EXHIBIT A

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571-272-7822

Paper 39
Entered: November 21, 2022

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

TCL INDUSTRIES HOLDINGS CO., LTD. and LG ELECTRONICS INC.,
Petitioners,[1]

v.

PARKERVISION, INC.,
Patent Owner.

IPR2021-00990[2]
Patent 7,110,444 B1

Before MICHAEL R. ZECHER, BART A. GERSTENBLITH, and IFTIKHAR AHMED, *Administrative Patent Judges*.

GERSTENBLITH, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining All Challenged Claims Unpatentable
35 U.S.C. § 318(a)

[1] The caption is updated to remove Petitioner Hisense Co., Ltd. ("Hisense") because Hisense is no longer a party to this proceeding. *See* Paper 38 (Termination due to Settlement After Institution of Trial Only as to Hisense Co., Ltd.). The parties shall use this caption (without this footnote) going forward.

[2] LG Electronics Inc., who filed a petition in IPR2022-00245, is joined as petitioner in this proceeding.

I. INTRODUCTION

A. Background

TCL Industries Holdings Co., Ltd. ("TCL") and Hisense filed a Petition (Paper 1, "Pet.") requesting institution of *inter partes* review ("IPR") of claims 2–4 ("the Challenged Claims") of U.S. Patent No. 7,110,444 B1 (Ex. 1001, "the '444 patent"). ParkerVision, Inc. ("Patent Owner") filed a Preliminary Response (Paper 8). Applying the standard set forth in 35 U.S.C. § 314(a), we instituted an *inter partes* review as to all claims and grounds set forth in the Petition. Paper 9 ("Inst. Dec.").

After institution, LG Electronics Inc. ("LG") filed a petition in IPR2022-00245 (challenging the same claims of the '444 patent on the same grounds), and a motion for joinder (seeking to join this proceeding as a petitioner). *LG Elecs. Inc. v. ParkerVision, Inc.*, IPR2022-00245 (PTAB Dec. 12, 2021), Papers 3 (petition), 4 (motion for joinder). We granted institution in IPR2022-00245 and granted LG's motion for joinder. *Id.* at Paper 9 (PTAB Apr. 12, 2022); IPR2021-00990, Paper 16. Recently, Hisense and Patent Owner reached a settlement and this proceeding was terminated only as to Hisense. Paper 38. Accordingly, we refer to TCL and LG, collectively, as "Petitioners."

Also following institution, Patent Owner filed a Patent Owner Response (Paper 12, "PO Resp."), Petitioners filed a Reply to Patent Owner's Response (Paper 20, "Pet. Reply"), and Patent Owner filed a Sur-reply (Paper 26, "PO Sur-reply"). Additionally, we granted Petitioners' Motion for Routine and/or Additional Discovery (Paper 13), ordering the production of Patent Owner's Final Infringement Contentions. Paper 18 (Order), 8. And, we denied Patent Owner's Motion to Strike portions of

Petitioners' Reply (Paper 21), finding that the "Reply does not raise new issues, is not accompanied by belatedly presented evidence, and does not otherwise exceed the proper scope of [a] reply brief as set forth in 37 C.F.R. § 42.23(b)." Paper 25 (Order), 13. An oral hearing was held on September 8, 2022, and the transcript is of record. Paper 34 ("Tr.").[3]

We have jurisdiction pursuant to 35 U.S.C. § 6. This Decision is a Final Written Decision under 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73 as to the patentability of the Challenged Claims. Petitioners bear the burden of proving unpatentability of the Challenged Claims. *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015). To prevail, Petitioners must prove unpatentability by a preponderance of the evidence. *See* 35 U.S.C. § 316(e) (2018); 37 C.F.R. § 42.1(d) (2020). Having reviewed the arguments and the supporting evidence, we determine that Petitioners have shown, by a preponderance of the evidence, that claims 2–4 of the '444 patent are unpatentable.

B. Related Proceedings

The parties identify the following as related matters: *ParkerVision, Inc. v. Intel Corporation*, 6:20-cv-00108 (W.D. Tex.); *ParkerVision, Inc. v. TCL Industries Holdings Co., Ltd. et al.*, No. 6:20-cv-00945 (W.D. Tex.); *ParkerVision, Inc. v. Hisense Co., Ltd. et al.*, No. 6:20-cv-00870 (W.D. Tex.); *ParkerVision, Inc. v. ZyXEL Communications Corp.*, No. 6:20-cv-

[3] Because of a substantial overlap in issues presented, the transcript includes oral argument from related case IPR2021-00985, although this proceeding and IPR2021-00985 are not consolidated or joined.

01010 (W.D. Tex.)[4]; *ParkerVision, Inc. v. LG Electronics Inc.*, No. 6:21-cv-00520 (W.D. Tex.); and *Intel Corporation v. ParkerVision, Inc.*, IPR2020-01265 ("the Intel IPR"). Pet. 4–5; Paper 5 (Petitioners' Updated Mandatory Notice), 1; Paper 7 (Patent Owner's Mandatory Notices), 1. Petitioners also identify *ParkerVision, Inc. v. Buffalo Inc.*, No. 6:20-cv-01009 (W.D. Tex.), as a related matter involving the '444 patent. Pet. 5. Additionally, Petitioners challenge several claims of U.S. Patent No. 7,292,835 B2 ("the '835 patent"), owned by Patent Owner, in IPR2021-00985. Pet. 5; Paper 7, 1.[5]

C. Real Parties in Interest

Petitioners identify TCL; TCL Electronics Holdings Ltd.; Shenzhen TCL New Technology Co., Ltd.; TCL King Electrical Appliances (Huizhou) Co., Ltd.; TCL Moka Int'l Ltd.; TCL Moka Manufacturing S.A. DE C.V.; TCL Technology Group Corp.; TTE Technology, Inc.; LG; and LG Electronics U.S.A., Inc. as real parties in interest. Pet. 4; *LG*, IPR2022-00245, Paper 3 at 5. Patent Owner identifies ParkerVision, Inc. as the sole real party in interest. Paper 7, 1.

[4] After the parties' briefing, the district court granted a joint motion to dismiss with prejudice and the case is now closed. *See* Ex. 3001 (Docket Entry 25, Order dated Sept. 27, 2001).

[5] Patent Owner identifies the instant proceeding—IPR2021-00990—as a related matter, but we understand Patent Owner to refer to IPR2021-00985. *See* Paper 7, 1.

D. The Asserted Grounds of Unpatentability and Declaration Evidence

Petitioners challenge the patentability of claims 2–4 of the '444 patent on the following grounds:

Claim(s) Challenged	35 U.S.C. §[6]	Reference(s)/Basis
2, 3	103(a)	Tayloe,[7] TI Datasheet[8]
2–4	103(a)	Lam,[9] Enz,[10] Tayloe

Pet. 7.

Additionally, Petitioners support their challenge with a Declaration of Matthew B. Shoemake, Ph.D. (Ex. 1002) and a Declaration of Maureen M. Honeycutt (Ex. 1009). Patent Owner supports its arguments with a Declaration of Dr. Michael Steer (Ex. 2038). Petitioners cross-examined Dr. Steer and a transcript of that deposition is of record. Ex. 1021.

E. The '444 Patent

The '444 patent is directed to "a wireless local area network (WLAN) that includes one or more WLAN devices (also called stations, terminals, access points, client devices, or infrastructure devices) for effecting wireless communications over the WLAN." Ex. 1001, 2:10–14. The '444 patent

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[6] The Leahy-Smith America Invents Act ("AIA") included revisions to 35 U.S.C. § 103 that became effective on March 16, 2013. Because the '444 patent has an effective filing date before March 16, 2013, we apply the pre-AIA version of the statutory basis for unpatentability.
[7] U.S. Patent No. 6,230,000 B1, issued May 8, 2001 (Ex. 1004, "Tayloe").
[8] SN74CBT3253 Dual 1-of-4 FET Multiplexer/Demultiplexer (rev. ed. May 1998) (Ex. 1005, "TI Datasheet").
[9] U.S. Patent No. 5,937,013, issued Aug. 10, 1999 (Ex. 1006, "Lam").
[10] Circuit Techniques for Reducing the Effects of Op-Amp Imperfections: Autozeroing, Correlated Double Sampling, and Chopper Stabilization, *Proceedings of the IEEE*, Vol. 84, No. 11, Nov. 1996 (Ex. 1007, "Enz").

explains that "[t]he WLAN device includes at least an antenna, a receiver, and a transmitter . . . . The WLAN receiver includes at least one universal frequency translation module that frequency down-converts a received electromagnetic (EM) signal." *Id.* at 2:14–22.

Figure 70A is reproduced below:

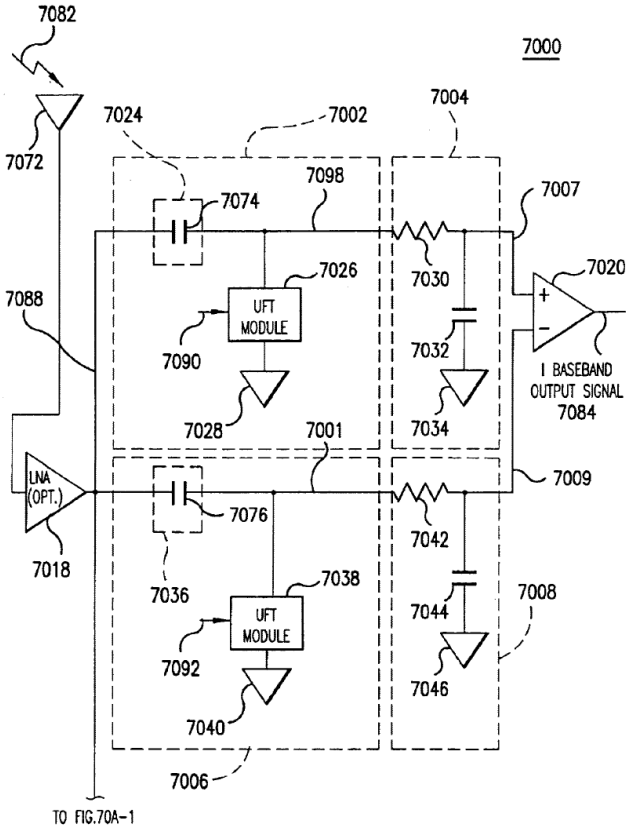


FIG.70A

Figure 70A of the '444 patent "illustrates an IQ [in-phase quadrature] receiver having shunt UFT [universal frequency translation] modules." Ex. 1001, 5:34–35. The '444 patent explains that "I/Q modulation receiver 7000 receives, down converts, and demodulates a[n] I/Q modulated RF [radio frequency] input signal 7082 to an I baseband output signal 7084, and a Q baseband output signal 7086." *Id.* at 35:51–54; *see id.* at 35:60–62 (Antenna 7072 receives and outputs I/Q modulated RF input signal 7082.).

The '444 patent states that, "[w]hen present, LNA 7018 amplifies I/Q modulated RF input signal 7082, and outputs amplified I/Q signal 7088." *Id.* at 35:63–64. Thereafter, "[f]irst UFD [universal frequency down-conversion] module 7002 receives amplified I/Q signal 7088 . . . [,] down-converts the I-phase portion of the amplified input I/Q signal 7088 according to an I control signal 7090 . . . [, and] outputs an I output signal 7098." *Id.* at 35:65–36:2. Similarly, UFD module 7006 "receives amplified I/Q signal 7088[,]" "down-converts the inverted I-phase signal portion of amplified input I/Q signal 7088 according to an inverted I control signal 7092[,]" and "outputs an inverted I output signal 7001." *Id.* at 36:33–37. Thereafter, "[f]irst differential amplifier 7020 receives filtered I output signal 7007 . . . subtracts filtered inverted I output signal 7007 from filtered I output signal 7001, amplifies the result, and outputs I baseband output signal 7084." *Id.* at 37:3–8.

The '444 patent's first and second UFD modules in Figure 70A include capacitors 7074 and 7076, respectively, and UFT modules 7026 and 7038, respectively. Ex. 1001, 36:3–5 (first UFD module 7002 comprises first storage module 7024 and first UFT module 7026), 36:14–15 (first storage module 7024 comprises first capacitor 7074), 36:38–40 (second UFD module 7006 comprises second storage module 7036 and second UFT module 7038), 36:50–51 (second storage module 7036 comprises second capacitor 7076).

Figure 1B is reproduced below:

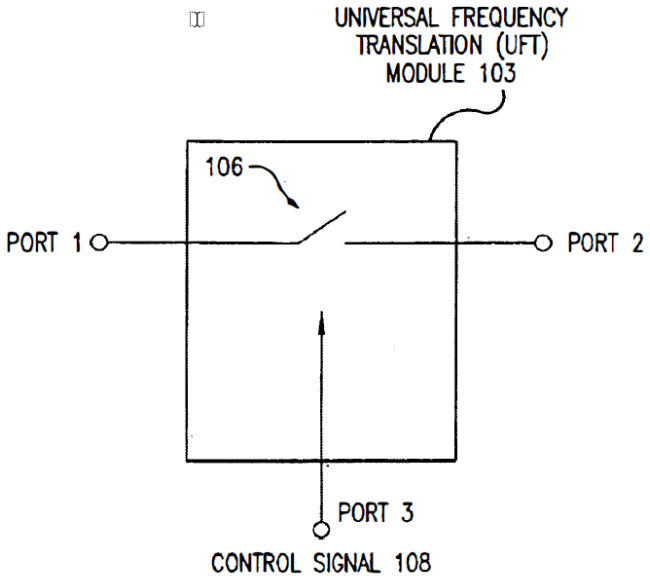


FIG. 1B

Figure 1B of the '444 patent "is a more detailed diagram of a universal frequency translation (UFT) module." Ex. 1001, 2:56–58. The '444 patent explains that, "[g]enerally, the UFT module 103 includes a switch 106 controlled by a control circuit 108." *Id.* at 8:62–64 (noting that switch 106 is referred to as a controlled switch); *see id.* at 36:5–7 (first UFT module, shown in Figure 70A, contains a switch that opens and closes as a function of I control signal 7090), 36:40–42 (second UFT module, also shown in Figure 70A, contains a switch that opens and closes as a function of inverted I control signal 7092).

