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Paper 32
Entered: March 7, 2017

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

QUALCOMM INCORPORATED and
QUALCOMM ATHEROS, INC.,
Petitioner,

v.

PARKERVISION, INC.,
Patent Owner.

Case IPR2015-01828
Patent 6,091,940

Before BART A. GERSTENBLITH, CHRISTOPHER L. CRUMBLEY, and JASON J. CHUNG, *Administrative Patent Judges*.

CRUMBLEY, *Administrative Patent Judge*.

FINAL WRITTEN DECISION
35 U.S.C. § 318 and 37 C.F.R. § 42.73

I. INTRODUCTION

In this *inter partes* review trial, instituted pursuant to 35 U.S.C. § 314, Qualcomm Incorporated and Qualcomm Atheros, Inc. (collectively, "Qualcomm") challenge the patentability of claims 21, 25, 26, 281, 283–286, 288, 289, 293, 363–366, 368, 369, and 373 of U.S. Patent No. 6,091,940 (Ex. 1001, "the '940 patent"), owned by ParkerVision, Inc.

We have jurisdiction under 35 U.S.C. § 6(b). This Final Written Decision, issued pursuant to 35 U.S.C. § 318(a), addresses issues and arguments raised during trial. For the reasons discussed below, we determine that Qualcomm has proven, by a preponderance of the evidence, that claims 21, 281, 283–286, 288, 289, and 293 of the '940 patent are unpatentable. Qualcomm has not proven by a preponderance of the evidence, however, that claims 25, 26, 363–366, 368, 369, and 373 are unpatentable.

A. Procedural History

On August 28, 2015, Qualcomm requested an *inter partes* review of claims 21, 25, 26, 281, 283–286, 288, 289, 293, 363–366, 368, 369, and 373 of the '940 patent. Paper 1, "Pet." ParkerVision filed a Patent Owner Preliminary Response. Paper 7, "Prelim. Resp." In a Decision on Institution of *Inter Partes* Review (Paper 8, "Dec. on Inst."), we instituted trial as to all challenged claims on the following ground of unpatentability:

> Whether claims 21, 25, 26, 281, 283–286, 288, 289, 293, 363–366, 368, 369, and 373 are unpatentable under 35 U.S.C. § 103(a), as having been obvious over the combined disclosures of Nozawa[1] and Philips 4052.[2]

Dec. on Inst. 29.

Following institution of trial, ParkerVision filed a Patent Owner Response (Paper 16, "PO Resp."), and Qualcomm filed a Reply (Paper 19, "Pet. Reply").

Qualcomm supported its Petition with the Declaration of Dr. Lawrence E. Larson. Ex. 1002. ParkerVision took cross-examination testimony of Dr. Larson via deposition on May 16, 2016, and submitted the transcript of that deposition. Ex. 2001.

With its Response, ParkerVision submitted the Declaration of Dr. Neil Birkett. Ex. 2008. Qualcomm noticed the deposition of Dr. Birkett (Paper 17), but did not submit the transcript of that deposition. Qualcomm did, however, submit the testimony of Dr. Birkett, taken by deposition in a related proceeding before the United States International Trade Commission. Ex. 1037.

Following Qualcomm's Reply, counsel for ParkerVision contacted the Board, alleging that the Reply exceeded the scope permitted under 37 C.F.R.

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[1] Yasuo Nozawa, *The Merigo Method: SSB Generator/Producing a Demodultor*, HAM Journal Special Edition: The Handmade SSB Challenge, 15–26 (July/August 1993) (Ex. 1003). Exhibit 1003 includes both the original Japanese version of Nozawa and a certified translation accompanied by a translator's declaration.

[2] Philips, *74HC/HCT4052 Dual 4-Channel Analog Multiplexer/Demultiplexer*, (December 1990) (Philips Semiconductors Data Sheet) (Ex. 1004).

§ 42.23(b). We authorized ParkerVision to file an identification of the portions of the Reply that allegedly exceeded the proper scope. Paper 22. ParkerVision filed the authorized list (Paper 24), and Qualcomm filed a response (Paper 27).

Neither party filed a motion to exclude evidence.

Oral hearing was requested by both parties (Papers 21, 23), and argument before the Board was held on November 29, 2016.

