

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

KANGXI COMMUNICATION TECHNOLOGIES (SHANGHAI) CO., LTD.
Petitioner,

v.

SKYWORKS SOLUTIONS, INC.
Patent Owner.

Case No. IPR2024-01456
U.S. Patent No. 9,450,579

PETITIONER’S REPLY TO PATENT OWNER RESPONSE

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Petitioners' Reply Exhibit List

EX-1001	U.S. Patent No. 9,450,579 to Madan et al. ("579 Patent"), Filing Date of August 22, 2015, Claimed Priority Date of July 7, 2012.
EX-1002	Prosecution History of U.S. Patent No. 9,450,579.
EX-1003	Declaration of Dr. Larry Larson under 37 C.F.R. § 1.68.
EX-1004	<i>Curriculum Vitae</i> of Larry Larson.
EX-1005	U.S. Patent Publication No. 2011/0254614 A1 to C-W Huang, et al., Filing Date of April 16, 2010 and Publication Date of October 20, 2011 ("Huang").
EX-1006	Japanese Patent Publication No. JP 2006-121217 to Seshimo, Toshiko et al., Publication Date of May 11, 2006 ("Seshimo")
EX-1007	Certified English Translation of Japanese Patent Publication No. JP 2006-121217 (EX-1006)
EX-1008	"General Purpose RF Switches", Skyworks Solutions., Inc., archived at Internet Archive's Wayback Machine on January 6, 2011 at https://web.archive.org/web/20110106070051/http://www.skyworksinc.com/uploads/documents/BR0378_10B.pdf .
EX-1009	U.S. Patent Pub. No. 2012/0081262 to Tanaka, et al. filed July 12, 2011 and published April 5, 2012.
EX-1010	U.S. Patent Pub. No. 2010/0327948 to Nisbet, et al., filed June 29, 2009 and published December 30, 2010.
EX-1011	Madan, et al., "Fully Integrated Switch-LNA Front-End IC Design in CMOS: A Systematic Approach for WLAN", IEEE Journal of Solid State Circuits, Vol. 46, No. 11, November 2011 (also available, and identified as published in October 2011, on Skyworks' web page archived on November 4, 2011 at Internet Archive's Wayback Machine at https://web.archive.org/web/20111104120653/http://www.skyworksinc.com/Press_Published_Articles.aspx). <i>Note: EX-1011 is also Exhibit 13 to the Wentzloff Deposition (EX-1050).</i>

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EX-1012	Excerpts from V. Veley, "The Benchtop Electronics Reference Manual," Tab Books Inc., 1987.
EX-1013	U.S. Patent Pub. No. 2004/0251952 to Nakatsuka et al. filed June 10, 2004 and published December 16, 2004.
EX-1014	Excerpts from Paul Horowitz, et al., "The Art of Electronics" (2d ed. 1989).
EX-1015	Japanese Patent Publication No. JP2011-166663A to Takashi et al., published August 24, 2011.
EX-1016	English Machine Translation of Japanese Patent Publication No. JP2011-166663A (EX-1015)
EX-1017	U.S. Patent Publication No. 2013/0154761 to Ilkov, filed December 14, 2011, and published June 20, 2013.
EX-1018	U.S. Patent No. 6,698,082 to Crenshaw, et al., filed August 28, 2001 and issued on March 2, 2004.
EX-1019	EP Pat. No. 2348532 to Brindle, et al., filed July 11, 2006 and published July 27, 2011.
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EX-1021	C-W Huang, et al., "Highly Linear SOI Single-Pole, 4-Throw Switch with an Integrated Dual-band LNA and Bypass Attenuators", SiGe Semiconductor, 2010 IEEE Radio Frequency Integrated Circuits Symposium, May 23-25, 2010.
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EX-1023	U.S. Patent No. 7,359,677 to C-W Huang, et al., filed June 10, 2005 and published April 15, 2008.
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EX-1027	Excerpts from R. Boylestead, et al., "Electricity, Electronics and Electromagnetics Principles and Applications," Prentice-Hall, Inc., 1977.
EX-1028	C-W Huang, et al., "Highly Linear 4.9-5.9 GHz WLAN Front-End Module Based on SiGe BiCMOS and SOI", 2011 IEEE MTT-S International Microwave Symposium, Baltimore, MD, USA, August 4, 2011, pp. 1-4.
EX-1029	F-J Huang, et al., "Single-Pole Double-Throw CMOS Switches for 900-MHz and 2.4-GHz Applications on p Silicon Substrates", IEEE Journal of Solid-State Circuits, Vol. 39, No. 1, January 2004
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EX-1031	Skyworks Solutions, Inc., "SKY14151-350LF High-Power Single Pole Four Throw (SP4T) Switch with Decoder", Data Sheet, October 6, 2010, archived at Internet Archive's Wayback Machine at https://web.archive.org/web/20110106074932/http://www.skyworksinc.com/uploads/documents/200983H.pdf .
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EX-1035	English Machine Translation of Korean Patent Publication No. KR100967847B1 (EX-1034)
EX-1036	J. Oerth, et al., "Evaluating pHEMT Process Improvements Using Wafer Level RF Tests", Skyworks Solutions, Inc., identified as published in May 2010 at the "GaAs Mantech 2010 Conference" at https://web.archive.org/web/20110104205915/http://www.skyworksinc.com/Press_Published_Articles.aspx , archived at Internet Archive's Wayback Machine on January 5, 2011 at https://web.archive.org/web/20110105002236/http://www.skyworksinc.com/downloads/press_room/published_articles/GaAs_Mantech_052010_4.pdf .
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EX-1051	Excerpt from McGraw-Hill Dictionary of Electrical and Computer Engineering (6 th ed. 2003) (Exhibit 10 of Wentzloff Deposition (EX-1050)).
EX-1052	Excerpts from Penguin Dictionary of Electronics (4 th ed. 2005) (Exhibit 12 of Wentzloff Deposition (EX-1050)).
EX-1053	Excerpts from EX-1037 (Prosecution History of '579 Patent) (Exhibit 9 of Wentzloff Deposition (EX-1050)).

