

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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GOOGLE LLC,  
Petitioner,

v.

KONINKLIJKE PHILIPS N.V.,  
Patent Owner.

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Case IPR2017-00437  
Patent 6,772,114 B1

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Before KEVIN F. TURNER, ROBERT J. WEINSCHENK, and  
KAMRAN JIVANI, *Administrative Patent Judges*.

WEINSCHENK, *Administrative Patent Judge*.

FINAL WRITTEN DECISION  
*35 U.S.C. § 318(a)*

## I. INTRODUCTION

Google LLC (“Petitioner”) filed a Petition (Paper 2, “Pet.”) requesting an *inter partes* review of claims 10–16, 20, and 21 (“the challenged claims”) of U.S. Patent No. 6,772,114 B1 (Ex. 1001, “the ’114 patent”). Koninklijke Philips N.V. (“Patent Owner”) filed a Preliminary Response (Paper 6, “Prelim. Resp.”) to the Petition. On June 8, 2017, we instituted an *inter partes* review of the challenged claims of the ’114 patent on the following grounds:

<b>Claims</b>	<b>Statutory Basis</b>	<b>Applied Reference(s)</b>
10–15 and 20	35 U.S.C. § 102(b) <sup>1</sup>	Tucker et al., PCT Publication No. WO 98/52187 (published Nov. 19, 1998) (Ex. 1004, “Tucker”)
10–16, 20, and 21	35 U.S.C. § 103(a)	Tucker and the well-known art

Paper 10 (“Dec. on Inst.”), 14.

After institution, Patent Owner filed a Response (Paper 14, “PO Resp.”) to the Petition, and Petitioner filed a Reply (Paper 18, “Pet. Reply”) to the Response. An oral hearing was held on February 13, 2018, and a transcript of the hearing is included in the record. Paper 33 (“Tr.”).

We issue this Final Written Decision pursuant to 35 U.S.C. § 318(a). For the reasons set forth below, Petitioner has not shown by a preponderance

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<sup>1</sup> The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112-29, which was enacted on September 16, 2011, made amendments to 35 U.S.C. §§ 102, 103. AIA § 3(b), (c). Those amendments became effective eighteen months later on March 16, 2013. *Id.* § 3(n). Because the application from which the ’114 patent issued was filed before March 16, 2013, any citations herein to 35 U.S.C. §§ 102, 103 are to their pre-AIA versions.

of the evidence that claims 10–16, 20, and 21 of the '114 patent are unpatentable.

A. *Related Proceedings*

The parties indicate that the '114 patent is the subject of the following cases in the United States District Court for the District of Delaware:

*Koninklijke Philips N.V. v. ASUSTeK Computer Inc.*, No. 1:15-cv-01125 (D. Del.); *Koninklijke Philips N.V. v. HTC Corp.*, No. 1:15-cv-01126 (D. Del.); *Koninklijke Philips N.V. v. Visual Land, Inc.*, No. 1:15-cv-01127 (D. Del.); *Koninklijke Philips N.V. v. Southern Telecom, Inc.*, No. 1:15-cv-01128 (D. Del.); *Koninklijke Philips N.V. v. Double Power Technology, Inc.*, No. 1:15-cv-01130 (D. Del.); *Koninklijke Philips N.V. v. Yifang USA, Inc.*, No. 1:15-cv-01131 (D. Del.); and *Koninklijke Philips N.V. v. Acer Inc.*, No. 1:15-cv-01170 (D. Del.). Pet. 9; Paper 4, 2–3.

B. *The '114 Patent*

The '114 patent relates to a transmission system that splits a signal into a low frequency portion and a high frequency portion. Ex. 1001, 1:8–13. According to the '114 patent, prior transmission systems that split a signal into spectral portions required considerable computation capacity. *Id.* at 1:52–57. The transmission system described in the '114 patent purports to improve upon those prior systems by reducing computation capacity. *Id.* at 1:60–62. Specifically, the '114 patent describes a transmitter that uses Linear Predictive Coding (“LPC”) to code the high frequency portion of a signal prior to transmission. *Id.* at 2:10–12. LPC coding reduces the computation capacity of a coding device in the transmitter because LPC

coding does not require a down-sampler.<sup>2</sup> *Id.* at 2:12–17. In addition, the '114 patent describes a receiver that uses white noise as a source to reconstruct the high frequency portion of a received signal. *Id.* at 2:18–24. This reduces the computation capacity of the receiver. *Id.* at 2:25–28.

C. *Illustrative Claim*

Claims 10 and 20 are independent. Claim 10 is reproduced below.

