United States Court of Appeals for the Federal Circuit

INTEL CORPORATION,
Appellant

v.

QUALCOMM INCORPORATED,
Appellee

2020-1664

Appeal from the United States Patent and Trademark Office, Patent Trial and Appeal Board in No. IPR2018-01429.

Decided: December 28, 2021

GREGORY H. LANTIER, Wilmer Cutler Pickering Hale and Dorr LLP, Washington, DC, argued for appellant. Also represented by DAVID LANGDON CAVANAUGH, THOMAS SAUNDERS; BENJAMIN S. FERNANDEZ, Denver, CO; JASON KIPNIS, Palo Alto, CA; CRISTINA SALCEDO, Los Angeles, CA.

JONATHAN S. FRANKLIN, Norton Rose Fulbright US LLP, Washington, DC, argued for appellee. Also represented by PETER B. SIEGAL; STEPHANIE DEBROW, EAGLE HOWARD ROBINSON, Austin, TX; DANIEL LEVENTHAL, RICHARD STEPHEN ZEMBEK, Houston, TX.

Before PROST, TARANTO, and HUGHES, *Circuit Judges*.

PROST, *Circuit Judge*.

Intel Corporation ("Intel") petitioned the Patent Trial and Appeal Board ("Board") for inter partes review ("IPR") of various claims of U.S. Patent No. 8,229,043 ("the '043 patent"), owned by Qualcomm Incorporated ("Qualcomm"). Intel proved unpatentable some (but not all) of these claims and some (but not all) of Qualcomm's proposed substitute claims. Now, Intel appeals the Board's determinations regarding the surviving claims. We affirm as to the originally challenged claims, but we vacate as to the substitute claims. We remand for further proceedings.

BACKGROUND

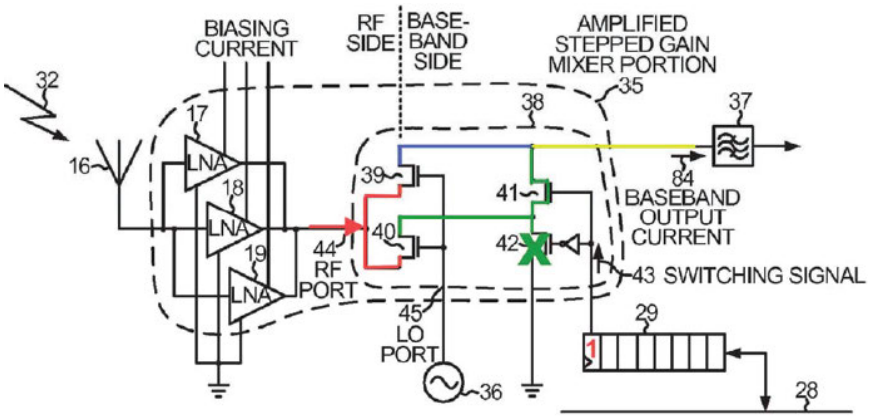
I

This appeal relates to radio frequency communication systems. On the sending end of such systems, a sending device converts a data signal (e.g., voice data) to a higher "carrier" frequency for transmission over the air. On the receiving end, a receiving device down-converts (or demodulates) that signal to its original "baseband" frequency. The receiver can also amplify the signal via an amplifier. A "low-noise amplifier" ("LNA"), for example, does so while minimizing noise, which distorts the signal. "Gain" quantifies the amplification a system provides, and the need for it varies with the incoming signal's strength.

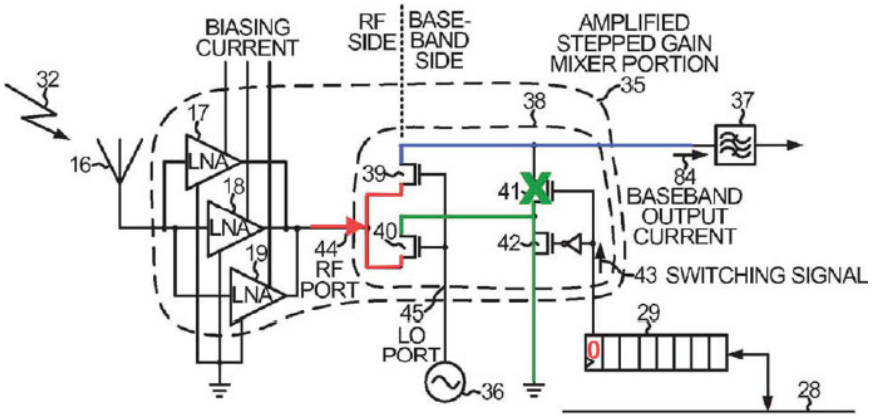
Qualcomm's patent is about the receiving end. Entitled Stepped Gain Mixer, it discloses a "mixer" (i.e., the component that performs demodulation) in a "receiver front end" that provides "stepped gain control" (i.e., gain adjustment in a stepwise manner). '043 patent col. 1 ll. 6–8. It explains that receivers with "many fine gain steps," as opposed to "just a few large gain steps," can "achieve a consistently high and smooth signal-to-noise ratio over a large gain range"—which helps them keep pace with the "higher data rates" of newer systems on the

sending end. *Id.* at col. 1 ll. 21–27, 54–57. Pursuing that benefit, therefore, the patent uses "multiple gain states." *Id.* at col. 2 ll. 9–12.