The ’444 patent includes two alternative configurations of switches and capacitors in UFD modules (Ex. 1001, 9:43–57), as shown in Figures 20A and 20A-1 reproduced below:

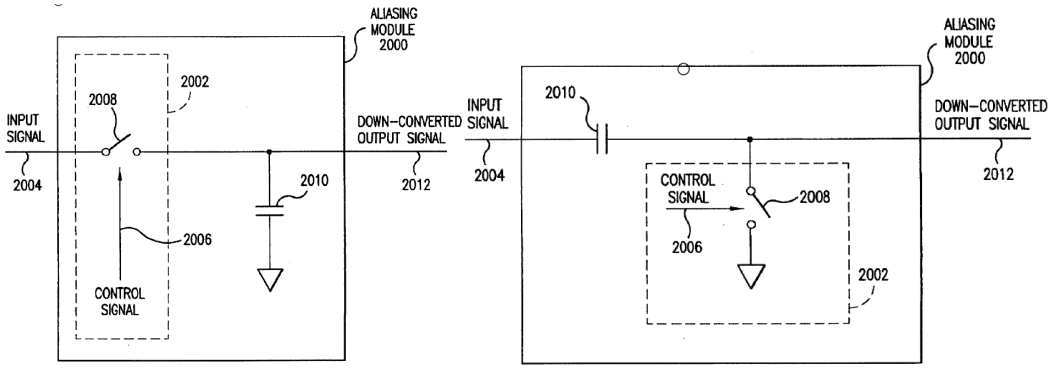


FIG.20A FIG.20A–1

Figures 20A and 20A-1 of the ’444 patent “are example aliasing modules.” Ex. 1001, 3:50–51. The ’444 patent explains that, in Figure 20A, switch 2008 is in series with input signal 2004 and capacitor 2010 is shunted to ground; in Figure 20A-1, however, capacitor 2010 is in series with input signal 2004 and switch 2008 is shunted to ground. *Id.* at 9:48–57 (also noting that “[t]he electronic alignment of the circuit components is flexible”).

The ’444 patent states that “[t]he down-conversion of an EM signal by aliasing the EM signal at an aliasing rate is fully described in . . . U.S. Pat[ent] No. 6,061,551 [(‘the ’551 patent’)] . . . , the full disclosure of which is incorporated herein by reference.” Ex. 1001, 9:32–38; *see id.* at 34:54–58 (“Down-conversion utilizing a UFD module (also called an aliasing module) is further described in . . . [the ’551 patent].”).[11]

[11] The ’551 patent is Exhibit 2029 in this proceeding.

F. Illustrative Claims

Claims 2 and 3, the independent claims challenged in this proceeding, are illustrative of the claimed subject matter and are reproduced below with Petitioners' bracketing added for reference:

2. [2-pre] A wireless modem apparatus, comprising:

[2A] a receiver for frequency down-converting an input signal including,

[2B] a first frequency down-conversion module to down-convert the input signal, wherein said first frequency down-conversion module down-converts said input signal according to a first control signal and outputs a first down-converted signal;

[2C] a second frequency down-conversion module to down-convert said input signal, wherein said second frequency down-conversion module down-converts said input signal according to a second control signal and outputs a second down-converted signal; and

[2D] a subtractor module that subtracts said second down-converted signal from said first down-converted signal and outputs a down-converted signal;

[2E] wherein said first frequency down-conversion module under-samples said input signal according to said first control signal, and [2F] said second frequency down-conversion module under-samples said input signal according to said second control signal.

3. [3-pre] A wireless modem apparatus, comprising:

[3A] a receiver for frequency down-converting an input signal including,

[3b] a first frequency down-conversion module to down-convert the input signal, wherein said first frequency down-conversion module down-converts said input signal according to a first control signal and outputs a first down-converted signal;

> [3C] a second frequency down-conversion module to down-convert said input signal, wherein said second frequency down-conversion module down-converts said input signal according to a second control signal and outputs a second down-converted signal; and
>
> [3D] a subtractor module that subtracts said second down-converted signal from said first down-converted signal and outputs a down-converted signal;
>
> [3E] wherein said first and said second frequency down-conversion modules each comprise a switch and a storage element.

Ex. 1001, 60:47–67, 61:1–18.

G. Level of Ordinary Skill in the Art

Petitioners, supported by Dr. Shoemake's testimony, propose that a person of ordinary skill in the art at the time of the invention would have had "at least an undergraduate degree in electrical engineering or a related subject and two or more years of experience in the fields of communication systems, signal processing and/or RF circuit design." Pet. 35 (citing Ex. 1002 ¶¶ 31–36). Petitioners explain that "[l]ess work experience may be compensated by a higher level of education, such as a master's degree." *Id.* (citing Ex. 1002 ¶¶ 31–36).

In the Institution Decision, we noted that Patent Owner had not expressed a position on the level of ordinary skill in the art in the Preliminary Response, and, based on the preliminary record, we adopted Petitioners' unopposed position, finding it consistent with the level of ordinary skill in the art reflected by the '444 patent and the prior art of record. Inst. Dec. 10 (citing *Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001); *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995); *In re Oelrich*, 579 F.2d 86, 91 (CCPA 1978)).

In the Patent Owner Response, Patent Owner, supported by Dr. Steer's testimony, proposes that a person of ordinary skill in the art at the time of the invention would have had

> (a) a Bachelor of Science degree in electrical or computer engineering (or a related academic field), and at least two (2) additional years of work experience in the design and development of radio frequency circuits and/or systems, or (b) at least five (5) years of work experience and training in the design and development of radio frequency circuits and/or systems.

PO Resp. 4 (citing Ex. 2038 ¶ 24). Neither Patent Owner nor Dr. Steer explain why their proposal materially differs from that proposed by Petitioners.

Patent Owner's option (a) is substantially the same as Petitioners' proposal—both require a bachelor's degree in the same or a related subject and two additional years of related work experience. Patent Owner's option (b) adds an additional option based on work experience in lieu of a formal degree.

Neither party contends that the difference in their proposals affects the outcome of this proceeding and we do not find that it does. Nonetheless, on the full record before us, we find that our identification of the level of ordinary skill in art in the Institution Decision as well as Patent Owner's option (b) are supported by the prior art of record, the '444 patent, and the opinion of Dr. Steer. Accordingly, we modify our preliminary finding to include option (b) from Patent Owner's proposal. Thus, we find that one of ordinary skill in the art would have had at least a bachelor's degree in electrical engineering or a related subject and two or more years of experience in the field of RF circuit design, or at least five years of work

experience and training in the design and development of RF circuits and/or systems. We also find that less work experience may be compensated by a higher level of education, such as a master's degree.

II. CLAIM CONSTRUCTION

In this *inter partes* review, claims are construed using the same claim construction standard that would be used to construe the claims in a civil action under 35 U.S.C. § 282(b). *See* 37 C.F.R. § 42.100(b) (2020). The claim construction standard includes construing claims in accordance with the ordinary and customary meaning of such claims, as would have been understood by one of ordinary skill in the art at the time of the invention. *See id.*; *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–14 (Fed. Cir. 2005) (en banc). In construing claims in accordance with their ordinary and customary meaning, we take into account the specification and prosecution history. *Phillips*, 415 F.3d at 1315–17.

If the specification "reveal[s] a special definition given to a claim term by the patentee that differs from the meaning it would otherwise possess[,] . . . the inventor's lexicography governs." *Phillips*, 415 F.3d at 1316 (citing *CCS Fitness, Inc. v. Brunswick Corp.*, 288 F.3d 1359, 1366 (Fed. Cir. 2002)). Another exception to the general rule that claims are given their ordinary and customary meaning is "when the patentee disavows the full scope of a claim term either in the specification or during prosecution." *Uship Intellectual Props., LLC v. United States*, 714 F.3d 1311, 1313 (Fed. Cir. 2013) (quoting *Thorner v. Sony Computer Entm't Am., LLC*, 669 F.3d 1362, 1365 (Fed. Cir. 2012)).

Additionally, only terms that are in controversy need to be construed, and these need be construed only to the extent necessary to resolve the

controversy. *See Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (holding that "only those terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy"); *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (citing *Vivid Techs.* in the context of an *inter partes* review).

A. "storage element"

In the Institution Decision, we did not construe any claim terms expressly because none of the terms were in dispute. Inst. Dec. 11. In the briefing following institution, Patent Owner proposed a construction for the term "storage element," *see, e.g.*, PO Resp. 36–38, and it became clear that the parties dispute the meaning of the term. Additionally, because many of Patent Owner's arguments hinge on the meaning of this term, its proper construction is important to address the issues presented in this proceeding. Further, the parties' arguments rely, almost exclusively, on disclosures in the '551 patent, incorporated by reference into the '444 patent.

In the final written decision in IPR2020-01265 (Ex. 2016), we construed the term "storage element," relying on its use in the '551 patent. In IPR2020-01265, after considering the parties' extensive arguments as well as prior constructions in related district court litigation, we construed "storage element" to mean "an element of a system that stores non-negligible amounts of energy from an input EM signal." Ex. 2016, 41. Critical to that determination was the finding that the patentees acted as their own lexicographers by defining the systems to which "storage modules" *refer to*. Specifically, we explained that the '551 patent expressly states "[s]torage modules and storage capacitances, on the other hand, *refer to*

systems that store non-negligible amounts of energy from an input EM signal."[12] *Id.* at 36 (emphasis added) (citing '551 patent,[13] 66:59–67). Additionally, we also explained that in a prior proceeding challenging claims of the '551 patent before the Board—IPR2014-00948—Patent Owner represented that the '551 patent "*provides an explicit definition*" and "*explicitly defines a storage module*." *Id.* at 39 (citing Ex. 1032,[14] 21). We found that "Patent Owner's acknowledgement that the '551 patent provides an explicit definition of 'storage module' directly supports our determination that the patentees acted as lexicographers." *Id.* at 40.

In this proceeding, in addition to raising substantially the same arguments addressed in IPR2020-01265, Patent Owner submitted a Claim Construction Order and Memorandum in Support Thereof from *ParkerVision, Inc. v. LG Electronics, Inc.*, No. 6:21-cv-00520-ADA (W.D. Tex. June 21, 2022) (Doc. 55) (Ex. 2040), and a Special Master's Report and Recommendation Regarding Claim Construction from *ParkerVision, Inc. v. Hisense Co.*, No. 6:20-cv-00870-ADA (W.D. Tex. Aug. 29, 2022) (Doc. 72)

[12] It is undisputed that "storage element" (recited in the '444 patent) and "storage module" (recited in the '551 patent) are synonymous. *See* PO Resp. 37–38 (referring to storage module); Pet. Reply 4 (consenting to the adoption of the Board's construction of "storage element" from IPR2020-01265, which relied on the use of "storage module" in the '551 patent).
[13] In IPR2020-01265, the '551 patent was Exhibit 2007.
[14] Exhibit 1032 from IPR2020-01265 is Patent Owner's Preliminary Response (Paper 7) from IPR2014-00948, which was not filed as an exhibit in this proceeding.

(Ex. 2043).[15] Each of these claim construction decisions construes "storage module" to mean "a module of an energy transfer system that stores non-negligible amounts of energy from an input electromagnetic signal." Ex. 2043, 33; *see* Ex. 2040, 16 (district court declining to modify its previous construction of "storage module," which was limited to an "energy transfer system"). In so determining, each of the district court's decisions finds that the patentees did not act as their own lexicographers. *See* Ex. 2040, 19; Ex. 2043, 32. Patent Owner advocates that we adopt the same construction here. PO Resp. 36–38.

Petitioners assert that "[u]nder any reasonable construction, a capacitor constitutes a 'storage element.'" Pet. Reply 2 (citing Pet. 59; Ex. 1002 ¶ 169). Petitioners rely on the '441 patent's statement that a storage module is a capacitor. *Id.* at 2–3 (citing Pet. 59; Ex. 1002 ¶ 169; Ex. 1001, 34:22–23 ("The storage module 6704A is a capacitor 6706A."), 36:14–15 ("In an embodiment, first storage module 7024 comprises a first capacitor 7404.")). Petitioners contend that "[t]his is consistent with [Patent Owner's] position on infringement, where [Patent Owner] alleges repeatedly across multiple related patents that a 'storage element' in the accused products is simply 'one or more capacitors.'" *Id.* at 3 (citing Ex. 1022 ¶¶ 127–131, 138–140, 150; Ex. 1023 ¶¶ 75, 92, 98). Nonetheless, "Petitioners do not object to adoption of the Board's construction for 'storage element' from IPR2020-01265." *Id.* at 4.

[15] Patent Owner also submitted the same Special Master's Report and Recommendation Regarding Claim Construction from *ParkerVision, Inc. v. TCL Industries Holdings Co.*, No. 6:20-cv-00945-ADA (W.D. Tex. Aug. 29, 2022) (Doc. 68) (Ex. 2042).

We have reviewed and considered the district court's construction (which limits "storage element" to an "energy transfer system"), but we are not persuaded that our construction from IPR2020-01265 should be altered. We expressly adopt and incorporate by reference our analysis from IPR2020-01265 and do not repeat it in full here. We do, however, take this opportunity to provide additional reasoning in support of our prior determination based on the arguments and evidence presented in this proceeding.

The '551 patent provides the following, which formed the focal point of Patent Owner's argument in IPR2014-00948 and which we found provides a lexicographic definition of "storage module"/"storage element" in IPR2020-01265:

> The terms storage module and storage capacitance, *as used herein*, are distinguishable from the terms holding module and holding capacitance, respectively. Holding modules and holding capacitances, as used above, identify systems that store negligible amounts of energy from an under-sampled input EM signal with the intent of "holding" a voltage value. Storage modules and storage capacitances, on the other hand, *refer to* systems that store non-negligible amounts of energy from an input EM signal.

Ex. 2029, 66:59–67 (emphases added); *see* Ex. 2016, 39–40 (discussing Patent Owner's prior arguments to construe "storage module" in IPR2014-00948). When defining certain terms in a section titled "General Terminology," the '551 patent repeatedly uses the phrase "when used herein" in combination with the phrase "refer(s) to." *See, e.g.*, Ex. 2029, 13:56–15:27 (mentioning a term followed by "when used herein," followed by "refers to," followed by a definition). For example, the '551 patent states, "[t]he term digital signal, when used herein, refers to a signal that

changes between discrete states, as contrasted to a signal that is continuous." *Id.* at 15:7–9. As shown, the '551 patent defines "digital signal" by stating "when used herein" followed by "refers to." And, the same sentence also provides a comparison between "digital signal" and a signal that is continuous. Even though the passage describing "storage module" is not listed under the "General Terminology" section of the '551 patent, the passage provides the same indications that the patentees clearly and unambiguously intended to define the term "storage module" by stating "as used herein" and "refer to"—hallmarks that the patentees were providing a lexicographic definition of the term. *Vasudevan Software, Inc. v. MicroStrategy, Inc.*, 782 F.3d 671, 679 (Fed. Cir. 2015) ("An applicant's use of the phrase 'refers to' generally indicates an intention to define a term.") (citing *In re Imes*, 778 F.3d 1250, 1252–53 (Fed. Cir. 2015); *Microsoft Corp. v. Int'l Trade Comm'n*, 731 F.3d 1354, 1360 (Fed. Cir. 2013); *Linear Tech. Corp. v. Int'l Trade Comm'n*, 566 F.3d 1049, 1054 (Fed. Cir. 2009)). Additionally, as with the term "digital signal," the above-passage provides a comparison between "storage module" and "holding module" and uses the definitions of the terms to compare and contrast them.