10. A transmission system, comprising:

a transmitter including

a splitter for splitting up a transmission signal into a low frequency signal within a low frequency range and a high frequency signal within a high frequency range, the low frequency range being lower than the high frequency range,

a first coder for deriving a first coded signal within the first frequency range from the low frequency signal, and

a second coder for deriving a second coded signal within the high frequency range from the high frequency signal;

a receiver in electrical communication with said transmitter to receive the first coded signal and the second coded signal, said receiver including

a first decoder for sequentially applying a narrow-band decoder, an up-sampler and a low-pass filter to the first coded signal to generate a first reconstructed signal within the first frequency range, and

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<sup>2</sup> A down-sampler reduces the sampling rate of a signal, whereas an up-sampler increases the sampling rate of a signal. Ex. 1002 ¶¶ 52, 54. A down-sampler typically is applied by a transmitter to reduce the bandwidth of a signal before transmission, and an up-sampler typically is applied by a receiver to reconstruct the original signal. *Id.* ¶¶ 53, 55.

a second decoder, wherein, based on the second coded signal, said second decoder sequentially applies a high-pass filter, a LPC synthesis filter and an amplifier to a noise signal to generate the second reconstructed signal.

Ex. 1001, 7:50–8:7.

## II. ANALYSIS

### A. *Level of Ordinary Skill in the Art*

Petitioner argues that a person of ordinary skill in the art would have had “a Master’s degree or better in electrical engineering (or a related discipline) with an emphasis in signal processing and at least 3 years of engineering experience,” as well as “experience with signal processing and the design of speech encoding and decoding schemes.” Pet. 23 (citing Ex. 1002 ¶¶ 30–31). Patent Owner does not dispute Petitioner’s definition of the level of ordinary skill in the art. *See* PO Resp. 11–12. Patent Owner also does not provide its own definition. *See id.* Based on the evidence of record, including the types of problems and solutions described in the ’114 patent and the asserted prior art, we adopt Petitioner’s definition of the level of ordinary skill in the art. Pet. 23; Ex. 1002 ¶¶ 30–31.

### B. *Claim Construction*

The claims of an unexpired patent are interpreted using the broadest reasonable interpretation in light of the specification of the patent in which they appear. 37 C.F.R. § 42.100(b); *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2144–45 (2016). “Under a broadest reasonable interpretation, words of the claim must be given their plain meaning, unless such meaning is inconsistent with the specification and prosecution history.” *TriVascular, Inc. v. Samuels*, 812 F.3d 1056, 1062 (Fed. Cir. 2016). An applicant may provide a definition of a term in the specification with reasonable clarity,

deliberateness, and precision. *In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994). In the absence of such a definition, limitations are not to be read into the claims from the specification. *In re Van Geuns*, 988 F.2d 1181, 1184 (Fed. Cir. 1993).

1. “*high-pass filter*”

Petitioner proposes construing the term “high-pass filter” to mean “a device or programming sequence that transmits frequencies above a given cutoff frequency and substantially attenuates all others.” Pet. Reply 3.

Petitioner argues that its proposed construction is supported by the specification of the ’114 patent and certain extrinsic evidence. *Id.* at 3–5 (citing Ex. 1001, 3:13–29, Fig. 2; Ex. 1002 ¶¶ 78–81; Ex. 1006, 271–274; Ex. 1042, 207; Ex. 1043, 45:4–46:25; Ex. 1044 ¶¶ 12–13; Ex. 2014 ¶¶ 30, 32, 45). Patent Owner proposes construing the term “high-pass filter” to mean “a filter that transmits frequencies above a given cutoff frequency and substantially attenuates all others.” PO Resp. 15. Patent Owner argues that its proposed construction also is supported by the specification of the ’114 patent and certain extrinsic evidence. *Id.* (citing Ex. 1001, 5:23–31; Ex. 2013, 246; Ex. 2014 ¶¶ 68–71; Ex. 2022, 34:13–36:23, 47:3–25).

The parties agree that a high-pass filter is a filter that transmits frequencies above a given cutoff frequency and substantially attenuates all others. PO Resp. 15; Pet. Reply 3–4. The parties’ agreement is consistent with the specification of the ’114 patent, which states that a signal “is processed by a sixth-order Infinite Impulse Response high-pass filter (‘IIRHPF’) 51 that has a 3500 Hz cut-off frequency, so that a filtered noise signal arises which has a frequency range that is comparable to the frequency range of the signal having a high frequency range.” Ex. 1001,

5:26–31. The parties’ agreement also is supported by a dictionary definition of the term “high-pass filter” (Ex. 2013, 246), and the testimony of Petitioner’s declarant, Dr. Schuyler Quackenbush, and Patent Owner’s declarant, Dr. Michael Johnson (Ex. 2014 ¶¶ 68–71; Ex. 2022, 34:13–36:23).