B. The '940 Patent

The '940 patent, titled "Method and System for Frequency Up-Conversion," is directed to "[a] method and system . . . wherein a signal with a lower frequency is up-converted to a higher frequency." Ex. 1001, [54], [57]. According to the '940 patent, "[t]he up-conversion is accomplished by controlling a switch with an oscillating signal, the frequency of the oscillating signal being selected as a sub-harmonic of the desired output frequency." *Id.* The '940 patent explains:

> The methods and systems of transmitting vary slightly depending on the modulation scheme being used. For some embodiments using frequency modulation (FM) or phase modulation (PM), the information signal is used to module an oscillating signal to create a modulated intermediate signal. If needed, this modulated intermediate signal is "shaped" to provide a substantially optimum pulse-width-to-period ratio. This shaped signal is then used to control a switch which opens and closes as a function of the frequency and pulse width of the shaped signal. As a result of this opening and closing, a signal that is harmonically rich is produced with each harmonic of the harmonically rich signal being modulated substantially the same as the modulated intermediate signal. Through proper filtering, the desired harmonic (or harmonics) is selected and transmitted.

Id. at 1:58–2:5. The '940 patent further explains:

> For some embodiments using amplitude modulation (AM), the switch is controlled by an unmodulated oscillating signal (which may, if needed, be shaped). As the switch opens and closes, it gates a reference signal which is the information signal. In an alternate implementation, the information signal is combined with a bias signal to create the reference signal, which is then gated. The result of the gating is a harmonically rich signal having a fundamental frequency substantially proportional to the oscillating signal and an amplitude substantially proportional to the amplitude of the reference signal. Each of the harmonics of the harmonically rich signal also have amplitudes proportional to the reference signal, and are thus considered to be amplitude modulated. Just as with the FM/PM embodiments described above, through proper filtering, the desired harmonic (or harmonics) is selected and transmitted.

Id. at 2:6–21.

C. Illustrative Claims

Of the claims on which trial was instituted, 21 and 25 are independent. Claims 281, 283–286, 288, 289, and 293 depend directly or indirectly from claim 21, and claims 26, 363–366, 368, 369, and 373 depend directly or indirectly from claim 25. Claims 21 and 25 are illustrative of the claimed subject matter and are reproduced below:

> 21. An apparatus for frequency up-conversion, comprising:
>
> a pulse shaping module to receive an oscillating signal and to output a shaped string of pulses that is a function of said oscillating signal;
>
> a switch module to receive said shaped string of pulses and a bias signal, wherein said shaped string of pulses causes said switch module to gate said bias signal and thereby generate a periodic signal having a plurality of harmonics, said bias signal being a function of an information signal, said periodic signal having an amplitude that is a function of said bias signal; and

a filter coupled to said switch module to isolate one or more desired harmonics of said plurality of harmonics.

Ex. 1001, 69:18–31.

25. A method of communicating, comprising the steps of:

(1) shaping an oscillating signal to create a string of pulses that is a function of said oscillating signal;

(2) gating a reference signal at a rate that is a function of said string of pulses to create a periodic signal having a plurality of harmonics, said reference signal being a function of an information signal, and at least one of said plurality of harmonics being a desired harmonic; and

(3) outputting said periodic signal, said periodic signal having an amplitude that is a function of said reference signal.

Id. at 70:1–12.

II. ANALYSIS

A. Claim Construction

For purposes of our Decision on Institution, we analyzed each claim term in light of its broadest reasonable interpretation, as understood by one of ordinary skill in the art and consistent with the specification of the '940 patent. 37 C.F.R. § 42.100(b); *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2144–46 (2016). Under the broadest reasonable interpretation standard, and absent any special definitions, claim terms are given their ordinary and customary meaning, as would be understood by one of ordinary skill in the art in the context of the entire disclosure. *In re Translogic Tech. Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). Any special definitions for claim terms or phrases must be set forth with reasonable clarity, deliberateness, and precision. *In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994).

In the Decision on Institution, we evaluated the parties' proffered constructions for the claim terms "switch module," "to gate," "harmonic," "desired harmonics," and "pulse shaping module." Dec. on Inst. 8–18. We determined that, based on the record at the time, the broadest reasonable interpretations of the terms were as follows:

switch module	"device with an input and output that can take two states, open and closed"
to gate	no express construction necessary
harmonic	"a frequency or tone that, when compared to its fundamental or reference frequency or tone, is an integer multiple of it . . . [and] includes the fundamental frequency as the first harmonic"
desired harmonic	no express construction necessary
pulse shaping module/ shaping an oscillating signal	no express construction necessary

During the trial, ParkerVision asserted that we should maintain our construction of "harmonic" (PO Resp. 19–23), and Qualcomm did not address the adopted construction. With respect to the remaining terms, ParkerVision argues that none of these terms are material to the remaining dispute between the parties, which is focused on the "harmonic" limitation. *Id.* at 24–25. On this, we agree. As the remaining terms are not material to the parties' dispute, we decline to construe them further. *See Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999).

