UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

QUALCOMM INCORPORATED and
ZYXEL COMMUNICATIONS CORPORATION,[1]
Petitioner,

v.

UNM RAINFOREST INNOVATIONS,
Patent Owner.

IPR2021-00377
Patent 8,249,204 B2

Before KRISTEN L. DROESCH, BARBARA A. PARVIS, and CHARLES J. BOUDREAU, *Administrative Patent Judges*.

DROESCH, *Administrative Patent Judge.*

JUDGMENT
Final Written Decision
Determining All Challenged Claims Unpatentable
Denying Patent Owner's Motion to Amend
Denying in-part and Dismissing in-part Patent Owner's Motion to Exclude
35 U.S.C. § 318(a)

[1] ZyXEL Communications Corporation was joined as a petitioner in this proceeding based on a petition and motion for joinder filed in IPR2021-00739, which was granted.

I. INTRODUCTION

We have authority to hear this *inter partes* review under 35 U.S.C. § 6, and this Final Written Decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73 (2019). For the reasons that follow, Petitioner has established by a preponderance of the evidence that claims 1, 2, and 11–13 ("challenged claims") of U.S. Patent No. 8,249,204 B2 (Ex. 1001, "'204 Patent") are unpatentable.

A. Procedural History

Qualcomm Incorporated ("Qualcomm") filed a Petition requesting an *inter partes* review of claims 1, 2, and 11–13 the '204 Patent. Paper 1 ("Pet."). Qualcomm concurrently filed a Motion for Joinder seeking to join as a petitioner in *Intel Corp. v. UNM Rainforest Innovations*, IPR2020-01578. (Paper 3, "Qualcomm's Motion for Joinder," "Mot. Joinder"). UNM Rainforest Innovations ("Patent Owner") filed a Preliminary Response. Paper 7 ("Prelim. Resp."). Pursuant to our authorization, Petitioner filed a Reply to the Preliminary Response (Paper 9) to address discretionary denial under 35 U.S.C. § 314(a), to which Patent Owner filed a Sur-reply (Paper 11).

Pursuant to 35 U.S.C. § 314, we instituted trial on July 19, 2021, as to all of the challenged claims of the '204 Patent and dismissed Qualcomm's Motion for Joinder as moot.[2] Paper 13 ("Institution Decision" or "Dec.").

ZyXEL Communications Corporation ("ZyXEL") filed a petition for *inter partes* review and a Motion for Joinder in IPR2021-00739, requesting

[2] Prior to instituting this proceeding, IPR2020-01578 was terminated upon granting a joint motion to terminate. *Intel Corp. v. UNM Rainforest Innovations*, IPR2020-01578, Paper 8.

that ZyXEL be joined as a petitioner in IPR2021-00377. *ZyXEL Commc'ns Corp. v. UNM Rainforest Innovations*, IPR2021-00739, Papers 1, 3. After considering the parties' papers, we instituted trial in IPR2021-00739, granted ZyXEL's Motion for Joinder, and added ZyXEL as a petitioner to IPR2021-00377. *ZyXEL Commc'ns Corp. v. UNM Rainforest Innovations*, IPR2021-00739, Paper 17. A copy of that decision was entered in this record. Paper 17.

After institution of trial, Patent Owner filed a Response (Paper 36, "PO Resp."), to which Qualcomm and ZyXEL (collectively "Petitioner") filed a Reply (Paper 38, "Pet. Reply"), to which Patent Owner filed a Sur-reply (Paper 41, "PO Sur-reply").

Patent Owner also filed a Motion to Amend (Paper 27, "Mot. Amend"), to which Petitioner filed an Opposition (Paper 39, "Pet. Opp. MTA"). Pursuant to Patent Owner's request (*see* Mot. Amend 1), we issued Preliminary Guidance (Paper 40, "PG") on Patent Owner's Motion to Amend. Patent Owner filed a Reply (Paper 61, "PO Reply MTA") to Petitioner's Opposition, to which Petitioner filed a Sur-reply (Paper 62, "Pet. Sur-reply MTA").

Petitioner relies on a first Declaration of Sumit Roy, Ph.D. (Ex. 1002) to support its Petition. Patent Owner relies on a Declaration of Branimir Vojcic, D.Sc. (Ex. 2001) to support its Response. Petitioner relies on a second Declaration of Dr. Roy (Ex. 1032) to support its Opposition to the Motion to Amend. Patent Owner relies on a second Declaration of Dr. Vojcic (Ex. 2014) to support its Reply to Petitioner's Opposition to the Motion to Amend. Petitioner filed a third Declaration of Dr. Roy (Ex. 1033)

to support Petitioner's Opposition to Patent Owner's Revised Motion to Amend.[3]

Dr. Roy and Dr. Vojcic were cross-examined during trial, and transcripts of Dr. Roy's deposition (Ex. 2013) and Dr. Vojcic's deposition (Ex. 1031) are included in the record.

Patent Owner filed a Motion to Exclude Evidence (Paper 53, "PO Mot. Excl."), to which Petitioner filed an Opposition (Paper 55, "Pet. Opp. Mot. Excl."), to which Patent Owner filed a Reply (Paper 59, "PO Reply Mot. Excl.").

Oral argument was held on May 12, 2022. A transcript of the oral argument is included in the record. Paper 63.

B. Real Parties in Interest

Qualcomm states that Qualcomm Incorporated is the real party in-interest and further identifies its customers Dell Technologies Inc., Dell Inc., and EMC Corporation as additional real parties in interest. *See* Pet. 3.

ZyXEL states that ZyXEL Communications Corporation is a real party in interest. *ZyXEL Commc'ns Corp. v. UNM Rainforest Innovations*, IPR2021-00739, Paper 1, 2–3. ZyXEL also identifies ZyXEL Communications Inc. as a U.S. subsidiary of ZyXEL Communications Corporation, but indicates that ZyXEL Communications Corporation does not believe that ZyXEL Communications Inc. qualifies as a real party in interest. *Id.*

[3] The parties filed an improper revised motion to amend, an opposition to the revised motion to amend, a reply, and a sur-reply. *See* Paper 60. These papers have been expunged. *See id.*

Patent Owner states that the University of New Mexico Board of Regents is an additional real party in-interest. *See* Paper 5, 2.

C. Related Matters

The parties indicate the following matters may affect or be affected by a decision in this proceeding: *UNM Rainforest Innovations v. Industrial Technology Research Institute*, No. D-202-CV-2021-02803 (N.M. 2d. Judicial District Court May 4, 2021); *UNM Rainforest Innovations v. ASUSTek Computer, Inc.*, No. 6:20-cv-00142-ADA (W.D. Tex.); *UNM Rainforest Innovations v. Dell Technologies, Inc.*, No. 6:20-cv-00468-ADA (W.D. Tex.); *UNM Rainforest Innovations v. D-Link Corp.*, No. 6:20-cv-00143-ADA (W.D. Tex.); *UNM Rainforest Innovations v. TP-Link Technologies Co.*, No. 6:19-cv-00428-ADA (W.D. Tex.); and *UNM Rainforest Innovations v. ZyXEL Communications Corp.*, No. 6:20-cv-00522-ADA (W.D. Tex.). *See* Pet. 3; Paper 5, 2; Paper 10, 1.

D. The '204 Patent (Ex. 1001)

The '204 Patent relates to a method for a mobile station to provide channel state information (CSI) to a base station. *See* Ex. 1001, code (57), 1:50–52. The mobile station estimates CSI for each of the plurality of communication channels between mobile station and base station by calculating a plurality of channel responses for each communication channel. *See id.* at 3:46–50. The channel response includes a plurality of channel taps corresponding to a time delay and having a complex value. *See id.* at 3:55–59. For each of the communication channels, the mobile station may select channel taps that have a magnitude larger than a threshold value. *See id.* at 4:7–10. The mobile station sends the estimated CSI as CSI

feedback to the base station. *See id.* at 4:4–7. The mobile station may quantize information regarding time delays and phases of selected channel taps. *See id.* at 4:12–14. The mobile station may compress the estimated CSI by generating a plurality of parameters to represent information regarding magnitudes of the selected channel taps. *See id.* at 4:14–17.

E. Illustrative Claim

Claims 1 and 11 are independent, claim 2 depends from claim 1, and claims 12 and 13 depend from claim 11. Claim 1 is illustrative and reproduced below:

> 1. A method for a mobile station to provide to a base station feedback of channel state information (CSI) regarding a plurality of communication channels between the mobile station and the base station, the method comprising:
>
> estimating the CSI by calculating a plurality of channel responses each for one of the communication channels;
>
> compressing the estimated CSI; and
>
> sending the compressed CSI as the feedback to the base station,
>
> wherein the estimating further comprises selecting a plurality of channel taps from each of the calculated channel responses to estimate the CSI.

Ex. 1001, 11:20–31.