Petitioner contends that Patent Owner’s proposed construction “is incomplete . . . because its definition circularly uses the term ‘filter,’ without explanation.” Pet. Reply 4. According to Petitioner, the term “filter” refers to a device or programming sequence. *Id.* at 3–4. Petitioner’s proposed construction of the term “filter” is consistent with the specification of the ’114 patent, which states:

The input signal is split up into two spectral portions, the signal having a low frequency range being the result of the processing of the input signal with the low-pass filter (“LPF”) 27, and the signal having a high frequency range being the result of determining the difference between the signal having a low frequency range coming from the low-pass filter 27 and the input signal delayed by a delay element (“DELAY”) 25.

Ex. 1001, 3:13–20. Petitioner’s proposed construction of the term “filter” also is supported by a dictionary definition of the term “filter” (Ex. 1042, 207), and the testimony of Petitioner’s declarant, Dr. Quackenbush (Ex. 1044 ¶¶ 12–13).

For the foregoing reasons, we construe the term “high-pass filter” to mean “a device or programming sequence that transmits frequencies above a given cutoff frequency and substantially attenuates all others.”

## 2. *Remaining Claim Terms and Phrases*

Petitioner proposes construing the phrase “second decoder sequentially applies a high-pass filter, a LPC synthesis filter and an amplifier

to a noise signal” (Pet. 25–26), and both parties propose construing the phrase “second coded signal within a high frequency range” (PO Resp. 12–14; Pet. Reply 3). We determine that those claim phrases do not require express construction to resolve the parties’ disputes regarding the asserted grounds of unpatentability in this case. *See infra* Sections II.C, II.D; *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (“[O]nly those terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy.”).

C. *Anticipation of Claims 10–15 and 20 by Tucker*

Petitioner argues that claims 10–15 and 20 are anticipated by Tucker. Pet. 10–11. A claim is anticipated if each limitation of the claim is disclosed in a single prior art reference arranged as in the claim. *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1369 (Fed. Cir. 2008). We have considered the parties’ arguments and supporting evidence, and we determine that Petitioner has not shown by a preponderance of the evidence that claims 10–15 and 20 are anticipated by Tucker.

1. *Overview of Tucker*

Tucker relates to “an audio coding system for encoding and decoding an audio signal.” Ex. 1004, 6:2–5. Specifically, to encode an input signal, Tucker discloses that the input signal is low-pass filtered to form a lower sub-band signal and decimated.<sup>3</sup> *Id.* at 13:19–24, Fig. 1. The lower sub-band signal is then supplied to a narrowband encoder, which may be a vocoder or waveband encoder. *Id.* at 14:5–7, Fig. 1. The input signal also is high-pass filtered to form an upper sub-band signal and decimated. *Id.* at

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<sup>3</sup> The term “decimate” in Tucker refers to down-sampling. Ex. 1002 ¶ 132 (“decimating (or downsampling)”); Ex. 2014 ¶ 88.

13:19–24, Fig. 1. The upper sub-band signal is then supplied to an upper sub-band analyzer, which analyzes the spectrum of the upper sub-band signal to determine its parametric coefficients and noise component. *Id.* at 14:7–10, Fig. 1. The spectral parameters and the log of the noise energy are differentially encoded, supplied to a Rice coder, and then combined with the coded output from the narrowband encoder. *Id.* at 14:11–15, Fig. 1.

To decode the encoded input signal, Tucker discloses that spectral parameters are obtained from the encoded data for the upper sub-band signal and applied to a spectral shape filter. *Id.* at 14:16–18, Fig. 2. The spectral shape filter produces a synthesized non-harmonic upper sub-band signal whose gain is adjusted in accordance with the noise energy value. *Id.* at 14:18–21, Fig. 2. The synthesized signal is supplied to a processor, which interpolates<sup>4</sup> the signal and reflects it to the upper sub-band. *Id.* at 14:21–23, Fig. 2. The encoded data for the lower sub-band signal is decoded by a narrowband decoder, interpolated, and then recombined with the upper sub-band signal to form a synthesized output signal. *Id.* at 14:23–27, Fig. 2.

