1359; *MBO Labs*. 474 F.3d at 1333.

Muh’s capacitor is substantially overlapped with the coil-conductor segment because a significant portion (and, in fact, all of the capacitors) are overlapped. Ex.2003, ¶170. Neither Muh nor Niknejad provides any basis to move the capacitor away from the depicted location and into the first region defined by the coil-conductor segment and the extension-conductor segments. In fact, as discussed above, Muh expressly states that as part of his research, the author was trying to

maximize the Q factor of its VCO circuit. Ex.1006, 41. Niknejad further explains that it was desirous to maximize the Q factor. Ex.1007, 29 (“The quality factor of capacitors drops inversely with frequency due to any series resistance, and this is a severe limitation for on-chip structures.”); Ex.2003, ¶171.

The capacitor component of Muh is expressly identified as linking the two ends of the coil segment, which is fundamental to maximizing the Q value of the LC circuit. Ex.2003, ¶¶171-172. This is at odds with the claimed requirement that the capacitor extend not be substantially overlapped by the coil-conductor segment, which slightly reduces the Q-value but provides the other benefits attained by the claimed configuration. A POSITA would not have modified Muh to move the capacitor component into the first region because such a modification would be opposite Muh’s stated goal of maximization of Q value. Ex.2003, ¶¶171-172. And Niknejad shows the capacitor of its LC circuit in exactly the same position as Muh, which confirms that a POSITA would not read those two references as teaching a capacitor component not substantially overlapped with the coil-conductor segment. Ex. 1007 at 26 Fig.3.10. Notably, Petitioner does not argue that Niknejad provides any basis to move the location of the capacitor, likely because Niknejad shows the capacitors in the same location and likewise focuses on the resulting Q factor. Ex. 1007 at 26; Ex.2003, ¶173. Niknejad’s capacitor is located in the same location of

the LC circuit. *See* Ex.2003, ¶184 (citing Ex.1006, 58; Ex.1007, 26).

In sum, Petitioner has not shown that adding a finger capacitor of Niknejad to the LC Circuit of Muh would yield an LC circuit in which the capacitor component is not substantially overlapped by the coil-conductor segment, or an LC circuit in which the electrodes segments are “located below the first region.” Petitioner cannot, and does not, provide a basis to modify Muh, against the teachings and stated goals of Muh and Niknejad, to achieve the inventions of the ’582 Patent. Ex.2003, ¶¶174-175.

4. Dr. Prucnal’s obviousness opinion is fraught with hindsight

The Petition does not provide an adequate basis to modify Muh to arrive at the challenged claims. The Petition, and Dr. Prucnal’s opinions, suffer from hindsight bias. Ex.2003, ¶176. While it may *seem* straightforward to orient the connecting segments and electrode segments in the manner claimed, “the prejudice of hindsight bias” often overlooks that the “genius of invention is often a combination of known elements which in hindsight seems preordained.” *Power Integrations, Inc. v. Fairchild Semiconductor Int’l, Inc.*, 711 F.3d 1348, 1368 (Fed. Cir. 2013) (quoting *McGinley v. Franklin Sports, Inc.*, 262 F.3d 1339, 1351 (Fed. Cir. 2001)). Indeed, while the ’582 Patent does not invent a new circuit, it does provide a modification to existing circuit designs, in a manner unknown before the

'582 Patent. *McGinley*, 262 F.3d at 1351 (citations omitted) (“[w]hen the art in question is relatively simple, as is the case here, the opportunity to judge by hindsight is particularly tempting.”)