F. Patentability Challenges and Asserted Prior Art

Petitioner asserts the following challenges to the patentability of claims 1, 2, and 11–13:

Claim(s) Challenged	35 U.S.C. §[4]	Reference(s)/Basis
1, 2, 11–13	102	Hui[5]
1, 2, 11–13	103	Hui
1, 2, 11–13	103	Hui, Maltsev[6]
1, 2, 11–13	102	Döttling[7]
1, 2, 11–13	103	Döttling
1, 2, 11–13	103	Döttling, Maltsev
1, 2, 11, 13	102	Koorapaty[8]
1, 2, 11, 13	103	Koorapaty
12	103	Koorapaty and the knowledge of a person of ordinary skill in the art

II. PATENT OWNER'S MOTION TO EXCLUDE

Before we address patentability of the challenged claims, we first address Patent Owner's Motion to Exclude Dr. Roy's Declaration (Ex. 1002) filed with the Petition and relied upon to support the Petition. Patent Owner moves to exclude Dr. Roy's Declaration on the basis that it violates Federal Rules of Evidence (FRE) 702 and 703. *See* PO Mot. Excl. 1–3, 9–10, 12.

Petitioner contends that Patent Owner's Motion to Exclude Dr. Roy's Declaration should be denied because Patent Owner's Motion failed to identify the objections in the record as required by 37 C.F.R. § 42.64(c) and failed to timely file an objection as required by 37 C.F.R. § 42.64(b)(1) in

[4] Petitioner challenges patentability under pre-AIA 35 U.S.C. §§ 102 and 103. Pet. 22, 39, 41, 56.
[5] Ex. 1006, US 8,213,368 B2, issued July 3, 2012 ("Hui").
[6] Ex. 1008, US 2006/0114816 A1, published June 1, 2006 ("Maltsev").
[7] Ex. 1007, EP 1760925 A2, published March 7, 2007 ("Döttling").
[8] Ex. 1009, US 2006/0018389 A1, published Jan. 26, 2006 ("Koorapaty").

order to preserve its objection. *See* Pet. Opp. Mot. Excl. 1–7. Petitioner contends that, pursuant to 37 C.F.R. § 42.64(b)(1), Patent Owner was required to file any objection to Dr. Roy's Declaration within ten business days of institution of trial. *See id.* at 2–3. We instituted trial on July 19, 2021. *See* Dec. Petitioner asserts that Patent Owner has waived its objection. *See* Pet. Opp. Mot. Excl. 1, 3–4.

Patent Owner asserts that Patent Owner did not become aware of the evidentiary problem with Ex. 1002 until Dr. Roy's deposition on December 6, 2021. *See* PO Reply Mot. Excl. 2. Patent Owner contends that it filed objections one day later in its Patent Owner Response filed on December 7, 2021. *See id.* (quoting Paper 26[9], 34). Patent Owner also asserts that it filed objections on December 16, 2021, in Paper 30.[10] *See id.* Patent Owner contends that it "filed its Motion to Exclude [] referring to its objection to EX1002 raised both in its Patent Owner's Response [] and Objections to Evidence." *Id.*

A motion to exclude evidence must be filed to preserve a prior objection to evidence and must identify the objections in the record. 37 C.F.R. § 42.64(c). An objection to evidence submitted prior to the institution of the trial, including evidence submitted with a petition to institute *inter partes* review, must be filed within ten business days of the institution of the trial. 37 C.F.R. § 42.64(b)(1). Once a trial is instituted, any objection must be filed within five business days of the service of evidence to which the objection is directed. *Id.* The objection must identify

[9] Patent Owner quotes Paper 26 which was expunged and replaced with Paper 36. *See* Ex. 3001.
[10] Paper 30 was expunged and replaced with Paper 37.

the grounds for the objection with sufficient particularity to allow for correction in the form of supplemental evidence. *Id.* An objection to deposition evidence "must be made during the deposition." 37 C.F.R. § 42.64(a).

As an initial matter, we do not consider Patent Owner's arguments presented in the Patent Owner Response to be an objection. The pertinent portions of the Patent Owner Response are reproduced as follows:

> The technical aspect of the Roy declaration (EX1002) should be discounted in their entirety because they do not reflect the work of Dr. Roy. Instead, the technical aspects of the Roy declaration are a carbon copy of the report of another expert in another proceeding. Patent Owner intends to request authorization from the Board to file a motion to strike the technical aspects of the Roy declaration in their entirety.

PO Resp. 27. Patent Owner's arguments fail to comply with the requirement to identify the objection with sufficient particularity to allow for correction because the arguments do not mention an objection nor contend that Dr. Roy's Declaration is inadmissible. *See id.*; 37 C.F.R. § 42.64(b)(1).

Patent Owner initially filed on December 16, 2021, a paper entitled "Patent Owner's Objection to the Expert Report of Dr. Roy (Ex. 1002)" (Paper 37) explaining: "[b]ased on the deposition testimony taken on Dec. 6, 2021 (EX2013), EX1002 is objectionable and inadmissible as incomplete, irrelevant, misleading, improper expert testimony and lacking authenticity under F.R.E. 106, 401, 403, 702, and 901." Paper 37, 1. Patent Owner's Objection complies with the requirement to identify the objection with sufficient particularity to allow for correction. *See id.*; 37 C.F.R. § 42.64(b)(1). Patent Owner's Objection, however, is untimely. Dr. Roy's Declaration (Ex. 1002) was submitted with the Petition, but Patent Owner's

Objection was not filed within 10 business days of the July 19, 2021, institution of trial. Patent Owner did not seek leave to file a motion to waive the timing requirement of 37 C.F.R. § 42.64(b)(1).

Patent Owner's Reply to the Motion to Exclude and Patent Owner's Objection both assert that Dr. Roy's December 6, 2021, deposition is the pertinent measurement date. In particular, Patent Owner

> assert[s] the following objection to evidence proffered by Petitioner [] submitted on December 23, 2021[11], and related deposition testimony taken on December 6, 2021. These objections are being provided within 10 business days of receipt of the evidence to which the objection is related and are thus timely pursuant to 37 C.F.R. § 42.64(b)(1).

Paper 37, 1; *see* PO Reply Mot. Excl. 2 ("Patent Owner did not become aware of the issue until the Roy deposition . . . on Dec. 6, 2021.").

Patent Owner mischaracterizes the Board's Rule because 37 C.F.R. § 42.64(b)(1) does not provide for new objections to evidence based on the date of related evidence. Even if 37 C.F.R. § 42.64(b)(1) permitted new objections based on the date of related evidence, once a trial is instituted, any objection must be filed within five business days. Even assuming that the December 6, 2021, deposition date could be a pertinent measurement date, Patent Owner's Objection filed December 16, 2021, was not filed within five business days as required by 37 C.F.R. § 42.64(b)(1). Again, Patent Owner did not seek leave to file a motion to waive the timing requirement of 37 C.F.R. § 42.64(b)(1).

For the foregoing reasons, Patent Owner does not direct us to timely filed objections to Dr. Roy's Declaration (Ex. 1002). Under these

[11] Ex. 1002 was filed on December 28, 2020.

circumstances, we will not waive the requirements for timely objection. Accordingly, we conclude that Patent Owner's Motion to Exclude should be denied on this basis.

In any event, even if Patent Owner's Objections had been timely filed, and thus preserved by Patent Owner's Motion to Exclude, Patent Owner's arguments presented in the Motion to Exclude are unpersuasive. Patent Owner argues that FRE Rules 702 and 703 require that the expert has reliably applied the principles and methods to the facts of the case and that the expert is not merely a mouthpiece for another non-testifying expert. *See* PO Mot. Excl. 1–2; PO Reply Mot. Excl. 5. According to Patent Owner, Rule 703 "does not allow the mere adoption of a hearsay document without independent analysis." PO Mot. Excl. 3. Patent Owner contends that Dr. Roy's Deposition testimony confirmed that Dr. Roy failed to apply the principles and methods to the facts of the case and simply adopted wholesale the expert opinion of another non-testifying expert, namely that set forth in a declaration of Dr. Robert Akl submitted in support of Intel Corporation's petition in IPR2021-01578, filed as Exhibit 1028 in this proceeding. *See id.* Patent Owner asserts that "[c]ourts routinely require expert witnesses to properly support their work and opinions." *Id.* In support of its arguments, Patent Owner asserts that the United States Court of Appeals for the Second Circuit affirmed a district court's exclusion of an expert opinion where the expert merely reviewed and made minor revisions to an opinion provided to him by plaintiff's counsel. *See id.* (citing *Puppolo v. Welch*, 771 Fed. Appx. 64 (2d Cir., June 20, 2019) (summary order). In support of its arguments, Patent Owner also quotes *United States v. Tomasian*, 784 F.2d 782, 786 (7th Cir. 1986); *Crowley v. Chait*, 322 F.Supp.2d 530, 553

(D.N.J. 2004), 29 Charles Alan Wright & Victor James Gold, *Federal Practice and Procedure* § 6273, at 312 (1997). Patent Owner contends that "Dr. Roy simply signed off on an expert report provided to him by counsel with effectively no substantive changes" and "fail[ed] to cite the original expert report in his materials considered list." *Id.* at 4; PO Reply Mot. Excl. 3 (citing Ex. 1002, 10–12). Patent Owner asserts that there are no substantive differences whatsoever between Dr. Roy's Declaration and Dr. Akl's Declaration, only edits regarding punctuation, ways of enumeration, and two or three paraphrasing efforts. *See* PO Mot. Excl. 5–9 (citing PO Mot. Excl., Attachment A 13–23, 33–36). Patent Owner contends that Dr. Roy did not perform his own independent analysis and is submitting the work product of another expert as his own. *See id.* at 9.