## 2. *Claims 10 and 20*

Claim 10 recites, *inter alia*, a receiver that includes “a second decoder, wherein, based on the second coded signal, said second decoder sequentially applies a high-pass filter, a LPC synthesis filter and an amplifier to a noise signal to generate the second reconstructed signal.” Ex. 1001, 8:3–7. Claim 20 recites a similar limitation. *Id.* at 10:1–8. Petitioner contends that Tucker discloses an upper sub-band decoder that applies a

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<sup>4</sup> The term “interpolate” in Tucker refers to up-sampling followed by low-pass filtering. Ex. 1002 ¶ 142 (“an up-sampler followed by a low pass filter”); Ex. 2014 ¶ 106.

spectral shaping filter, a gain multiplier, and a processor to a noise signal. Pet. 39 (citing Ex. 1004, Fig. 2). With respect to the high-pass filter recited in claims 10 and 20, Petitioner contends:

*First*, Tucker’s disclosure of a “processor 26” confirms that a “high pass filter” is among the components sequentially applied to the white noise signal. This processor interpolates (upsamples) the signal and “reflect[s]” the signal to the “upper band,” as shown in Figure 2. The POSA would understand that the teaching of “reflecting to the upper band” is a teaching that one should apply a “reflected” low pass filter (i.e., a high pass filter) to the signal, as illustrated below. Ex. 1002 (Quackenbush) ¶¶ 150–52.

Pet. 39–40 (internal footnote omitted), 53–54.<sup>5</sup> In a footnote, Petitioner further asserts:

Though interpolation typically involves application of a low pass filter to a signal, a “reflected” low pass filter is understood in the art to be a high pass filter. Ex. 1002 (Quackenbush) ¶¶ 150-[1]51. Thus, the “interpolation” procedure invoked by the processor 26 in Tucker would be understood to apply a high pass filter to the signal. *Id.*

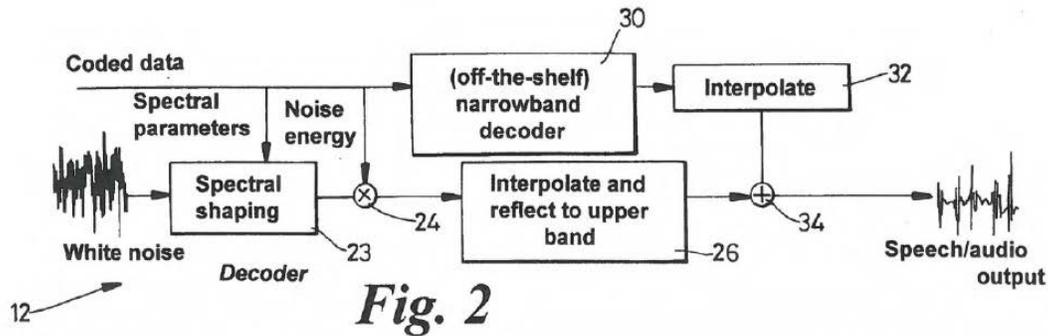
Pet. 40 n.4. In other words, Petitioner contends that the phrase “[i]nterpolate and reflect to upper band” in Figure 2 of Tucker discloses a high-pass filter. *Id.* at 39–40, 53–54.

Patent Owner responds that Petitioner has not shown sufficiently that Tucker discloses a decoder that applies a high-pass filter. PO Resp. 50–58.

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<sup>5</sup> Petitioner includes a figure on pages 40 and 54 of the Petition that purportedly shows the “‘Reflected’ Magnitude Response of the Low-Pass Filter.” Pet. 40, 54. That figure is not from Tucker. That figure is from a different document (Ex. 1025, Fig. 4.1-8) and includes annotations by Petitioner’s declarant, Dr. Quackenbush (Ex. 1002 ¶ 151). As discussed below, Tucker does not disclose a reflected low-pass filter.

We agree with Patent Owner. As discussed above, Petitioner contends that processor 26 in Figure 2 of Tucker includes a high-pass filter. Pet. 39–40, 53–54. Figure 2 of Tucker is reproduced below.



Ex. 1004, Fig. 2. Figure 2 of Tucker is a block diagram of a decoder. *Id.* at 10:18–20. The block for processor 26 in Figure 2 of Tucker states “[i]nterpolate and reflect to upper band.” *Id.* at Fig. 2. Petitioner asserts that the term “[i]nterpolate” in Figure 2 of Tucker refers to an up-sampler followed by a low-pass filter. Pet. 38 (“It was well-known in the art as of the priority date that an interpolator comprises an up-sampler followed by a low-pass filter.”); Pet. Reply 24 (“‘Interpolate’ means ‘upsample and low-pass filter.’”); Tr. 5:12–6:6; Ex. 1002 ¶¶ 54, 142, 151; Ex. 1044 ¶ 50. Thus, to show that processor 26 in Figure 2 of Tucker includes a high-pass filter,

Petitioner relies on the phrase “reflect to upper band.”<sup>6</sup> Pet. 39–40 (“The POSA would understand that the teaching of ‘reflecting to the upper band’ is a teaching that one should apply a ‘reflected’ low pass filter (i.e., a high pass filter).”), 53 (same); Pet. Reply 24 (“Box 26, in contrast, also says ‘reflect to upper band.’”); Tr. 5:12–6:6; Ex. 1002 ¶¶ 150–153; Ex. 1044 ¶¶ 48–50.