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<i>In re Fulton</i> , 391 F.3d 1195 (Fed. Cir. 2004)	16, 28
<i>GE v. Raytheon Techs. Corp.</i> , 983 F.3d 1334 (Fed. Cir. 2020)	16, 28
<i>Hybritech Inc. v. Monoclonal Antibodies, Inc.</i> , 802 F.2d 1367 (Fed. Cir. 1986)	10
<i>Intel Corp. v. Qualcomm Inc.</i> , 21 F.4th 784 (Fed. Cir. 2021)	16
<i>Medichem S.A. v. Rolabo, S.L.</i> , 437 F.3d 1157 (Fed. Cir. 2006).....	16, 28
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Regulations

37 C.F.R. § 42.104(B)(4)	3
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I. INTRODUCTION

Nothing in Patent Owner's Response ("POR") refutes the strong grounds for obviousness that led this Board to institute this IPR on the Grounds that *Huang* and *Seshimo* each render obvious claims 1-3, 7-9, and 13-15 of U.S. Patent No. 9,450,579 (the "'579 Patent").

As the Petition explains and the intrinsic evidence demonstrates, the Applicant asserted, both in the '579 Patent and during its prosecution, that the distinguishing feature over the prior art of record was the particular positioning of first and second capacitors with respect to the RF switch antenna node and first and second switch circuits in the transmit and receive paths respectively, and further with respect to the first shunt arm. This feature is recited in each independent claim of the '579 Patent. The USPTO's reasons for allowance of the '579 Patent was this particular capacitor positioning relative to the positions of the RF switch antenna node and the first shunt arm.

PO does not dispute that *Huang* (Ground 1) and *Seshimo* (Ground 2) disclose the particular positioning of first and second capacitors recited in each of the independent claims of the '579 Patent. **Thus, PO does not assert that *Huang* or *Seshimo* does not disclose independent claim 13, nor the equivalent limitations in independent claims 1 and 7.**

Instead, PO first asserts that neither *Huang* nor *Seshimo* disclose “*inhibiting a low-frequency blocker signal from mixing with a fundamental frequency signal in the RF switch*” recited in independent claim 7. POR, 30-36, 46-49. However, this limitation simply requires selecting a size for a blocking capacitor suitable for reducing the amplitude (attenuating) well-known low-frequency blocker signals. A POSITA understood that the '579 Patent, *Huang* and *Seshimo* considered the selection of the size of the blocking capacitor to be a simple design choice.

PO next asserts that neither *Huang* nor *Seshimo* disclose that their respective capacitors are formed on (or a part of) the same substrate as the “[first/second] switch circuit” as recited in independent claim 1 and dependent claim 15. POR, 40-41, 50-51. This argument fails for the same reason. A POSITA understood that the '579 Patent, *Huang* and *Seshimo* considered whether the respective capacitors are formed on (or a part of) the same substrate as the switch circuits, or on a different substrate as the switch circuits, was a simple design choice.

The Applicant did not purport to invent a new capacitor, a new use of a capacitor, nor a new technique for forming RF switch components (including capacitors) on a semiconductor substrate. As the Petition explains, the Applicant recognized, by not disclosing any other implementation details of this solution outside of capacitor positioning, nor advantages and disadvantages of available

design choices in such implementations, that all such details were well-within the knowledge of POSITAs. Accordingly, the Petition properly relied on Dr. Larson's testimony, and the underlying, un rebutted factual support for such testimony detailed in the State of the Art section of his declaration (and the corresponding Petition section), to demonstrate how POSITAs would have understood the disclosure of the '579 Patent and the prior art in the Petition's Grounds (*Huang* and *Seshimo*), and to support a POSITA's motivation for making a design choice.¹

II. THE CHALLENGED CLAIMS ARE OBVIOUS OVER THE PRIOR ART IN EACH GROUND

PO does not dispute that *Huang's* capacitor 211, and *Seshimo's* capacitor C3, are respectively disclosed as being positioned relative to the other RF switch components as recited in independent claims 1, 7 and 13, and as disclosed and shown for capacitor C1 in '579 Patent FIG. 9. Thus, PO does not assert that

¹ PO asserts that the Director Memorandum, "Enforcement and Non-Waiver of 37 C.F.R. § 42.104(B)(4) and Permissible Uses of General Knowledge in Inter Partes Reviews" (July 31, 2025) applies to the present Petition. POR, 32, 41. However, the Memorandum states that it "will apply to any petition for IPR filed on or after September 1, 2025." Because the present Petition was filed before September 1, 2025, the Memorandum is inapplicable.

Huang or *Seshimo* does not disclose independent claim 13, nor the equivalent limitations in independent claims 1 and 7.

Instead, the POR makes two arguments for both Grounds. First, PO argues that neither *Huang* nor *Seshimo* disclose “*inhibiting a low-frequency blocker signal from mixing with a fundamental frequency signal in the RF switch using the first capacitor*” recited in independent claim 7. POR 14-40, 44-49. Second, PO argues that neither *Huang* nor *Seshimo* disclose “*a [first/second] capacitor formed on the semiconductor substrate*” as recited in independent claim 1, and “*the first capacitor is part of the same semiconductor die as the first switch*” as recited in dependent claim 15. POR, 40-43, 50-53. Neither of PO's arguments are factually or legally supported.²

² Contrary to PO's arguments, the Petition did not rely on the general knowledge of a POSITA “to supply a missing claim limitation.” POR, 31-33, 40-41. Rather, as detailed below, Petitioner relied on the unrebutted State of the Art to demonstrate how a POSITA understood the disclosure of the '194 Patent, *Huang* and *Seshimo*, and to demonstrate that the references disclosed the recited claim limitations, even if they did not use the same words.