"To act as its own lexicographer, a patentee must 'clearly set forth a definition of the disputed claim term' other than its plain and ordinary meaning." *Thorner*, 669 F.3d at 1366 (citing *CCS Fitness*, 288 F.3d at 1366). "It is not enough for a patentee to simply disclose a single embodiment or use a word in the same manner in all embodiments, the patentee must 'clearly express an intent' to redefine the term." *Id.* (citing *Helmsderfer v. Bobrick Washroom Equip., Inc.*, 527 F.3d 1379, 1381 (Fed. Cir. 2008); *Kara Tech. Inc. v. Stamps.com*, 582 F.3d 1341, 1347–48 (Fed.

Cir. 2009)). That is precisely what the patentees did in the above-passage. Specifically, we find that they clearly set forth a definition that is different than the plain and ordinary meaning and, in so doing, clearly expressed an intent to redefine the term. That the patentees intended to redefine the term "storage module" is clearly expressed by the use of "as used herein"[16] and "refers to" in the above-passage and is consistent with the patentees' use of these same phrases when defining other terminology in the '551 patent, as discussed above.

We also do not agree with Patent Owner's argument that this passage in the '551 patent does not provide a lexicographic definition for at least two reasons. First, in related case IPR2021-00985, Patent Owner argues that the patent-at-issue in that proceeding (the '835 patent) provides a definition of the term "cable modem" and points to the following from the '835 patent specification: "Cable Modems *refer to* modems that communicate across ordinary cable TV [television] network cables" (IPR2021-00985, Ex. 1001, 36:19–20 (emphasis added)). During the oral argument, Patent Owner stated that "we just used *the same definition that was in the spec*. . . . We just took *the same exact definition from the spec*" (Tr. 83:16–20 (emphases added)). In other words, Patent Owner's acknowledgement that the '835 patent provides a definition of the term "cable modem" undermines Patent Owner's argument that the patentees did not define "storage module" even though the patentees used *the same phrase* "refer(s) to."

Second, Patent Owner has absolutely no (even remotely) colorable explanation as to why it repeatedly argued, in IPR2014-00948, that the

[16] There is no substantive difference between the phrase "when used herein" and "as used herein."

'551 patent "*provides an explicit definition*" and "*explicitly defines a storage module*." *See* Ex. 2016, 39–40 (discussing Patent Owner's prior arguments to construe "storage module" in IPR2014-00948). The only plausible explanation is that Patent Owner has simply changed positions to suit its current litigation strategy. But that is not how claim construction works. There either *is* a lexicographic definition or there *is not*, regardless of the claim construction standard applied (i.e., broadest reasonable interpretation v. the same claim construction standard that would be used to construe the claims in a civil action under 35 U.S.C. § 282(b)). In IPR2014-00948, Patent Owner argued that there was a lexicographic definition and emphasized the same exact statements in the above-passage from the '551 patent. That passage has not changed and provides definitive confirmation of the patentees' intent to provide a lexicographic definition of "storage module" for the reasons discussed above.[17]

In its Sur-reply, Patent Owner argues that the above-passage from the '551 patent "is comparative, *not* definitional." PO Sur-reply 4. We agree that it is comparative, but it is *also definitional*. These are not mutually exclusive concepts. And, the above-discussion reflects that the '551 patent defines other terms by providing a definition *and* comparing that definition to definitions of other terms.

Accordingly, for the reasons explained in detail in the Board's final written decision in IPR2020-01265 and as further explained above, we find that the patentees clearly and unmistakably set forth a definition of "storage

[17] None of the district court claim construction decisions address Patent Owner's representations, in IPR2014-00948, that the '551 patent explicitly defines "storage module." *See generally* Exs. 2040, 2043.

module" in the incorporated '551 patent, and, therefore, we construe "storage element" to mean "an element of a system that stores non-negligible amounts of energy from an input EM signal."

B. "wireless modem apparatus"

The preambles of claims 2 and 3 recite "[a] wireless modem apparatus." Ex. 1001, 60:47 (claim 2), 61:1 (claim 3). Patent Owner contends that each preamble is limiting "because it provides an essential structure or necessary meaning for the claim." PO Resp. 38 (citing *Pitney Bowes, Inc. v. Hewlett-Packard Co.*, 182 F.3d 1298, 1305–06 (Fed. Cir. 1999)). Patent Owner asserts that "the claims recite 'an input signal'" and "[t]he use of 'wireless modem' in the preamble clarifies that the 'input signal' is not just any signal, but a wireless (RF) signal to a modem." *Id.* at 39 (citing Ex. 1014,[18] 1:52–57). Additionally, Patent Owner argues that, "as the name suggests, a 'modem' is a device that performs *both* **mod**ulation *and* **dem**odulation of analog carrier signals. . . . The claims and specification disclose a configuration of a receiver that can operate along with a transmitter." *Id.* (citing Ex. 2038 ¶¶ 228–229).

Petitioners raise several arguments in response. First, Petitioners contend that Patent Owner is collaterally estopped from arguing that the preamble is limiting because Patent Owner did not assert that position in IPR2020-01265. Pet. Reply 10 (noting that claim 3 was at issue in IPR2020-01265 and that claims 2 and 3 each recite the same preamble).

[18] Patent Owner contends that "[t]he disclosure regarding wireless modems in U.S. Patent No. 5,764,693 ('the '693 patent') is incorporated into the '444 patent. Thus, a [person of ordinary skill in the art] would consider the '693 patent." PO Resp. 39 n.10 (citing Ex. 2038 ¶ 228 n.13).

Thus, Petitioners assert that Patent Owner "should not be heard now to argue that the preamble is limiting." *Id.*

Second, Petitioners contend that, in related litigation, Patent Owner never argued that the preamble is limiting because it "is non-essential and does not give meaning to the structurally-complete bodies of claims 2 and 3." Pet. Reply 11. Petitioners contend the preamble (1) does not provide antecedent basis for any later term; (2) does not represent "essential structure"; and (3) merely states an intended use, which is confirmed by the specification. *Id.* at 11–12. In particular, Petitioners assert that a "wireless modem" "is just one of the many exemplary applications of the apparatuses disclosed in the specification." *Id.* at 12. And, Petitioners point to the '444 patent's statement that "[t]hese applications and embodiments are *not intended to limit the invention*." *Id.* (alteration in original) (citing Ex. 1001, 30:56–67, 60:7–10). Petitioners argue that "the body of the claim defines a structurally complete invention and the term 'wireless modem apparatus' does not give life, meaning, and vitality to the claim"; in other words, Petitioners contend that, "if 'wireless modem apparatus' was deleted from the preamble or replaced with a generic term like device, the body of each claim would still define a structurally complete device that down-converts an input signal by using frequency down-conversion modules, as shown in Figure 70A of the '444 patent." *Id.* (citing *TomTom, Inc. v. Adolph*, 790 F.3d 1315, 1323 (Fed. Cir. 2015); Pet. 10).

Patent Owner does not address whether "wireless modem apparatus" is limiting nor does Patent Owner address its proposed construction in the Sur-reply. *See generally* PO Sur-reply.

"Generally . . . the preamble does not limit the claims." *Am. Med. Sys., Inc. v. Biolitec, Inc.*, 618 F.3d 1354, 1358 (Fed. Cir. 2010). A term in the preamble is a limitation only if it "recites essential structure or steps, or if it is 'necessary to give life, meaning, and vitality' to the claim." *TomTom*, 790 F.3d at 1323.

We agree with Petitioners that "wireless modem apparatus," as recited in the preambles of claims 2 and 3, is not limiting. In particular, "wireless modem apparatus" does not provide antecedent basis for any term subsequently recited in claims 2–4; it does not provide any essential structure because the body of the claim recites a structurally complete invention; and it is not necessary to give life, meaning, and vitality to the claim. Further, Patent Owner's argument that the preamble is limiting because it makes clear that the input signal is input to a wireless modem apparatus is unavailing because the body of claims 2 and 3 expressly recite, as the first element, "a receiver for frequency down-converting an input signal." *See* Ex. 1001, 60:48–49 (claim 2), 61:2–3 (claim 3). And, Patent Owner's arguments make clear that its attempt to read "wireless modem apparatus" as limiting is solely for the purpose of arguing that claims 2–4 require a transmitter, which is a structural element that is not recited in the claims. *See, e.g.*, PO Resp. 72 (arguing that Tayloe does not disclose a transmitter), 79 (raising the same arguments directed to Lam). When the patentees intended to limit a claim to a transmitter, they expressly recited a transmitter in the body of the claim. *See, e.g.*, Ex. 1001, 61:25–57 (Claim 6 recites "[a] wireless modem apparatus, comprising," and expressly recites "a receiver" and "a transmitter" in the body of the claim.).

Accordingly, for each of these reasons, we find that "wireless modem apparatus" recited in the preambles of claims 2 and 3 is not limiting.

C. Additional Terms

Petitioners propose that we construe the following three terms: "frequency down-conversion module," "subtractor module," and "under-samples." Pet. 15–18. Patent Owner responds to Petitioners' constructions for "frequency down-conversion module" and "subtractor module." PO Resp. 39–41.

On the full record before us, none of the parties' arguments nor the outcome of this proceeding hinge on the construction of these additional terms. Accordingly, we need not construe them expressly to resolve the present disputes between the parties. *See Nidec Motor Corp.*, 868 F.3d at 1017.

III. ANALYSIS

A. Legal Standards – Obviousness

The U.S. Supreme Court set forth the framework for applying the statutory language of 35 U.S.C. § 103 in *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1, 17–18 (1966):

> Under § 103, the 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. Against this background, the obviousness or nonobviousness of the subject matter is determined. Such 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.

The Supreme Court explained in *KSR International Co. v. Teleflex Inc.* that

> [o]ften, it will be necessary for a court to look to interrelated teachings of multiple patents; the effects of demands known to the design community or present in the marketplace; and the background knowledge possessed by a person having ordinary skill in the art, all in order to determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue. To facilitate review, this analysis should be made explicit.

550 U.S. 398, 418 (2007) (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006) ("[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.")).

"Whether an ordinarily skilled artisan would have been motivated to modify the teachings of a reference is a question of fact." *WBIP, LLC v. Kohler Co.*, 829 F.3d 1317, 1327 (Fed. Cir. 2016) (citations omitted). "[W]here a party argues a skilled artisan would have been motivated to combine references, it must show the artisan 'would have had a reasonable expectation of success from doing so.'" *Arctic Cat Inc. v. Bombardier Recreational Prods. Inc.*, 876 F.3d 1350, 1360–61 (Fed. Cir. 2017) (quoting *In re Cyclobenzaprine Hydrochloride Extended-Release Capsule Patent Litig.*, 676 F.3d 1063, 1068–69 (Fed. Cir. 2012)).

B. Obviousness over Tayloe and TI Datasheet

Petitioners assert the combination of Tayloe and TI Datasheet would have rendered the subject matter of claims 2 and 3 obvious to one of ordinary skill in the art at the time of the invention. Pet. 30–32 (discussing

motivation to combine Tayloe and TI Datasheet), 35–59 (discussing the application of the art to the claims).

1. Level of Ordinary Skill in the Art

The level of ordinary skill in the art is set forth above. *See supra* § I.G.

2. Scope and Content of the Prior Art

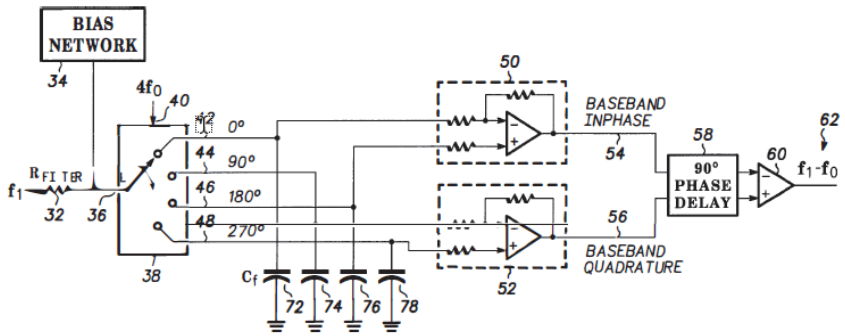
a. Tayloe

Tayloe is directed to a direct conversion receiver (also referred to as a "product detector") "for converting a signal to baseband." Ex. 1004, code (57); *see id.* at 1:51–52 (describing Figure 3). Tayloe explains that its direct conversion receiver

> includes a commutating switch which serves to sample an RF waveform four times per period at the RF frequency. The samples are integrated over time to produce an average voltage at 0 degrees, 90 degrees, 180 degrees and 270 degrees. The average voltage at 0 degrees is the baseband in-phase signal . . . .

Id. at code (57). Tayloe teaches that, "[a]lternatively, to increase gain, the 0 degree average can be differentially summed with the 180 degree average to form the baseband in-phase signal . . . ." *Id.* Tayloe states that "[d]irect conversion receivers are desirable in part because they convert signals of interest directly to baseband (or near zero hertz) from a radio frequency (RF) or an intermediate frequency (IF)." *Id.* at 1:10–13.

Tayloe's Figure 3 is reproduced below:



30 FIG. 3

Tayloe's Figure 3 "shows a direct conversion receiver." Ex. 1004, 1:51–52.

Tayloe discloses the following regarding the operation of the direct conversion receiver shown in the Figure 3:

> [A]n RF or IR signal f_1 is received at resistor 32. . . . After passing through resistor 32, the input signal is received by commutating switch 38 at input 36. Commutating switch 38 switches input 36 to outputs 42, 44, 46, and 48. The rate at which commutating switch 38 operates is controlled by a signal present at control input 40. In the preferred embodiment as shown in FIG. 3, the control signal input to control input 40 is substantially equal to four times the local oscillator frequency that would exist in a simple direct conversion receiver. As a result, input 36 is switched to each of the four outputs substantially once during each period of the input signal f_1.
>
> In the preferred embodiment, commutating switch 38 remains closed at each of the four outputs for substantially 90 degrees at the frequency of the input signal. In alternate embodiments, commutating switch 38 remains closed at each of the four outputs for less than 90 degrees.
>
> During the time that commutating switch 38 connects input 36 to output 42, charge builds up on capacitor 72. Likewise, during the time commutating switch 38 connects input 36 to output 44, charge builds up on capacitor 74. The same principle holds true for capacitors 76 and 78 when commutating switch 38 connects input 36 to outputs 46 and 48

> respectively. As commutating switch 38 cycles through the four outputs, capacitors 72–78 charge to voltage values substantially equal to the average value of the input signal during their respective quadrants. . . .
>
> Output 42 represents the average value of the input signal during the first quarter wave of the period, and is termed the 0 degree output. Output 44 represents the average value of the input signal during the second quarter wave of the period, and is termed the 90 degree output. Output 46 represents the average value of the input signal during the third quarter wave of the period, and is termed the 180 degree output. Output 48 represents the average value of the input signal during the fourth quarter wave of the period, and is termed the 270 degree output.