Specifically, Petitioner argues that the phrase “reflect to upper band” means that processor 26 in Tucker applies “a ‘reflected’ low pass filter (i.e., a high pass filter).” Pet. 39, 53; *see* Ex. 1002 ¶ 151; Ex. 1044 ¶ 48. In other words, Petitioner argues that the phrase “reflect to upper band” means that the low-pass filter itself is reflected to the upper band. Pet. 39, 53; Ex. 1002 ¶ 151; Ex. 1044 ¶ 48. Similarly, Petitioner’s declarant, Dr. Quackenbush, states that “if the low-pass filter that is used in conjunction with the Tucker PCT had a cutoff frequency of 4kHz . . . , *the ‘reflected’ version of this filter used in the upper band would be a high-pass filter with a cutoff frequency of 4kHz.*” Ex. 1002 ¶ 151 (emphasis added). Dr. Quackenbush also cites to Smith<sup>7</sup> as evidence that using spectral reversal to create a high-pass filter from a low-pass filter was well-known in the art. *Id.* ¶ 152.

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<sup>6</sup> We do not understand Petitioner as asserting that the term “[i]nterpolate” in Figure 2 of Tucker by itself refers to a high-pass filter. However, to the extent Petitioner presents such an argument, it is not persuasive. First, it is inconsistent with Petitioner’s assertion that the term “[i]nterpolate” in Figure 2 of Tucker refers to an up-sampler followed by a low-pass filter. Pet. 38; Pet. Reply 24; Tr. 5:12–6:6; Ex. 1002 ¶¶ 54, 142, 151; Ex. 1044 ¶ 50. Second, if the term “[i]nterpolate” in Figure 2 of Tucker by itself referred to a high-pass filter, it would render the phrase “reflect to upper band” superfluous, as there would be no reason to reflect the output of a high-pass filter to the upper band. Ex. 2014 ¶¶ 118–119.

<sup>7</sup> Steven W. Smith, *The Scientist and Engineer’s Guide to Digital Signal Processing* (1st ed. 1997) (Ex. 1006, “Smith”).

Petitioner's argument is not persuasive. As Patent Owner points out, the written description of Tucker indicates that the phrase "reflect to upper band" in Figure 2 refers to reflecting a signal to the upper band, not reflecting the low-pass filter to the upper band. PO Resp. 55 ("the last step in the processor is to reflect the signal to the upper band"); Ex. 2014 ¶ 121. In particular, Tucker states that "[t]he synthesised signal then passes to a processor 26[,] which *interpolates the signal and reflects it* to the upper sub-band." Ex. 1004, 14:21–23 (emphasis added). In other words, Tucker discloses that processor 26 interpolates a signal (which, as discussed above, involves applying an up-sampler and a low-pass filter) and then reflects the interpolated signal to the upper band. *Id.*; Tr. 6:25–7:8; Ex. 2014 ¶ 121 ("The 'it' in this sentence is clearly referring back to the signal itself."). Thus, contrary to Petitioner's assertion, Tucker does not disclose reflecting a low-pass filter to the upper band so as to create a high-pass filter.

Petitioner also argues that, even if the phrase "[i]nterpolate and reflect to upper band" in Figure 2 of Tucker means that processor 26 applies an up-sampler, a low-pass filter, and then reflects the output of the low-pass filter to the upper band, Tucker still discloses a high-pass filter. Pet. Reply 20–26. Specifically, Petitioner contends that Tucker discloses "a two-step process, where after interpolating and low-pass filtering, the low-frequency 0–4 kHz signal is reflected to the 4–8 kHz band." *Id.* at 25 (citing Ex. 1044 ¶ 48). According to Petitioner, because that two-step process produces an upper sub-band signal, the "implementation details are immaterial." Pet. Reply 25 (citing Ex. 1044 ¶ 48).

Petitioner's argument is not persuasive. As discussed above, we construe the term "high-pass filter" to mean a device or programming

sequence that transmits frequencies above a given cutoff frequency and substantially attenuates all others. *See supra* Section II.B.1. Consistent with that construction, Petitioner’s declarant, Dr. Quackenbush, explains that a high-pass filter “take[s] an input signal and then transmit[s] the higher frequencies of that input signal while substantially attenuating the lower frequencies of that signal.” Ex. 1044 ¶ 12. Further, according to Dr. Quackenbush, the difference between a low-pass filter and a high-pass filter is that “a low pass filter is applied to a signal to preserve its low frequency components, and . . . a high pass filter is applied to a signal to preserve its high frequency components.” Ex. 1002 ¶ 51.