B. Obviousness over Nozawa and Philips 4052

We instituted trial to determine whether claims 21, 25, 26, 281, 283–286, 288, 289, 293, 363–366, 368, 369, and 373 are unpatentable under 35 U.S.C. § 103(a), as they would have been obvious over the combined

disclosures of Nozawa and Philips 4052. Dec. on Inst. 29. An obviousness inquiry involves four underlying determinations: the scope and content of the prior art; the differences between the prior art and the claims at issue; the level of ordinary skill; and any objective indicia of nonobviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17 (1966). We begin by assessing the scope and content of the prior art, namely the disclosures of Nozawa and Philips 4052.

1. *Nozawa*

Nozawa teaches a single sideband (SSB) transceiver for transmitting and receiving audio signals. Ex. 1003, 15–16; Ex. 1002 ¶ 140. Figure 8 of Nozawa, reproduced below, is a circuit diagram of the transmitter, depicting an SSB generator circuit:

FIG. 8: Diagram of New Type of SSB Generator Circuit

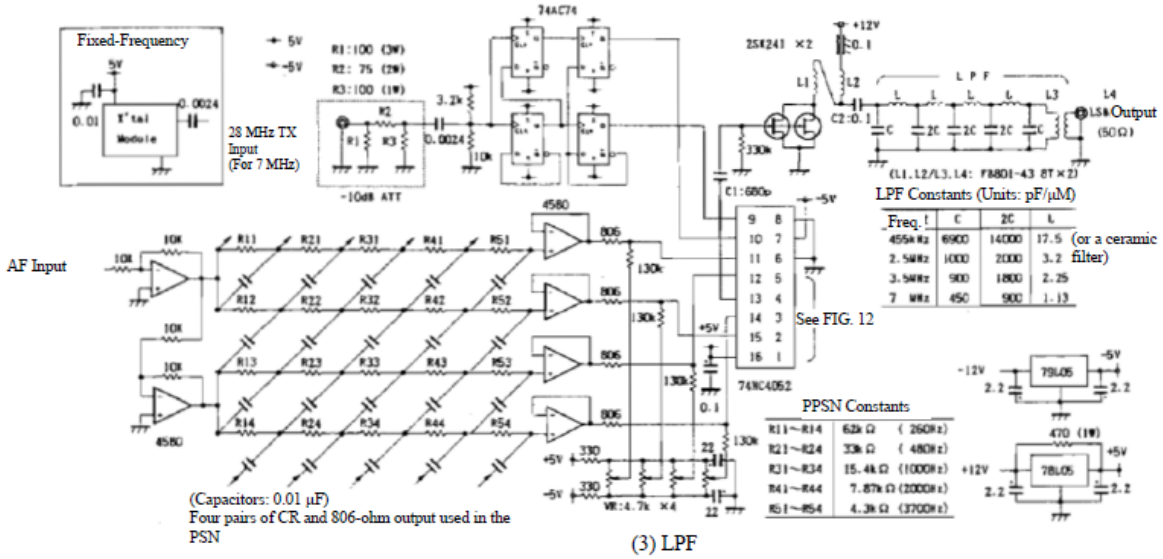

Figure 8 depicts, at bottom left, an audio frequency input ("AF Input") that is split into four signals that have 90° phase differences from one another. Ex. 1003, 20. The signals are then input to a 4052 chip—Nozawa specifically recites "a 74HC4052"—which includes a CMOS analog switch.

Id. The split AF signals are input to pins 11, 12, 14, and 15 of the chip. *Id.* at Fig. 8.

Nozawa also teaches providing to the 4052 chip an oscillating signal ("Lo") output from a 74AC74 chip. *Id.* at 20. This Lo signal is input to pins 9 and 10 of the 74HC4052 chip. *Id.* at Fig. 8. In his Declaration, Dr. Larson annotates Figure 8 of Nozawa as follows:

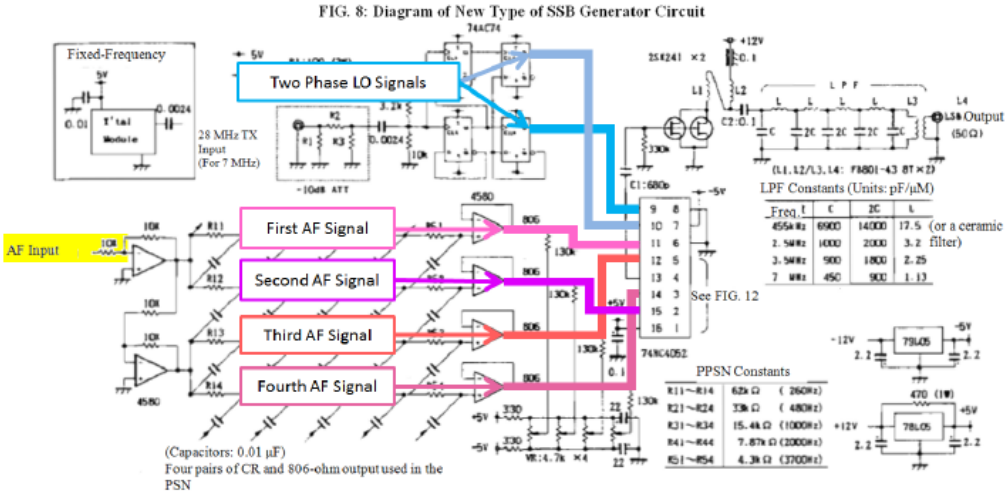

Figure 8 of Nozawa, as annotated by Dr. Larson, depicts two phase LO signals and first through fourth AF signals entering the 4052 chip at pins 9–12, 15, and 16. Ex. 1002 ¶ 142.

Nozawa also teaches the use of a low-pass filter, which filters the output of the 4052 chip (from pin 13) because it "in principle includes many harmonics." Ex. 1003, 20. According to Dr. Larson, this low-pass filter is depicted in the upper right of Figure 8. Ex. 1002 ¶ 147.

A receiver, also described as a single sideband ("SSB") demodulator, is taught by Nozawa and depicted below in Figure 12:

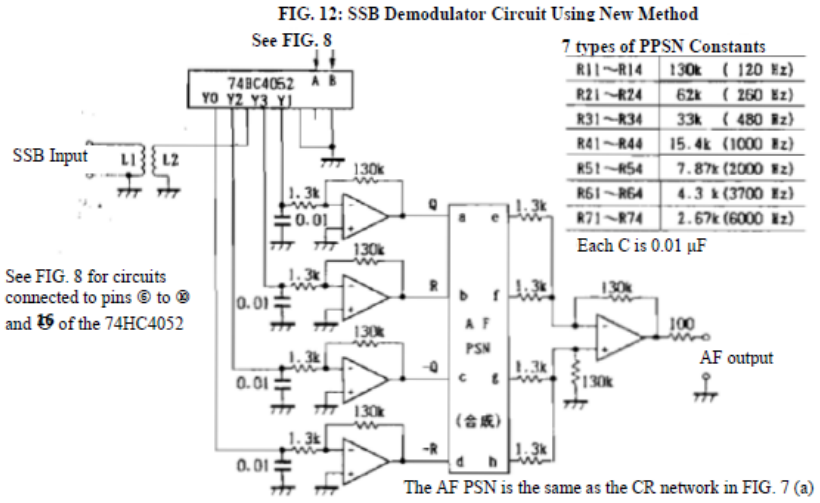

Figure 12 shows that the Nozawa receiver uses the same 4052 chip "rotary switch" as used in the transmitter, in the "opposite of its role in the generator in that it acts as a distributor that distributes the SSB input signal to the four capacitors." Ex. 1003, 24. The four component AF signals are then reconstituted into the final AF output. *Id.*

2. Philips 4052

Philips 4052 is a product specification for a 74HC/HCT4052 Dual 4-channel analog multiplexer/demultiplexer, manufactured by Philips Semiconductors. Ex. 1004, 1. Dr. Larson testifies that the chip described in Philips 4052 is the same as that referenced by Nozawa as "74HC4052," and that a person of skill in the art "would have considered it obvious to look at the Philips 4052 datasheet to help explain the operation of the device in Nozawa." Ex. 1002 ¶¶ 152–53. Philips 4052 provides details on the function of the chip, including a functional diagram as Figure 4, depicted below:

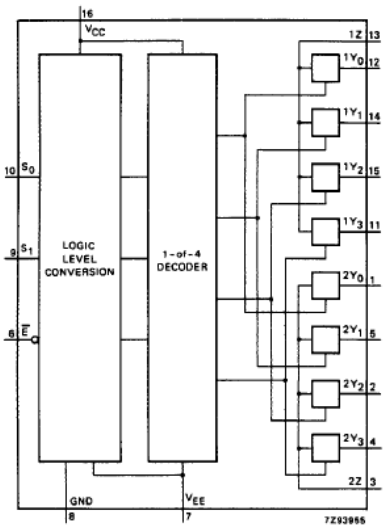

Fig.4 Functional diagram.

Figure 4 of Philips 4052 shows the inputs at various pins 1–16 of the 74HC4052 chip and how those inputs are fed to various components within the chip. Each of pins 1–5 and 11–15 is connected to a CMOS switch, detailed in Figure 5 of Philips 4052. Ex. 1004, 4; Ex. 1002 ¶ 144.