Id. at 2:13–55.

Tayloe describes the following regarding summing amplifiers 50 and 52:

> The outputs of commutating switch 38 are input to summing amplifiers 50 and 52. Summing amplifier 50 differentially sums the 0 degree output [42] and the 180 degree output [46], thereby producing baseband in-phase signal 54. Summing amplifier 52 differentially sums the 90 degree output and the 270 degree output, thereby producing baseband quadrature signal 56. Baseband in-phase signal 54 and baseband quadrature signal 56 are input to phase delay 58 which shifts the phase of baseband quadrature signal 56 by 90 degrees relative to baseband in-phase signal 54. The resulting signals are then summed by summing amplifier 60 to produce the signal of interest 62.

Ex. 1004, 2:56–67. Summing amplifiers 50, 52, and 60 show "+" and "-" input ports. *Id.* at Fig. 3.

Tayloe's Figure 4 is reproduced below:

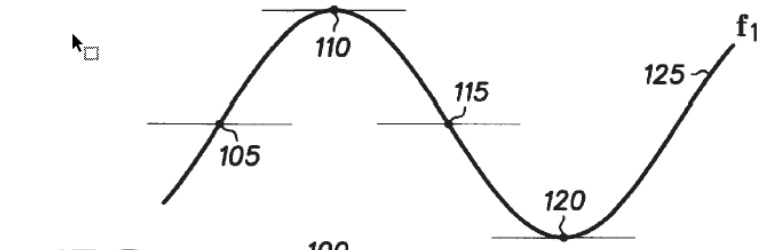


FIG. 4

Tayloe's Figure 4 "shows a waveform." Ex. 1004, 1:53–54.

Tayloe explains the following regarding Figure 4:

> Waveform 100 includes signal 125 which corresponds to the input signal f_1. Superimposed on signal 125 are points 105, 110, 115, and 120. Point 105 represents the voltage to which capacitor 72 (FIG. 3) charges. Likewise, point 110 represents the voltage to which capacitor 74 charges, point 115 represents the voltage to which capacitor 76 charges, and point 120 represents the voltage to which capacitor 78 charges.

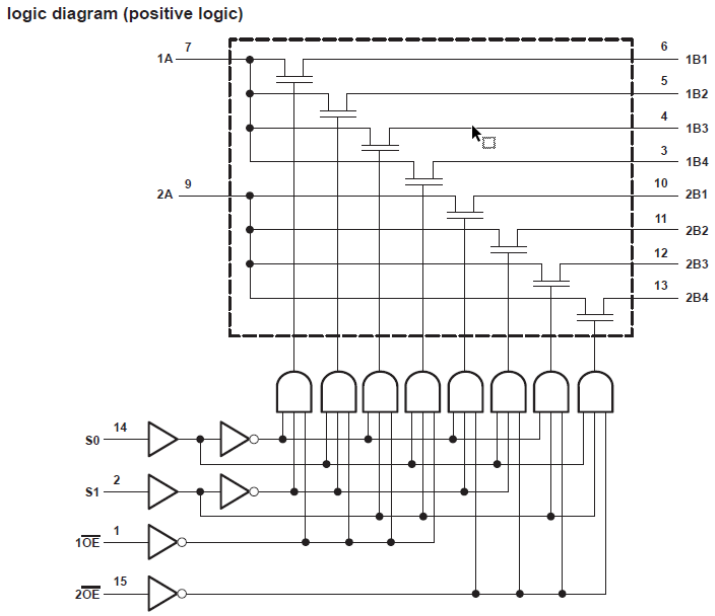
Id. at 3:40–48.

Tayloe further discloses the equipment used to achieve its stated experimental results, explaining: "A direct conversion receiver which utilizes a Tayloe Product Detector has been built. The receiver design is the same as direct conversion receiver 30 (FIG. 3) utilizing an analog multiplexer and a digital counter as shown in FIG. 7. The analog multiplexer is a Texas Instruments SN74BCT3253D." Ex. 1004, 5:32–37.

b. TI Datasheet

TI Datasheet is directed to SN74CBT3253, a "dual 1-of-4 high-speed [transistor-transistor logic]-compatible [field-effect transistor] multiplexer/demultiplexer." Ex. 1005, 1. TI Datasheet states "[t]he low on-state resistance of the switch allows connections to be made with minimal propagation delay." *Id.*

TI Datasheet includes the following figure:



The above figure illustrates a logic diagram (positive logic). Ex. 1005, 2. TI Datasheet explains "$1\overline{OE}$, $2\overline{OE}$, S0, and S1 select the appropriate output for the A-input data." *Id.* at 1.

3. Differences Between the Prior Art and the Claims; Motivation to Modify

Petitioners set forth a detailed analysis showing how the combined teachings of Tayloe and TI Datasheet meet the limitations of claims 2 and 3. Pet. 35–59. In particular, Petitioners rely on Tayloe as disclosing most of the elements of the claims, but rely on TI Datasheet for details of how to implement Tayloe's multiplexer/demultiplexer. *See, e.g.*, *id.* at 42 (discussing TI Datasheet's logic diagram of the TI SN74CBT3253D multiplexer/demultiplexer and its use of four switches to selectively supply an input signal to one of four outputs according to four control signals); 42–43 (discussing switches shown in TI Datasheet that Petitioners contend "show the implementation details of Tayloe's switch 38 (Figure 3) or its

multiplexer 202 (Figure 7)"). Petitioners contend Tayloe "specifically discloses a direct conversion receiver that includes a[n] SN74CBT3253 multiplexer/demultiplexer, and TI Datasheet describes the implementation details of the demultiplexer." *Id.* at 30 (citations omitted).

Additionally, Petitioners assert "Tayloe's express reference to the SN74CBT3253 provides sufficient motivation to combine Tayloe with the TI Datasheet describing that device." Pet. 30 (citing Ex. 1004, 5:33–37; Ex. 1005). Petitioners contend "combining Tayloe with TI Datasheet . . . would have yielded expected, predictable results." *Id.* at 32. Petitioners assert

> [e]ach combination would have been (1) a combination of prior art elements according to known methods to yield predictable results, since a [person of ordinary skill in the art] would have understood how to implement a demultiplexer in the context of Tayloe; (2) a simple substitution of one known element (the SN74CBT3253 demultiplexer in TI Datasheet) for another (the demultiplexer in Tayloe) to obtain predictable results; and (3) obvious to try—a choice of one type of demultiplexer from a finite number of identified, predictable solutions, with a reasonable expectation of success.

Id. (citing *KSR*, 550 U.S. at 421; *Leapfrog Enters., Inc. v. Fisher-Price, Inc.*, 485 F.3d 1157, 1162 (Fed. Cir. 2007); Ex. 1002 ¶ 116).

a. Claim 2

Patent Owner's sole argument directed to claim 2 is that Tayloe "does not disclose/teach/suggest" a "wireless modem apparatus." PO Resp. 72; *see id.* at 72–74. As discussed above, we determine that "wireless modem apparatus," which is recited in the preamble of claim 2, is not limiting. Thus, Patent Owner's argument directed to claim 2 does not detract from Petitioners' challenge.

We find Petitioners' arguments persuasive to demonstrate how the combination of Tayloe and TI Datasheet teaches the subject matter of claim 2 and supported sufficiently on the complete record before us, and, therefore, we adopt them as our own findings. Accordingly, for the reasons explained by Petitioners, we find that the combination of Tayloe and TI Datasheet teaches the subject matter of claim 2 and that one of ordinary skill in the art would have been motivated to combine the teachings of these two references as proposed by Petitioners with a reasonable expectation of success.

b. Claim 3

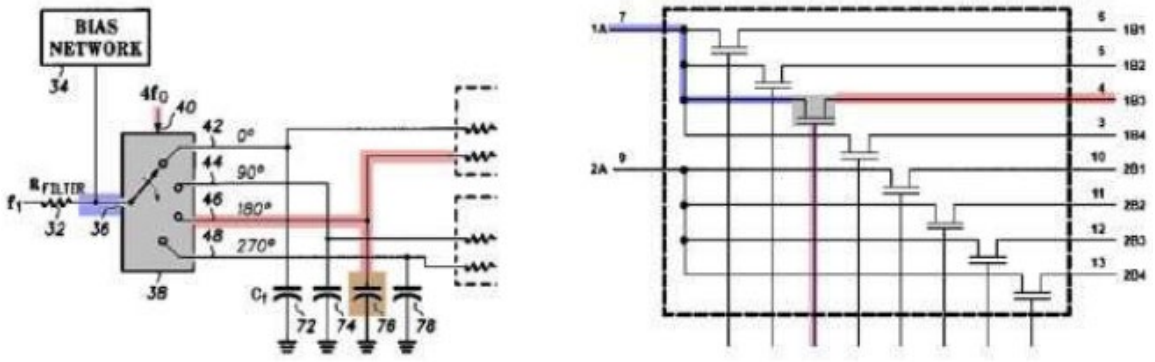
Regarding claim 3, Patent Owner's arguments, aside from its contentions regarding "wireless modem apparatus,"[19] are (1) that Tayloe fails to teach a "storage element" (recited in element [3E]), PO Resp. 59–72[20]; (2) it would not have been obvious to replace the voltage sampling configuration of Tayloe with an energy sampling configuration, *id.* at 72; and (3) objective evidence of nonobviousness weigh in favor of Patent Owner (*id.* at 17–19, 72). We first focus on Patent Owner's argument directed to "storage element" (recited in element [3E]) and then address

[19] Patent Owner's argument regarding "wireless modem apparatus" also applies to claim 3 (*see* PO Resp. 72), but, for the same reasons discussed above in the context of claim 2, does not detract from Petitioners' challenge to claim 3.

[20] Under its heading "**GROUND 1: Tayloe in View of the TI Datasheet**," Patent Owner notes that "[c]laims 3 and 4 recite a 'storage element.'" PO Resp. 59. Although Patent Owner is correct that claim 4 recites "storage elements," Petitioners do not challenge claim 4 under the combination of Tayloe and TI Datasheet; rather, Petitioners challenge claim 4 based on the combination of Lam, Enz, and Tayloe. *See* Pet. 7 (identifying the grounds for challenge).

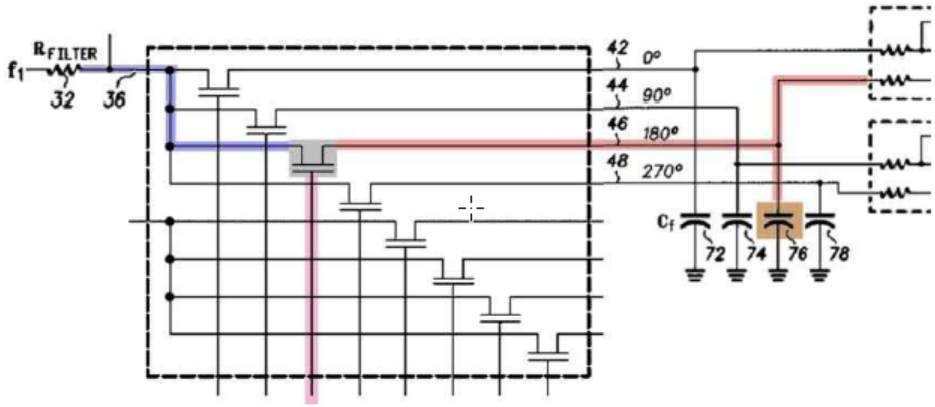
Patent Owner's additional arguments. For the other elements of claim 3 that are not challenged by Patent Owner, however, on the complete record, we find that Petitioners' argument and evidence establishes that the combination of Tayloe and TI Datasheet teaches each element and that one of ordinary skill in the art would have been motivated to combine the teachings of these two references as proposed by Petitioners with a reasonable expectation of success.

Element [3E] recites "wherein said first and said second frequency down-conversion modules each comprise a switch and a storage element." Ex. 1001, 61:16–18. Petitioners contend that, "[a]s explained for Elements [2B]-[2C], the combination of Tayloe and TI datasheet teaches a first frequency down-conversion module (for Tayloe's 180° output 46 (red)) comprising a first switch (TI Datasheet's transistor (gray)) and a first capacitor (Tayloe's capacitor 76 (brown))." Pet. 58 (citing Ex. 1002 ¶ 167; Ex. 1004, Fig. 3; Ex. 1005, 2). Petitioners rely on the annotated versions of Tayloe's Figure 3 (left) and TI Datasheet's logic diagram (right), reproduced below.



Id. Petitioners annotated Tayloe's Figure 3 (left) to highlight RF input signal f_1 36 in purple, 180° output 46 in red, and capacitor 76 in brown, and annotated TI Datasheet's logic diagram (right) to highlight input signal 1A

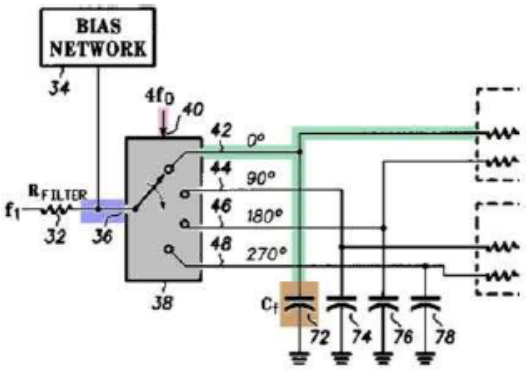
in purple, a transistor in gray, and output 4 in red. *Id.* Petitioners also provide the following figure showing the combined teachings of Tayloe and TI Datasheet.



Combined Teachings

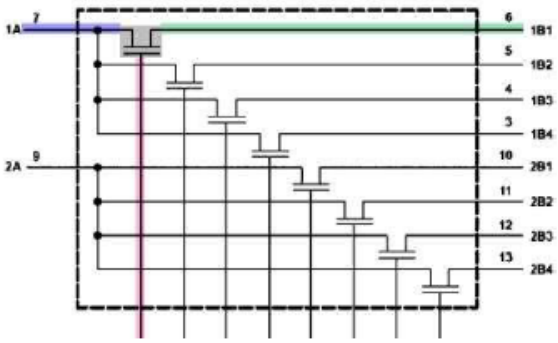
Id. Petitioners' figure of the combined teachings of Tayloe and TI Datasheet shows an annotated version of TI Datasheet's logic diagram (left), with the same highlighting described above, and an annotated version of Tayloe's Figure 3 (right), highlighted to show capacitor 76 in brown and 180° output 46 in red.