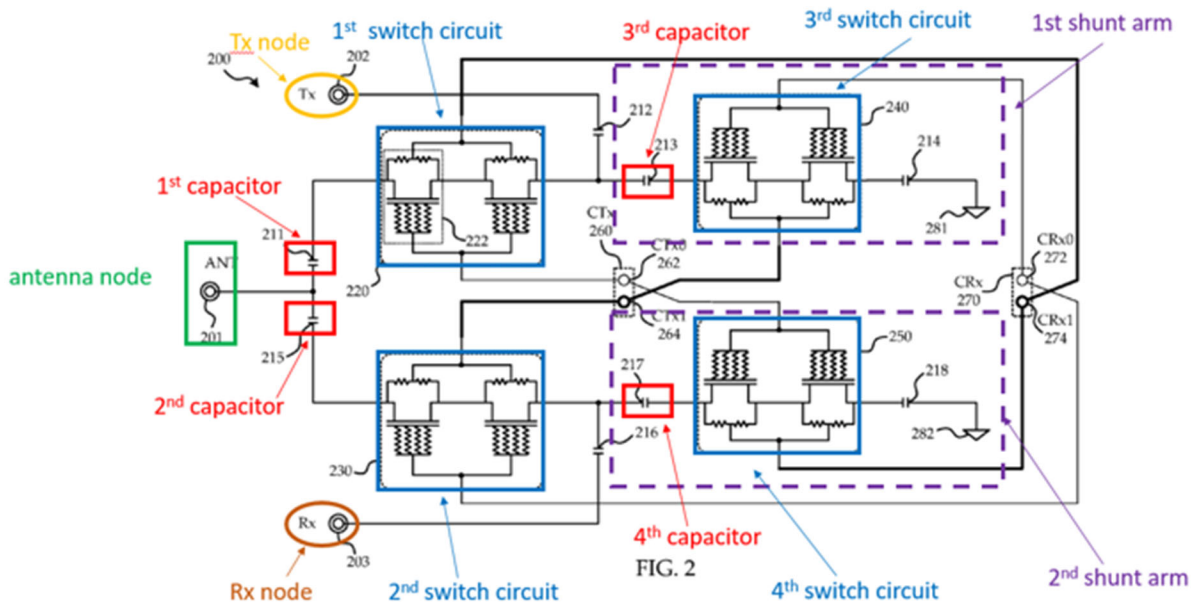
A. The Grounds Disclosed and Rendered Obvious *Inhibiting a Low-Frequency Blocker Signal from Mixing with a Fundamental Frequency Signal in the RF Switch Using the First Capacitor* (Independent Claim 7)

Notably, PO does not assert that *Huang* or *Seshimo* does not disclose independent claim 13, nor the equivalent limitations in independent claims 1 and 7. Instead, PO argues that neither *Huang* nor *Seshimo* disclose “*inhibiting a low-frequency blocker signal from mixing with a fundamental frequency signal in the RF switch using the first capacitor*” recited in independent claim 7. POR 14-40, 44-49. However, as the Petition explains, this limitation simply requires selecting a size for a blocking capacitor suitable for reducing the amplitude (attenuating) of well-known low-frequency blocker signals. A POSITA understood that the ’579 Patent, *Huang* and *Seshimo* considered the selection of the size of the blocking capacitor to be a simple design choice. Moreover, the only capacitor configuration disclosed by the ’579 Patent to “*inhibit a low-frequency blocker signal from mixing with a fundamental frequency signal in the RF switch*” was this particular capacitor positioning, relative to the positions of the other RF switch components, as recited in ’579 Patent independent claims 1, 7 and 13. Pet. 13-17. The ’579 Patent is absolutely silent regarding selecting a size for a blocking capacitor suitable for reducing the amplitude (attenuating) well-known low-frequency blocker signals

and thus demonstrates that the Applicant recognized this was a simply a design choice. *Id.*

1. Huang Discloses and Renders Obvious “Inhibiting a Low-Frequency Blocker Signal from Mixing with a Fundamental Frequency Signal in” SPDT Switch 200 “Using” Blocking Capacitor 211

Huang discloses positioning, in SPDT switch 200 (the RF switch), (i) blocking capacitor 211 (the first capacitor) between antenna 201 (the antenna node) and Tx series FET group switch 220 (the first switch circuit), and (ii) blocking capacitor 215 between antenna 201 and Rx series FET group switch 230. Pet. 48-49.



Huang expressly refers to capacitor 211 as “**blocking capacitor 211**”, and discloses that SPDT switch 200 may be “utilized in a traditional WLAN radio”,

which POSITAs understood refers to “wireless LAN radio” with operational frequency bands of, for example, 2.4GHz (802.11b,g) and 5 GHz (802.11a), and that, “[i]n modern RF communication systems a semiconductor-based transmit receive switch is often the last/first component encountered by a transmitted/received signal before/after encountering an antenna.” Pet. 49, 46-47, 52.

The Petition described *Huang* as disclosing SPDT switch 200 is a “non-linear RF switch.” Pet. 49-50.³ Indeed, *Huang* discloses that non-linearities **will** exist in SPDT switch 200 even when the 2.0-2.5V “on-state” and 1.0-1.5V “off-state” V_{gsd} values in the preferred embodiment are used, **and**, for some applications, that more non-linearity will be present in SPDT switch 200 (*e.g.*, application has a lower “pre-identified lower limit of acceptable linearity” so “off-

³ PO misleadingly asserts “Huang teaches that **linearity** in a switch device **can still be achieved** by choosing 1.0-1.5V for the off-state V_{gsd} and 2.0-2.5V for the on-state V_{gsd} instead of fully biasing transistors on/off”, which inaccurately implies that, in *Huang*’s preferred embodiment, **no** mixing will occur between unwanted signals and fundamental frequency signals (*i.e.*, **no** IMD). POR, 11-12; EX-1050 133:5-134:22.

state V_{gsd} ... is less than on-state V_{gsd} ” but the voltage difference is less than the preferred embodiment relied-on by PO). *Id.*; EX-1005, [0042], [0015], [0017], claims 1, 16.

A POSITA understood that a “well-known consideration in designing RF switches in wireless devices, especially those operating in ‘multi-mode and multiband’ environments, was that, if an ‘unwanted’ signal... is allowed to mix with a ‘wanted’ (‘fundamental’) RF signal... in an RF switch, the desired transmitted/received information may be degraded, further ‘unwanted’ signals (...IMD products...) may be created.” Pet. 25-27. A POSITA understood the many examples of low-frequency, “out-of-band blocking” signals, such as a low-frequency television blocking signal (190MHz) relative to fundamental cellular signals (1950-2140MHz), and, because of RF switch non-linearities, the IMD caused by the mixing of such signals. Pet. 26-27.