In the Opposition, Petitioner contends that the substance of Dr. Roy's Declaration is largely the same as Dr. Akl's Declaration because it is required by the rules of joinder, and Dr. Roy confirmed that he has read and agrees with Dr. Akl's opinions. *See* Pet. Opp. Mot. Excl. 1, 8–9. Petitioner contends that Patent Owner's arguments ignores the joinder requirements, and that if Dr. Roy's Declaration had not been substantively identical to Dr. Akl's Declaration, it may have introduced new issues and the basis for denying joinder. *Id.* at 8–9 (quoting Mot. Joinder 6 n.1; citing *Celltrion, Inc. v. Genentech, Inc.*, IPR2018-01019, Paper 11 at 14 (PTAB Oct. 30, 2018). Petitioner asserts Patent Owner's claim that Petitioner tried to hide the substantive similarity of Dr. Roy's Declaration to Dr. Akl's Declaration is meritless because the Petition and Qualcomm's Motion for Joinder acknowledged the substantive similarity, and Dr. Roy acknowledged that he used Dr. Akl's Declaration as the basis for his Declaration. *See id.* at 9

(quoting Pet. 6 n.2; Ex. 2013, 55:3–4; citing Mot. Joinder). Petitioner argues that Patent Owner's Motion to Exclude ignores that Dr. Roy reviewed Dr. Akl's Declaration in its entirety and agreed with Dr. Akl's opinions. *See id.* (citing Ex. 2013, 111:18–112:5).

Patent Owner also argues that Dr. Roy's credibility has been diminished by not disclosing or citing Dr. Akl's Declaration as the basis for his Declaration and misrepresenting his under oath his own work in drafting the Declaration. PO Mot. Excl. 1, 9–10. Patent Owner contends that Dr. Roy testified that: (1) he wrote the report and incorporated his own analysis into it; (2) Dr. Akl's Declaration was not part of the exhaustive list of materials he considered; (3) he wrote Section the analysis for the '204 Patent and contributed to Sections V and VII and provided corrections, edits, etc.; (4) he wrote the analysis for '204 Patent and changed the technical sections, e.g., Section VII; and (5) he only took a quick look at Dr. Akl's Declaration and contributed himself to the drafts of the Declaration. *See id.* at 4–5 (quoting Ex. 2013, 54:1–55:7), 5–6 (quoting Ex. 2013, 55:19–56:18), 6–7 (quoting Ex. 2013, 83:3–85:10), 7–8 (quoting Ex. 2013, 105:3–106:25), 8–9 (quoting Ex. 2013, 110:14–111:17).

Petitioner contends that Patent Owner's arguments go to the weight not the admissibility of Dr. Roy's Declaration. *See* Opp. Mot. Excl. 10–11.

In the Reply, Patent Owner contends that "Dr. Roy . . . *made no mention of the Akl Report whatsoever,* until specifically asked about it. Even then, he only said he took 'a quick look' at it." PO Reply Mot. Excl. 3 (citing Ex. 2013, 110:14–111:17).

Even if Patent Owner's objections were timely, we would deny Patent Owner's Motion to Exclude because Dr. Roy's testimony should not be

excluded under Federal Rules of Evidence 702 and 703. Rule "702 imposes a special obligation upon a trial judge to 'ensure that any and all scientific testimony . . . is not only relevant, but reliable,'" which is a "basic gatekeeping obligation." *Kumho Tire Co. v. Carmichael*, 526 U.S. 137, 147 (1999) (quoting *Daubert v. Merrell Dow Pharm., Inc.*, 509 U.S. 579 (1993)). The policy considerations for excluding expert testimony, such as those implemented by *Daubert*'s gatekeeping framework, are less compelling in bench proceedings such as *inter partes* reviews than in jury trials because, unlike a lay jury, the Board has significant experience in evaluating expert testimony. Accordingly, the danger of prejudice in this proceeding would be considerably lower than in a lay jury trial and the wholesale exclusion of a witness's declaration is rarely called for in a proceeding before the Board.

Furthermore, Patent Owner's arguments challenging the credibility of Dr. Roy go to the weight that should be given to Dr. Roy's Declaration testimony, not the admissibility of the Declaration. In our patentability analysis that follows, we account for the evidence that Dr. Roy's Declaration is substantially the same as Dr. Akl's Declaration, the supporting evidence cited therein, as well as Dr. Roy's deposition testimony in determining the appropriate weight to give Dr. Roy's testimony when weighing the record evidence.

Patent Owner also moves to exclude Dr. Roy's third Declaration (Ex. 1033) filed to support Petitioner's opposition to Patent Owner's improper revised motion to amend. *See* Paper 60; *supra* fn. 3. The opposition was expunged (*see* Paper 60), and Petitioner's subsequently filed Sur-reply does not cite to Exhibit 1033 (*see generally* Pet. Sur-reply MTA).

Because this evidence is not relied upon by Petitioner, Patent Owner's motion to exclude as to Exhibit 1033 is *dismissed* as moot.

In sum, Patent Owner's Motion to Exclude is *denied* in-part and *dismissed* in-part.

III. ANALYSIS OF PATENTABILITY CHALLENGES

A. Claim Construction

The Board applies the same claim construction standard as applied in federal courts in a civil action under 35 U.S.C. § 282(b), which is generally referred to as the *Phillips* standard. *See* 37 C.F.R. § 42.100(b) (2020); *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). Under the *Phillips* standard, words of a claim are generally given their ordinary and customary meaning. *Phillips*, 415 F.3d at 1312.

"compress[ing] the estimated CSI" / "compressed CSI"

Claims 1 and 11 recite "compress[ing] the estimated CSI" and "send[ing] the compressed CSI as the feedback to the base station." Ex. 1001, 11:26–27, 12:17–18. Patent Owner asserts "the CSI contains 'information regarding time delays of the channel taps in each of the calculated channel responses,' and this information is compressed as part of claims 1 and 11." *See* PO Resp. 12 (citing Ex. 1001, 4:19–22). Patent Owner contends that "[t]the term 'compress[ing] the estimated CSI' should thus be construed as [its] plain and ordinary meaning, which excludes 'quantizing the estimated CSI' without further separately applied compression." *Id.* at 20. Patent Owner contends that the '204 Patent Specification distinguishes the terms quantization from compression. *See id.* at 12 (citing Ex. 2001 ¶¶ 69–77). To support its assertions, Patent Owner quotes paragraphs 70 through 72 of its Declarant Dr. Vojcic's testimony

addressing the understanding by a person of ordinary skill in the art of the terms "quantization" and "compression." *See id.* at 13–14 (quoting Ex. 2001 ¶¶ 70–72). In particular, Dr. Vojcic testifies that a person of ordinary skill in the art

> would understand quantization to refer to the process of mapping input values from a continuous set, such as discretized waveform samples, to output values in a finite set of elements, such as digital data. Compression, on the other hand, is the process of encoding digital data using fewer bits than the original digital representation, ideally using minimal possible number of bits yet with sufficiently good description of the original digital data.

Ex. 2001 ¶ 70.

Patent Owner also points out that dependent claims 7, 9, and 10 include limitations requiring quantizing in addition to the compression of claim 1. *See* PO Resp. 14. Patent Owner points out that claim 1 recites "compressing the estimated CSI" and "sending the compressed CSI," while claim 7 recites "wherein the sending further comprises: quantizing the generated parameters before the sending," claim 9 recites "wherein the sending further comprises: quantizing information regarding phases of the channel taps in each of the calculated channel responses before the sending," and claim 10 recites "wherein the sending further comprises: quantizing information regarding time delays of the channel taps in each of the calculated channel responses before the sending." *See id.* According to Patent Owner, "[t]reating quantization and compression as equal in the context of the '204 patent would render dependent claims 7, 9, and 10 nonsensical." *See id.*

Patent Owner asserts that,

> [b]ased on the specification and claims of the '204 Patent and the knowledge of a [person of ordinary skill in the art], Dr. Vojcic opines that "compression in the '204 Patent is different and apart from quantization. Although quantization may also result in a reduction of data bits, it is a different method used for a different purpose in the '204 Patent."