Indeed, in cases like this, it is incredibly important to focus on what a POSITA would have been *motivated* to do, not simply what a POSITA would have been *able* to do. *Polaris Indus., Inc. v. Arctic Cat, Inc.*, 882 F.3d 1056, 1068 (Fed. Cir. 2018). Indeed, over-reliance on unsupported and conclusory expert opinions is often a sign of hindsight bias. *InTouch Techs., Inc. v. VGO Commc'ns, Inc.*, 751 F.3d 1327, 1352 (Fed. Cir. 2014) (concluding that a party's expert “succumbed to hindsight bias in her obviousness analysis” where such analysis “primarily consisted of conclusory references to her belief that one of ordinary skill in the art *could* combine these references, not that they *would* have been motivated to do so”). This is exactly what Dr. Prucnal did. Ex.2004, 1082:1-5 (“but *one way that it could be arranged* would be with the orientation that I show here, where it is effectively slid under to meet the position of the parallel plate capacitor that is shown there.”) Not only did he admit that this was only one way it could be done, he walked back his opinion even further to confirm that “it is at least *a way* of doing it.” *Id.* at 1082:16-17. He further admitted that “[a]nother way it could be arranged would be having it perpendicular to this direction.” *Id.* at 1082:17-19.

Dr. Prucnal and Petitioner have no reference depicting the claimed orientation of connecting segments and electrode segments. Instead, it is only based on this “could” and “at least a way” type of opinion that Petitioner supports its proposed combination. This is insufficient. Dr. Prucnal’s opinions are full of hindsight and are the only basis for the Petition’s conclusions.

The Petition’s proposed changes are contrary to the teachings of Muh. Muh discloses two LC tank test structures (Fig. 3-22) for the designed push-push VCO. One test structure includes only the MOS varactors (which are active devices), and the other test structure includes MOS varactors and MIM capacitors (connected to the tank in order to estimate MIM capacitors’ effect on the resonant frequency). In addition, the MOS varactors in these two LC tanks substantially overlap with the coil-segment of the inductor, which teaches away from the claimed invention of the ’582 Patent and undercuts the conclusion that a POSITA would be modified to change Muh to the claimed structure. *Id.* at Fig. 3-22; Ex.2003, ¶177.

Muh also discloses that MOS varactors used in the LC tank for the push-push VCO are active devices (e.g., the capacitance is variable based on the controlled gate voltage). However, the MOM (metal-oxide-meta) finger capacitor of Niknejad is a passive device where its capacitance is not variable based on input voltage as the MOS varactor. Muh further identifies that the challenge using the HFSS simulation,

which Petitioner improperly relies upon, lies in making sure that the simulated capacitor has a similar capacitance as the fabricated capacitor. Ex.1006 at 55. If a structurally more complicated interdigitated finger capacitor is used in the HFSS, it would defeat the purpose of simplifying the structure in the HFSS mode, and make the evaluation of the accuracy of HFSS more difficult than its original purpose. Ex.2003, ¶178.

Most notably, Niknejad only describes using MIM capacitors (such as the plate capacitors of Muh) in tank (LC) circuits. *See* Ex.1007, 26. In no instance does Niknejad describe using the finger capacitors it elsewhere discusses in place of a MIM capacitor, and Niknejad certainly does not describe how to orient such a capacitor if one were used. Ex.2003, ¶179.

Dr. Prucnal and the Petition improperly attempt to replace the capacitor of Muh with the capacitor of Niknejad, but they disregard the teachings discussed above. They rely on the relative size of Niknejad's capacitor having, allegedly, 24 fingers. Ex.1003, ¶236. But they ignore the configuration that Niknejad teaches for that number of fingers. Similarly, they rely on a figure in the patent itself, which demonstrates hindsight bias, but that figure is an unclaimed embodiment. Ex.2003, ¶¶180-181.