3. Level of Ordinary Skill in the Art

Qualcomm contends, citing Dr. Larson's testimony, that one of ordinary skill in the art

> as of October 1998 would possess, at a minimum, either (a) a master of science degree in electrical engineering and two or more years of experience in radio frequency circuit design, or (b) a bachelor of science degree in electrical engineering with three or more years of experience with the design and development of RF circuits.

Pet. 10–11 (citing Ex. 1002 ¶¶ 31–39). ParkerVision does not contest Qualcomm's designation of the level of ordinary skill in the art as of the date of the invention. Accordingly, we adopt Qualcomm's proposed level of ordinary skill in the art.

4. Proposed Combination of Nozawa and Philips 4052

Qualcomm contends that "Nozawa and Philips 4052 both provide architectures and methods for upconversion that can be used for a transmitter." Pet. 21. Indeed, as Qualcomm observes, the 74HC4052 chip described in Philips 4052 is used in Nozawa. *Id.* at 28–29. We agree with Qualcomm that a person of ordinary skill in the art would have had reason to look to the disclosure of Philips 4052 to learn more about the operation of the 74HC4052 chip disclosed in Nozawa. ParkerVision does not challenge that a person of ordinary skill in the art would have combined Nozawa with Philips 4052.

Nor does ParkerVision contest that most of the limitations of the challenged claims are taught by Nozawa and Philips 4052. With respect to apparatus claim 21, for example, Qualcomm relies upon Nozawa's SSB Generator Circuit, as informed by the disclosure of Philips 4052, to provide each element of the claim. Pet. 22–42. Qualcomm contends that the 74HC4052 chip is the claimed "switch module," which receives a bias signal from one or more of the AF Inputs, and generates a periodic signal having a plurality of harmonics. *Id.* at 28–37. Qualcomm cites to Dr. Larson's testimony, which explains that the oscillating signals sent to each switch of the 4052 chip "gate" the bias signal, by causing the switch to change from an ON-state to an OFF-state. Ex. 1002 ¶ 190.

Qualcomm also contends that the 74HC4052 chip of Nozawa receives two local oscillator signals at pins 9 and 10, which are then converted using the chip's "1-of-4 DECODER" into four 25% duty cycle signals. Pet. 22–27. Dr. Larson testifies that a 1-of-4 decoder (also known as a 1-of-4 demultiplexer) was well known to those of ordinary skill in the art and

would have been understood to shape waveforms in the same manner as the pulse shaper of the '940 patent. Ex. 1002 ¶¶ 165–167. Thus, Qualcomm concludes that the 1-of-4 decoder of the Philips 4052 chip satisfies claim 21's requirement of a "pulse shaping module" under either proposed construction of the term. Pet. 24–28.

Similarly, for method claim 25, Qualcomm contends that the first step of "shaping an oscillating signal" is disclosed by the 1-of-4 decoder of Nozawa, which creates a string of four 25% duty cycle oscillating signals. *Id.* at 43. The second step, which requires "gating a reference signal . . . to create a periodic signal having a plurality of harmonics," is said to be taught by Nozawa's gating of the audio AF input signal using the four 25% duty cycle oscillating signals and the switches of the Philips 4052 chip. *Id.* at 43–46. And, with respect to claim 25's third step, Qualcomm contends that "outputting said periodic signal . . . having an amplitude that is a function of said reference signal" is taught by Nozawa outputting an upconverted periodic signal from its 74HC4052 chip. *Id.* at 47.

As such, Qualcomm argues that the proposed combination of Nozawa and Philips 4052 teaches each limitation of the independent claims. ParkerVision contests only one limitation: whether Qualcomm has proven that the combination discloses a "plurality of harmonics." PO Resp. 25–32. We address this argument below.

As to the uncontested limitations of claims 21 and 25, as well as the additional limitations of the challenged dependent claims, we have reviewed Qualcomm's unchallenged arguments and evidence on these points (Pet. 22–53), find them persuasive that the references teach the limitations, and adopt Qualcomm's analysis as our findings herein. Additionally, we agree with

Qualcomm that one of ordinary skill in the art would have been prompted to look to the disclosure of Philips 4052 to learn more about the operation of the 74HC4052 chip taught in Nozawa. Accordingly, one of ordinary skill in the art had a reason with rational underpinnings to combine the teachings of Philips 4052 and Nozawa.

5. Analysis of Apparatus Claims

Claim 21 and its dependent claims are directed to apparatuses for frequency up-conversion that have, *inter alia*, "a switch module to receive [a] shaped string of pulses and a bias signal, wherein said shaped string of pulses causes said switch module to gate said bias signal and thereby generate a periodic signal having a plurality of harmonics." ParkerVision's sole[3] argument for patentability is that the combination of Nozawa and Philips 4052 fails to teach or suggest this limitation, particularly the "plurality of harmonics." PO Resp. 25–32.