A POSITA understood that typical solutions to “minimize[]” the “distortion products for current dependent nonlinearity” in RF switches, *e.g.*, “nonlinear series resistance[]... of the OFF paths”, involved “adjusting the phase so... the switch sees an open circuit at the blocker frequency.” Pet., 27. A POSITA also understood that “[a] fundamental characteristic of all capacitors is that their... ‘impedance’... is ‘*inversely*’ determined by the product of the frequency and the

capacitance””; stated differently, “capacitors allow high frequencies to pass through... while blocking low frequencies...” Pet. 19-21. And, POSITAs understood “a basic high-pass filter... was... simply a capacitor connected in series between [an] RF waveform source node and output node, and in series with a resistor (... ‘50-ohm standard impedance... commonly used...).” Pet. 21-22. The Petition described “[s]electing a capacitance value of capacitors in RF switches based on, for example, desired (fundamental) frequency values..., practical size constraints, and low frequencies of undesired, potentially interfering signals..., was widely known to... POSITAs.” Pet. 22-23. Moreover, POSITAs understood that tuning the high-pass filter frequency response of a circuit with a capacitor connected in series between an RF waveform source node and output node is simply a matter of picking the size capacitor that yields the desired pass/inhibit thresholds within the practical size constraints for the RF device with a reasonable expectation of success. Pet. 22-23, 51. Furthermore, POSITAs understood that, “...typical capacitance values were... in picofarads (pF)... for use in semiconductor-based RF switches.” Pet. 23.

Thus, the Petition's State of the Art section demonstrated how POSITAs would have understood the disclosure of the '579 Patent, *Huang* and *Seshimo*, and provided details known to POSITAs that neither the Patent nor the prior art

disclosed (because they were well-known to POSITAs). *Hybritech Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 1384 (Fed. Cir. 1986).

Accordingly, the Petition identified overwhelming evidence that POSITAs understood *Huang*'s disclosed implementation of blocking capacitor 211, positioned between antenna 201 and switch 220 and "along a signal path from... antenna 201 to... transmit terminal 202", in non-linear SPDT switch 200, as being configured to provide a high-pass filter frequency response that had "low insertion loss" (relatively small capacitive reactance) at the RF device operational frequency (e.g., 2.4GHz for "traditional WLAN radios") and that would reduce the amplitude of lower-frequency, "out-of-band blocker" signals. Pet. 49-50; EX-1052, 3.

PO does not dispute that this simply involves picking a size for capacitor 211. POR 16-17. Instead, PO asserts that *Huang* does not disclose the limitation recited in Claim 7 because *Huang* does not "teach or suggest that the size of blocking capacitor 211 can be used to inhibit any low-frequency blocker signal from mixing with a fundamental-frequency signal." *Id.* This argument ignores the Petition's State of the Art demonstrating a POSITA's understanding that a fundamental purpose of a capacitor was to attenuate out-of-band, low-frequency signals. Pet. 18-23.

Moreover, PO's focus on the absence of the words "intermodulation distortion", "low-frequency", "fundamental frequency", and "blocker signal" in *Huang* is legally irrelevant so long as POSITAs reading *Huang* understood that those features are disclosed. For example, POSITAs would read and understand *Huang* in view of the State of the Art to disclose fundamental capacitor functioning, well-known problems (IMD including "spurious harmonic emissions"⁴) resulting from the disclosed non-linearities in SPDT switch 200, and well-known solutions to the same (including using capacitors to provide a high-pass filter frequency response between RF signal input/output nodes of an RF switch). "What a reference teaches a [POSITA] is not... limited to... what is specifically 'mentioned' or 'written' in the reference." *Syntex LLC v. Apotex, Inc.*, 407 F.3d 1371, 1380 (Fed. Cir. 2005).

⁴ Dr. Wentzloff acknowledged "the second order and third order intermodulation distortion products that are described in the ['579] patent... do include... harmonic signals being generated"—e.g., *Huang's* disclosed "spurious harmonic emissions"—and "these would be spurious harmonic[] signals that were generated[sic] as a result of mixing in a nonlinear switch." EX-1050 135:19-136:12, 139:13-19, 141:4-12.

Thus, POSITAs reading Huang understood that blocking capacitor 211 inhibits any low-frequency blocker signal from mixing with a fundamental-frequency signal in non-linear SPDT switch 200. This configuration only required selection of the appropriate size, which is expressly taught by *Huang* when it teaches respectively positioning blocking capacitors 211 and 215 between the antenna node 201 and switches 220 and 230, and “along a signal path from... antenna 201 to... [transmit terminal 202/receive terminal 203]”, and the importance of “judiciously chosen... capacitors” to, among other performance factors, achieve “reduce[d] spurious harmonic emissions”, and “improve[d] linearity” for the switch. Pet. 48-49.

Moreover, *Huang*'s disclosure of this limitation is consistent with the '579 Patent's disclosure of this limitation which does not include any disclosure of the size of the capacitors C1-C4 used as blocking capacitors in FIG. 9, but instead states that the configuration can be “relatively simpler and easier to implement.” EX-1001 9:60-63. PO's expert confirmed that the details of selecting an appropriate capacitor size to inhibit any low-frequency blocker signal from mixing with a fundamental-frequency signal were well-known to POSITAs, such that the '579 Patent did not need to disclose (i) any examples of fundamental-frequency signals or low-frequency blocker signals; (ii) any example origins of low-

frequency blocker signals; (iii) how a capacitor, in the disclosed FIG. 9 positions, would perform the “*inhibit...*” function; (iv) any example capacitance values to perform this function; nor (v) how much attenuation of blocker signals by a capacitor is required to perform this function. EX-1050 110:16-111:15, 93:19-96:3, 98:11-99:5, 106:17-107:3, 120:3-122:9; Pet. 5-6, 13-14. Thus, the Petition demonstrates how *Huang* discloses this limitation.