Take the example pictured below (Qualcomm's annotation of '043 patent Fig. 2). Antenna 16 receives radio frequency input signal 32, which is amplified by one of three LNAs 17–19 and then (annotated in red) proceeds to transistors 39 and 40 of stepped gain mixer 38. The mixer demodulates this carrier signal by processing it with local oscillator signal 36. The signal ultimately emerges as baseband signal 84. Notably, switches 41 and 42 can alter the gain. Closing switch 41 (forming a connection) and opening switch 42 (breaking a connection) increases gain, as the transistor outputs (green and blue) add to make a higher-amplitude baseband signal (yellow):



J.A. 3697. Things change if the switches' states are swapped. Then, green goes to ground while blue becomes the baseband:



J.A. 3698. Thus, toggling "two mixer gain modes for each of three amplifier gain modes" translates to "six gain states." *Id.* at col. 7 ll. 24–26.

II

Intel petitioned for IPR identifying itself and its customer Apple, Inc. ("Apple") as real parties-in-interest. *Intel Corp. v. Qualcomm Inc.*, No. IPR2018-01429, 2020 WL 573274, at *1 (P.T.A.B. Jan. 30, 2020) ("*Final Written Decision*"). It advanced three unpatentability grounds: that claims 1, 17, 19, and 21 were anticipated by Der[1]; that claims 2, 3, and 7 were obvious in view of Der and Razavi[2]; and that claims 1–3, 6, 7, 17–19, and 21 were obvious in view of Der and Valla.[3] *Id.* at *3. Intel prevailed on claims 1–3 and 7 but not claims 6, 17–19, and 21. *Id.* at *30. Granting in part Qualcomm's motion to amend, the Board replaced claims 2, 3, and 7 with substitute claims 27,

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[1] Lawrence Der & Behzad Razavi, *A 2-GHz CMOS Image-Reject Receiver with LMS Calibration*, 38(2) IEEE J. Solid-State Circuits 167 (2003).

[2] Behzad Razavi, *Rf Microelectronics* (1998).

[3] Valla et al., *A 72-mW CMOS 802.11a Direct Conversion Front-End With 3.5-dB NF and 200-KhZ 1/f Noise Corner*, 40(4) IEEE J. Solid-State Circuits 970 (2005).

28, and 31 after disagreeing that these claims were obvious in view of Der, Razavi, and Burgener.[4] *Id.* at *28, *30.

After Intel appealed, Qualcomm moved to dismiss for lack of standing. We denied that motion and directed the parties to address standing in their briefs.[5] We have jurisdiction over final Board decisions under 28 U.S.C. § 1295(a)(4)(A). As discussed below, Intel has standing to invoke that jurisdiction.

DISCUSSION

I

Before proceeding to the merits, we address the threshold question of our jurisdiction. We are limited to deciding "cases" and "controversies." U.S. CONST. art. III, § 2. This "fundamental limitation" is reflected in the Article III standing requirement. *Summers v. Earth Island Inst.*, 555 U.S. 488, 493 (2009). Although "not necessarily a requirement to appear before an administrative agency," it "kicks in when a party seeks review in a federal court." *Apple Inc. v. Qualcomm Inc.*, 17 F.4th 1131, 1135–36 (Fed. Cir. 2021) (cleaned up). That party must demonstrate: (1) an "injury in fact" (2) "fairly traceable" to the defendant's challenged conduct and (3) "likely to be redressed by a favorable judicial decision." *Spokeo, Inc. v. Robins*, 578 U.S. 330, 338 (2016).

Relevant here, an injury in fact must be "concrete and particularized and actual or imminent, not conjectural or hypothetical." *Id.* at 339 (cleaned up). That's generally so when an IPR petitioner "has engaged in, is engaging in, or will likely engage in activity that would give rise to a possible infringement suit." *Grit Energy Sols., LLC v. Oren*

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[4] U.S. Patent No. 6,804,502.

[5] We also denied Apple's motions to intervene and to participate as amicus curiae.

Techs., LLC, 957 F.3d 1309, 1319 (Fed. Cir. 2020) (cleaned up). The appellant in *Grit*, for instance, engaged in acts that not only could have but "*did* give rise to an infringement suit"—a suit dismissed without prejudice, leaving the patentee "free to reassert those infringement claims." *Id.* at 1320. Intel's predicament here is similar. Although Qualcomm didn't sue Intel for infringement, Qualcomm has not disputed that it mapped the '043 patent claims to an Intel product (and only an Intel product) in a prior suit against Apple. *See* Appellant's Br. 46; J.A. 4713–65; J.A. 4794–96; Intel's Response to Qualcomm's Motion to Dismiss, ECF No. 40 at 5 (and cited exhibits)). Like in *Grit*, therefore, Intel's acts "*did* give rise to an infringement suit." 957 F.3d at 1320. In Intel's words, Qualcomm "already has engaged in litigation involving *that* technology and *this* patent." Reply Br. 29.

It is of no moment that the suit wasn't against Intel, as Intel "need not face a specific threat of infringement." *Grit*, 957 F.3d at 1319 (cleaned up). Nor does it matter that the suit settled in 2019. *See* J.A. 4594–95. True, such settlements can deprive parties of standing. *E.g.*, *Apple*, 17 F.4th at 1134; *Apple Inc. v. Qualcomm Inc.*, 992 F.3d 1378, 1385 (Fed. Cir. 2021). But Intel isn't a party to this one. In contrast, Intel was informed that "Qualcomm is not offering a covenant not to sue." J.A. 4713. Although that refusal isn't on its own "sufficient to create an actual controversy," *Prasco, LLC v. Medicis Pharm. Corp.*, 537 F.3d 1329, 1341 (Fed. Cir. 2008), it reinforces the analogy to *Grit*, where the patentee declined to stipulate that it would not reassert its previous infringement allegations, 957 F.3d at 1320 n.3.

Moreover, Intel represents that it continues to sell the relevant products to Apple and at least one other customer, and that in doing so it must "address[] the '043 patent and the risk of an infringement suit by Qualcomm."