Qualcomm argues that Nozawa teaches generating a periodic signal from its 74HC4052 chip (Pet. 35–36), shown highlighted in green in the following portion of Nozawa's Figure 8, as annotated by Dr. Larson:

[3] ParkerVision also argues that the prior art does not teach a filter to isolate the desired harmonics of a plurality of harmonics, but this argument is based entirely on the prior argument that no plurality of harmonics is generated. PO Resp. 32. Resolution of the "plurality of harmonics" issue, therefore, resolves the "filter" issue.

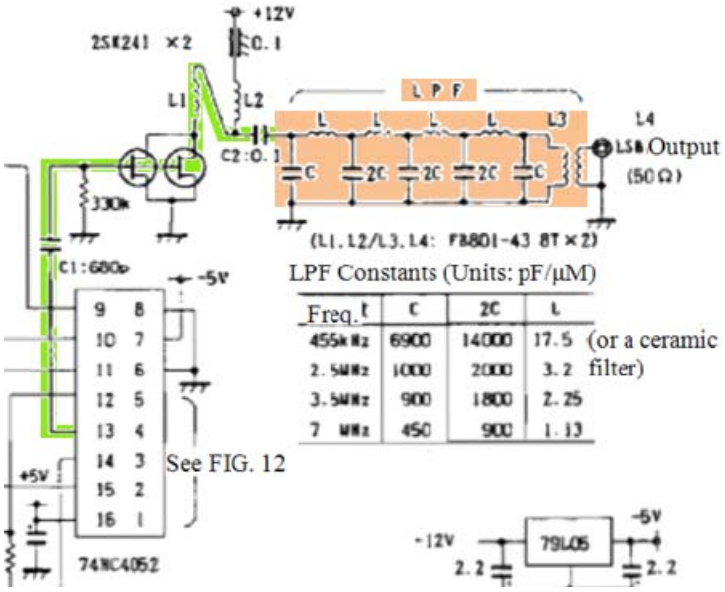

Figure 8 of Nozawa, as annotated by Dr. Larson, shows a periodic signal (green highlight), produced by chip 74HC4052 at pin 13, going to a low-pass filter (LPF, orange highlight). Ex. 1002 ¶ 200. Qualcomm points to Nozawa's statement that the low-pass filter is needed because "the method used to realize this system is 'switching,' which in principle includes many harmonics." Ex. 1003, 20. Dr. Larson also testifies that a person of ordinary skill in the art would have recognized that the output signal of the 74HC4052 chip contains harmonics, using the formula for mixer output frequencies given in Maas.[4] Ex. 1002 ¶ 194 (citing Ex. 1017, 30).

In response, ParkerVision contends that Nozawa does not disclose expressly that its periodic signal contains a plurality of harmonics, because there is no evidence that the "many harmonics" of Nozawa are the integer multiple harmonics required by the claims. PO Resp. 27–28. On this point, we agree with ParkerVision. Nozawa's disclosure that the output "in

[4] Stephen A. Maas, MICROWAVE MIXERS (Artech House Publishers, 2nd ed. 1993) (Ex. 1017).

principle" contains many harmonics does not convince us that the output actually, or necessarily, contains the integer multiple harmonics.

Regarding the Maas equation, ParkerVision directs us to a portion of Dr. Larson's deposition, in which Dr. Larson used the Maas equation to calculate the harmonics produced by a mixer, given certain assumed inputs supplied by ParkerVision's counsel (an input signal of 100 kHz and an LO input of 1 MHz). *Id.* at 29–31 (citing Ex. 2001, 177–87). ParkerVision notes that Dr. Larson's calculations produced -0.9, 3.1, and -4.9 MHz as the first three harmonics, which are not integer multiples. PO Resp. 31. Thus, ParkerVision argues, the circuit of Nozawa does not necessarily produce a plurality of harmonics, defined by the '940 patent as being integer multiples of the fundamental frequency. *Id.*

Qualcomm argues that the Maas equation "shows that Nozawa will necessarily produce the required 'integer multiple' harmonics for *many* input frequencies." Pet. Reply 4 (emphasis added). According to Qualcomm, it is not required to show that Nozawa will produce integer multiple harmonics for all operating conditions; rather, it is only relevant that Nozawa *could* be operated to produce the harmonics. *Id.* Regarding Dr. Larson's calculations during his deposition, Qualcomm contends that even using the assumed inputs provided by ParkerVision, the Maas equation shows that the 35th and 37th harmonics are 35.1 and -36.9 MHz, respectively, which are integer multiples of the fundamental frequency of 0.9 MHz. *Id.* at 7. Qualcomm also notes that selecting slightly different input frequencies for the Maas equation will produce much lower integer multiple harmonics, such as at the 7th and 9th harmonics. *Id.* at 8.