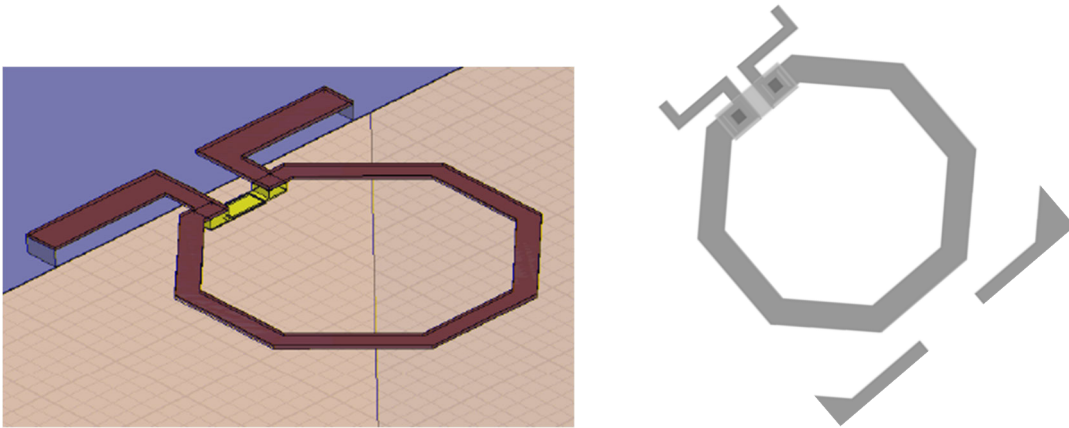
Niknejad is a single chapter of a larger textbook. Ex.1007, 1, 9-12; Ex.2005,

75:3-78:8. Dr. Prucnal never looked at the reference as a whole, which itself is an error. It is settled law that to establish obviousness, each prior art reference must be evaluated as a whole. Dr. Prucnal did not do this. Chapter 5, the unexamined section of the textbook, is titled “Voltage-Controlled Oscillators and Frequency Dividers” with sub-parts directed towards mm-Wave Oscillators, and Push-Push Oscillators. Ex.1007, 10. Similarly, Muh’s title is “Design of a FinFET static frequency divider and a millimeter-wave CMOS push-push VCO.” Ex.1006, 1. Despite these obvious directions to a POSITA to at least skim Chapter 5, Dr. Prucnal did not, instead focusing on “the fact that [Muh] referred to a test chip that had an inductor and finger capacitor.” Ex.2005, 78:3-8. This focus, and omission of Chapter 5, is attributable to Petitioner, who only provided Dr. Prucnal with a subsection of the textbook. Ex.2005, 9:12-17. However, if Dr. Prucnal himself had additional experience designing VCO’s, he would have understood the difficulties associated with making the type of changes he proposes; instead it is his practice to leave such difficulties to his graduate students. Ex.2005, 11:18-14:12.

When the additional, more pertinent portions of the textbook are analyzed, Dr. Prucnal’s unsupported conclusions regarding ease of modification quickly unravel. The most pertinent portion of this chapter states “high performance oscillators and dividers operating in the mm-wave range continue to pose difficult challenges even

in today's technology" and it goes on to explain that "careless modification of the structure can lead to unpredictable results." Ex.2006, 1, 9. These careless substitutions that Dr. Prucnal posits would be easy in fact would not be as trivial as he suggests. Ex.2003, ¶184. In fact, the art itself confirms the difficulties associated with making changes to high frequency circuits such as Muh and Niknejad. Ex.2006, 1, 9; Ex.2005, 70:23-71:24 (confirming the high frequency of Muh, and some concerns with such high frequencies); Ex.1007, 1 (Niknejad's operating frequencies at 60 GHz and beyond); Ex.2003, ¶184. Contrary to Dr. Prucnal's conclusions that a POSITA would have made the Muh/Niknejad combination with an expectation of success is rebutted when the full text of the textbook is examined, the art confirms that any changes to high frequency VCOs such as that of Muh or Niknejad are difficult and prone to unpredictable results—the opposite of any expectation of success. Ex.2003, ¶184.

Notably, it is telling that each of Muh and Niknejad depict the same LC circuit, and one that is different than that of the '582 Patent, this was a predictable way of constructing such a circuit:



Ex.1006, 58 (left); Ex.1007, 26 (right, and rotated); Ex.2003, ¶184. There is no basis rooted in anything other than the '582 Patent itself for deviating from this structure.