Further, the Petition demonstrates that, even if *Huang* did not disclose using capacitor 211 to inhibit a low-frequency blocker signal from mixing with a fundamental-frequency signal in non-linear SPDT switch 200, the unrebutted State of the Art demonstrates that the configuration is simply a design choice, and POSITAs would have been motivated to select an appropriately-sized (*e.g.*, picofarad) capacitor 211 to provide this same high-pass filter frequency response in non-linear, SPDT switch 200 of the RF device (*e.g.*, “WLAN radio” operating at 2.4GHz or 5GHz), including attenuating low, out-of-band frequencies, within the practical size constraints of such radios, to achieve the known and predictable benefits of improved switch performance (including improved IMD performance) with a reasonable expectation of success given that this involves nothing more than the conventional and routine use of *Huang*'s blocking capacitors. Pet. 50-52.

PO does not dispute that capacitor size was a design choice. POR 16-17. Rather, PO distorts *Huang*'s full teachings by relying on the unsupported testimony of Dr. Wentzloff who attempts to limit a POSITA's design choices by narrowly reading *Huang* to focus only on "DC biasing and insertion loss." POR, 36; EX-2001, ¶57, 65, 69. In doing so, PO's expert comes to the nonsensical conclusion that POSITAs would **only** be motivated to select capacitors with very large capacitance values such that they would (i) pass **all** RF signals uninhibited, regardless of frequency, and (ii) be placed off-chip from other RF switch components. *Id.*

PO's expert ignores *Huang*'s express teachings that non-linearities **will** exist in SPDT switch 200 even when the "on-state" and "off-state" V_{gsd} values in the preferred embodiment are used, **and**, for some applications, that more non-linearity will be present in the SPDT switch 200 (*e.g.*, application has a lower "pre-identified lower limit of acceptable linearity" so "off-state V_{gsd} ... is less than on-state V_{gsd} " but the voltage difference is less than the preferred embodiment relied-on by PO). EX-1005, [0042] ("the off-state V_{gsd} level should be determined after an acceptable upper limit to the spurious harmonic emissions and an acceptable lower limit of linearity have been identified... [s]uch identification will of course depend upon the application in which the switch is to be used."), [0015], [0017],

claims 1, 16 (repeatedly stating, while “off-state” and “on-state” V_{gsd} are different, the “magnitude of... off-state V_{gsd} ... is **less than** a magnitude of... on-state V_{gsd} ... **by only** an amount sufficient for **at least one of**: [1] bringing spurious harmonic emissions... below a pre-identified upper limit...; **and** [2] bringing a linearity of the high power switch above a pre-identified lower limit of acceptable linearity for the high power switch.”) (emphasis and bracketed text added). As Dr. Wentzloff acknowledged, “the more nonlinearity that a switch... has, the more mixing, or more higher levels of... intermodulation distortion products will be produced as a result.” EX-1050 194:2-12, 194:19-195:2. And Dr. Wentzloff acknowledged that, as the Petition explains, “nearby RF... transmitters were a well-known source of unwanted RF signals for RF switches and RF devices”, including “wire[les]s LAN radio[s]” and “cellular phones”, and that, because of non-linearities in the FETs in RF switches, IMD products would be generated from the mixing of unwanted signals (like blockers) and desired signals (at fundamental frequencies). EX-1050 131:15-132:11, 132:22-134:22. Moreover, Dr. Wentzloff acknowledged that **any** non-zero value capacitor would meet *Huang’s* DC blocking requirements. EX-1050, 60:17-18 (EX-1053, 38), 83:9-13, 146:9-18.

By failing to consider the full teachings of *Huang*, the expert did not recognize the known tradeoffs between the advantages and disadvantages routinely considered when making a design choice. *Medichem S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1165 (Fed. Cir. 2006) (“[A] given course of action often has simultaneous advantages and disadvantages, and this does not necessarily obviate motivation to combine.”); *In re Fulton*, 391 F.3d 1195, 1200-1202 (Fed. Cir. 2004) (“the question is whether there is something in the prior art as a whole to suggest the *desirability*, and thus the obviousness, of making the combination’, not whether there is something in the prior art as a whole to suggest that the combination is the *most desirable* combination available.”); *GE v. Raytheon Techs. Corp.*, 983 F.3d 1334, at 1345, 1349-1352 (Fed. Cir. 2020).

PO’s expert’s failure to consider the well-known tradeoffs is particularly critical here where the facts establish that it was known to use capacitors to attenuate low-frequency blocker signals. *Intel Corp. v. Qualcomm Inc.*, 21 F.4th 784, 799-800 (Fed. Cir. 2021).

Due to *Huang*’s “blocking capacitor” nomenclature, PO relies on Dr. Wentzloff’s testimony that POSITAs would understand that “blocking capacitor” and “DC blocking capacitor” mean a capacitor that “blocks **only** DC signals, while allowing **any** frequency AC signal to pass”, and “minimize[s] insertion loss at the

fundamental frequency.” EX-2001, ¶57 (emphasis added); EX-1050 151:2-152:19. Stated differently, PO's expert's testimony is that POSITAs would understand “blocking capacitor” and “DC blocking capacitor” to mean a capacitor with such a large capacitance value that it passes all RF signals uninhibited, regardless of frequency, and must be placed off-chip from other RF switch components. *Id.*; EX-2001, ¶¶69, 80; EX-1050 61:5-18, 153:4-21; *id.*, 83:9-13, 129:1-20, 146:9-18.