PO Resp. 14–15 (quoting Ex. 2001 ¶ 74). Patent Owner reproduces a portion of the '204 Patent Specification, with certain words added, and contends that

> Dr. Vojcic points out, [column 4, lines 11 through 22 of the '204 Patent] clearly indicates to a [person of ordinary skill in the art] that in addition to quantization, the estimated CSI may be further compressed, *i.e.*, that "compression and quantization are separate techniques and not one and the same."

Id. at 15 (quoting Ex. 1001, 4:11–22; citing Ex. 2001 ¶ 75). According to Patent Owner, "[t]he '204 patent makes clear that the 'the mobile station 104 may quantize information' and then 'may further compress the estimated CSI.'" *Id.* (quoting Ex. 1001, 4:11–13). Patent Owner reproduces an additional excerpt of the '204 Patent Specification and contends that the '204 Patent "further discloses that 'the information regarding the magnitude of channel taps may be compressed using the least squares method,'" with parameters A2, B2, and C2 representing the compressing information, and further quantizes the parameters. *See id.* at 15–16 (quoting Ex. 2001 ¶ 76; citing Ex. 1001, 6:31–43). According to Patent Owner, "the '204 Patent applies quantization separately and in addition to compression." *Id.* at 16 (quoting Ex. 2001 ¶ 76). Patent Owner contends that

> [f]ull consideration of the available evidence fully supports Dr. Vojcic's opinion that "a [person of ordinary skill in the art] would understand these examples to clearly teach that the '204 Patent treats quantization different from compression. Based on my experience, this understanding comports with the general use of the terms 'quantization' and 'compression' in the art as separate methods . . . ."

Id. at 16–17 (quoting Ex. 2001 ¶ 77).

The foregoing Patent Owner Response arguments were presented previously in the Preliminary Response. *Compare* PO Resp. 12–17, *with* Prelim. Resp. 20–25. We do not agree with Patent Owner's arguments, as explained in the Institution Decision. The '204 Patent Specification is the single best guide to the meaning of a disputed claim term. *See* Dec. 19. The '204 Patent discloses the estimated CSI for the communication channel may include the time delays, the magnitudes, and the phases, of the channel taps. *See id.* (citing Ex. 1001, 3:66–4:2, 8:40–42). The '204 Patent discloses:

> [t]he mobile station 104 may quantize information regarding time delays and phases of the selected channel taps. The mobile station 104 may further compress the estimated CSI by generating a plurality of parameters to represent information regarding magnitudes of the selected channel taps, . . . and quantize the generated parameters.

Ex. 1001, 4:11–19; *see* Dec. 19–20. A plain reading of the foregoing sentences, in the context of the '204 Patent's description of an estimated CSI, demonstrates that the quantization of information regarding time delays and phases of the selected channel taps is a compression of one portion of the estimated CSI, and the generation of a plurality of parameters to represent information regarding magnitudes of the selected channel taps is a further (i.e., additional) compression of another portion of the estimated CSI.

See Dec. 20. Figures 9A–9C, which show compressed estimated CSI for one of the communication channels, including phases of channel taps, is consistent with the plain reading of the aforementioned sentences of the '204 Patent. *See* Ex. 1001, 2:51–53, 10:36–46; Dec. 20. The '204 Patent discloses that the quantized information regarding the phases of the channel taps is part of the "compressed estimated CSI," which is consistent with the disclosure of claim 21. *See* Ex. 1001, 12:60–62, 13:29–33; Dec. 20. In view of the '204 Patent Specification, the scope of "compressing the estimated CSI" includes quantizing information regarding time delays and phases of the selected channel taps, generating a plurality of parameters to represent information regarding magnitudes of the selected channel taps, and quantizing the generated parameters. *See* Dec. 20–21. This comprehensive scope is confirmed by the '204 Patent Specification disclosure that "[t]he mobile station 104 then sends to the base station the quantized parameters, together with the quantized information regarding the time delays and the phases of the selected channel taps." Ex. 1001, 4:19–22; *see* Dec. 21. We view dependent claims 7, 9, and 10 as narrowing the scope of "compressing the estimated CSI; and sending the compressed CSI as the feedback to the base station," recited in claim 1. *See* Dec. 21. When considered in the context of the '204 Patent Specification, Dr. Vojcic's testimony does not yield a reliable interpretation for compressing the estimated CSI. *See id.*

Patent Owner does not agree with the analysis set forth in the Institution Decision, and discussed above, rejecting its proposed construction for "compressing the estimated CSI." *See* PO Resp. 17–20. Patent Owner reproduces the '204 Patent Specification disclosure at column 4, lines 11 through 19 and asserts that this disclosure does not

support the Board's conclusions. *See id.* at 17. According to Patent Owner, "[g]iven that 'the estimated CSI for the communication channel may include the time delays, the magnitudes, and the phases, of the channel taps' . . . a *literal* reading supports that the time delays and phases are quantized, while the magnitudes are compressed." *Id.* Patent Owner contends that "[r]eferring to the entirety of the CSI as 'compressed' is accurate even if only the magnitudes are compressed—this does not require that all components of the estimated CSI are compressed." *Id.* at 17–18. Patent Owner further asserts that "[t]he fact that 'the '204 Patent discloses that the quantized information regarding the phases of the channel taps is part of the *compressed estimated CSI*' . . . does not support that quantization alone is sufficient to render the estimate[d] CSI *compressed*." *Id.* at 18 (quoting Dec. 20). According to Patent Owner, "[t]he '204 Patent does not disclose any instance in which only quantization is referred to as compression. Instead, the reason the estimated CSI is referred to as *compressed* in the '204 Patent is because the magnitudes are *actually compressed*." *Id.* Patent Owner contends that the recitation of claim 21 is consistent with this understanding, and refers to one part of the estimated compressed CSI that was quantized (the phases), as opposed to compressed (the magnitudes). *See id.* (quoting Ex. 1001, 12:60–62, 13:29–33).

Patent Owner further argues that the '204 Patent in every instance limits the description of its invention to "compressing an estimated CSI" that always contains at least a part that is actually compressed." *See* PO Resp. 19–20 (citing *Gentry Gallery, Inc. v. Berkline Corp.*, 134 F.3d 1473 (Fed. Cir. 1998). Patent Owner contends that the narrow disclosure of the '204 Patent must limit the extent of the claim. *See id.* According to

Patent Owner, "[t]he Board's construction effectively equating 'quantization' with 'compression' effectively reads the claim limitation '*compressing*' the estimated CSI out of the claims—by treating the disclosure as supporting '*compressing or quantizing*' the estimated CSI." *Id.* at 20.

In Reply, Petitioner contends that Patent Owner's assertions regarding the meaning of the disclosure at column 4, lines 11–19 of the '204 Specification amount to attorney argument, and do not provide objective evidence rebutting Dr. Roy's testimony. *See* Pet. Reply 9 (citing *Estee Lauder Inc. v. L'Oreal, S.A.*, 129 F.3d 588, 595 (Fed. Cir. 1997); *see also RPX Corp. v. Link Engine Techs.*, IPR2017-00886, Paper 30 (PTAB Aug. 23, 2018)). Petitioner also asserts that Patent Owner's argument that "[t]he '204 Patent does not disclose any instance in which only quantization is referred to as compression" is unsupported and wrong. According to Petitioner,

> the only reasonable interpretation of the '204 Patent Specification's disclosure that "[t]he mobile station 104 may *further* compress the estimated CSI" is that the preceding action performed by mobile station 104—"quantiz[ing] information regarding time delay and phases of the selected channel taps"—actually compresses the estimated CSI. . . . Otherwise, the word "further" would be meaningless.

Id. at 7 (quoting Ex. 1001, 4:11–16), 10 (quoting Ex. 1001, 4:11–19). Petitioner contends that "contrary to Patent Owner's assertion, this disclosure indicates that 'only quantization'—specifically, 'quantiz[ing] information regarding time delays and phases of the selected channel taps'—is referred to as 'compress[ing] the estimated CSI.'" *Id.* at 10. Petitioner

contends that this interpretation is supported by Dr. Roy's testimony. *See id.* at 7 (quoting Ex. 1002 ¶¶ 59, 94), 10 (quoting Ex. 1002 ¶¶ 59, 94).

Petitioner further argues that "even if the '204 Patent Specification did not expressly indicate that compression encompasses quantization – which . . . is not the case . . . – that would not limit the compression claimed by the '204 Patent to compression performed in ways other than quantizing." Pet. Reply 13–14. Petitioner contends that the holding in *Kara Tech Inc. v. Stamps.com, Inc*., 582 F.3d 1341 (Fed. Cir. 2009) supports this conclusion. *See id.* at 14 (quoting *Kara Tech*, 582 F.3d at 1347–48). Petitioner asserts that *Gentry Gallery* is distinguishable because the Federal Circuit concluded that the disclosure of the console as the only possible location for the controls. *See id.* at 15 (quoting *Gentry Gallery*, 134 F.3d at 1479, citing *Gentry Gallery*, 134 F.3d at 1474, 1475). According to Petitioner,

> [i]n contrast, . . . the '204 Patent disclosure does not limit compression to compression performed in ways other than quantizing, but rather teaches that compression may be performed via quantization, and further contains expansive language stating that the patent is intended to cover all manner of variations and applications of the disclosed concepts.