Additionally, Petitioners assert that, "[s]imilarly . . . , the combination teaches a second frequency down-conversion module (for Tayloe's 0° output 42 (green) comprising a second switch (TI Datasheet's transistor (gray)) and a second capacitor (Tayloe's capacitor 72 (brown))." Pet. 59. Petitioners rely on the annotated versions of Tayloe's Figure 3 (left) and TI Datasheet's logic diagram (right), reproduced below.



Ex.1004-Tayloe

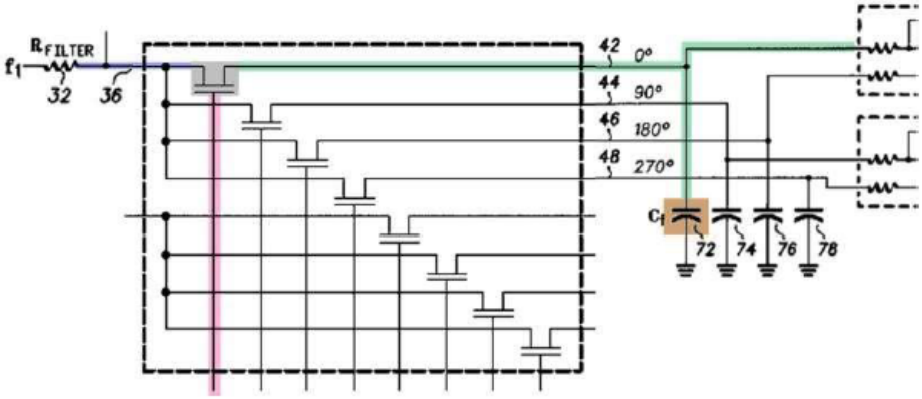
Fig. 3



Ex.1005-TI

Datasheet, 2

Id. Petitioners annotated Tayloe's Figure 3 (left) to highlight RF input signal f_1 36 in purple, 0° output 42 in green, and capacitor 72 in brown, and annotated TI Datasheet's logic diagram (right) to highlight input signal 1A in purple, a transistor in gray, and output 6 in green. *Id.* Petitioners also provide the following figure showing the combined teachings of Tayloe and TI Datasheet.



Combined Teachings

Id. Petitioners' figure of the combined teachings of Tayloe and TI Datasheet shows an annotated version of TI Datasheet's logic diagram (left), with the same highlighting described above, and an annotated version of Tayloe's Figure 3 (right), highlighted to show capacitor 72 in brown and 0° output 42 in green.

Further, Petitioners contend that "[a] capacitor is a well-known storage element, and the '444 patent embodiment discloses a capacitor as the storage element." Pet. 59 (citing Ex. 1001, 34:22–23, 36:14–15; Ex. 1002 ¶ 169).

Patent Owner contends that Tayloe's capacitor 30 is not a "storage element." PO Resp. 59. Patent Owner asserts that "[t]he Petition fails to set forth any argument/theory that any capacitor in Tayloe '*stores non-negligible* amounts of energy from an input electromagnetic signal,' and, thus, the Petition fails." *Id.*

Patent Owner raises three primary arguments directed to element [3E]. First, Patent Owner argues that Tayloe's capacitor is not a "storage element" because it does not store *non-negligible* amounts of energy; rather, according to Patent Owner, Tayloe's capacitors hold *negligible* amounts of energy. PO Resp. 59 (referring to Patent Owner's Response §§ VII, VIII.B.1, VIII.B.2). Relying on Dr. Steer's declaration testimony, Patent Owner contends that "one way to determine energy storage is to perform calculations based on a time constant. Using a time constant together with a capacitance value provides the proportion of available energy that is transferred during a sampling aperture." *Id.* at 60 (citing Ex. 2038 ¶ 307). Patent Owner walks through three steps of calculations, spanning four pages of its Patent Owner Response, and, relying on those calculations, asserts that "[o]nly **0.193%** of the energy available is held on a Tayloe capacitor." *Id.* at 61–65 (citing Ex. 2038 ¶¶ 309, 315–335). Patent Owner asserts that "the size of Tayloe's capacitors has nothing to do with energy storage." *Id.* at 61 (providing reasons why Tayloe's uses a higher capacitance (citing Ex. 1003, 2:14–15, 3:21–22; Ex. 2038 ¶¶ 310–314)). Patent Owner also calculates an amount of

energy from Figure 82B of the '551 patent, which Patent Owner identifies as showing an exemplary energy transfer system. *Id.* at 61, 65–67 (citing Ex. 2038 ¶¶ 309, 336–342).

Second, Patent Owner asserts that Tayloe's capacitors are not elements of an energy transfer system, a limitation Patent Owner contends "should be incorporated into the construction" of "storage element." PO Resp. 68, *see id.* at 68–71. Rather, Patent Owner contends that Tayloe is a voltage sampling system. *Id.* at 68. As an alleged voltage sampling system, Patent Owner contends that Tayloe's capacitors are *holding* elements, not *storage* elements. *Id.* Patent Owner asserts that "[t]he type of load used in Tayloe further demonstrates that Tayloe is a *voltage* sampling system." *Id.*; *see id.* at 68–71 (asserting that Tayloe uses a high impedance load). Based on a series of calculations, Patent Owner argues that a very small fraction of the energy (0.0000001378%) is delivered to the load relative to the available energy. *Id.* at 70–71 (citing Ex. 2038 ¶¶ 351–352). As Patent Owner acknowledges, this argument primarily is based on Patent Owner's claim construction of "storage element," which seeks to limit this term to "energy transfer systems." *See id.* at 68.

Third, and related to Patent Owner's argument that energy transfer system should be incorporated into the construction of "storage element," Patent Owner asserts that "it would not have been obvious to a [person of ordinary skill in the art] to replace the voltage sampling configuration of Tayloe with an energy sampling configuration." PO Resp. 72. Patent Owner contends that "[t]here is no teaching/suggestion/motivation to do so; voltage and energy sampling are *fundamentally different and competing*

technologies."[21] *Id.* And, Patent Owner argues that "secondary considerations of non-obviousness demonstrate that, at the time of the invention, (1) such a dramatic modification of Tayloe was not envisioned by a [person of ordinary skill in the art], and (2) the challenged claims are not obvious in view of Tayloe."[22] *Id.* (citing PO Resp. § VII.D). Patent Owner also argues that "[o]ne would have to use hindsight to modify Tayloe to use a *low* impedance load and *energy* sampling to get to the claimed invention." *Id.* (citing Ex. 2038 ¶¶ 353–354).

In their Reply, Petitioners first contend that "[t]he Board previously found that Tayloe discloses a first storage element (*i.e.*, capacitor 76) and a second storage element (*i.e.*, capacitor 72)." Pet. Reply 13 (citing Ex. 2016, 57–58; Pet. 58–59; Ex. 1004, Fig. 3; Ex. 1002 ¶¶ 167–169). Petitioners assert that collateral estoppel applies and the Board's Final Written Decision in IPR2020-01265 resolves this dispute in favor of Petitioners. *Id.* at 14. Petitioners argue that, "even if the Board's previous decision does not trigger collateral estoppel, it should be given persuasive effect in these proceedings." *Id.*

Second, Petitioners contend that, "[t]o the extent that the Board elects to revisit this issue, it should reach the same conclusion." Pet. Reply 15. In particular, Petitioners assert that Tayloe uses switch 38 and capacitors 72 and 76 to down-convert an input signal to baseband. *Id.* at 15–16 (citing Ex. 1004, 2:13–67; Ex. 1002 ¶¶ 88–89; Ex. 2016, 44–70; Ex. 1021, 39:17–

[21] Patent Owner's argument is inapposite as Petitioners do not propose modifying Tayloe to perform energy sampling as Patent Owner contends.
[22] We address Patent Owner's argument as to objective indicia of nonobviousness below. *See infra* § III.B.4.

42:6). Petitioners argue that, "[g]iven that Tayloe's capacitors perform down-conversion, '***that is proof***' under the '444 [patent's] lead inventor's own testimony that the capacitors store non-negligible energy." *Id.* at 16 (citing *ParkerVision, Inc. v. Qualcomm Inc.*, 621 F. App'x 1009, 1019 (Fed. Cir. 2015)). Petitioners contend that Patent Owner's "argument that Tayloe does not disclose storage elements . . . , fails to apply the Board's construction, and further contradicts the sworn testimony from its own lead inventor." *Id.* at 16–17 (citing PO Resp. 59–72; Pet. Reply § II.A).

In particular, Petitioners challenge Patent Owner's "attempts to further construe 'non-negligible' from the construction of 'storage [element]' to require that the amount of energy on a capacitor must be shown 'mathematically' in a complex, three-step calculation that compares the 'total available energy' to the 'energy in a capacitor.'" Pet. Reply 5. Petitioners assert that Patent Owner and Dr. Steer "offer no legitimate reason for requiring a comparison of the capacitor's energy to the 'total available energy' in the context of down-converting an input EM signal." *Id.* at 5–6. Petitioners point to prior testimony regarding the meaning of a "non-negligible" amount of energy by named-inventor David Sorrells from litigation between Patent Owner and Qualcomm, Inc. ("Qualcomm"). *Id.* at 6 (citing, *inter alia*, *ParkerVision*, 621 F. App'x at 1018).

Specifically, Petitioners contend that

> Mr. Sorrells "explained at trial that transferring a non-negligible amount of energy into the storage capacitor means 'that you have to transfer enough energy *to overcome the noise in the system* to be able to meet your specifications.'" 621 F. App'x at 1019 (emphasis added). Mr. Sorrells thus concluded that when a product functions according to its specifications, this "is *proof that a 'non-negligible' amount of energy is transferred to*

> *the storage element* in those products." 621 F. App'x at 1019 (emphasis added). As viewed by the Federal Circuit, "Mr. Sorrells' testimony thus establishes that to determine whether or not energy in amounts distinguishable from noise has been transferred from the carrier signal, one may look to whether the down-converting circuit functions in practice. If a circuit successfully down-converts, *that is proof that enough energy has been transferred to overcome the noise in the system*." *Id.* (emphasis added).

Pet. Reply 6–7. Petitioners assert that, "if the Board deems it necessary to construe the word "non-negligible" from its construction of 'storage [element],' it should hold that when a device employs a capacitor in order to 'successfully down-convert' a signal, then 'that is proof' that the capacitor stores non-negligible energy." *Id.* at 7 (citing *ParkerVision*, 621 F. App'x at 1019).[23]

Additionally, Petitioners argue that, "even if a mathematical calculation of negligible and non-negligible energy was somehow required (which it is not), the energy stored in each of Tayloe's capacitors is 'non-negligible' even under Dr. Steer's own calculations," which resulted in 0.193% of the available energy, because dependent claim 42 of the '551 patent "teaches that 'one tenth of one percent of the energy' is 'non-negligible.'" Pet. Reply 17 (citing Ex. 2029, claims 41, 42; Ex. 1021, 51:3–52:11).

In its Sur-reply, Patent Owner challenges Petitioners' reliance on Mr. Sorrells' testimony, contending that "instead of providing expert

[23] Petitioners also assert that Dr. Steer "failed to consider crucial materials in arriving at his opinion here, as he did not review Mr. Sorrell[s'] prior testimony regarding the meaning of 'non-negligible,' nor did he consider the Federal Circuit and District Court opinions relying on that testimony." Pet. Reply 7 n.6 (citing Ex. 1016, 55:25–56:14, 60:5–67:20, 72:11–74:5).

rebuttal, Petitioners chose to rely on out-of-context testimony by one inventor of the '444 patent and *attorney* interpretation of the cited references in view of that testimony." PO Sur-reply 1. Patent Owner asserts that it is not seeking to *require* a complex, three-step mathematical calculation to define non-negligible. *Id.* at 8. Rather, according to Patent Owner "whether mathematical calculations are used depends on the prior art's disclosure and, even then, does not require a specific calculation." *Id.* at 7 n.8. Patent Owner points to its arguments in the Patent Owner Response that the calculations show "*one way*" to determine energy storage. *Id.* In other words, Patent Owner suggests that there may be *other* ways to demonstrate non-negligible energy storage.[24] *See id.* But, Patent Owner asserts that "'[n]on-negligible' is a relative term and must be demonstrated in some manner," which Petitioners fail to do. *Id.* at 8.

Patent Owner contends that Petitioners' argument based on Mr. Sorrells' prior testimony is flawed because (1) it "is a concept and just attorney argument"; (2) the concept is solely based on extrinsic evidence—testimony by one inventor years after the '444 patent issued; and (3) Petitioners ignore key portions of Mr. Sorrells' testimony. PO Sur-reply 7–8. Patent Owner walks through Mr. Sorrells' testimony, contending that Petitioners' argument fails to accurately reflect both his actual testimony and how the testimony was applied by the Federal Circuit in its prior decision. *Id.* at 10–15. Patent Owner asserts that the "two key take-aways"

[24] Patent Owner notes that its "energy storage analysis" of the Lam/Enz capacitors, in response to Petitioners' challenge based on those references, "does not include mathematical calculations." PO Sur-reply 8 n.8 (citing PO Resp. 74–75).

from the Federal Circuit's decision are "(1) Mr. Sorrells's position is *one way* (not the only way) of determining non-negligible amounts of energy, and (2) whether a circuit 'successfully' down-converts depends on whether it meets cellular/wireless specifications." *Id.* at 12.

Patent Owner's primary argument in response to Petitioners' reliance on Mr. Sorrells' testimony is that Petitioners do not address whether the prior art references meet cellular/wireless specifications.[25] PO Sur-reply 13–15. Patent Owner contends that, "if Petitioners are going to follow the Federal Circuit's decision, simply showing the prior art down-converts a signal is not enough. Petitioners must show that the prior art 'successfully' down-converts a signal. To do so, Petitioners must identify cellular/wireless specifications and demonstrate that the prior art meet those specifications." *Id.* at 13–14. Patent Owner asserts that Petitioners "ignore the requirement of 'successfully' down-converting because they cannot prove it." *Id.* at 14. Specifically, Patent Owner argues that "there is no concept of cellular/wireless specifications to be met in those references, there is no evidence that such specifications were met, and there is no expert testimony otherwise. There is simply no evidence for Petitioners to meet their burden." *Id.* By not relying on a reply declaration, Patent Owner contends that Petitioners are left only with attorney argument and that Tayloe performs down-conversion. *Id.* But, according to Patent Owner, performing

[25] Patent Owner also contends that Mr. Sorrells' testimony is directed to "transferring" energy to a capacitor whereas the claims here pertain to "storing" energy in a capacitor. PO Sur-reply 13. Nonetheless, Patent Owner does not argue that this difference results in any distinction in terms of our consideration of the primary question before us—whether the prior art teaches a "storage element."

down-conversion alone, "says nothing about how [Tayloe's] system[] work[s] and does not meet Mr. Sorrells's standard." *Id.* Further, Patent Owner argues that Petitioners' position is "illogical" because voltage sampling systems also perform down-conversion, but they use capacitors that hold negligible amounts of energy. Thus, it cannot follow that merely because down-conversion occurs, that means Tayloe's capacitors store a non-negligible amount of energy. *Id.* at 14–15.