J.A. 4794–96; *see* J.A. 4785.[6] Because Intel's risks transcend mere conjecture or hypothesis, *see Spokeo*, 578 U.S. at 339, we conclude that Intel has standing. *See also Intel Corp. v. Qualcomm Inc.*, No. 20-1828, slip op. at 9–10 (Fed. Cir. Dec. 28, 2021).

II

On to the merits. We start with the parties' dispute over the proper construction of the phrase "radio frequency input signal" in '043 patent claims 17, 19, and 21. Before the Board, Intel said this phrase "should take its ordinary meaning of an input signal having a radio frequency." *Final Written Decision*, at *7. Qualcomm disagreed, arguing that a skilled artisan reading the patent would have understood the phrase to reference the radio frequency signal that is received before down-conversion: "a signal centered at a carrier frequency at which the signal was transmitted/received." *Id.* at *6.

The upshot is that Intel's proposal (and not Qualcomm's) covers a signal called the intermediate frequency ("IF") signal in the two-stage "super heterodyne" architecture of prior-art reference Der. Unlike the one-stage "homodyne" architecture disclosed in the '043 patent, receivers in super heterodyne architectures like Der demodulate a carrier signal in two stages: first to that IF signal, and then to baseband. Adopting Qualcomm's proposal, the Board determined that Der didn't anticipate claims 17, 19, and 21. *Id.* at *15.

"We review claim construction based on intrinsic evidence de novo and review any findings of fact regarding extrinsic evidence for clear error." *SpeedTrack, Inc. v.*

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[6] Given Intel's past and ongoing acts, Apple's 2019 acquisition of "the majority of Intel's smartphone modem business" also doesn't negate Intel's standing. *See* J.A. 4597–607.

Amazon.com, Inc., 998 F.3d 1373, 1378 (Fed. Cir. 2021) (citing *Teva Pharms. USA, Inc. v. Sandoz, Inc.*, 574 U.S. 318, 331–32 (2015)). Applying the "broadest reasonable interpretation" standard,[7] we affirm the Board's construction.

Claim terms are generally accorded their ordinary meaning—that is, their meaning to a skilled artisan at the time of the invention. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–13 (Fed. Cir. 2005) (en banc). This approach "provides an objective baseline" for our inquiry. *Id.* at 1313. To that end, we consult the sources available to such artisans, including "the words of the claims themselves, the remainder of the specification, the prosecution history, and extrinsic evidence concerning relevant scientific principles, the meaning of technical terms, and the state of the art." *Id.* at 1314 (quoting *Innova/Pure Water, Inc. v. Safari Water Filtration Sys., Inc.*, 381 F.3d 1111, 1116 (Fed. Cir. 2004)). "Importantly," skilled artisans are "deemed to read the claim term . . . in the context of the entire patent." *Id.* at 1313. Even when seeking the "broadest reasonable construction in light of the specification," 37 C.F.R. § 42.100(b) (2017), we still give words "their plain meaning" unless "inconsistent with the specification and prosecution history." *Arista Networks, Inc. v. Cisco Sys., Inc.*, 908 F.3d 792, 796–98 (Fed. Cir. 2018) (rejecting construction as "overly broad, even under the broadest reasonable interpretation standard"). "Above all, the broadest reasonable interpretation must be *reasonable* in light of the claims and specification." *PPC Broadband, Inc. v. Corning Optical Commc'ns RF, LLC*, 815 F.3d 747, 755 (Fed. Cir. 2016).

Considering the disputed phrase "radio frequency input signal" in a vacuum, both proposals have some appeal.

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[7] Although that standard applies in this case, it has been superseded by the standard "used to construe the claim[s] in a civil action." 37 C.F.R. § 42.100(b) (2018).

From that vantage, it's plausible that the disputed phrase equals the sum of its parts as Intel contends—a "signal" that is "within the range defined as the radio frequency spectrum" and is an "input to a circuit or component receiver part." *E.g.*, Appellant's Br. 25. But the phrase could just as easily mean something more specific, referring to a particular signal in the receiving process, as Qualcomm contends. Even without considering the surrounding claim language or the rest of the patent document, we note that it is not always appropriate to break down a phrase and give it an interpretation that is merely the sum of its parts. *See FCC v. AT&T Inc.*, 562 U.S. 397, 406 (2011) (rejecting interpretation of "personal privacy" as "simply the sum of its two words"). In any event, and decisively, our inquiry is not limited to an analysis of the phrase in isolation. *See*, *e.g.*, *Hockerson-Halberstadt, Inc. v. Converse Inc.*, 183 F.3d 1369, 1374 (Fed. Cir. 1999) ("Proper claim construction . . . demands interpretation of the entire claim in context, not a single element in isolation."). "[A] term can be defined only in a way that comports with the instrument as a whole." *Markman v. Westview Instruments, Inc.*, 517 U.S. 370, 389 (1996).

We therefore continue by examining the surrounding claim language. *Phillips*, 415 F.3d at 1314. Claim 17 below (emphasis added) has a tripartite structure: it describes (a) the signal received, (b) the signal output, and (c) the switching functionality:

> 17. A method comprising:
>
> (a) receiving a *radio frequency input signal* onto a source lead of a first transistor and onto a source lead of a second transistor;
>
> (b) outputting a baseband signal from a drain lead of the first transistor, wherein the baseband signal has a current with a magnitude; and

> (c) increasing the magnitude of the current of the baseband signal by coupling the drain lead of the first transistor to a drain lead of the second transistor, wherein the drain lead of the first transistor is coupled to the drain lead of the second transistor by closing a switch that is coupled to both the drain lead of the first transistor and the drain lead of the second transistor.