Id. at 15–16 (citing Ex. 1001, 4:11–16; 11:1–17).

In the Sur-reply, Patent Owner argues "[t]he '204 Patent, in every instance, limits the description of its invention to 'compressing an estimated CSI' that *always* contains at least a part that is actually compressed." *See* PO Sur-reply 8–9 (citing Pet. Reply 13–15). Patent Owner contends that Petitioner's only citations to support its arguments are Ex. 1001, column 4, lines 11–16 and column 11, lines 1–17, which is at best ambiguous as to whether it discusses quantization and then further compression, or compression and further compression, and includes catchall boilerplate

language. *See id.* (citing Pet. Reply 8, 15). Patent Owner asserts that Petitioner's assertion regarding the only reasonable interpretation is not correct. *See* PO Sur-reply 5. According to Patent Owner, "'[f]urther compression' can occur either before or after quantization, and nothing in the '204 Patent indicates otherwise." *Id.* (citing Ex. 1004 ¶ 29; PG 7). Patent Owner contends that Petitioner "provides no explanation why its interpretation of 'further compress' as 'compress, and then compress more' is proper as opposed to 'quantize, and then compress.'" *Id.* Patent Owner contends that Petitioner's argument that the '204 Patent refers to "quantization alone" as "compression" is not properly supported because this passage is ambiguous at best. *See id.* Patent Owner contends that this is not enough to overcome the meaning of these terms established in the art. *See id.* (citing *Thorner v. Sony Comput. Entm't Am. LLC*, 669 F.3d 1362, 1367 (Fed. Cir. 2012)). Patent Owner asserts that Petitioner's interpretation is wrong, as pointed out by Dr. Vojcic. *See id.* (citing Ex. 2001 ¶ 74).

Patent Owner also contends that Petitioner misrepresents the record because the '204 Patent further identifies examples where compression and quantization are described as different methods, and Patent Owner's expert explicitly opined that the referenced section of the specification clearly indicates to a person of ordinary skill in the art that compression and quantization are separate techniques and not one and the same. *See* PO Sur-reply 6 (quoting Ex. 1001, 6:31–43; Ex. 2001 ¶ 75).

We do not agree with Patent Owner's argument that "[t]he fact that 'the '204 Patent discloses that the quantized information regarding the phases of the channel taps is part of the *compressed estimated CSI*' . . . does not support that quantization alone is sufficient to render the estimate[d] CSI

compressed." Patent Owner's argument is belied by Dr. Vojcic's testimony that "quantization may also result in a reduction of data bits." Ex. 2001 ¶ 74; PO Resp. 14. We agree with Petitioner that the '204 Patent Specification does not limit compression to compression performed only in ways other than quantizing. We, however, do not agree with Petitioner that the disclosure of column 4, lines 11 through 19 indicates that "'only quantization'—specifically, 'quantiz[ing] information regarding time delays and phases of the selected channel taps'—is referred to as 'compress[ing] the estimated CSI.'" Pet. Reply 10. The '204 Patent Specification's disclosure that the mobile station may further compress the estimated CSI indicates that the preceding disclosure that the mobile station may quantize information regarding time delays and phases of the selected channel taps means that the mobile station also compresses, to some extent, the same information regarding time delays and phases. Accordingly, column 4, lines 11–19 of the '204 Patent Specification discloses that quantizing the information regarding the time delays and phases of channel taps results in some compression of the same information regarding time delays and phases, and further discloses compressing the magnitude component of the estimated CSI by generating a plurality of parameters to represent information regarding magnitudes of the channel taps and thereafter quantizing those parameters.

Patent Owner also disagrees with our preliminary finding that "the scope of 'compressing the estimated CSI' includes quantizing information regarding time delays and phases of the selected channel taps, generating a plurality of parameters to represent information regarding magnitudes of the selected channel taps, and quantizing the generated parameters." *See* PO

Resp. 18 (citing Dec. 20). According to Patent Owner, "[e]ven so, this does not support the position that any process that does not include some compression would meet this limitation." *Id.* Patent Owner contends that Dr. Roy confirmed that quantizing may not result in compression at all and can instead result in arbitrarily large data sets, depending on two parameters, the sample frequency and the sample precision, and depending on the parameters, improving the sample quality would increase data size. *See id.* at 19 (quoting Ex 2013, 98:14–22; citing Ex. 2013, 97:24–98:2). According to Patent Owner, "quantization, therefore, may not be compression at all." *Id.* Patent Owner argues that compressing the estimated CSI requires that at least one part of the estimated CSI is actually compressed. *See id.*

In the Reply, Petitioner contends that Patent Owner's conclusion that quantization may not be compression at all does not follow from Dr. Roy's quoted testimony. *See* Pet. Reply 10–11 (quoting Ex. 2013, 98:14–22; citing PO Resp. 19). According to Petitioner, "assessing the level of compression provided by quantization requires comparing the number of bits needed to represent a sample prior to quantization with the number of bits needed to represent a sample following quantization." *Id.* at 11. Petitioner asserts that Dr. Roy's quoted testimony merely acknowledged that as the number of bits used to represent a sample increases, the data size of that sample becomes larger. *See id.* Petitioner contends that "[i]f the proper comparison between the number of bits needed to represent a sample prior to quantization with the number of bits needed to represent a sample following quantization is considered, it is readily apparent that quantization always reduces the number of bits needed to represent a sample." *Id.* Petitioner asserts that prior to quantization, a signal is mapped to a continuous range of values,

which in theory would require an infinite number of bits to be present, and after quantization, the number of bits needed to represent a sample is finite and is given by a simple equation, with $\log_2 N$ bits being sufficient to encode N possibilities for the quantized levels. *Id.* at 11–12 (quoting Ex. 2001, 86 (Ex. C), 88 (Ex. D); Ex. 1031, 23:9–24:2). Petitioner contends that "quantization reduces the number of bits needed to represent a sample from an infinite number prior to quantization to an arbitrarily small number following quantization, with the number of bits being dependent on the number of discrete amplitude levels represented, as Dr. Vojcic confirms." *Id.* at 12–13 (quoting Ex. 1031, 22:21–23:3, 27:18–19; Ex. 2001 ¶ 74; citing Ex. 1031, 20:8–21:11; Ex. 2001 ¶ 74). Petitioner further asserts that "even assuming, arguendo, that it is possible to contrive an example in which quantization would not result in compression, such an outlier would not warrant excluding quantizing from the plain and ordinary meaning of 'compress[ing] the estimated CSI,' as confirmed by the '204 Patent Specification." *Id.* at 13.

In the Sur-reply, Patent Owner contends Petitioner's assertion that quantization always reduces the number of bits needed to represent a sample is false because Dr. Roy admitted that quantization may result in a larger data set. *See* PO Sur-reply 6–7 (quoting Ex. 2012, 96:16–24). Patent Owner also contends that Petitioner's citations to Dr. Vojcic's deposition testimony, in the aggregate, do not support Petitioner's position. *See id.* at 7. Patent Owner asserts that Petitioner omits Dr. Vojcic's testimony that directly contradicts Petitioner's point. *See id.* at 7–8 (quoting Ex. 1031,

29:15–30:1,[12] 30:2–17,[13] 32:8–13). Patent Owner contends that the '204 Patent discloses examples of quantization that are just as likely to result in a larger dataset than the original data. *See id.* at 8. According to Patent Owner, "[t]here is no instance in which the '204 Patent describes compression as yielding that result." *Id.*

The cited evidence supports Patent Owner's arguments that quantization does not always result in compression, which Patent Owner equates with decreased data size or a reduction in the number of bits needed to represent a sample. Nonetheless, based on the '204 Patent disclosure that the mobile station may quantize information regarding time delays and phases of the selected channel tap and may further compress the estimated CSI by generating a plurality of parameters to represent information regarding magnitudes of the selected channel taps, the quantization disclosed in the '204 Patent results in some compression. *See* Ex. 1001, 4:19–22. We are unaware of, and Patent Owner does not direct us to, disclosure in the '204 Patent that quantizing results in increased data size.

Petitioner's reply also addresses the Institution Decision. According to Petitioner, "[t]he Board's decision to decline Patent Owner's overly narrow and unnecessary construction finds further support in *Thorner v. Sony*." Pet. Reply 8 (quoting *Thorner*, 669 F.3d at 1367). Petitioner asserts that both claims 1 and 11 recite "compress[ing] the estimated CSI" which, according to Petitioner, is "a broad and basic term, with plain and ordinary meaning, encompassing any form of compression." *Id.* (citing Ex. 1001, 4:11–22, 11:26–27, 12:17–18). Petitioner asserts that the '204 Patent

[12] Patent Owner incorrectly cites Ex. 1031, 32:8–13.
[13] Patent Owner incorrectly cites Ex. 1031, 29:4–30:17.