The parties' disagreements over the various inputs and permutations of the Maas equation aside, one point appears to be beyond dispute: under some conditions, but not all conditions, the Maas equation shows that Nozawa's structure will produce a periodic signal that contains integer multiples of the fundamental frequency. In other words, the structure of Nozawa is *capable* of producing a signal that satisfies the limitations of the claim. Qualcomm argues that this is sufficient to show unpatentability. Pet. Reply 13 (citing *Gen. Electric Co. v. Jewel Incandescent Lamp Co.*, 326 U.S. 242, 248–49 (1945)). On this point, we agree. Claim 21 and its dependents are apparatus claims; as such, they "cover what a device *is*, not what a device *does*." *Hewlett-Packard Co. v. Bausch & Lomb Inc.*, 909 F.2d 1464, 1469 (Fed. Cir. 1990). In other words, the "periodic signal" limitations, which are directed to the transitory electrical signals produced by the apparatus, cannot give rise to patentability so long as the underlying apparatus has been shown to be capable of generating those signals. Here, it is undisputed that Nozawa's circuit is capable of generating a periodic signal having a plurality of harmonics, wherein those harmonics are integer multiples of the fundamental frequency. Furthermore, we agree with Qualcomm that Nozawa's low-pass filter is capable of isolating one or more of those harmonics, as desired.

Accordingly, we find that Qualcomm has shown, by a preponderance of the evidence, that the combination of Nozawa and Philips 4052 teaches each and every limitation of claims 21, 281, 283–286, 288, 289, and 293. Additionally, for the reasons discussed above, we find that Qualcomm has shown that one of ordinary skill in the art would have been prompted to combine the teachings of the references in the manner proposed.

6. Analysis of Method Claims

Claims 25 and its dependents are directed to methods of communicating requiring, *inter alia*, the step of "gating a reference signal at a rate that is a function of [a] string of pulses to create a periodic signal having a plurality of harmonics." As above, this is the sole limitation that ParkerVision asserts is not disclosed by the combination of Nozawa and Philips 4052. PO Resp. 25–32. Unlike the above analysis of the apparatus claims, however, for these method claims it is not sufficient for Qualcomm to show that Nozawa *could* be operated in a manner that meets the claimed method; rather, Qualcomm must show that a person of ordinary skill in the art *would* have performed the method as claimed.

On this point, Qualcomm's Petition is deficient. The Petition cites to Nozawa's recitation that its periodic signal "in principle includes many harmonics," and also Dr. Larson's testimony regarding the Maas equation. Pet. 45 (citing Ex. 1003, 20). But, as discussed above, these arguments merely show that the Nozawa chip *could*, if given the proper inputs, produce the required harmonics. The Petition does not speak to whether a person of ordinary skill in the art *would* have any reason to do so.

In its Reply, Qualcomm argues that "a person skilled in the art would have been motivated to select input and control signal frequencies for Nozawa's transceiver in order to generate" the claimed harmonics. Pet. Reply 11. For this proposition, Qualcomm cites Maas's discussion of subharmonically pumped mixers. *Id.* at 12 ("For many applications, it is expensive, inconvenient, or even impossible to generate a fundamental-frequency LO. . . . In these cases, it may be wise to use a mixer that is pumped at half the LO frequency, and to mix the RF signal with the second

harmonic of the junction's conductance waveform." (quoting Ex. 1017, 34–35)). Qualcomm also points to Dr. Larson's testimony that "the idea of potentially transmitting a higher harmonic is nearly as old as radio itself." *Id.* (citing Ex. 1002 ¶ 96).

ParkerVision objected to these arguments, because they allegedly were raised for the first time in Qualcomm's Reply. We agree. While the evidence cited by Qualcomm was not new to the record, we consider the arguments to be a new theory of unpatentability, improperly raised for the first time in the Reply.

An *inter partes* review trial before the Board is a formal adjudication under the Administrative Procedure Act; as such, the parties to the trial are guaranteed certain procedural protections. *See Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1080 (Fed. Cir. 2015) ("A patent owner . . . is undoubtedly entitled to notice of and a fair opportunity to meet the grounds of rejection."). Significant among these protections is that parties must be given notice of the "matters of fact and law asserted," and the opportunity to meaningfully respond. *Id.* For this reason, the United States Court of Appeals for the Federal Circuit has held that we may not base our patentability decision on late-arising factual assertions or theories. *See Dell Inc. v. Acceleron, LLC*, 818 F.3d 1293, 1301 (Fed. Cir. 2016). In *Dell*, "an opportunity to respond was needed when the petitioner, to make its anticipation showing, newly pointed to a previously unmentioned portion of the allegedly anticipatory prior-art patent, even though it had earlier focused extensively on other portions of that prior-art patent." *In re Nuvasive Inc.*, 841 F.3d 966, 972 (Fed. Cir. 2016) (discussing *Dell*, 818 F.3d at 1301).