This language points in favor of Qualcomm's reading adopted by the Board. First, if the "radio frequency input signal" refers to just any radio frequency signal that is an input, then the word "input" makes no contribution to the claim. Omitting it would change nothing, given the mixer's "receiving" of the signal "onto a source lead." *See* Antonin Scalia & Bryan A. Garner, *Reading Law* 176 (2012) ("Because legal drafters should not include words that have no effect, courts avoid a reading that renders some words altogether redundant."); *see also Intel*, No. 20-1828, slip op. at 13 (collecting cases). Second, part (a) of the claim doesn't strictly parallel part (b), raising the question why part (a) doesn't instead say "inputting a radio frequency signal" if indeed "a radio frequency input signal" is just a radio frequency signal that is input. These linguistic clues suggest that "radio frequency input signal," to the relevant audience, refers to the signal entering the device as a whole, not (as Intel proposes) to any radio frequency signal entering any component.

The specification provides further support for the Board's reading. It consistently and repeatedly uses "radio frequency input signal" to reference the carrier frequency signal received at the antenna, amplified by the low-noise amplifiers, and received at the mixer's transistors for direct down-conversion to baseband. For example, Figure 2 (see annotated versions above) shows a signal 32 that's received at antenna 16 and that, Qualcomm has not disputed, is the carrier frequency signal sent over the air. Indeed, the patent in the context of Figure 1 expressly calls signal 32 "the

carrier signal" that is "downconvert[ed]" to "baseband." *Id.* at col. 5 ll. 43–58.[8] And then in its subsequent discussion of Figure 2, the patent explains that "*[r]adio frequency input signal* 32 is amplified by LNAs 17–19 and then received onto the source leads of transistors 39–40," after which point "a baseband signal current 84 is output from the drain lead [of the] first transistor 39." *Id.* at col. 10 l. 64–col. 11 l. 8 (emphasis added); *see also id.* at col. 3 ll. 52–58 (similar); *id.* at col. 3 ll. 18–30 (similar). That discussion also references and parallels the flowchart of Figure 11, which as its first step recites "receive a radio frequency input signal onto a source lead of a first transistor and onto a source lead of a second transistor" followed by direct down-conversion of that signal to baseband. *Id.* at Fig. 11 (capitalization normalized). We find this consistency compelling.

Intel objects that the Board's construction limits the ordinary meaning of the claims to the patent's embodiments, an approach we've "expressly rejected." *Info-Hold, Inc. v. Applied Media Techs. Corp.*, 783 F.3d 1262, 1267 (Fed. Cir. 2015). Just because the patent doesn't "specifically use the term 'RF input signal' to describe the input into a second-stage mixing circuit," Intel says, that doesn't limit the patent "to homodyne receiver architectures" and exclude "super heterodyne" ones. Appellant's Br. 26–27. But this presupposes the point it purports to prove. It takes for granted that Intel has the ordinary meaning right. In this case, however, the question is what the contextually correct meaning *is*, not whether anything affirmatively limits an undisputed ordinary meaning.

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[8] Elsewhere, the patent also suggests that the invention could be used in reverse to "modulate baseband data" *up* to a radio frequency signal "*transmitted* from the wireless device" (i.e., a carrier signal). '043 patent col. 11 ll. 56–61 (emphasis added).

And although the patent doesn't disclose any super heterodyne embodiments, it does (once) mention intermediate frequencies in a way that favors the Board's construction. As background, it states: "Receivers for wireless communication systems typically require low noise amplifiers (LNAs) followed by double-balanced mixers to pre-amplify incoming signals and to down-convert those signals to an appropriate intermediate frequency (IF) or baseband frequency." '043 patent col. 1 ll. 11–15. This statement doesn't describe an intermediate frequency as a species of "radio frequency input signal." Rather, it uses a distinct label, "intermediate frequency (IF)." Generally speaking, "[a] word or phrase is presumed to bear the same meaning throughout a text; a material variation in terms suggests a variation in meaning." Scalia & Garner, *supra*, at 170; *see PPC*, 815 F.3d at 752 (noting this canon is "employed in both statutory interpretation and claim construction"). Here we discern such a material variation, suggesting that "intermediate frequency (IF)" means something different from "radio frequency input signal."

Further, beyond indicating a material variation in terms, the structure of the patent's "IF" passage also hints that an intermediate frequency isn't covered by the claimed "radio frequency input signal." By describing both the "intermediate frequency (IF)"and the "baseband frequency" as results of down-converting "incoming" signals, the passage parallels the claim's structure—which reflects "receiving" an incoming "radio frequency input signal" and outputting the result of down-conversion: a "baseband signal." *Id.* at claim17. As Intel's counsel observed, the claim structure "juxtapos[es]" the "radio frequency input signal" with the "baseband." Oral Arg. at 2:30–50, No. 20-1664.[9] Therefore, although the passage may not explicitly distinguish

[9] https://oralarguments.cafc.uscourts.gov/default.aspx?fl=20-1664_10072021.mp3.

IF from RF, *see* Oral Arg. at 30:15–32:37; *Final Written Decision*, at *7, it treats intermediate frequencies as akin to baseband signals—which map to the "outputting" phrase of part (b) rather than the "radio frequency input signal" of part (a).

Indeed, this framing illuminates how, rather than being limited to homodyne architectures as Intel suggests, the Board's construction can indeed cover super heterodyne architectures. The first stage would "receiv[e]" a "radio frequency input signal" that, per the Board's construction, is centered at a carrier frequency, and the second stage would "output[]" a baseband signal. *Id.* at claim 17. In between would be the work of down-conversion, first to an intermediate frequency and then to the "output[]" baseband signal of the claim. *Id.* The effect of the Board's construction is not, therefore, that all super heterodyne architectures are excluded, but more modestly that the intermediate signal of such an architecture simply isn't the "radio frequency input signal" of the claims.