As purported factual support, PO's expert cites to a dictionary's (EX-2005) definition of “coupling capacitor” as “[a] capacitor used to block the flow of direct current while allowing alternating or signal current to pass” and that states that “blocking capacitor” has the same meaning. EX-2001, ¶57 (EX-2005, 124). Notably, his relied-on dictionary definition does not restrict blocking to **only** DC signals, nor does it state that it allows **any** frequency AC signal to pass. *Id.*

Moreover, during cross-examination, it became apparent that PO's expert's definition of “blocking capacitor” (with and without “DC”) was **not** supported by his cited evidence. For example, PO's expert acknowledged that “[e]very capacitor with a finite capacitance, meaning not zero or non-infinity, would block a DC signal.” EX-1050, 61:16-18, 83:9-13, 146:9-18; Pet. 16. PO's expert acknowledged, consistent with the definition of “capacitor” from his relied-on dictionary (EX-2005), a “DC blocking capacitor”, like **every** capacitor, will

attenuate some low-frequency AC signals because it has “an impedance that varies with frequency” in a manner “inversely proportional to frequency and capacitance” such that, “if you compare any two frequencies for the same voltage, the current passing through the capacitor at the lower frequency will be less than the current passing through the capacitor [at] the higher frequency.” EX-1050, 169:11-170:3, 147:3-150:4, 155:13-17; Pet. 19-21.

Furthermore, PO's expert conceded that, in the RF field, “DC blocking capacitor” was used consistently—including *in his relied-on EX-1011*—with the “blocking capacitor” definition in the Dictionary of Electronics (4th ed. 2005) (EX-1052, 3) that “[a] capacitor included in a circuit in order to limit the flow of direct current and low-frequency alternating current while allowing the passage of higher frequency alternating current. The capacitance is chosen so that there is a relatively small reactance at the lowest frequency at which the circuit is designed to operate.” EX-1050 169:3-170:9. And, he conceded that, in the RF field, “DC blocking capacitor” was used—*in his relied-on EX-1011*—to refer to capacitors with 10pF values that blocked DC signals, attenuated low-frequency AC signals, passed higher-frequency AC signals (2.4GHz and higher), and were formed **on-chip** EX-1050 168:7-169:15, 171:10-173:7 (discussing EX-1011, EX-1052, 3);

see Pet. 17-19, 29-30 (identifying $f_{3dB}=636.9\text{MHz}$ of transmit throw high-pass filter with $2 \times 10\text{pF}$ capacitors).

The other four references on which Dr. Wentzloff relies (EX-2001, ¶¶57, 67) likewise do **not** provide **any** support for his definition of “blocking capacitor” and “DC blocking capacitor”; rather, three of the four references disclose using **on-chip** DC blocking capacitors, and all confirm that these terms had, including in the RF field, a meaning consistent with EX-1052’s “blocking capacitor” definition. EX-1003, ¶¶60, 74, 76 (EX-1009, FIG. 2, [0004], [0058], [0083]-[0084], [0088]); EX-1003, ¶¶61-66 (EX-1024, 3-5); EX-1003, ¶¶63, 73 (EX-1035, 2-5); EX-1003, ¶¶60, 64, 73, 75 (EX-1029, 36-39). In other words, as detailed in the unrebutted State of the Art, the five references cited by Dr. Wentzloff (EX-2001, ¶¶57, 67), provide exemplary evidence of wireless devices (WLAN radio, mobile/portable phone) in which, (i) four of the five disclose forming all components (including DC blocking capacitors) of SP3T or SPDT switches on the same semiconductor die, and, (ii) four of the five disclose picofarad capacitance values whereby the capacitors would inhibit well-known low-frequency-blocker signals from mixing with fundamental-frequency signals (2.4GHz, 1.8GHz, 900MHz). *Id.*

Accordingly, Dr. Wentzloff's testimony related to a POSITA's understanding of "blocking capacitor" and "DC blocking capacitor" should be entitled to little weight.

2. Seshimo Discloses and Renders Obvious "*Inhibiting a Low-Frequency Blocker Signal from Mixing with a Fundamental Frequency Signal in*" FIG. 3 SPDT Switch "*Using*" Capacitor C3

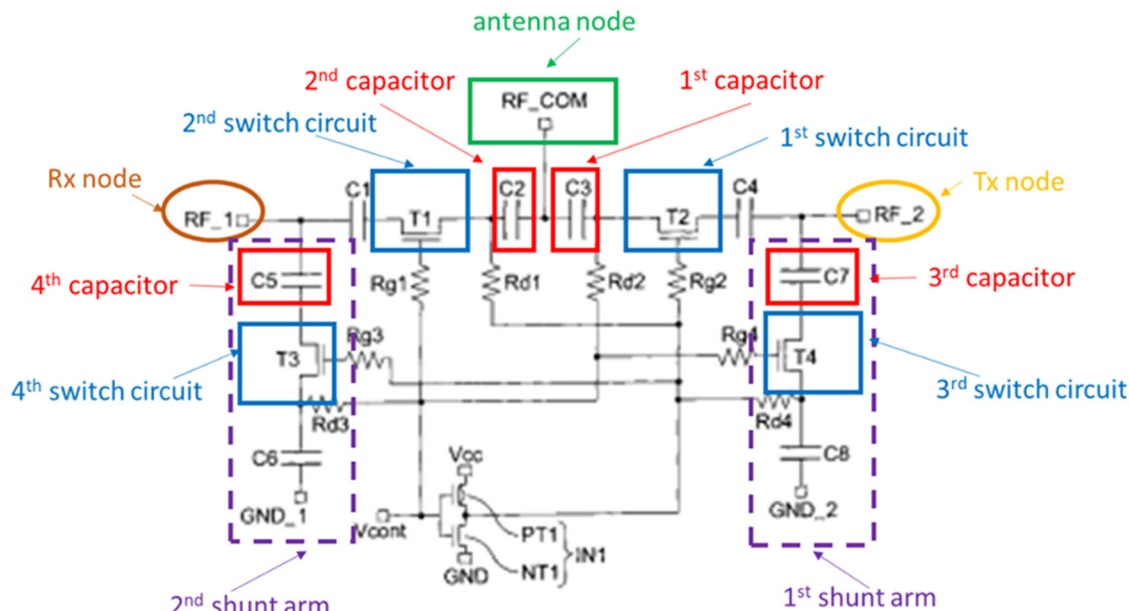
For Ground 2, PO makes the same arguments, and relies on the same legally and factually unsupported testimony of Dr. Wentzloff, as Ground 1. POR 51-55. POSITAs would understand *Seshimo*'s "DC component removal capacitors" to be "blocking capacitors" as discussed above and in the Petition, and Dr. Wentzloff's legally and factually unsupported testimony should be rejected for the same reasons discussed above.