As reflected above, element [3E] recites "a storage element." Ex. 1001, 61:17–18. As also reflected above, the parties dispute the proper construction of "storage element" and also dispute the meaning of the construction. In other words, there are multiple levels of complexity regarding the dispute between the parties pertaining to this limitation. For the reasons discussed above, we construe "storage element" to mean "an element of a system that stores non-negligible amounts of energy from an input EM signal." *See supra* § II.A. That determination resolves the first level of the parties' dispute because we do not construe "storage element" as limited to an energy transfer system.

The second level of the parties' dispute, to which the discussion above is primarily directed, is the meaning of "non-negligible amounts of energy." On this point, although Patent Owner presents a multi-step series of calculations, Patent Owner expressly states that determining whether an amount of energy is a non-negligible amount of energy "does not require a specific calculation" (PO Sur-reply 8 n.8) and that its calculations are but "*one way*" to approach the question (*id.*). Additionally, Patent Owner acknowledges that Mr. Sorrells' testimony also provides "*one way*" of determining a non-negligible amount of energy. *Id.* at 12. Yet, as discussed

in several instances at the oral hearing, Patent Owner cannot or would not identify any specific amount that indicates when a negligible amount of energy becomes a non-negligible amount of energy. *See, e.g.*, Tr. 73:15–18, 77:18–79:11. Patent Owner's arguments give the impression that a non-negligible amount of energy is a moving target because Patent Owner is the only party that can tell when an amount is negligible or non-negligible, a non-negligible amount is relative, and it depends on the circuit in question at any given time.

Fortunately, the Federal Circuit already has addressed essentially the same question. In *ParkerVision, Inc. v. Qualcomm Inc.*, the Federal Circuit addressed claims of several patents, including the '551 patent—the precise patent on which the parties rely to explain the meaning and application of "storage element." *ParkerVision*, 621 F. App'x at 1011 (identifying four patents at issue). Claim 23 of the '551 patent, which the Federal Circuit identified as a representative claim, is directed to an apparatus for down-converting a carrier signal to a lower frequency signal, comprising, *inter alia*, "a storage module" and recites "wherein said storage module receives non-negligible amounts of energy transferred from a carrier signal." *Id.* As part of its cross-appeal, Qualcomm argued that claim 23, and others, should have been held invalid by the district court. *See id.* at 1017–18. One of the arguments raised by Patent Owner, similar to the one here, was that the prior art at issue did not disclose transferring non-negligible amounts of energy from a carrier signal to a storage capacitor. *See id.* at 1018 ("First,

Weisskopf[26] does not disclose transferring 'non-negligible amounts of energy' from the carrier signal to the storage capacitor.").

In addressing that argument by Patent Owner, the Federal Circuit explained, "[t]he asserted claims all require transferring 'non-negligible amounts of energy' from the carrier signal to a store device, such as the storage capacitor in Weisskopf." *ParkerVision*, 621 F. App'x at 1018. The Federal Circuit explained that "[t]he district court construed 'non-negligible amounts of energy' to mean 'energy in amounts that are distinguishable from noise.'" *Id.* And, the Federal Circuit noted that the "construction is not disputed on appeal." *Id.* Here, neither party has provided any sufficient reason why we should construe "non-negligible amounts of energy" differently than the Federal Circuit in *ParkerVision*. Accordingly, because this specific issue of what amounts to "non-negligible amounts of energy" was already decided by the Federal Circuit, we construe this term to mean "energy in amounts that are distinguishable from noise."[27]

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[26] P.A. Weisskopf, "Subharmonic Sampling of Signal Processing Requirements," Microwave Journal, May 1992, 239–47. The same article is Exhibit 1023 in IPR2014-00948.

[27] The intrinsic record does not define "non-negligible amounts of energy," but the '551 patent does state, when referring to an energy transfer signal, that it includes "a train of pulses having non-negligible apertures *that tend away from zero*." Ex. 2029, 66:36–39 (emphasis added); *see also* Ex. 1001, 13:15–17 ("In another embodiment, the pulses of control signal 2006 have non-negligible apertures that tend away from zero."). Even if we applied a meaning of non-negligible as tending away from zero, that construction would not assist in resolving the parties' dispute because neither party can explain where to draw the line between negligible and non-negligible amounts of energy simply based on that meaning. Thus, the Federal Circuit's decision provides a better basis from which to understand the meaning of non-negligible in this context.

The next logical question the Federal Circuit faced in *ParkerVision* was how to determine if energy in amounts that are distinguishable from noise is transferred from the carrier signal to the storage device. *ParkerVision*, 621 F. App'x at 1018–19. The Federal Circuit relied on Mr. Sorrells' testimony to answer this specific question. The Federal Circuit stated:

> Mr. Sorrells explained at trial that transferring a non-negligible amount of energy into the storage capacitor means "that you have to transfer enough energy to overcome the noise in the system to be able to meet your specifications." He further testified that the fact that the accused Qualcomm products meet "all of the cellular/cellphone specifications" is proof that a "non-negligible" amount of energy is transferred to the storage element in those products.
>
> Mr. Sorrells' testimony thus establishes that to determine whether or not energy in amounts distinguishable from noise has been transferred from the carrier signal, one may look to whether the down-converting circuit functions in practice. If a circuit successfully down-converts, that is proof that enough energy has been transferred to overcome the noise in the system.

Id. at 1019.[28]

Having decided how to determine whether energy in amounts distinguishable from noise has been transferred to a storage module, the Federal Circuit turned to testimony provided by Qualcomm's expert, who the Federal Circuit found "testified, without contradiction, that the Weisskopf system is designed to maximize the amount of energy transferred

[28] Mr. Sorrells' testimony was directed to the issue of infringement (hence the discussion of "the accused Qualcomm products"). *ParkerVision*, 621 Fed. App'x at 1012 ("To prove infringement, ParkerVision called . . . David Sorrells, one of the inventors.").

from the carrier signal." *ParkerVision*, 621 F. App'x at 1019. The Federal Circuit concluded that "[t]he fact that Weisskopf transfers as much energy as possible from the carrier signal, resulting in a commercially viable down-converting system is proof that the system successfully distinguishes the transferred energy from noise." *Id.*

Applying the discussion above, we first recognize that, although claim 3 does not expressly recite transferring energy from the carrier signal to the storage device, the construction we adopt for "storage element" is "an element of a system that stores non-negligible amounts of energy from an input EM signal." Thus, the language we consider is substantially similar to the language at issue in *ParkerVision*. In both circumstances, energy *from* a signal is stored at a storage element/device. And, neither party raises any specific reason why the Federal Circuit's analysis would not apply equally here.[29] Accordingly, Patent Owner's argument that the Federal Circuit "refers to *transferring* energy to a capacitor to *overcome noise* whereas Petitioners refer to *storing* energy in a capacitor" is a distinction without a difference. *See* PO Sur-reply 13.

Second, we disagree with Patent Owner's strained reading of the Federal Circuit's decision and with Patent Owner's argument that places far too much emphasis on what Patent Owner contends the Federal Circuit meant by "successfully" down-converting. Patent Owner asserts that to show Tayloe successfully down-converts, in accordance with the Federal Circuit's decision, Petitioners were required to "identify cellular/wireless

[29] In fact, Patent Owner acknowledges that "Mr. Sorrells's position is *one way* (not the only way) of determining non-negligible amounts of energy." PO Sur-reply 12.

specifications and demonstrate that the prior art meet[s] those specifications." PO Sur-reply 14. We disagree because the Federal Circuit's decision fails to support Patent Owner's argument. In particular, when considering whether Weisskopf satisfied this aspect of the claims at issue in that case, the Federal Circuit did not identify or rely on evidence regarding cellular or wireless specifications.[30] Rather, the Federal Circuit noted that Weisskopf transfers as much energy as possible resulting in a "commercially viable down-converting system" and that was "proof that the system successfully distinguishes the transferred energy from noise." *ParkerVision*, 621 F. App'x at 1019. The Federal Circuit's discussion does not identify how the court determined that Weisskopf's system was commercially viable. But, Weisskopf is an article, not an issued patent, such as Tayloe.[31] Tayloe expressly states that it "relates in general to radio receivers" and describes that a specific product ("[a] direct conversion receiver which utilizes a Tayloe Product Detector") has been built and that it successfully down-converts an input EM signal. Ex. 1004, 1:5–6, 5:32–60; *see also* Tr. 125:21–126:10 (addressing Tayloe's performance of down-conversion).

[30] Patent Owner focuses primarily on the Federal Circuit's discussion of Mr. Sorrells' testimony regarding Qualcomm's accused products as opposed to considering how the Federal Circuit specifically *applies that testimony* to determining whether Weisskopf (an anticipatory reference) satisfies the test for infringement set forth by Mr. Sorrells. We also note that, in *ParkerVision*, despite Mr. Sorrells' testimony, Patent Owner contended that Weisskopf failed to disclose transferring non-negligible amounts of energy, a position the Federal Circuit found "[n]o reasonable jury could have concluded . . . ." *See ParkerVision*, 621 F. App'x at 1019.

[31] As an issued patent, Tayloe is presumed to be enabled. *See, e.g.*, *Cephalon v. Watson Pharms., Inc.*, 707 F.3d 1330, 1337 (Fed. Cir. 2013) (recognizing that an issued patent is presumed to be enabled).

Accordingly, because Tayloe is a patent that is presumed to be enabled such that it operates in a manner that successfully down-converts and does so in a viable system that has been used in radio receivers, we find that constitutes sufficient evidence that Tayloe's capacitors 72 and 76 are "storage elements" as that term is used in the context of the '444 patent. In other words, Tayloe's capacitors are "element[s] of a system that store[] non-negligible amounts of energy [i.e., energy in amounts that are distinguishable from noise] from an input EM signal."[32] Thus, we find that Petitioners have shown that Tayloe teaches element [3E].

c. Summary as to Claims 2 and 3

For the reasons discussed above, we find that Petitioners have established on the complete record before us that the combination of Tayloe and TI Datasheet teaches the subject matter of claims 2 and 3 and that one of ordinary skill in the art would have been motivated to combine the teachings of these two references as proposed by Petitioners with a reasonable expectation of success.

4. Objective Indicia of Nonobviousness

Patent Owner contends that, "[i]n the late 1990s through March 2000, there was a long-felt need for a solution for direct down-conversion." PO Resp. 17. Patent Owner asserts that "[t]he industry was looking to voltage sampling and mixing using nonlinear or time-varying elements to solve the direct down-conversion problem. But these solutions had their own

[32] In light of our determination, we need not also address the parties' arguments regarding dependent claim 42 of the '551 patent and whether 0.1% is a non-negligible amount of energy.

problems (e.g., too much noise) and were never widely implemented commercially (if at all)." *Id.* at 18 (citing Ex. 2038 ¶¶ 234–235).

Patent Owner contends that "[u]sing energy sampling at the time was counter-intuitive and against the thinking of the industry, which was looking to replicate the voltage of the RF signal and use that voltage to derive a baseband signal. Energy sampling did not accurately replicate the voltage of an RF signal." PO Resp. 18 (citing Ex. 2038 ¶¶ 237–238). Patent Owner asserts that

> [e]nergy sampling had a number of unexpected results: an energy sampling downconverter (1) enables selection of just one channel from a band, (2) uses enough of the available RF energy so that the desired baseband signal stands out from the noise which, in turn, improves RF receiver performance, lowers power consumption, allows for reduction/elimination of expensive/bulky external components, and (3) is surprisingly linear (at the time of the invention, the common understanding was that competing mixing technologies were nonlinear).

Id. (citing Ex. 2038 ¶¶ 239–242). Patent Owner argues that "[u]nknown at this time by industry and academia was that, by using an energy transfer system, RF receivers could be built smaller, cheaper and with improved performance." *Id.* Patent Owner contends that Qualcomm recognized the significance of Patent Owner's energy transfer system "as set forth in [the] challenged claims" and subsequently Qualcomm and others in the industry "transitioned away from superheterodyne receivers and mixer technology and began to use the energy transfer system set forth in the challenged claims." *Id.* at 18–19 (citing Ex. 2038 ¶¶ 243–245).

As set forth above, in its discussion of Tayloe, Patent Owner contends that it would not have been obvious to one of ordinary skill in the art "to replace the voltage sampling configuration of Tayloe with an energy

sampling configuration." PO Resp. 72. And, Patent Owner contends that "secondary considerations of non-obviousness demonstrate that, at the time of the invention, (1) such a dramatic modification of Tayloe was not envisioned by a [person of ordinary skill in the art], and (2) the challenged claims are not obvious in view of Tayloe." *Id.* Patent Owner contends that "[o]ne would have to use hindsight to modify Tayloe to use a *low* impedance load and *energy* sampling to get to the claimed invention." *Id.* (citing Ex. 2038 ¶¶ 353–354).

Objective indicia of nonobviousness are "only relevant to the obviousness inquiry 'if there is a nexus between the claimed invention and the [objective indicia of nonobviousness].'" *In re Affinity Labs of Tex., LLC*, 856 F.3d 883, 901 (Fed. Cir. 2017) (quoting *Ormco Corp. v. Align Tech., Inc.*, 463 F.3d 1299, 1312 (Fed. Cir. 2006)). For objective indicia of nonobviousness to be accorded substantial weight, their proponent must establish a nexus between the evidence and the merits of the claimed invention. *ClassCo, Inc., v. Apple, Inc.*, 838 F.3d 1214, 1220 (Fed. Cir. 2016). "[T]here is no nexus unless the evidence presented is 'reasonably commensurate with the scope of the claims.'" *Id.* (quoting *Rambus Inc. v. Rea*, 731 F.3d 1248, 1257 (Fed. Cir. 2013)).

A patentee is entitled to a presumption of nexus "when the patentee shows that the asserted objective evidence is tied to a specific product and that product 'embodies the claimed features, and is coextensive with them.'" *Fox Factory, Inc. v. SRAM, LLC*, 944 F.3d 1366, 1373 (Fed. Cir. 2019) (quoting *Polaris Indus., Inc. v. Arctic Cat, Inc.*, 882 F.3d 1056, 1072 (Fed. Cir. 2018) (quoting *Brown & Williamson Tobacco Corp. v. Philip Morris Inc.*, 229 F.3d 1120, 1130 (Fed. Cir. 2000))); *Lectrosonics, Inc. v. Zaxcom,*

Inc., IPR2018-01129, Paper 33, 32 (PTAB Jan. 24, 2020) (precedential, designated Apr. 14, 2020). On the other hand, a patentee is not entitled to a presumption of nexus if the patented invention is only a component of a commercially successful machine or process. *Fox Factory*, 944 F.3d at 1373 (reaffirming the importance of the "coextensiveness" requirement).