In sum, while Intel's interpretation may have superficial appeal, Qualcomm's better reflects the usage of "radio frequency input signal" in the intrinsic record. It prevents the word "input" from being redundant in the claim and comports with the claim's tripartite structure. And it reflects the specification's repeated use of the disputed phrase to reference incoming carrier signals before down-conversion. *See Arista*, 908 F.3d at 798 (construing "broadcast" to mean "a transmission to one or more devices using a multicast address" based on "the specification's consistent focus on broadcasting via a multicast address"). Because the Board's construction gives effect to the contextually appropriate meaning of "radio frequency input signal," we affirm it.

III

Next we turn to obviousness, addressing first the originally challenged claims and second the substitute claims.

The ultimate judgment of obviousness under 35 U.S.C. § 103 is a legal determination based on underlying factual inquiries. "[T]he scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved." *Graham v. John Deere Co. of Kan. City*, 383 U.S. 1, 17 (1966). Also, "[s]uch secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented." *Id.* at 17–18.

In cases where "the question is whether a patent claiming the combination of elements of prior art is obvious," "it can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does." *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 417–18 (2007). That, too, is a factual inquiry. *ZUP, LLC v. Nash Mfg., Inc.*, 896 F.3d 1365, 1371 (Fed. Cir. 2018). We review the Board's factual findings for substantial evidence and its legal conclusions de novo. *Donner Tech., LLC v. Pro Stage Gear, LLC*, 979 F.3d 1353, 1358 (Fed. Cir. 2020).

Both obviousness issues on appeal involve "whether there was an apparent reason to combine" the prior-art elements. *KSR*, 550 U.S. at 418. In *KSR* (decided over 10 years ago now), the Supreme Court rejected the "teaching, suggestion, or motivation" ("TSM") test that we inherited from our predecessor court. *Id.* at 407, 418. Under that test, "a patent claim [was] only proved obvious if some motivation or suggestion to combine the prior art teachings [could] be found in the prior art, the nature of the problem, or the knowledge of a person having ordinary skill in the art." *Id.* at 407 (cleaned up). The Court acknowledged that the TSM test "captured a helpful insight" by addressing the intuition that "a patent composed of several elements is not proved obvious merely by demonstrating that each of its

elements was, independently, known in the prior art." *Id.* at 418. "Helpful insights, however, need not become rigid and mandatory formulas." *Id.* at 419. Therefore, the Court instead adopted an "expansive and flexible approach." *Id.* at 415. No longer would "[t]he obviousness analysis . . . be confined by a formalistic conception of the words teaching, suggestion, and motivation, or by overemphasis on the importance of published articles and the explicit content of issued patents." *Id.* at 419.

We assess Intel's challenges to the Board's obviousness determinations under the principles in *KSR*. We reject the first, (A) that the Board didn't satisfactorily explain why a skilled artisan would not have combined Der with Valla. We accept the second, (B) that a skilled artisan would have had reason to combine Burgener with Der, because the Board's decision rejecting that rationale is not supported by substantial evidence.

A

We begin with the Board's determination that Intel didn't prove claims 6, 17–19, and 21 were obvious in light of Der and Valla (nor, for the same reason, substitute claims 27, 28, and 31 in light of Der, Valla, and Burgener).

Before the Board, Intel argued that a skilled artisan would have "modified Valla to include two parallel passive mixers having outputs coupled by a gain control block consisting of switches . . . to achieve the advantages of Der and Valla." *Final Written Decision*, at *19. Qualcomm disagreed, reasoning that "the transistors from Der would impair the low impedance that Valla seeks for its amplifier." *Id.* at *20. The Board agreed with Qualcomm. As the Board explained, "Valla discusses the importance of a passive mixer with a 'low impedance' load" for obtaining the system's benefits, calling this a "key feature." *Id.* at *21. Along the way, it rejected Intel's riposte: that in "triode mode" Der's transistors "would have very low impedance

and would have no adverse impact" on Valla's circuit. *Id.* at *20 (quoting J.A. 1834 ¶ 61).

On appeal, Intel doesn't argue that the Board's determination lacks substantial-evidence support.[10] Rather, it says the Board didn't "apply the proper mode of legal analysis [of] weigh[ing] the putative disadvantage . . . against the combination's undisputed benefits." Reply Br. 18. As an initial matter, we agree that "simultaneous advantages and disadvantages . . . do[] not necessarily obviate motivation to combine." *Medichem, S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1165 (Fed. Cir. 2006). In *KSR* itself, for example, evidence indicating that a prior-art product was "bulky, complex, and expensive" wasn't on its own enough to dismiss it as "too flawed to upgrade." 550 U.S. at 425–26. But here we conclude the Board's analysis is adequate, applying the proper standard.

Specifically, the Board noted that Intel's expert didn't disagree with Qualcomm's expert as to what would happen in the non-triode modes. *Final Written Decision*, at *21–22. The thrust of both experts' testimony, the Board explained, is that "although there are some conditions . . . that result in Der's transistor M9 operating in the triode mode . . . over most of the operating conditions the transistor is in a different mode." *Id.* at *22. Therefore, the Board concluded, a skilled artisan would have lacked motivation to combine Valla with Der because that "would impair Valla's need for low impedance *during the majority of operation*." *Id.* (emphasis added). On this record, we're satisfied that the Board weighed the competing evidence regarding the

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[10] Oral Arg. at 14:06–32 (Q: "So you're not making a substantial-evidence challenge?" A: "No your Honor, we're not."); Oral Arg. at 15:34–49 (Q: "So, just to be clear, if we don't find that the Board applied the incorrect legal test for obviousness, you're not saying their conclusion lacks substantial evidence?" A: "That is correct, your Honor.").

relevant tradeoffs and concluded, based on the stated importance of low impedance as "key" to Valla, that negating this benefit during "the majority of the operation" would have outweighed any reason to combine.[11]