As discussed above, Tucker discloses applying a low-pass filter to an input signal and then reflecting the output of the low-pass filter to the upper band. Pet. Reply 25; Tr. 6:25–7:8; Ex. 1004, 14:21–23; Ex. 2014 ¶ 121. In that sequence, the low-pass filter transmits frequencies of the input signal *below* a given cutoff frequency, thereby preserving the low frequency components of the input signal, and then reflects those low frequency components to a higher frequency band. Ex. 1002 ¶ 51; Ex. 2014 ¶ 122; Ex. 2023, 20:4–14. Petitioner acknowledged at the oral hearing that transmitting the low frequency components of an input signal and reflecting them to a higher frequency band is *not* the same as transmitting the high frequency components of an input signal. Tr. 7:22–8:6 (“if you were to simply take a low-pass filter and reflect its output you might not get the same result as if you applied a high-pass filter.”). Similarly, Petitioner’s declarant, Dr. Quackenbush, acknowledged that a low-pass filter whose output is reflected to the upper band does not transmit the high frequency components of an input signal. Ex. 2023, 66:5–17. Thus, although the

output of processor 26 in Tucker is an upper sub-band signal, processor 26 does not apply a high-pass filter. Tr. 7:22–8:6; Ex. 2014 ¶ 122; Ex. 2023, 66:5–17.

We are careful to note that we do not interpret the term “high-pass filter” to require a single-step operation. As Petitioner points out (Pet. Reply 4–5), the ’114 patent describes applying a high-pass filter by “determining the difference between the signal having a low frequency range coming from the low-pass filter 27 and the input signal delayed by a delay element (‘DELAY’) 25” (Ex. 1001, 3:13–20). In other words, the ’114 patent describes a two-step sequence for applying a high-pass filter. *Id.*

However, the sequence described by the ’114 patent is different than the sequence disclosed by Tucker. Specifically, the sequence described by the ’114 patent transmits frequencies of an input signal *above* a given cutoff frequency and substantially attenuates all others, thereby preserving the high frequency components of the input signal. Ex. 1002 ¶ 79. In contrast, although the output of processor 26 in Tucker is an upper sub-band signal, Tucker does not apply a high-pass filter. Tr. 7:22–8:6; Ex. 2014 ¶ 122; Ex. 2023, 66:5–17. As discussed above, the sequence disclosed by Tucker transmits frequencies of an input signal *below* a given cutoff frequency, thereby preserving the low frequency components of the input signal, and then reflects those low frequency components to a higher frequency band. Ex. 1004, 14:21–23; Ex. 1002 ¶ 51; Ex. 2014 ¶ 122; Ex. 2023, 20:4–14. As also discussed above, transmitting the low frequency components of an input signal and reflecting them to a higher frequency band is *not* the same as transmitting the high frequency components of an input signal. Tr. 7:22–

8:6; Ex. 2014 ¶ 122; Ex. 2023, 66:5–17. Thus, the sequence disclosed by Tucker is not a high-pass filter.

Petitioner also argues that, because the low-pass filter in Tucker is preceded by an up-sampler, the result of applying a low-pass filter and reflecting its output to the upper band “in this context” would be the same as applying a high-pass filter. Pet. Reply 21–23; Tr. 8:6–11. More specifically, Petitioner contends that the up-sampler produces a signal that is a mirror image around the center of the spectrum (e.g., the 4–8 kHz portion of the signal is a mirror image of the 0–4 kHz portion of the signal). Pet. Reply 21; Tr. 8:6–11. Thus, according to Petitioner, if “you low-pass filter and reflect that output, *the result* is exactly the same as if in one step you attenuated only the lower frequencies.” Tr. 8:10–11 (emphasis added).

Petitioner’s argument is not persuasive. As discussed above, a low-pass filter whose output is reflected to the upper band does *not* transmit frequencies of an input signal *above* a given cutoff frequency and substantially attenuate all others, so as to preserve the high frequency components of the input signal. Tr. 7:22–8:6; Ex. 2014 ¶ 122; Ex. 2023, 66:5–17. Thus, even if Petitioner is correct that a low-pass filter whose output is reflected to the upper band will produce the same result as a high-pass filter in the specific context of Tucker’s system (i.e., when preceded by an up-sampler), Tucker does not disclose a high-pass filter.