Specification and claims do not redefine "compress[ing] the CSI" to exclude quantization, or otherwise limit the term to using any particular form of compression. *See id.* Patent Owner contends that the '204 Patent Specification and claims also do not disavow any of the scope of the term. *See id.* According to Petitioner, "as confirmed by Dr. Roy, the '204 [Patent] Specification specifically recognized quantization as a technique for compressing estimated CSI." *Id.* (citing Ex. 1002 ¶¶ 59, 94).

In the Sur-reply, Patent Owner contends that Petitioner's statements that the '204 Patent Specification and claims do not redefine "compress[ing] the CSI" and do not disavow any claim scope are incorrectly premised on the plain and ordinary meaning of compression as equivalent to quantization. *See* PO Sur-reply 1. Patent Owner contends that Petitioner's premise is not in line with the plain and ordinary meaning of either of these two terms, nor with the '204 Patent's use of "compression" and "quantization." *See id.* Patent Owner contends that "they are entirely different concepts: compression is the limiting of data size; quantization is a mapping function that is agnostic as to data size." *Id.* at 1. Patent Owner contends that its "positions are in complete alignment with the Board's recent [Preliminary Guidance] observation that 'we interpret [the '204 Patent] as describing quantizing information regarding time delays and phases of selected channel taps as being part of an estimating step rather than just part [of] a compressing step.'" *Id.* at 1–2 (quoting PG 7–8). Patent Owner reproduces the same quote from *Thorner*, and contends that "[t]he '204 Patent deliberately uses the terms 'compression' and 'quantization' in different instances and does not conflate these terms." *Id.* at 2. Patent Owner contends that Petitioner and the Board do not point to any instance in

the '204 Patent Specification that deliberately equates the two terms. *See id.* at 2. Patent Owner further contends that Petitioner and the Board do not dispute the definition of the two terms. *See id.* "Quantization is 'the process of mapping input values from a continuous set, such as discretized waveform samples, to output values in a finite set of elements, such as digital data.'" *Id.* at 2 (quoting Ex. 2001 ¶¶ 70–71). "Compression, on the other hand, is the process of encoding digital data using fewer bits than the original digital representation, ideally using minimal possible number of bits yet with sufficiently good description of the original digital data." *Id.* at 3 (quoting Ex. 2001 ¶¶ 70–71). According to Patent Owner, "[t]he key point is that the whole purpose of compression is to reduce the data set that must be transmitted," and "[q]uantization does not serve that purpose." *Id.* at 4 (quoting Ex. 2001 ¶ 71). Patent Owner contends that Dr. Roy admitted that quantization may result in a larger data set. *See id.* (citing Ex. 2012, 96:16–24). Patent Owner further contends that "[t]he '204 Patent confirms this distinction by explicitly describing first 'compress[ing] the estimated CSI *by generating a plurality of parameters*' and then 'quantize the generated parameters.'" *Id.* (quoting Ex. 1001, 4:11–19). Patent Owner contends that "[i]nterpreting compression and quantization as the same algorithm would mean the patent describes first 'compress[ing] the estimated CSI by generating a plurality of parameters' and then '*compressing* the generated parameters.'" *Id.* Patent Owner contends that '204 Patent Specification does not support such an interpretation, and it "would be a technologically absurd interpretation." *See id.* at 4–5 (citing Ex. 2001 ¶ 75).

We agree with Petitioner's arguments. Petitioner is correct that the '204 Patent does not redefine compression to exclude quantization, or otherwise disavow the scope of "compression." We also agree that compression is a broad and basic term that encompasses any form of compression. We agree, however, with Patent Owner that compression and quantization should not be interpreted as having the exact same meaning. Patent Owner's arguments, however, focusing on the purposes of quantization and compression are misplaced. In cases where quantization results in a reduced data size, quantization can be encompassed by the term compression. We find that, consistent with the '204 Patent Specification, the scope of the term "compress[ing]" may include quantization, so long as the quantization results in using fewer bits than the original digital representation, i.e., a reduction in data size.

For the foregoing reasons, we decline to adopt Patent Owner's proposal that "'compress[ing] the estimated CSI,' should be construed as plain and ordinary meaning, which excludes 'quantizing the estimated CSI' without further separately applied compression." *See* PO Resp. 20; PO Sur-reply 9. As demonstrated in the analysis below, we need not provide an explicit claim construction for "compress[ing] the estimated CSI." The ordinary and customary meaning applies to "compress[ing] the estimated CSI."

Other claim terms

Petitioner identifies the following claim constructions, entered by the court in *UNM Rainforest Innovations v. Apple Inc.*, No. 1:20-cv-00351

(W.D. Tex.) (Ex. 1005),[14] as consistent with the positions advanced in the Petition:

Claim Term or Phrase	Construction
"channel responses"	"communication channels' responses in the time domain to transmitted signals"
"data/ non-data"	"[p]lain-and-ordinary meaning"
"a plurality of channel taps"	"at least two samples of a channel response at different time delays"

See Pet. 20. Patent Owner identifies the same claim terms or phrases construed by the court. *See* PO Resp. 11–12. Patent Owner further points out that the court construed the preambles of the claims as limiting. *See id.* at 20. Petitioner further asserts that "channel state information" should be construed as "information regarding the communication channels between the base station and the mobile station." Pet. 20 (citing Ex. 1001, 1:42–44; Ex. 1002 ¶ 64). Patent Owner agrees with Petitioner's construction. *See* PO Resp. 12 (quoting Ex. 1001, 1:41–46).

As demonstrated in the analysis below we need not construe any additional claim terms or phrases. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) ("[W]e need only construe terms 'that are in controversy, and only to the extent necessary to resolve the controversy.'" (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

[14] Patent Owner previously asserted the '204 Patent in *UNM Rainforest Innovations v. Apple Inc.*, No. 1:20-cv-00351 (W.D. Tex. Apr. 9, 2020), which was ultimately dismissed. *See* Pet. 3 n.1.

B. Level of Ordinary Skill in the Art

Petitioner asserts:

> As of 2008, a person of ordinary skill in the art ("POSA") in the field of the '204 patent would have had a Bachelor's degree in electrical engineering, computer engineering, or a related field, and around two years of experience in the design or development of wireless communication systems, or the equivalent plus knowledge of [multiple-input, multiple-output ("MIMO")] and [orthogonal frequency-division multiplexing ("OFDM")].

Pet. 19 (citing Ex. 1002 ¶ 19). Patent Owner offers a slightly different description as follows:

> At the relevant time, a person of ordinary skill in the art in the technical field of the '204 patent would have had at least a Bachelor's Degree in electrical engineering, computer engineering, or a related field, and approximately one year of experience in the design or development of wireless communications systems or the equivalent, including knowledge of MIMO and OFDM.

Id. (citing Ex. 2001 ¶ 31).

We adopt Patent Owner's definition of a person of ordinary skill in the art because it is consistent with the level of skill reflected by the '204 Patent Specification and the asserted prior art, but our conclusions would be the same under Petitioner's definition.

C. Principles of Law

"Under 35 U.S.C. § 102 a claim is anticipated 'if each and every limitation is found either expressly or inherently in a single prior art reference.'" *King Pharm., Inc. v. Eon Labs, Inc.*, 616 F.3d 1267, 1274 (Fed. Cir. 2010) (quoting *Celeritas Techs. Ltd. v. Rockwell Int'l Corp.*, 150 F.3d 1354, 1360 (Fed. Cir. 1998)).

A claim is unpatentable under 35 U.S.C. § 103 if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) if in evidence, so-called secondary considerations. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

D. Unpatentability of Claims 1, 2, 11, 12, and 13 over Hui

1. Overview of Hui (Ex. 1006)

Hui discloses a multiple antenna communication system that may comprise a MIMO system. *See* Ex. 1006, 3:10–15, Fig. 1. The communication system includes a base station, a mobile station, and multiple communication channels. *See id.* at 3:19–35, 3:64–65. Gains in system capacity can be realized if the transmitting station has detailed knowledge of the channel response for the channel from the transmitting station to the receiving station. *See id.* at 3:40–43. The receiving station computes estimates of the channel from the transmitting station to the receiving station and transmits channel state feedback to the transmitting station. *See id.* at 3:44–47. Hui discloses that detailed channel information feedback consumes valuable bandwidth that could otherwise be used to carry user data, and in multiple antenna systems, the amount of channel state feedback increases drastically with the number of antenna pairs. *See id.* at 3:47–53.