B

Last, we conclude that substantial evidence does not support the Board's determination that a skilled artisan would have lacked reason to combine Der with Burgener (in the Der-Burgener-Razavi combination) to achieve substitute claims 27, 28, and 31. Those claims depend on substitute claim 26, which adds a single limitation to claim 1 (additions italicized; deletions bracketed):

> 26. (Proposed Substitute for Claim 1) A device comprising:
>
> (a) an amplifier having an output lead;
>
> (b) a first transistor having a source lead, a drain lead and a gate lead;
>
> (c) a second transistor having a source lead, a drain lead and a gate lead, wherein the output lead of the amplifier is coupled to the source lead of the first

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[11] The Board also said Intel relied "at least in part[] on impermissible hindsight" because it "provide[d] no support—whether from Valla, Der, or some other source" for a benefit also identified in the patent. *Final Written Decision*, at *22. We're skeptical that this necessarily translates to hindsight. There's another possibility: that without "seek[ing] out precise teachings," Intel merely took "account of the inferences and creative steps" a skilled artisan would employ. *KSR*, 550 U.S. at 418. At any rate, Intel doesn't press a substantial-evidence challenge (see above), so we affirm the Board's Der-Valla determination.

> transistor and to the source lead of the second transistor; [[and]]
>
> (d) a *first* switch, wherein the drain lead of the first transistor is coupled to the drain lead of the second transistor through the *first* switch when the *first* switch is closed, and wherein an oscillating signal is present on the gate lead of the first transistor and on the gate lead of the second transistor; *and*
>
> *(e) a second switch, wherein the drain lead of the second transistor is coupled to ground through the second switch when the second switch is closed*.

J.A. 3763 (alterations in original).

Intel relied on Burgener to disclose this added limitation. Burgener describes as background a "prior art switch" that includes "a switching transistor" and "a shunting transistor." J.A. 1873. Via that switch, Burgener states, "RF signals are either routed from an RF input node" to "an RF output node," or else are "shunted to ground through the shunting transistor M2 7." J.A. 1873. From there, Intel argued that a skilled artisan would have had reason to combine Burgener's switch with Der's receiver architecture (and the teachings of Razavi)—rendering these substitute claims unpatentable. Intel's asserted rationale proceeds in two steps. First, a skilled artisan would have sought to improve energy efficiency by turning off a portion of Der's circuit when not in use. Second, doing so would have triggered a known problem to which Burgener's switch was a predictable solution.

The Board disagreed for three reasons: (1) that Intel's energy-efficiency theory was too generic, (2) that Burgener described the switch as prior art with shortcomings, and (3) that the combination would render Der unsuitable for its intended purpose. Under applicable legal principles, none of the Board's reasons are supported by substantial evidence.

1

First, we evaluate whether substantial evidence supports the Board's conclusion that Intel's energy-efficiency rationale was deficient because, in the Board's view, it was "nothing more than a *generic* reason to make something better" and "[i]ncreasing energy efficiency is no more than a *generic* concern that exists in many, if not all, electronic devices." *Final Written Decision*, at *27 (emphasis added). For support, the Board looked to *ActiveVideo Networks, Inc. v. Verizon Communications, Inc.*, in which we rejected a rationale premised on the following testimony:

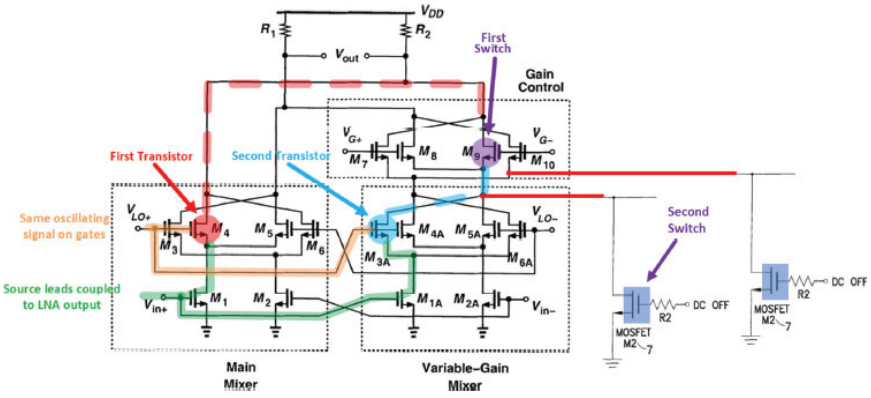
> The motivation to combine would be because you wanted to build something better. You wanted a system that was more efficient, cheaper, or you wanted a system that had more features, makes it more attractive to your customers, because by combining these two things you could do something new that [you] hadn't been able to do before.

694 F.3d 1312, 1328 (Fed. Cir. 2012). That decision, however, didn't denounce energy efficiency as *per se* insufficient as the Board's decision suggests. Such a rationale is not inherently suspect merely because it's generic in the sense of having broad applicability or appeal. Quite the opposite. Even before *KSR*, we held that *because* such improvements are "technology-independent," "universal," and "even common-sensical," "there exists in these situations a motivation to combine prior art references *even absent any hint of suggestion* in the references themselves." *DyStar Textilfarben GmbH v. C.H. Patrick Co.*, 464 F.3d 1356, 1368 (Fed. Cir. 2006) (emphasis added) (referencing an "implicit motivation to combine" to make a device "more desirable, for example because it is stronger, cheaper, cleaner, faster, lighter, smaller, more durable, or more efficient"); *see KSR*, 550 U.S. at 421 (quoting *DyStar*, 464 F.3d at 1367).