To be sure, we are not "limited to citing only portions of the prior art specifically drawn to [our] attention" in a petition. *Id.* at 971. But where the newly cited portions are "sufficiently distinct" from those previously presented by a party, the opposing party is entitled to the opportunity to respond. *Id.* at 972. Therefore, while we must consider the disclosure of a prior art reference as a whole, this does not mean that we may permit Qualcomm to change its theory of unpatentability during trial.

From the Petition, it is apparent that Qualcomm's theory of unpatentability rested on the assertion that Nozawa *taught* a plurality of harmonics. Pet. 45 ("Nozawa itself recognizes that its switch *would* create an output periodic signal with a plurality of harmonics.") (emphasis added); *id.* at 37 ("Maas also teaches that switches such as those in the 74HC4052 *generate* an output signal with harmonics of the fundamental frequency.") (emphasis added). Dr. Larson's testimony in support of the Petition also leads to this conclusion. *See* Ex. 1002 ¶ 241 ("Nozawa *discloses* generating a periodic signal having a plurality of harmonics.") (emphasis added); *see id.* ¶ 242 ("[T]hose of skill in the art would recognize that each switch in the 74HC4052 *will* generate an output signal with harmonics of the fundamental frequency.") (emphasis added). There is no relevant discussion, in either the Petition or Dr. Larson's Declaration, of the need for a person of ordinary skill in the art to select operating conditions that would cause Nozawa to generate a plurality of integer-multiple harmonics or why one of ordinary skill in the art would have done so.

To support its position that its argument is not new, Qualcomm directs us to a statement in its Petition that "the difference between selecting the fundamental frequency (n = 1) and a harmonic (n > 1) would have been

obvious to a person of skill." Paper 27, item #11 (quoting Pet. 41). We are not persuaded. This argument was provided in a ground of unpatentability on which we did not institute trial, because it was conditioned on a construction of "harmonics" that excluded the fundamental frequency. Pet. 41, 46. Qualcomm had argued it would have been obvious, in view of Maas, to operate the local oscillator of Nozawa at a sub-harmonic and then select a desired harmonic to transmit. *Id.* This is a different argument than Qualcomm is making in its Reply: that a person of ordinary skill in the art would have selected the inputs of Nozawa to produce *integer-multiple* harmonics of the fundamental frequency.

For these reasons, we do not rely on Qualcomm's late-arising theory on pages 11–12 of its Reply, that a person of ordinary skill in the art would have operated Nozawa in a manner to generate the claimed plurality of harmonics. Accordingly, Qualcomm has not shown that Nozawa and Philips 4052 teach the claimed step of "gating a reference signal . . . to create a periodic signal having a plurality of harmonics" recited in claim 25 and, via dependency, claims 26, 363–366, 368, 369, and 373.

III. CONCLUSION

We have reviewed the evidence and arguments presented by the parties and found that a person of ordinary skill in the art would have had reason to combine the disclosures of Nozawa and Philips 4052 and would have had a reasonable expectation of success in doing so, and the combination would have taught all elements of the challenged apparatus claims. Furthermore, ParkerVision has not presented any evidence pertaining to objective indicia of nonobviousness. We conclude that Qualcomm has met its burden to prove, by a preponderance of the evidence,

that claims 21, 281, 283–286, 288, 289, and 293 would have been obvious over the combined disclosures of Nozawa and Philips 4052. We conclude, however, that Qualcomm has not met its burden to prove, by a preponderance of the evidence, that claims 25, 26, 363–366, 368, 369, and 373 are unpatentable.

IV. ORDER

Accordingly, it is:

ORDERED that claims 21, 281, 283–286, 288, 289, and 293 of U.S. Patent No. 6,091,940 are *unpatentable*;

FURTHER ORDERED that claims 25, 26, 363–366, 368, 369, and 373 of U.S. Patent No. 6,091,940 *have not been proven unpatentable*;

FURTHER ORDERED that, pursuant to 35 U.S.C. § 318(b), upon expiration of the time for appeal of this Decision, or the termination of any such appeal, a certificate shall issue canceling claims 21, 281, 283–286, 288, 289, and 293, and confirming the patentability of claims 25, 26, 363–366, 368, 369, and 373, of U.S. Patent No. 6,091,940; and

FURTHER ORDERED that, because this is a Final Written Decision, parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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