A receiver at the receiving station uses vector quantization techniques to reduce the channel state feedback. *See* Ex. 1006, 3:54–57, Fig. 2. A channel estimator at the receiver provides channel estimates by modeling the channel with channel coefficients and a sampling interval that includes time delays. *See id.* at 4:11–31. A feedback encoder quantizes the channel coefficients and provides the quantized channel coefficients to the transmitting station as feedback. *See id.* at 4:35–38. An adaptive quantization technique is used that assigns a greater number of bits to the more significant channel taps and a lesser number to the less significant channel taps. *See id.* at 4:52–55.

2. Analysis

Petitioner contends that Hui discloses, teaches, suggests, and renders obvious all the limitations recited in independent claims 1 and 11, and dependent claims 2, 12, and 13. *See* Pet. 22–38. For the reasons that follow, we are persuaded that Petitioner has established by a preponderance of the evidence that Hui discloses, teaches, suggests, and renders obvious the subject matter of claims 1, 2, and 11–13.

a. Claims 1 and 11

"[A method for] a mobile station to provide a base station feedback of channel state information (CSI) regarding a plurality of communication channels between the mobile station and the base station"

Petitioner contends that Hui discloses, teaches, or suggests the preamble recitations of claims 1 and 11, based on Hui's disclosures of a multiple antenna communication system comprising a base station and mobile station, each including multiple antennas, and a plurality of M communication channels existing between the base station and mobile

station, and Hui's disclosure of the mobile station providing quantized channel tap coefficients to the base station as feedback. *See* Pet. 24–27 (quoting Ex. 1006, 3:12–15, 3:19–21, 3:29–32, 3:57–65, 4:35–38, 6:2–3; Ex. 1001, 3:62–4:2; Ex. 1019, 107; citing Ex. 1006, 4:11–31; Ex. 1002 ¶¶ 34, 59, 83–87), 36.

Patent Owner does not dispute Petitioner's assertions addressing the preamble. *See generally* PO Resp. Nonetheless, the burden remains on Petitioner to demonstrate unpatentability. *See Dynamic Drinkware, LLC v. National Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015).

Based on the entire record, we find that Hui discloses, teaches, or suggests the preamble recitation. *See* Pet. 24–27.

"estimat[ing] the CSI by calculating a plurality of channel responses each for one of the communication channels"

Petitioner asserts that Hui discloses, teaches, or suggests "estimating the CSI by calculating a plurality of channel responses each for one of the communication channels," as recited in claim 1 and similarly recited in claim 11, based on Hui's disclosure that each M downlink channel had a channel response $g_m(t)$ in the time domain that is sampled at certain time delays τ_k to calculate and estimated channel response $\hat{g}_m(t)$ for each of M channels. *See* Pet. 27–28 (quoting Ex. 1006, 3:62–4:1, 4:11–30, 4:39–42, 6:2–3; citing Ex. 1002 ¶¶ 86, 88–91), 36.

Patent Owner does not dispute Petitioner's assertions addressing this limitation. *See generally* PO Resp. Nonetheless, the burden remains on Petitioner to demonstrate unpatentability. *See Dynamic Drinkware*, 800 F.3d at 1378.

Based on the entire record, we find that Hui discloses, teaches, or suggests estimating the CSI by calculating a plurality of channel responses each for one of the communication channels. *See* Pet. 27–28.

"compress[ing] the estimated CSI"

Petitioner asserts that Hui discloses, teaches, or suggests "compressing the estimated CSI," as recited in claim 1 and similarly recited in claim 11, based on Hui's disclosure that the mobile station quantized channel tap coefficients using different compression rates based on the statistics of the corresponding channel tap. *See* Pet. 28–30 (quoting Ex. 1006, 2:4–6, 4:33–38, 5:6–19; citing Ex. 1006, 4:52–55; Ex. 1002 ¶¶ 92–94), 36. Petitioner contends that Hui recognized quantization as a known technique for compressing CSI. *Id.* at 28 (quoting Ex. 1006, 1:32–35, 1:47–48). According to Petitioner, "[t]he '204 patent recognized quantization as a technique for compressing estimated CSI." *Id.* at 30 (citing Ex. 1001, 4:11–19; Ex. 1002 ¶ 94).

Patent Owner contends that the solution Hui teaches specifically relates only to application of quantization techniques, and does not disclose "compression" as that term is used in the '204 patent. *See* PO Resp. 27 (quoting Ex. 2001 ¶¶ 80–81). Patent Owner contends that the technique disclosed by Hui is adaptive quantization. *See id.* at 28 (citing Ex. 2001 ¶¶ 84, 91), 34–37 (quoting Ex. 1006, 1:32–62, 2:2–4, 2:8–15; Ex. 1002 ¶¶ 89, 90, 92, 94, 101; Ex. 2001 ¶¶ 84, 91; citing Ex. 1002 ¶ 93). Patent Owner repeats its arguments, addressed above in the Section III.A., that the '204 Patent distinguishes quantization from compression. *Compare* PO Resp. 28–34, *with id.* at 12–17. We do not agree with Patent Owner's arguments because, as explained above in Section III.A., we decline to adopt

Patent Owner's proposed narrow construction for "compressing the estimated CSI" that excludes quantization.

Based on the entire record, we find that Hui discloses, teaches, or suggests compressing the estimated the CSI. *See* Pet. 28–30.

"send[ing] the compressed CSI as the feedback to the base station"

Petitioner asserts that Hui discloses, teaches, or suggests "sending the compressed CSI as the feedback to the base station," as recited in claim 1 and similarly recited in claim 11, based on Hui's disclosure that the mobile station transmits quantized channel tap coefficient to the base station. *See* Pet. 30 (quoting Ex. 1006, 5:19–21; citing Ex. 1006, 2:16–18, 4:35–38; Ex. 1002 ¶ 95), 36.

Patent Owner does not dispute Petitioner's assertions addressing this limitation. *See generally* PO Resp. Nonetheless, the burden remains on Petitioner to demonstrate unpatentability. *See Dynamic Drinkware*, 800 F.3d at 1378.

Based on the entire record, we find that Hui discloses, teaches, or suggests sending the compressed CSI as the feedback to the base station.

"wherein estimating further comprises selecting a plurality of channel taps from each of the calculated channel responses to estimate the CSI"

Petitioner asserts that Hui discloses, teaches, suggests, and renders obvious "wherein estimating comprises selecting a plurality of channel taps from each of the calculated channel response to estimate the CSI," as recited in claims 1 and 11, based on Hui's disclosure of "selecting a plurality of Q channel tap coefficients (complex coefficients $\hat{a}_{m,k}$) from each calculated estimated channel response $\hat{g}_m(t)$." Pet. 30–31 (quoting Ex. 1006, 4:19–49, 5:65–6:3; citing Ex. 1002 ¶¶ 96–100); *see id.* at 36. According to

Petitioner, "[t]hese channel tap coefficients corresponded to multiple samples of the larger channel response $\hat{g}_m(t)$ at different 'sampling intervals' (*i.e.*, time delays) and satisfied the *Apple* construction of 'a plurality of channel taps.'" *Id.* at 31 (citing Pet. 20–21 (claim construction)).

Patent Owner argues that Hui does not teach this claim limitation because Hui only discloses two methods related to channel taps. *See* PO Resp. 37. More specifically, Patent Owner contends that Hui discloses representing certain channel taps with more bits than others, which does not disclose selection at all. *See id.* (citing Ex. 2001 ¶ 94). Patent Owner also argues that Hui discloses selection of channel taps that fall into a certain predetermined delay spread window. *See id.* at 38 (quoting Ex. 2001 ¶ 94; Ex. 1006, 2:34–37). Patent Owner contends that this method is not a selection of the best channel taps, and does not provides the benefits of, and serves a different purpose than selecting the most significant channel taps taught by the '204 Patent. *See id.*

Patent Owner's arguments are misplaced because they do not address all of the teachings of Hui relied upon by Petitioner. *See* PO Resp. 37–38. For example, Patent Owner's arguments do not address Petitioner's assertion that Q channel tap coefficients (complex coefficients $\hat{a}_{m,k}$) from each calculated estimated channel response $\hat{g}_m(t)$ are selected. *See id.*; Pet. 30–31. Moreover, Patent Owner's arguments are not commensurate in scope with claims 1 and 11. Claims 1 and 11 do not require "selection of the best channel taps," nor require "selecting the most significant channel taps."

Petitioner also asserts that a person of ordinary skill in the art would have found it obvious for the Q channel taps to be selected from a larger number of channel taps within estimated channel response $\hat{g}_m(t)$. *See*

Pet. 31–34. Based on Petitioner's citations to Hui and Dr. Roy's supporting testimony (Ex. 1002), we are persuaded Petitioner has set forth sufficient articulated reasoning with rational underpinning to support the conclusion that it would have been obvious to one of ordinary skill in the art to select Q channel taps from a larger number of channel taps within estimated channel response $\hat{g}_m(t)$ to reduce the amount of feedback of channel state information transmitted from the mobile station to the base station. *See id.* (quoting Ex. 1006, 4:30–31, 4:54–55; citing Ex. 1006, 1:26–31, 1:61–62, 4:11–20; Ex. 1002 ¶¶ 99–100); *KSR*, 550 U.S. at 421.