Of course, "generic" might also have a different sense: conclusory. Certainly, "[c]onclusory expert testimony does not qualify as substantial evidence," *TQ Delta, LLC v. Cisco Sys., Inc.*, 942 F.3d 1352, 1358–59 (Fed. Cir. 2019), as demonstrated in *ActiveVideo*. But unlike *ActiveVideo*, this isn't a case "where the motivation of increased efficiency is asserted so generically as to be legally insufficient." *Huawei Techs. Co. v. Iancu*, 813 F. App'x 505, 510 (Fed. Cir. 2020) (describing *ActiveVideo*). The testimony in *ActiveVideo* bore "no relation to any specific combination of prior art elements . . . from specific references" and didn't explain why a skilled artisan would have combined them "*in the way the claimed invention does*," 694 F.3d at 1328, but here Intel's expert indicated precisely how and why a skilled artisan would have combined the references.

Recall that Der has a super heterodyne architecture. Der's second stage "employs two parallel mixers . . . a main mixer and a variable-gain mixer," along with "a gain control circuit at the output of the variable-gain mixer." Appellee's Br. 42 (cleaned up). According to Intel's expert, a skilled artisan "would have recognized that, in cases where gain control is not required (e.g. when the gain of the 'main mixer' alone is sufficient), it would have been advantageous to disable the variable-gain mixer to save power." J.A. 1840 ¶ 70 (capitalization normalized). Specifically, such an artisan "would have combined the mixer circuit of Der Figure 9(b) with the shunt transistor M2 7 of

Burgener," as shown in Intel's annotated Figure 9(b) below (which incorporates Burgener's switches into Der's circuit):



J.A. 3802. As Intel's expert explained, "one way to disable the variable-gain mixer in Der would be to turn off transistor switches M7-M10 to shut off the input signal into the gain control circuit, by setting Der's V_{G+} and V_{G-} to a low voltage (e.g. 0V)." *Id.* (capitalization normalized and emphasis omitted). This explanation for the *how* isn't remotely conclusory. J.A. 1840 ¶ 70.

Nor is Intel's explanation for the *why*. For one thing, Intel's expert pointed out that Der expressly highlights power consumption as a consideration. J.A. 1840 ¶ 70 (citing J.A. 1178 (quantifying power consumption)). For another, Intel's expert explained that the idea of "disabl[ing] the variable-gain mixer to save power" flows directly from the observation that the variable-gain mixer isn't always needed. J.A. 1840 ¶ 70 (capitalization normalized). That, in turn, follows from Der's statement that the "gain-control circuit . . . can add, subtract, *or null* signal currents from the variable-gain mixer." J.A. 1840 ¶ 70 (quoting J.A. 1182 (emphasis added)). In Intel's words, "the gain-control circuit will block all, some, or none of the output signal current from the variable-gain mixer, whichever is appropriate to achieve the desired level of gain." Appellant's Br. 10. Consistent with that observation, Qualcomm's expert acknowledged at least one scenario in which

"the output of the variable gain mixer would not contribute anything to the output." J.A. 1909–10. And if that weren't enough, Der expressly contemplates the idea of turning off unused circuits. As Intel noted to the Board, "although Der does not expressly describe turning off the variable gain mixer, it does describe turning off the calibration circuit." *Final Written Decision*, at *26.

The facts of *KSR* are instructive here. The patent in *KSR* claimed a design for an adjustable pedal with an electronic sensor mounted on its fixed pivot point. 550 U.S. at 425. This, the Court concluded, was an obvious improvement to a prior-art adjustable pedal (disclosed in the Asano reference) with a sensor (like those disclosed in other references). *Id.* at 425–26. Just as *KSR* examined whether a skilled artisan "would have seen a benefit to upgrading Asano with a sensor," Intel argued that a skilled artisan would have "seen a benefit" to upgrading Der with Burgener's switch. *Id.* at 424. Intel explained that doing so would improve energy efficiency for situations in which the variable-gain mixer is not in use. Far from being conclusory, Intel "fit the teachings of multiple patents together like pieces of a puzzle." *Id.* at 420. The Board's critique of this rationale as impermissibly "generic" is not supported by substantial evidence.

2

The Board's second complaint about Intel's rationale is that it relied on the prior-art switch described as background in Burgener, which Burgener criticizes and purports to improve. Under the applicable legal standard, substantial evidence does not support rejecting Intel's rationale on this ground.

Before the Board, Intel argued that a skilled artisan would have used Burgener's prior-art switch to solve a known problem—the "feedthrough problem"—that was an expected negative consequence of disabling Der's variable-gain mixer. As Intel's expert explained, "due to the finite

isolation of the transistor switches M7-M10, even when those transistors are off, some of the local oscillator ('LO') signal (applied to the gates of transistors M3A-M6A) would still feed through and appear at the output of the variable-gain mixer, degrading the signal quality." J.A. 1840 ¶ 70 (capitalization normalized). Using the prior-art switch of Burgener, with its "shunting transistor," Intel's expert explained, would "allow for improved signal quality . . . by shunting any LO feedthrough current to ground." J.A. 1840 ¶ 71. Intel's expert opined, accordingly, that this combination "would have involved nothing more than use of a known technique (adding a shunt switch to an RF switch) to improve a similar device (e.g., the overall mixer of Der) in the same way (providing a shunt path to ground to improve isolation)." J.A. 1840 ¶ 72.