In addition, neither Niknejad nor the '582 Patent have any disclosure that suggest the images are to scale and can be treated in the way Petitioner uses them. *Hockerson-Halberstadt, Inc. v. Avia Group Int'l*, 222 F.3d 951, 956, 55 USPQ2d 1487, 1491 (Fed. Cir. 2000) (The disclosure gave no indication that the drawings were drawn to scale. “[I]t is well established that patent drawings do not define the precise proportions of the elements and may not be relied on to show particular sizes if the specification is completely silent on the issue.”).

Petitioner identifies no basis for its conclusion regarding any expectation of success, evidencing the Petition's use of impermissible hindsight to replace a horizontal plate capacitor used in the HFSS model by a more complicated multilayer stacked finger capacitor disclosed in Niknejad which further requires the metal

layers to connect together through the maximum number of vias. Ex.1007, 27 (Niknejad's teachings on vias). Further, Petitioner's reliance on only a single layer of Niknejad's multi-layer finger capacitor is misplaced and contrary to the teachings of Niknejad. Ex.1007, 72 ("[e]ach finger consists of all available metal layers stacked on top of each other to decrease its resistance which increasing both its quality factor and the self-resonance frequency"). A POSITA would not have made the combination Petitioner alleges.

In sum, contrary to Dr. Prucnal's opinion, there would not have been any expectation of success to support the alleged combination. Moreover, there is no basis rooted in any reference or any prior art perspective of a POSITA to support the combination advanced by Petitioner and Dr. Prucnal. Accordingly, there is no showing that a POSITA would have modified Muh to arrive at the claimed capacitor configuration. Claims 1-3 and 9 are patentable and not obvious over Muh and Niknejad if Muh is prior art (a finding that the Petition fails to support).

5. Claim 4 is patentable and not obvious over Muh and Niknejad

The Petition only addresses Claim 4 under an improper interpretation that suggests Claims 1 and 4 have no differences in claim scope. This is axiomatically false. *Ortho-McNeil Pharm. v. Mylan Lab 'ys, Inc.*, 520 F.3d 1358, 1362 (Fed. Cir. 2008) ("[T]his court strives to reach a claim construction that does not render claim

language in dependent claims meaningless.”). The Petition’s election to not even attempt to explain why its prior art meets the narrower Claim 4 is fatal to its analysis. Ex.2003, ¶185.

Dependent Claim 4 further limits the size of the claimed first region from that defined in Claim 1. Specifically, Claim 1 recites a first region “defined *by* the two extension-conductor segments and the coil-conductor segment” whereas Claim 4 adds the additional requirement of a first region “defined *between* the two extension-conductor segments.” Ex.2003, ¶185.

The Petition fails to explain how any alleged capacitor component would be arranged in relation to this more narrow first region of dependent Claim 4, or why the capacitor of Muh (or that of Niknejad) would be modified to both be corresponding to the more narrow first region, while still including two connecting segments respectively overlapped with the extension conductor segments or how they would be coupled to any alleged electrode segments. The Petition’s failure to undertake any analysis for this more narrowly claimed first region is fatal.

Even assuming Muh’s plate capacitor would be replaced with the finger capacitor of Niknejad, and the Niknejad capacitor would be oriented in the claimed manner, the Petition fails to explain why this capacitor would render obvious Claim 4.

VI. CONCLUSION

For the reasons set forth above, Realtek respectfully submits the Petition fails to establish any claim of the '582 Patent is unpatentable.

Dated: February 8, 2024

Respectfully submitted,

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CERTIFICATION UNDER 37 C.F.R. § 42.24(d)

Under the provisions of 37 C.F.R. § 42.24(d), the undersigned hereby certifies that the word count for the foregoing Patent Owner's Response totals 13,770 words, which is less than the 14,000 words allowed under 37 C.F.R. § 42.24(b)(1).

Dated: February 8, 2024

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CERTIFICATE OF SERVICE

I hereby certify that on February 8, 2024, I caused a true and correct copy of the foregoing to be served on the following counsel for Petitioner by electronic mail to the following email address:

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