"[T]he purpose of the coextensiveness requirement is to ensure that nexus is only presumed when the product tied to the evidence of secondary considerations '*is* the invention disclosed and claimed.'" *Fox Factory*, 944 F.3d at 1374 (quoting *Demaco Corp. v. F. Von Langsdorff Licensing Ltd.*, 851 F.2d 1387, 1392 (Fed. Cir. 1988)). "[T]he degree of correspondence between a product and a patent claim falls along a spectrum. At one end of the spectrum lies perfect or near perfect correspondence. At the other end lies no or very little correspondence." *Id.* "A patent claim is not coextensive with a product that includes a 'critical' unclaimed feature that is claimed by a different patent and that materially impacts the product's functionality." *Id.* at 1375.

However, "[a] finding that a presumption of nexus is inappropriate does not end the inquiry into secondary considerations." *Fox Factory*, 944 F.3d at 1375. "To the contrary, the patent owner is still afforded an opportunity to prove nexus by showing that the evidence of secondary considerations is the 'direct result of the unique characteristics of the claimed invention.'" *Id.* at 1373–74 (quoting *In re Huang*, 100 F.3d 135, 140 (Fed. Cir. 1996)). "Where the offered secondary consideration actually results from something other than what is both claimed and *novel* in the claim, there is no nexus to the merits of the claimed invention," meaning that "there must be a nexus to some aspect of the claim not already in the prior

art." *In re Kao*, 639 F.3d 1057, 1068–69 (Fed. Cir. 2011). On the other hand, there is no requirement that "objective evidence must be tied exclusively to claim elements that are not disclosed in a particular prior art reference in order for that evidence to carry substantial weight." *WBIP*, 829 F.3d at 1331. A patent owner may show, for example, "that it is the claimed combination as a whole that serves as a nexus for the objective evidence; proof of nexus is not limited to only when objective evidence is tied to the supposedly 'new' feature(s)." *Id.* at 1330.

Ultimately, the fact finder must weigh the objective indicia evidence presented in the context of whether the claimed invention, as a whole, would have been obvious to a skilled artisan. *WBIP*, 829 F.3d at 1331–32. Once the patentee has presented a prima facie case of nexus, the burden of coming forward with evidence in rebuttal shifts to the challenger "to adduce evidence to show that the commercial success was due to extraneous factors other than the patented invention." *Demaco*, 851 F.2d at 1393.

Here, we first note that Patent Owner's arguments as to objective indicia appear to be responding to a position not asserted by Petitioners—to replace the voltage sampling configuration of Tayloe with an energy sampling configuration. *See* PO Resp. 72. As discussed above, Petitioners do not propose to modify Tayloe as Patent Owner contends. And, as also discussed above, we decline to construe "storage element" as limited to an "energy transfer system." *See supra* § II.A. Thus, in large part, Patent Owner's arguments as to nonobviousness do not respond to Petitioners' arguments and evidence discussed above.

Nonetheless, even assuming that all or some of Patent Owner's arguments and Dr. Steer's testimony are directed to the combination

proposed by Petitioners, Patent Owner's evidence of nonobviousness remains insufficient to "be accorded substantial weight" because Patent Owner fails to "establish a nexus between the evidence and the merits of the claimed invention." *ClassCo*, 838 F.3d at 1220. In particular, neither Patent Owner nor Dr. Steer makes any attempt to establish nexus with the elements recited in any specific challenged claim based on a presumption of co-extensiveness or otherwise. Rather, Patent Owner and Dr. Steer only tie the discussion to energy transfer systems or energy sampling *in general*, which is based on Patent Owner's proposed claim construction that we do not adopt, and make no attempt to tie their discussion to the specific language of any of the Challenged Claims. *See* Ex. 2038 ¶¶ 234–245 (referring generally to "energy sampling" or "energy transfer" systems as set forth in "claims 2-4 of the '444 patent"). Moreover, Patent Owner does not contend that claim 2 of the '444 patent is limited to energy transfer systems. *See* PO Resp. 59–72 (arguing, *inter alia*, that claims 3 and 4[33] (not claim 2, which does not recite a "storage element") are directed to energy transfer systems). This disconnect further reflects that Patent Owner's arguments as to objective indicia of nonobviousness are not tied to specific claims. Thus, for each of these reasons, we find that Patent Owner fails to establish that a presumption of nexus is warranted and similarly fails to establish nexus absent the presumption. Accordingly, for the reasons above, Patent Owner has not satisfied its burden to establish nexus. *See WMS Gaming Inc. v. Int'l*

[33] As noted above, Petitioners do not challenge the patentability of claim 4 based on the combination of Tayloe and TI Datasheet; rather, Petitioners challenge claim 4 based on the combination of Lam, Enz, and Tayloe. *See* Pet. 7 (grounds for challenge).

Game Tech., 184 F.3d 1339, 1359 (Fed. Cir. 1999) (patent owner "bears the burden of showing that a nexus exists").

Nonetheless, in spite of the above failures, we consider Patent Owner's weak evidence of nonobviousness in our weighing of the *Graham* factors below.

5. Weighing the Graham Factors

"Once all relevant facts are found, the ultimate legal determination [of obviousness] involves the weighing of the fact findings to conclude whether the claimed combination would have been obvious to an ordinary artisan." *Arctic Cat*, 876 F.3d at 1361. On balance, considering the complete record before us and for the reasons explained above, the evidence of obviousness is very strong and the evidence of nonobviousness, which includes Patent Owner's objective evidence of nonobviousness, is very weak. As a result of that balancing, we determine that Petitioners have established by a preponderance of the evidence that the combination of Tayloe and TI Datasheet would have rendered the subject matter of claims 2 and 3 obvious to one of ordinary skill in the art at the time of the invention.

C. Obviousness over Lam, Enz, and Tayloe

Petitioners assert the combination of Lam, Enz, and Tayloe would have rendered the subject matter of claims 2–4 obvious to one of ordinary skill in the art at the time of the invention. Pet. 32–35 (discussing motivation to combine Lam, Enz, and Tayloe), 60–78 (discussing the application of the art to the claims).

1. Level of Ordinary Skill in the Art

The level of ordinary skill in the art at the time of the invention is discussed above. *See supra* § I.G.

2. Scope and Content of the Prior Art

a. Lam

Lam is directed to a "quadrature demodulation receiver for narrow-band communication systems comprising means for directly sampling an incoming signal which is modulated on a radio-frequency carrier at a sampling frequency which can be substantially lower than the carrier frequency to demodulate said signal into its in-phase and quadrature components." Ex. 1006, 4:3–9. Figure 3 is reproduced below:

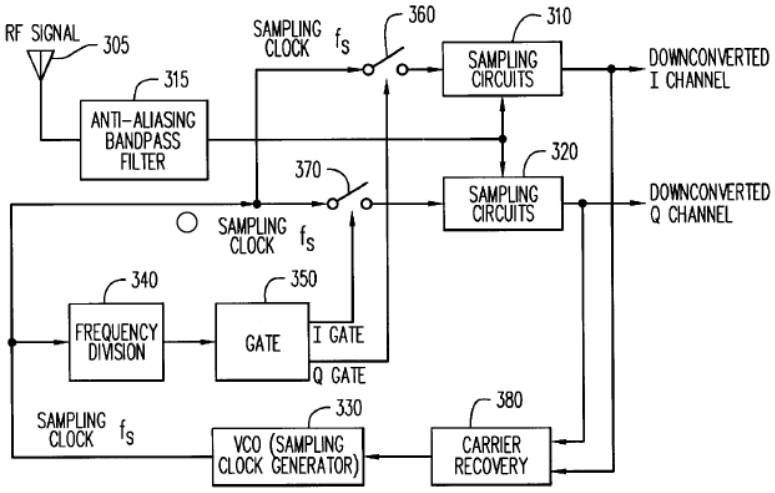

FIG. 3

Lam's Figure 3 is a schematic block diagram showing an example of a circuit arrangement suitable for the disclosed receiver. *Id.* at 5:41–44.

With respect to Figure 3, Lam states that the receiver

> down-converts the incoming RF signal 305 into its base-band in-phase (I) and quadrature (Q) components by means of in-phase and quadrature sampling circuits 310 and 320 respectively which sample the incoming RF waveform directly at a considerably lower sampling frequency than the carrier frequency. The signal sampling may for example be performed by conventional sampling circuits which comprise simple CMOS [(complementary metal-oxide-semiconductor)] switches

> and sample-and-hold capacitors and integrated with low-frequency differential amplifiers to drive IF circuits.

Ex. 1006, 5:50–60. Lam explains that the sampling circuits take "four sub-samples which represent the in-phase (I), the quadrature (Q), negative of the in-phase (-I) and negative of the quadrature (-Q) components." *Id.* at 4:21–24. After down-conversion by the sampling circuits 310 and 320, "the -I and -Q components can be inverted and combined with the I and Q components respectively," resulting in a down-converted in-phase (I) baseband signal being output from the sampling circuits 310 and a down-converted quadrature (Q) baseband signal being output from the sampling circuits 320. *See id.* at 5:50–60, 10:20–23, Fig. 3.

b. Enz

Enz describes a number of "circuit techniques" employing an "operational amplifier (op-amp), whose main function in the circuit is to create a virtual ground, i.e., a node with a zero (or constant) voltage at its input terminal without sinking any current." Ex. 1007, 3. Enz describes the techniques as "applicable to such important building blocks as . . . sample-and-hold (S/H) circuits." *Id.*

Enz's Figure 29 is reproduced below:

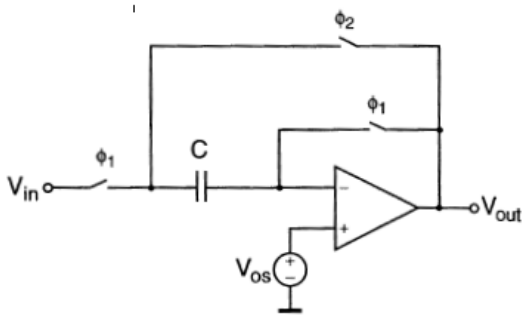

Fig. 29. A SC S/H stage.

Ex. 1007, 19. Figure 29 shows a circuit that "can be used as a simple S/H circuit." *Id.* at 22. Enz discloses that this circuit uses a capacitor (C), which

charges "during φ1 = 1 [sampling] period" and "utilizes [correlated double sampling] to reduce dc offset effects." *Id.*

c. Tayloe

The scope and content of Tayloe is described above. *See supra* § III.B.2.a.

3. Differences Between the Prior Art and the Claims; Motivation to Modify

Petitioners set forth a detailed analysis showing how the combined teachings of the references meet the elements of claims 2–4 of the '444 patent. Pet. 32–35, 60–78. In particular, Petitioners rely on Lam as disclosing most of the elements of the claims, but asserts that one of ordinary skill in the art would have been motivated to "look to the teachings of Enz and Tayloe to implement Lam's 'sampling circuits,' and would have understood the benefits of doing so." *Id.* at 32. Petitioners assert that "each of the components—the sample-and-hold switched-capacitor of Enz, and the differential amplifier of Tayloe—all are disclosed in the prior art as being used for the exact purposes called for by Lam" and, therefore, it would have been obvious for one of ordinary skill in the art to "look to such components to implement the 'conventional sampling circuits which comprise simple CMOS switches and sample-and-hold capacitors and integrated with low-frequency differential amplifiers' taught in Lam for down-converting an RF input signal." *Id.* at 34 (citing Ex. 1002 ¶ 120).

Further, Petitioners contend that "using the specific components from Enz and Tayloe to implement Lam's 'conventional sampling circuits' would have yielded only expected, predictable results" because

> [e]ach combination would have been (1) a combination of prior art elements according to known methods to yield predictable results, since a [person of ordinary skill in the art] would have understood how to implement a "sampling circuits" using such conventional components in the context of Lam; and (2) obvious to try—a choice of one type of demultiplexer, switched capacitor, and differential amplifier from a finite number of identified, predictable solutions, with a reasonable expectation of success.

Pet. 34 (citing *KSR*, 550 U.S. at 416–17, 421; *Leapfrog*, 485 F.3d at 1162; Ex. 1002 ¶ 121).

a. Claim 2

As with Patent Owner's response to Petitioners' first challenge of claim 2 (based on Tayloe and TI Datasheet), Patent Owner's sole argument directed to claim 2 is that Lam "does not disclose/teach/suggest" a "wireless modem apparatus." PO Resp. 79. Patent Owner contends that "[t]he same arguments regarding this element in connection to Tayloe (above) apply equally to Lam." *Id.* (citing PO Resp. § XI.A.3). As discussed above, we determine that "wireless modem apparatus," which is recited in the preamble of claim 2, is not limiting. *See supra* § II.B. Thus, Patent Owner's argument directed to claim 2 does not detract from Petitioners' challenge.

We find Petitioners' arguments persuasive to demonstrate how the combination of Lam, Enz, and Tayloe teaches the subject matter of claim 2 and supported sufficiently on the complete record before us and, therefore, we adopt them as our own findings. Accordingly, for the reasons explained by Petitioners, we find that the combination of Lam, Enz, and Tayloe teaches the subject matter of claim 2 and that one of ordinary skill in the art would have been motivated to combine the teachings of these references as proposed by Petitioners with a reasonable expectation of success.

b. Claim 3

Regarding claim 3, Patent Owner's arguments, aside from its contentions regarding "wireless modem apparatus,"[34] are (1) that "[a] capacitor in Lam/Enz only *holds negligible* amounts of energy" (PO Resp. 74–75); (2) Lam and Enz are voltage sampling systems, not energy transfer systems (*id.* at 76–77); (3) Enz does not disclose a circuit that down-converts an input signal (*id.* at 77–78); (4) one of ordinary skill in the art would not "use Enz's sample-and-hold circuit as the sampling circuits in Lam because the Enz circuit is incompatible with Lam's sampling circuits" (*id.* at 78); and (5) there is no motivation to combine Lam and Enz (*id.* at 80–81).

In their Reply, Petitioners contend that Lam's capacitors perform down-conversion, and thus that is proof that the capacitors store non-negligible energy. Pet. Reply 17–19 (citing *ParkerVision*, 621 F. App'x at 1019).