Further, the specification of the ’114 patent indicates that the decoder of claims 10 and 20 that applies a high-pass filter is an improvement over the decoder of Tucker that applies an up-sampler followed by a low-pass filter whose output is reflected to the upper band. As discussed above, Tucker’s encoder decimates (i.e., down-samples) an upper sub-band signal.

Ex. 1004, 13:19–24, Fig. 1; Ex. 1002 ¶ 132 (“decimating (or downsampling)”); Ex. 2014 ¶ 88. As a result, Tucker’s decoder interpolates (i.e., up-samples and low-pass filters) the encoded upper sub-band signal and then reflects it to the upper band in order to reconstruct the original signal. Ex. 1004, 14:21–23, Fig. 2; Ex. 1002 ¶ 142 (“an up-sampler followed by a low pass filter”); Ex. 2014 ¶ 106. To improve on prior systems, the ’114 patent states that “[i]t is an object of the invention to provide a transmission system in which the necessary computation capacity is reduced.” Ex. 1001, 1:60–62. In particular, the ’114 patent reduces the computation capacity needed for the high frequency portion of an input signal by omitting a down-sampler from the encoding process, and, thus, also omitting an up-sampler from the decoding process. *Id.* at 2:10–17, 4:7–11, Figs. 2, 3. Both the encoder and the decoder of the ’114 patent instead use a simple high-pass filter. *Id.* at 2:10–17, 3:13–20, 4:7–11, 5:26–31, Figs. 2, 3. As such, the ’114 patent indicates that it reduces computation capacity and improves on prior systems, such as Tucker’s system, by applying a high-pass filter instead of an up-sampler and a low-pass filter whose output is reflected to the upper band.

For the foregoing reasons, Petitioner has not shown sufficiently that Tucker discloses a decoder that applies a high-pass filter, as recited in claims 10 and 20. Therefore, Petitioner has not shown by a preponderance of the evidence that claims 10 and 20 are anticipated by Tucker.

### 3. *Claims 11–15*

Claims 11–15 depend from claim 10. Ex. 1001, 8:8–41. Petitioner’s arguments and evidence regarding claims 11–15 do not compensate for the deficiency discussed above for claim 10. *See* Pet. 42–50. Therefore,

because Petitioner has not shown by a preponderance of the evidence that claim 10 is anticipated by Tucker, Petitioner also has not shown by a preponderance of the evidence that claims 11–15 are anticipated by Tucker. *See supra* Section II.C.2.

D. *Obviousness of Claims 10–16, 20, and 21 Over Tucker and the Well-Known Art*

Petitioner argues that claims 10–16, 20, and 21 would have been obvious over Tucker and the well-known art. Pet. 11. A claim is unpatentable as obvious under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) any objective indicia of non-obviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

We have considered the parties’ arguments and supporting evidence, and we determine that Petitioner has not shown by a preponderance of the evidence that claims 10–16, 20, and 21 would have been obvious over Tucker and the well-known art.

1. *Claims 10 and 20*

As discussed above, claim 10 recites, *inter alia*, a receiver that includes “a second decoder, wherein, based on the second coded signal, said second decoder sequentially applies a high-pass filter, a LPC synthesis filter and an amplifier to a noise signal to generate the second reconstructed

signal,” and claim 20 recites a similar limitation. Ex. 1001, 8:3–7, 10:1–8. Petitioner’s obviousness analysis in the Petition focuses on the phrase “sequentially applies.” Pet. 56–58. Specifically, Petitioner argues that “[i]f the order matters . . . , the claims would still have been obvious.” *Id.* at 57. Petitioner’s obviousness analysis in the Petition does not address the “high-pass filter” recited in claims 10 and 20. *See id.* at 56–58. Thus, Petitioner’s theory of unpatentability in the Petition relies solely on Petitioner’s assertion that Tucker discloses a high-pass filter. Pet. 39–40, 53–54; *see supra* Section II.C.2.

Petitioner argues for the first time in the Reply that it would have been obvious to include a high-pass filter in processor 26 of Tucker. Pet. Reply 26–28. In particular, Petitioner argues:

If there were any doubt that Tucker teaches a low-pass filter and high-pass filter in boxes 32 and 26 of Tucker’s first and second decoders, respectively, the POSA would have found it obvious to include the respective filters in each interpolation step. As Dr. Quackenbush testified at his deposition, even if one were to assume that Tucker did not teach these filters, “one of ordinary skill would find it obvious” to include a low-pass filter in box 32 of the low-band decoder “to achieve the coding function of correctly reconstructing the output signal as a faithful replica of the input.” Ex. 2022 at 150:23–151:5; Ex. 1044, ¶54; Ex. 1043 at 174:15–175:25, 176:7–20, 186:19–187:17, 248:25–249:17, 253:14–21; Ex. 2014, ¶100; *see also id.* ¶¶40–42. It would have been obvious to include a high-pass filter in box 26 of the high-band decoder of Tucker for the very same reason. *Id.* As discussed above, the POSA would have understood that a faithful replica of Tucker’s outputs in both the low and high band would have been achieved if, after upsampling, box 32 performed a low-pass filter operation and box 26 performed a high-pass filter operation. Thus, the POSA would have been motivated, with a reasonable expectation of success, to include the respective filters in Tucker.