Here again, *KSR* is our guide. In *KSR*, a key question was "where to attach the sensor" to Asano's pedal—specifically, whether a skilled artisan "starting with Asano would have found it obvious to put the sensor on a fixed pivot point." 550 U.S. at 424–25. One prior-art reference taught "putting the sensor on the pedal device." *Id.* at 425. Another (Smith) taught putting it "not on the pedal's footpad but instead on its support structure," and a third (Rixon) noted that a "wire-chafing" problem arises when placing a sensor on a moving part of a pedal. *Id.* From this constellation of references, a skilled artisan "would know to place the sensor on a nonmoving part of the pedal structure" and that "[t]he most obvious nonmoving point on the structure from which a sensor can easily detect the pedal's position is a pivot point" like the one in Asano—arriving at the claimed invention. *Id.*

Just as the known wire-chafing problem in *KSR* had an obvious solution (placing the sensor on a nonmoving point), so too here undisputed evidence shows that incorporating Burgener's switch was an "obvious solution" to the "known [feedthrough] problem." *Id.* at 420; *see generally* J.A. 1873 (Burgener discussing feedthrough problem and shunting

solution). There is therefore little difference between this circumstance and the one in *KSR*, where "the prior art was replete with patents indicating that a fixed pivot point was an ideal mount for a sensor." 550 U.S. at 420. Intel's expert explained that combining Der with Burgener "results in the LO feedthrough being reduced," and "predictable results and benefits are obtained as described in Burgener." J.A. 1840 ¶ 72 (emphasis omitted). To use *KSR*'s words, this is "the predictable use of prior art elements according to their established functions." 550 U.S. at 417.

The Board saw things differently. Noting that "Burgener discusses problems associated with [the] prior art designs" (namely "insertion loss, switch isolation, and switch compression"), and that for that reason Burgener "provides improvements," the Board reasoned that although a skilled artisan "*could* have selected the less effective prior art RF switches over the improved switches that are the subject of Burgener, [Intel] has not sufficiently demonstrated" why such an artisan "*would* have selected using elements from the less effective prior art designs." *Final Written Decision*, at *27. "Without such an explanation," the Board said, "the only reasonable inference is that [Intel] focused on Burgener's description of prior art switches using impermissible hindsight." *Id.* Not so. Our caselaw is clear. It's not necessary to show that a combination is "the *best* option, only that it be a *suitable* option." *PAR Pharm., Inc. v. TWI Pharms., Inc.*, 773 F.3d 1186, 1197–98 (Fed. Cir. 2014). And "if a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill." *KSR*, 550 U.S. at 417. That's what we have here. Given the facts and reasoning of *KSR*, it is readily apparent that the Board's hindsight inference lacks substantial evidence.

Qualcomm describes Intel's theory as fixing a "problem of their own making." Appellee's Br. 52. But the same can

be said of the known wire-chafing problem in *KSR*, which arose by virtue of combining an adjustable pedal with an electronic sensor. 550 U.S. at 425. As the *KSR* Court noted, "[i]n automotive design, as in many other fields, the interaction of multiple components means that changing one component often requires the others to be modified as well." *Id.* at 424. So too here. Like modifying Asano in a way that avoided the wire-chafing problem in *KSR*, modifying Der with Burgener in a way that avoids the feed-through problem doesn't neutralize Intel's rationale.

3

Last, the Board rejected Intel's asserted rationale because "powering off the variable gain mixer would have resulted in the circuit not being suitable for its intended purpose." *Final Written Decision*, at *27. In so concluding, the Board explained that "Der describes two modes: a calibration mode and an operating mode" and then reasoned that "it does not logically flow that because the calibration mode is only used for calibration, other parts of the circuit that are intended to be used during normal operation would be turned off during normal operation." *Id.* That, apparently, is because "nothing in Der suggests turning off any part of the functional circuit elements, let alone the 'important' variable gain mixer." *Id.*

Once again, the Board's decision lacks substantial evidence under the standards articulated in *KSR*. Intel's obviousness rationale isn't defective merely because "nothing in Der suggests" it. *Id.* But even if that were the correct test, which it is not, portions of Der *do* suggest this rationale—suggesting that power consumption was a consideration, that circuits may be turned off when not in use, and that the variable-gain mixer is not always in use, as detailed above. *See generally* J.A. 1840 ¶ 70.

Further, the intended purpose of Der does not control. "Common sense teaches . . . that familiar items may have obvious uses beyond their primary purposes." *KSR*,

550 U.S. at 420. Indeed, one of the points on which the Court in *KSR* disagreed with our decision below in that case was our reliance on the primary purposes of prior-art references. We had pointed out that Asano "was designed to solve the constant ratio problem," that Rixon "suffered from the problem of wire chafing but was not designed to solve it," and that Smith "did not relate to adjustable pedals and did not necessarily go to the issue of motivation to attach the electronic control on the support bracket of the pedal assembly." *Id.* at 414 (internal quotation marks omitted). That was misguided. "Regardless of Asano's primary purpose, the design provided an obvious example of an adjustable pedal with a fixed pivot point" such that "[t]he idea that a designer hoping to make an adjustable electronic pedal would ignore Asano because Asano was designed to solve the constant ratio problem makes little sense." *Id.* at 420–21. Finally, the Board didn't explain how disabling Der's variable-gain mixer would hinder its purpose in use cases where "achieving the 'desired output' requires that the output of the variable-gain mixer be 'null[ed]'—a possibility that Der itself contemplates." Appellant's Br. 45–46 (quoting J.A. 1182) (alteration in original).

Accordingly, the Board's analysis lacks substantial evidence under *KSR*. We vacate the Board's decision as to substitute claims 27, 28, and 31 and remand with instructions that Intel demonstrated sufficient reason for combining Der with Burgener. The Board should resolve any remaining disputes regarding that combination on remand. *E.g.*, Appellee's Br. 52 n.11.

CONCLUSION

We have considered the parties' remaining arguments but find them unpersuasive. We affirm the Board's claim construction and decision as to claims 6, 17–19, and 21. We vacate the Board's determination as to substitute claims 27, 28, and 31 and remand for further proceedings.

AFFIRMED-IN-PART, VACATED-IN-PART, AND REMANDED

COSTS

The parties shall bear their own costs.