Dr. Wentzloff also ignores *Seshimo*'s disclosure that, when formed using CMOS processes (including SOI), **all** FIG. 3 components, including the MOSFETs, capacitors, resistors, "inverter circuit and other logic circuits", are "configured as CMOS circuits **and integrated on the same semiconductor substrate**", which undercuts his argument regarding the required large capacitor size. Pet. 57-58; EX-1007, [0084], [0088], [0003], FIG. 3. And, as Dr. Wentzloff acknowledged for the 10pF "on-chip...DC blocking capacitors" of EX-1011 (*see*

§III.A.1), “[i]n this case, these were on-chip capacitors... for an integrated capacitor you won’t be able to make it as big as let’s say an off-chip capacitor... So one would understand for this DC blocking capacitor... there would be some amount of insertion loss at the fundamental frequency that is tolerated.” EX-1050, 171:10-172:16, 168:7-169:15; EX-1052, 3.

Furthermore, as explained above and in the Petition, POSITAs reading Seshimo understood that **any** non-zero capacitance value capacitor will meet Seshimo’s DC blocking requirement, and non-linearities **will** exist in the FIG. 3 SPDT switch; thus, IMD products **will** be generated from the mixing of unwanted signals (*e.g.*, from the “well-known source”, including for “cellular phone” (PHS), of “nearby RF... transmitters”) with Seshimo’s desired PHS signals. §III.A.1; Pet. 68-70, 19-23, 25-27.

Accordingly, POSITAs would understand Seshimo’s disclosed implementation of **capacitor C3**, in non-linear FIG. 3 SPDT switch, as being an on-die capacitor configured to provide a high-pass filter frequency response that had relatively small capacitive reactance at the PHS fundamental-frequencies (1.88-1.93GHz) and would attenuate lower-frequency, “out-of-band blocker” signals. *Id.*; EX-1052, 3.



Moreover, even if *Seshimo* did not disclose using capacitor C3 to inhibit a low-frequency blocker signal from mixing with a fundamental frequency signal in non-linear FIG. 3 SPDT switch, as explained above for Ground 1, POSITAs would have been motivated to select appropriately-sized (e.g., picofarad) capacitor C3 as a design choice to achieve this high-pass filter frequency response within the practical size constraints of the PHS (EX-1047, EX-1048), and to achieve the known and predictable benefits of improved non-linear SPDT switch performance (including improved IMD performance) with a reasonable likelihood of success.

§III.A.1; Pet. 70-72.

Dr. Wentzloff's testimony that POSITAs implementing *Seshimo* would **only** be "motivated to select capacitors to achieve better insertion loss" and, thus, would

only select capacitors with very large capacitance values such that they would (i) pass **all** RF signals uninhibited, and (ii) be placed off-chip from other RF switch components, is legally and factually unsupported, not credible, and contradicted by his own deposition testimony, as discussed above for Ground 1. EX-2001, ¶¶57, 65, 69, 73, 80; §III.A.1.

B. The Grounds Disclosed and Rendered Obvious a *[First/Second]* Capacitor Formed on the Semiconductor Substrate (Independent Claim 1 and Relatedly Dependent Claim 15)

Claim 1 recites positioning of the capacitors as recited in each of the other independent claims, but also recites that the capacitors are “*formed*” on the same substrate as the switch circuits and shunt arm, the only limitation in dispute. PO does not dispute that *Huang* and *Seshimo* each disclose that the non-capacitor components (“switch circuits”, “shunt arm”) are “*formed*” on the same semiconductor substrate of a semiconductor die.

Instead, PO argues that neither *Huang* nor *Seshimo* disclose that their respective capacitors are formed on the same substrate as the “[first/second] switch circuit” as recited in independent claim 1 (and similarly in dependent claim 15). However, as the Petition explains, POSITAs understood that the ’579 Patent, *Huang* and *Seshimo* considered whether the respective capacitors are formed on

the same substrate as the switch circuits, or on a different substrate as the switch circuits, was a simple design choice.

1. *Huang Discloses and Renders Obvious Blocking Capacitors 211 and 215 “Formed on the Semiconductor Substrate”*

As the Petition explains, POSITAs understood that *Huang* discloses all of the FIG. 3 SPDT switch components are formed on a semiconductor substrate of a semiconductor die because *Huang* states “[t]he invention relates to high power semiconductor switches”, and discloses the “transistor switches” in such high power, “semiconductor-based transmit-receive switches”, including SPDT switch 200, can be “silicon-on-insulator FET switches.” Pet. 39. The Petition also explained, compared to “using pHEMT FETs in SPnT switches”, it was well-understood by POSITAs that choosing to “fabricat[e] the SPnT switch components in... SOI” would realize “well-understood benefits” including “lower cost,... ‘reduce[d] dielectric losses associated with the silicon substrate’, **allowing monolithic (same die/chip) integration of SPnT switch and control components** and other front-end module (FEM) components, etc.” Pet. 29-30. The Petition further described, and provided several illustrative examples, that “[i]t was well-known to POSITAs that **monolithic (same die/chip) integration benefits** result from forming RF SPnT switches” using SOI technology. Pet. 30-31.

Thus, the Petition identified a plethora of exemplary, un rebutted evidence that POSITAs reading *Huang* understood that “Huang discloses that all of the components of the SPDT switch 200 [including blocking capacitors 211 and 215] are formed on a semiconductor substrate of a semiconductor die, where, in some embodiments, the semiconductor die is a silicon-on-insulator die in which the SPDT switch 200 components would be formed on an insulator layer.” *Id.*; Pet. 39-40. As detailed in the Petition, *Huang* fairly conveyed to POSITAs the prevailing and conventional monolithic result of fabricating “silicon-on-insulator FET switches” of a “semiconductor-based transmit-receive switch” (SPDT switch 200). *Id.*

Further, even if *Huang* did not disclose that capacitors 211 and 215 are formed on the same semiconductor substrate as the non-capacitor components (“switch circuits”, “shunt arm”) of SPDT switch 200, POSITAs would have been motivated to do so as a mere design choice to achieve known and predictable benefits, including making manufacturing, testing, and production of SPDT switch 200 (and integrated circuits (ICs) incorporating the same) easier and less costly. Pet., 39-40, 42-43.