Pet. Reply 26–27. Petitioner acknowledged at the oral hearing that the Petition does not include this obviousness analysis, and that the Petition relies solely on an anticipation analysis with respect to the “high-pass filter” recited in claims 10 and 20. Tr. 13:1–18; *see* Pet. 39–40, 53–54, 56–58. Thus, Petitioner’s argument that it would have been obvious to include a high-pass filter in processor 26 of Tucker is an improper new theory of unpatentability presented for the first time in the Reply, and Patent Owner has not had a fair and meaningful opportunity to respond to that argument. *See* 37 C.F.R. § 42.23(b); *Intelligent Bio-Systems, Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1369–70 (Fed. Cir. 2016); *Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1078–79 (Fed. Cir. 2015). As a result, we decline to consider Petitioner’s argument in the Reply that it would have been obvious to include a high-pass filter in processor 26 of Tucker.<sup>8</sup>

Therefore, Petitioner has not shown by a preponderance of the evidence that claims 10 and 20 would have been obvious over Tucker and the well-known art.

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<sup>8</sup> Moreover, even if Petitioner’s argument was proper, it is not persuasive. Petitioner, at best, explains that a person of ordinary skill in the art *could* have used a high-pass filter to reconstruct the upper sub-band signal in Tucker, but does not explain *why* it would have been obvious to use a high-pass filter instead of the low-pass filter (and subsequent reflection) disclosed by Tucker. *See* Pet. Reply 27 (“the POSA would have understood that a faithful replica of Tucker’s outputs in both the low and high band would have been achieved if, after upsampling, box 32 performed a low-pass filter operation and box 26 performed a high-pass filter operation”); *In re Nuvasive*, 842 F.3d 1376, 1382 (Fed. Cir. 2016) (“PTAB must articulate a *reason why* a PHOSITA would combine the prior art references.”); *KSR*, 550 U.S. at 418 (“there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness”).

2. *Claims 11–16 and 21*

Claims 11–16 depend, directly or indirectly, from claim 10. Ex. 1001, 8:8–46. Claim 21 depends from claim 20. *Id.* at 10:13–17. Petitioner’s arguments and evidence regarding claims 11–16 and 21 do not compensate for the deficiency discussed above for claims 10 and 20. *See* Pet. 56–59. Therefore, because Petitioner has not shown by a preponderance of the evidence that claim 10 or claim 20 would have been obvious over Tucker and the well-known art, Petitioner also has not shown by a preponderance of the evidence that claims 11–16 and 21 would have been obvious over Tucker and the well-known art. *See supra* Section II.D.1.

E. *Patent Owner’s Motion to Strike*

Patent Owner filed Observations on the cross examination of Dr. Quackenbush (Paper 23), to which Petitioner filed a Response (Paper 25). Patent Owner filed a Motion to Strike Petitioner’s Response to Patent Owner’s Observations (Paper 29, “PO Mot. Str.”), to which Petitioner filed an Opposition (Paper 32, “Pet. Opp. Str.”).<sup>9</sup> Patent Owner argues that Petitioner’s Response to Patent Owner’s Observations “is replete with improper and excessive argument.” PO Mot. Str. 2. This argument is moot because, even considering Petitioner’s Response to Patent Owner’s Observations, we determine that Petitioner has not shown by a preponderance of the evidence that claims 10–16, 20, and 21 of the ’114 patent are unpatentable. *See supra* Sections II.C, II.D. Therefore, Patent Owner’s Motion to Strike is *dismissed* as moot.

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<sup>9</sup> We authorized Patent Owner to file a motion to strike and Petitioner to file an opposition. Paper 26, 3.

### III. CONCLUSION

Petitioner has not shown by a preponderance of the evidence that claims 10–16, 20, and 21 of the '114 patent are unpatentable.

### IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that claims 10–16, 20, and 21 of the '114 patent are not shown unpatentable;

FURTHER ORDERED that Patent Owner's Motion to Strike is *dismissed*; 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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