Petitioners also address an alternative argument, raised in the Petition, that relies on the combination of Lam and Enz, contending that the combination also "discloses or renders obvious a 'storage element.'" Pet. Reply 20 (citing Pet. 74–78). Petitioners explain that "Enz describes a number of conventional 'circuit techniques' employing an operational amplifier 'whose main function in the circuit is to create a virtual ground, i.e., a node with a zero (or constant) voltage at its input terminal without sinking any current.'" *Id.* (quoting Ex. 1007, 3). And, Petitioners assert that

[34] Patent Owner's argument regarding "wireless modem apparatus" also applies to claim 3 (*see* PO Resp. 79), but, for the same reasons discussed above in the context of claim 2, does not detract from Petitioners' challenge to claim 3.

"[t]he techniques are described as 'applicable to such important building blocks as . . . sample-and-hold (S/H) circuits.'" *Id.* (citing Ex. 1007, 3) (also noting that Enz's Figure 29 shows "a circuit 'that can be used as a simple S/H circuit,'" which includes capacitor C (citing Ex. 1007, 22)).

Petitioners also address the other arguments raised by Patent Owner as follows. First, Petitioners explain that whether Enz itself down-converts is largely irrelevant because Petitioners do not rely on Enz for that element of claim 3; rather, Petitioners rely on Lam. Pet. Reply 22–24. Additionally, Petitioners assert that "whether Enz expressly discloses the sampling rate of [its] switches . . . is not critical, as Petitioner[s] [are] not relying on Enz for that disclosure." *Id.* at 23–24 (citing *In re Merck & Co., Inc.* 800 F.2d 1091, 1097 (Fed. Cir. 1986) ("Non-obviousness cannot be established by attacking references individually where the rejection is based upon the teachings of a combination of references.")).

In its Sur-reply, Patent Owner contends that Petitioners "rely on the configuration of the switched-capacitor 'sample-and-hold' circuit in Figure 29 of Enz as the structure of the sampling circuit disclosed in Lam,'" yet "Lam provides no details regarding the circuity contained within a 'sampling circuit.'" PO Sur-reply 23. Patent Owner asserts that "[s]witches/capacitors operate as different devices depending on their configuration. Unlike Lam's 'simple CMOS switches and sample-and-hold capacitors,' which operate as a down-converter, the switched-capacitor circuit of Enz is configured to operate as a completely different device—a voltage buffer." *Id.* Thus, Patent Owner argues that, "[s]ince the switched-capacitor circuit of Enz operates as a completely different device than the

'conventional sampling' circuit of Lam, there is no motivation to combine Lam and Enz." *Id.* at 24.

Patent Owner's argument does not detract from Petitioners' argument and evidence that one of ordinary skill in the art would have been motivated to combine Lam and Enz as proposed and with a reasonable expectation of success. The above-discussion, and evidence of record, reflects that these references teach similar circuit components that can be used to perform both similar and different functions. In light of the record before us, even accepting Patent Owner's argument that one circuit performs a different function than another, that does not mean that one of ordinary skill in the art would not have been motivated to modify one reference in light of the other, especially when, as here, the components "all are disclosed . . . as being used for the exact purposes called for by Lam." *See* Pet. 34 (discussing the reasons to combine) (citing Ex. 1002 ¶ 120).

Second, Petitioners respond to Patent Owner's argument that Enz's input may be at a constant voltage by explaining that the challenge under this ground is based on a combination of teachings, "not Enz in isolation." Pet. Reply 24. And, Petitioners assert that "[i]t would have been obvious to combine the sample and hold circuitry of Lam—which indisputably uses a switched capacitor to down-convert an RF signal—with the similar sample and hold feedback capacitor arrangement of Enz's Figure 29." *Id.*

In its Sur-reply, Patent Owner asserts that the voltage of Enz's input is relevant because "it causes Enz's circuit to operate as a voltage buffer." PO Sur-reply 24. And, Patent Owner contends that one of ordinary skill in the art "will not use Enz's voltage buffer in place of Lam's down-converter to alter the 'sampling circuit' of Lam." *Id.* at 24–25.

Again, Patent Owner's arguments do not detract from Petitioners' argument and evidence on this point for the same reasons discussed above; namely, Petitioners rely on the combined teachings of the references whereas Patent Owner's arguments attack the references in isolation. *See, e.g.*, *In re Keller*, 642 F.2d 413, 426 (CCPA 1981) ("non-obviousness [cannot be established] by attacking references individually" when the asserted ground of obviousness is based upon combined teachings); *In re Young*, 927 F.2d 588, 591 (Fed. Cir. 1991) (the test is what the combined teachings of the references would have taught or suggested to one of ordinary skill in the art at the time of the invention).

Further, Petitioners respond to each of Patent Owner's additional arguments regarding motivation to combine and compatibility of Lam and Enz. *See* PO Resp. 77–78, 80–81; PO Sur-reply 23–26, 27; Pet. Reply 22–26, 26–27. We've addressed several of those arguments above. For the additional positions taken, we also do not agree with Patent Owner that one of ordinary skill in the art would not have been motivated to combine the teachings of these references as proposed by Petitioners. *See, e.g.*, PO Resp. 80–81 (asserting that Lam and Enz are incompatible). In particular, we find each of Petitioners' arguments persuasive on the complete record before us and adopt Petitioners' arguments and evidence as our own findings.[35]

In addition, as with Petitioners' challenge based on Tayloe and TI Datasheet, Patent Owner's arguments based on the construction of "storage element" and attempts to limit the meaning of the term to energy transfer

[35] We address the parties' arguments as to claim 4 below.

systems does not undermine Petitioners' position because they are not commensurate in scope with our construction of the term. And, our discussion above regarding Mr. Sorrells' testimony applies equally here. Specifically, we find that Petitioners have established that Lam functions in practice and successfully down-converts. *See* Pet. Reply 17–19. In particular, Lam is directed, *inter alia*, to "high-speed receivers for narrow-band communication systems" and describes use of receivers in "mobile hand-held communication systems." Ex. 1006, 1:6–7, 1:19–25. Accordingly, because Lam is a patent that is presumed to be enabled such that it operates in a manner that successfully down-converts and does so in a system that can be used for mobile hand-held communication systems, we find that constitutes sufficient evidence that Lam teaches a "storage element" as that term is used in the context of the '444 patent.

c. Claim 4

Claim 4 depends from claim 3 and recites "wherein said storage elements comprise a capacitor that reduces a DC offset voltage in said first down-converted signal and said second down-converted signal." Ex. 1001, 61:19–22.

Petitioners contend that "Lam alone, or in combination with Enz and Tayloe, renders claim 4 obvious." Pet. 76. Petitioners rely on their discussion of claim 3 and further assert that "it would have been obvious to a [person of ordinary skill in the art] to use the switched-capacitor 'sample-and-hold circuit' of Figure 29 of Enz for each of the two down-conversion modules in Lam's in-phase sampling circuits 310." *Id.* at 76–77. Petitioners argue that, "[a]s taught in Enz, the switched capacitor arrangement of Figure 29 serves to 'reduce dc offset effects' in the RF input

signal from reaching the output node, thereby reducing (or entirely eliminating) a DC offset voltage in the resulting down-converted signal." *Id.* at 77 (citing Ex. 1002 ¶¶ 202–203). And, Petitioners point to Figure 70A of the '444 patent, asserting that "[t]his is the same principle by which the capacitor reduces the 'DC offset voltage' . . . in the '444 specification." *Id.* (citing Ex. 1001, Fig. 70A, 36:14–18).

Patent Owner asserts that Enz does not disclose the subject matter of claim 4. PO Resp. 79–80. Patent Owner contends that "[t]he reduction in DC offset described in Enz relates to the DC offset resulting from the internal circuitry of the op-amp and is not the reduction of 'DC offset voltage' in a 'down-converted signal' as required by claim 4." *Id.* at 79 (citing Ex. 2038 ¶ 385). Specifically, Patent Owner asserts the following:

> the '444 specification identifies the DC offset voltage as including "a DC offset voltage resulting from charge injection . . . ." Ex. 1001, 36:16-17). A [person of ordinary skill in the art] would understand that DC offset voltage resulting from charge injection is due to the *sampling* clock at the control input of the *switch*, e.g., CMOS transistor. If a capacitor follows the switch, an offset voltage $V_{OFFSET} = \Delta Q/C$ will appear on the capacitor and, over time, this becomes a DC offset voltage. The '444 specification states that a 'storage module . . . reduces or prevents a DC offset voltage resulting from charge injection from appearing on . . . [the] output signal" *See, e.g., id.*, 36:16-18.
>
> The only DC offset that Enz addresses is the effective DC offset due to circuitry internal to an operational amplifier. The circuit in Figure 29 does not address DC offset voltage resulting from charge injection.
>
> The technique of Enz is specific to a switched-capacitor circuit used as "an on-chip reference buffer." Ex-1008, 5. The voltage reference is a stead (DC) voltage and <u>not</u> an RF input signal. The technique taught by Enz removes DC offset due to

> internal imperfections in the operational amplifier which otherwise provides linear gain. The op-amp is not involved in the down-conversion process. Ex.-2038 ¶388.

PO Resp. 79–80 (alterations in original).

In their Reply, Petitioners assert that claim 4 "requires 'a capacitor that reduces a DC offset voltage'—it does not require that the DC offset voltage 'result' from charge injection." Pet. Reply 26. Petitioners argue that "[t]he specification portion [of the '444 patent] upon which [Patent Owner] relies for this argument merely describes 'an embodiment.'" *Id.* (citing Ex. 1001, 36:14–18); *see id.* at 26–27 (also noting that the '444 patent states that the embodiments are "presented by way of example only, and not limitation" (citing Ex. 1001, 60:17–24)). Petitioners contend that "Enz discloses that its circuit is used 'to reduce dc offset effects,' which is all that claim 4 requires when properly interpreted." *Id.* at 27 (citing Ex. 1007, 22; Pet. 76–77; Ex. 1002 ¶¶ 201–203).

In its Sur-reply, Patent Owner responds in two places. First, Patent Owner contends that, "unlike claim 4 which requires the reduction of DC offset *in a down-converted signal*, the only DC offset that Enz addresses has nothing to do with a down-converted signal." PO Sur-reply 25. Rather, Patent Owner asserts that "the DC offset that Enz refers to is the effective DC offset due to circuitry internal to an operational amplifier in Enz." *Id.* (citing PO Resp. 79, 80; Ex. 2038 ¶ 385). Additionally, Patent Owner asserts that Petitioners "gloss over that reduction of DC offset relates to a 'down-converted signal'" and that Patent Owner relies on the specification of the '444 patent "to explain how the capacitor in a down-converter reduces DC offset, and identifies the DC offset voltage as including 'a DC offset voltage resulting from charge injection.'" *Id.* at 26–27 (citing PO Resp. 79).

As noted above, claim 4 recites that the storage elements comprise "a capacitor that reduces a DC offset voltage in said first down-converted signal and said second down-converted signal." Ex. 1001, 61:19–22. As the language of claim 4 states, the reduction in DC offset voltage is *in* the first and second down-converted signals. Claim 4 is not limited to charge injection, although, as the parties contend, that is an example provided in the specification of the '444 patent. *See id.* at 36:14–18 ("In an embodiment, first storage module 7024 comprises a first capacitor 7074. In addition to storing I output signal 7098, first capacitor 7074 reduces or prevents a DC offset voltage resulting from charge injection from appearing on I output signal 7098."). What Patent Owner's arguments fail to appreciate is that Petitioners rely on *the combination* of Lam and Enz. Patent Owner challenges Petitioners' argument primarily because Enz does not disclose down-conversion. But, Petitioners do *not* rely on Enz for down-conversion. So, Patent Owner's argument that Enz does not disclose reducing a DC offset voltage *in* the down-converted signals does not respond to Petitioners' challenge because it focuses on Enz in isolation instead of considering the *combination* proposed by Petitioners. In the *combination*, Petitioners rely on using the switched-capacitor circuit shown in Enz's Figure 29 "for each of the two down-conversion modules in Lam's in-phase sampling circuits 310." Pet. 76–77. In that *combination*, Petitioners have shown persuasively that the elements of claim 4 would be met. Patent Owner's arguments to the contrary either fail to appreciate the combination or focus on an embodiment disclosed in the specification of the '444 patent as though the language descriptive thereof was recited in the claim, which it is not.

i. Summary as to Claims 2–4

For the reasons discussed above, we find that Petitioners have established on the complete record before us that the combination of Lam, Enz, and Tayloe teaches the subject matter of claims 2–4 and that one of ordinary skill in the art would have been motivated to combine the teachings of these references as proposed by Petitioners with a reasonable expectation of success in so doing.

4. Objective Indicia of Nonobviousness

Patent Owner relies on the same arguments and evidence regarding objective indicia of nonobviousness that we addressed above, in the context of considering Petitioners' obviousness ground based on Tayloe and TI Datasheet. *See* PO Resp. 17–19 (addressing objective indicia generally), 77 (addressing the combination of Lam, Enz, and Tayloe). Our discussion, analysis, and findings from the obviousness ground based on Tayloe and TI Datasheet apply equally here. *See supra* § III.B.4 (finding that Patent Owner fails to establish that a presumption of nexus is warranted and similarly fails to establish nexus absent the presumption). As in the obviousness ground based on Tayloe and TI Datasheet, we consider Patent Owner's weak evidence of nonobviousness in our weighing of the *Graham* factors below.

5. Weighing the Graham Factors

"Once all relevant facts are found, the ultimate legal determination [of obviousness] involves the weighing of the fact findings to conclude whether the claimed combination would have been obvious to an ordinary artisan." *Arctic Cat*, 876 F.3d at 1361. On balance, considering the complete record before us and for the reasons explained above, the evidence of obviousness is very strong and the evidence of nonobviousness, which includes Patent

Owner's objective evidence of nonobviousness, is very weak. As a result of that balancing we determine that Petitioners have established by a preponderance of the evidence that the combination of Lam, Enz, and Tayloe would have rendered the subject matter of claims 2–4 obvious to one of ordinary skill in the art at the time of the invention.

IV. SUMMARY[36]

For the reasons discussed above, Petitioners have demonstrated, by a preponderance of the evidence, that claims 2–4 of the '444 patent are unpatentable.

Our conclusions regarding the Challenged Claims are summarized below:

Claims Challenged	35 U.S.C. §	Reference(s) /Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
2, 3	103(a)	Tayloe, TI Datasheet	2, 3	
2–4	103(a)	Lam, Enz, Tayloe	2–4	
Overall Outcome			2–4	

[36] Should Patent Owner wish to pursue amendment of claims 2–4 in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner's attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. *See* 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. *See* 37 C.F.R. § 42.8(a)(3), (b)(2).

V. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that claims 2–4 of U.S. Patent No. 7,110,444 B1 are determined to be unpatentable; and

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

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