POSITAs would have understood, that achieving these known and predictable benefits had a reasonable expectation of success, including because (i)

it was well-known, as explained in the State of the Art section, that “[o]n-chip... capacitor[s] can be easily manufactured through a semiconductor process” (on pHEMT, CMOS, SOI) and, unlike external capacitors, “does not require additional work such as capacitor bonding from an external user”, and (ii) as discussed in §III.A.1 for the only disputed limitation in claim 7, low capacitance value (*e.g.*, picofarad) capacitors are small in size and typically used in RF switches since, as was well-known to POSITAs, they would pass (with adequately low impedance) the desired high frequencies of interest (*e.g.*, 2.4GHz for “WLAN radio[s]”) while attenuating low, out-of-band blocker frequencies. Pet., 39-40, 42-43.

PO does not dispute that POSITAs understood this as simply a design choice between “on-die capacitors” and “off-die capacitors”, as admitted in the '579 Patent. POR 42, 52; Pet. 11 (EX-1003, ¶40); EX-1001, 9:60-63. Instead, PO relies on Dr. Wentzloff's unsupported testimony that POSITAs implementing Huang would **only** be “motivated to select capacitors to achieve better insertion loss” and, thus, would **only** select capacitors with very large capacitance values such that they would (i) pass **all** RF signals uninhibited, regardless of frequency, and (ii) be placed off-chip from other RF switch components. POR, 42-43. PO's assertion is not only based on Dr. Wentzloff's unsupported testimony, but also on PO

mischaracterizing, and narrowly reading, Huang's disclosure as discussed above in §III.A.1.

Moreover, as Dr. Wentzloff acknowledged, and consistent with the State of the Art, POSITAs (i) understood the “tradeoffs with on-chip versus off-chip capacitor[s]”, (ii) would want to form capacitors on the same substrate as the switch circuits of an RF switch for “multiple reasons” including “to reduce the number of external components to have a more integrated or smaller solution”, and (iii) understood that these known benefits could “be beneficial in the case of a wireless LAN radio”—*e.g.*, the “traditional WLAN radio” disclosed by *Huang*. EX-1050, 83:14-84:1, 85:2-18; Pet. 28-31.

Dr. Wentzloff also acknowledged that EX-1011 (*see* §III.A.1) disclosed forming all components of an SP3T switch and LNA, including 10pF “on-chip DC...blocking capacitors”, on the same semiconductor die for a WLAN radio. *Id.*, EX-1050 163:13-166:1; EX-1003, ¶¶73, 75-76. Dr. Wentzloff further acknowledged that (i) EX-1011 disclosed that “saving die size and cost was an important consideration” for WLAN radios, (ii) “a POSITA understood that saving cost was [an] important consideration when designing a front-end circuit for a wireless LAN radio”, and (iii) “in general it's usually a good thing to reduce cost or save cost.” EX-1050 166:2-167:7, 172:19-173:7.

Thus, although there may be circumstances where, regardless of the increase in size, complexity, number of components and cost of RF switch manufacturing, achieving the lowest possible insertion loss (with off-chip, very large capacitors) is desirable, this does not negate the desirability of selecting “on-chip capacitors” for other applications and circumstances that are known to POSITAs and have a reasonable expectation of success (as the Petition explains). *Medichem*, 437 F.3d at 1165; *Fulton*, 391 F.3d at 1200-1202; *GE*, 983 F.3d at 1345, 1349-1352.

2. *Seshimo* Discloses and Renders Obvious Capacitors C3 and C2 “Formed on the Semiconductor Substrate”

Seshimo discloses that, when formed “using CMOS processes” (including SOI), **all** FIG. 3 components, including the MOSFETs, capacitors, resistors, “inverter circuit and other logic circuits”, are “configured as CMOS circuits **and integrated on the same semiconductor substrate.**” Pet. 57-59. Moreover, as explained for Ground 1, the Petition identified overwhelming evidence that POSITAs understood that *Seshimo* disclosed all FIG. 3 components “integrated on the same semiconductor substrate” because this was the prevailing and conventional monolithic result of fabricating a “high-frequency semiconductor switching circuit” (e.g., FIG. 3 SPDT switch) using SOI. *Id.*; §III.B.1; §III.A.2.

Further, even if *Seshimo* did not disclose forming capacitors C3 and C2 on the same semiconductor substrate as the non-capacitor components of FIG. 3

SPDT switch to POSITAs, as discussed for Ground 1 and in the Petition, POSITAs would have been motivated to do so as a mere design choice to achieve known and predictable benefits, including making manufacturing, testing, and production of SPDT switch (and integrated circuits (ICs) incorporating the same) easier and less costly. *See* Pet. 58-59, 61-62; §III.B.1 (Ground 1).

III. CONCLUSION

For the reasons explained above, Petitioner requests that the Board find all Challenged Claims unpatentable over Grounds 1 and 2.

Respectfully submitted,

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Dated: December 23, 2025

Reply to Patent Owner's Response
IPR2024-01456
U.S. Patent No. 9,450,579

CERTIFICATE OF COMPLIANCE WITH WORD COUNT

Pursuant to 37 C.F.R. § 42.24(d), I certify that this Reply complies with the type-volume limits of 37 C.F.R. § 42.24(c)(1) because it contains 5,581 words, excluding the parts of this Reply that are exempted by 37 C.F.R. § 42.24(c), according to the word processing system used to prepare this Reply.

Dated: December 23, 2025

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IPR2024-01456
U.S. Patent No. 9,450,579

CERTIFICATE OF SERVICE

I hereby certify that, on December 23, 2025, I caused a true and correct copy of Petitioner's Reply to Patent Owner's Response to be served via electronic mail on the following attorneys of record:

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