Based on the entire record, we determine Petitioner shows by a preponderance of the evidence that Hui discloses, teaches, suggests, and renders obvious selecting a plurality of channel taps from each of the calculated channel response to estimate the CSI. *See* Pet. 30–34.

Secondary Considerations

We next consider Patent Owner's proffered evidence of secondary considerations before reaching our conclusion on obviousness as to the subject matter of claims 1 and 11. *See WBIP, LLC v. Kohler Co.*, 829 F.3d 1317, 1328 (Fed. Cir. 2016). Patent Owner asserts that there is evidence of commercial success and licensing of the '204 Patent to industry leaders in the wireless chip industry. *See* PO Resp. 53–54 (citing Exs. 2007–2010; IPR2020-01578, Ex. 1021 (confidential patent license agreement filed under seal)). Exhibit 2007 is a notice regarding withdrawn claims entered in *UNM Rainforest Innovations v. Dell Technologies, Inc.*, No. 6:20-cv-00468-ADA (W.D. Tex.). Exhibit 2008 is a notice regarding withdrawn claims entered in *UNM Rainforest Innovations v. ASUSTek Computer, Inc.*, No. 6:20-cv-00142-ADA (W.D. Tex.). Exhibits 2009 and 2010 are a joint motion to

dismiss with prejudice, and an order of dismissal, respectively, entered in *UNM Rainforest Innovations v. Apple Inc.*, No. 1:20-cv-00351 (W.D. Tex.). A copy of IPR2020-01578, Ex. 1021 has not been entered in the record of this proceeding. According to Patent Owner, "[t]hese attractive licenses, negotiated by wireless industry leaders, provide strong evidence of secondary considerations supporting a finding of non-obviousness of the patent[] at issue in this IPR." *Id.* at 54. In the Reply, Petitioner contends that Patent Owner made no showing of a nexus, and, therefore, did not establish secondary considerations of non-obviousness. *See* Pet. Reply 21.

Factual inquiries for an obviousness determination include evaluation and crediting of evidence of secondary considerations. *Graham*, 383 U.S. at 17 (1966). "For objective evidence of secondary considerations to be accorded substantial weight, its 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). Ultimately, "[t]he patentee bears the burden of showing that a nexus exists." *WMS Gaming, Inc. v. Int'l Game Tech.*, 184 F.3d 1339, 1359 (Fed. Cir. 1999). Our reviewing court "specifically requires[s] affirmative evidence of nexus where the evidence . . . presented is a license, because it is often 'cheaper to take licenses than to defend infringement suits.'" *Iron Grip Barbell Co. Inc. v. USA Sports, Inc.*, 392 F.3d 1317, 1324 (Fed. Cir. 2004) (quoting *EWP Corp. v. Reliance Universal Inc.*, 755 F.2d 898, 908 (Fed Circ. 1985)).

> When the specific licenses are not in the record, it is difficult for the court to determine if "the licensing program was successful either because of the merits of the claimed invention or because they were entered into as business decisions to avoid litigation, because of prior business relationships, or for other economic reasons."

In re Cree, Inc., 818 F.3d 694, 703 (Fed. Cir. 2016) (quoting *In re Antor Media Corp.*, 689 F.3d 1282, 1294 (Fed. Cir. 2012)).

Exhibits 2007 through 2010 proffered by Patent Owner are not license agreements, rather they are documents settling Patent Owner's disputes with several defendants in different District Court proceedings. *See* Exs. 2007–2010. IPR2020-01578, Ex. 1021 is not entered in the record in this proceeding and thus we cannot discern whether the licensee took the license "out of recognition and acceptance of the subject matter claimed" in the '204 patent, or for other reasons. *In re GPAC Inc.*, 57 F.3d 1573, 1580 (Fed. Cir. 1995). Therefore, Patent Owner fails to provide evidence that the license agreement has a nexus to the merits of the claimed invention. Accordingly, Patent Owner's evidence of secondary considerations of non-obviousness is entitled to little weight.

Conclusion Regarding the Analysis of Claims 1 and 11

We have considered Patent Owner's arguments that Dr. Roy's Declaration testimony (Ex. 1002) should be given no weight. *See* PO Resp. 27; PO Sur-reply 9–15. Patent Owner's Sur-reply arguments are substantially similar to arguments raised in Patent Owner's Motion to Exclude. *Compare* PO Sur-reply 9–15, *with* PO Mot. Excl. 1, 3–10. After carefully considering Dr. Roy's Declaration testimony (Ex. 1002), in view of the supporting evidence cited therein, as well as Dr. Roy's deposition testimony (Ex. 2013), we decline to give no weight to Dr. Roy's Declaration testimony (Ex. 1002).

After considering the parties' arguments, the entire record, and weighing the evidence of obviousness and the secondary considerations of nonobviousness of the subject matter of claims 1 and 11, we determine that

Petitioner's showing of obviousness is strong and outweighs the minimally weighted evidence of secondary considerations of nonobviousness. Accordingly, based on the entire record, Petitioner has established by a preponderance of the evidence that claims 1 and 11 are unpatentable under 35 U.S.C. §§ 102 and 103 over Hui.

b. Dependent Claims 2, 12, and 13

Claim 2 depends from claim 1, and claims 12 and 13 depend from claim 11. Ex. 1001, 11:33–36, 12:24–31. Patent Owner does not address substantively Petitioner's patentability challenges to dependent claims 2, 12, and 13. *See generally* PO Resp. Nonetheless, the burden remains on Petitioner to demonstrate unpatentability. *See Dynamic Drinkware*, 800 F.3d at 1378.

We have reviewed Petitioner's contentions and cited supporting evidence addressing how Hui teaches, suggests, and renders obvious the additional limitations of claims 2, 12, and 13. *See* Pet. 34–38. Based on the entire record, Petitioner has established by a preponderance of the evidence that Hui teaches, suggests, and renders obvious the limitations of claims 2, 12, and 13. For the reasons presented by Petitioner, in addition to those explained above addressing claims 1 and 11, based on the entire record, Petitioner has established by a preponderance of the evidence that claims 2, 12, and 13 are unpatentable under 35 U.S.C. §§ 102 and 103 over Hui. *See* Pet. 34–38.

E. Unpatentability of Claims 1, 2, 11, 12, and 13 over Hui and Maltsev

1. Overview of Maltsev (Ex. 1008)

Maltsev discloses a wireless communication system that may comprise a MIMO system, which includes a multicarrier receiving station

and a multicarrier transmitting station that transmit and receive communication signals using two or more antennas. *See* Ex. 1008 ¶¶ 9, 10, Figs. 1–2. The mobile station provides channel feedback to the base station by generating an initial sampled channel impulse response estimate comprising a plurality of rays for each channel path and selecting the most significant predetermined number of rays. *See id.* ¶¶ 36–38, Fig. 5.

2. Analysis

Petitioner contends the combination of Hui and Maltsev teaches, suggests, and renders obvious all the limitations recited in independent claims 1 and 11, and dependent claims 2, 12, and 13. *See* Pet. 22–40. For the reasons that follow, we are persuaded that Petitioner has established by a preponderance of the evidence that the combination of Hui and Maltsev renders obvious the subject matter of claims 1, 2, and 11–13.

a. Claims 1 and 11

"wherein estimating further comprises selecting a plurality of channel taps from each of the calculated channel responses to estimate the CSI"

In an additional position, Petitioner asserts, "[t]o the extent Patent Owner argues that Hui did not disclose or render obvious . . . 'wherein the estimating further comprises selecting a plurality of channel taps from each of the calculated channel responses to estimate the CSI,' this would have been obvious over Hui combined with Maltsev." Pet. 39. Petitioner asserts that Maltsev teaches a MIMO communication system that includes a mobile station that generates a channel impulse response estimate for each channel path between a base station and a mobile station and selects the most significant predetermined number of rays from the estimated sampled channel response, and later sends the information to the base station. *See id.*

at 39–40 (quoting Ex. 1008 ¶¶ 10, 11, 36–38; citing Ex. 1008, Figs. 1, 5, ¶¶ 40–41; Ex. 1002 ¶¶ 74–76, 101). Petitioner contends that a person of ordinary skill in the art would have been motivated to incorporate Maltsev's teaching of selecting only the most significant rays from each channel response into Hui to reduce the amount of CSI feedback being transmitted to the base station. *See id.* at 40 (citing Ex. 1002 ¶¶ 101–102). According to Petitioner, a person of ordinary skill in the art

> would have recognized Maltsev's disclosure that selecting the most significant rays provided benefits of "reduc[ing] the amount of processing required 10 by the mobile station to provide channel feedback information" and "reduc[ing] the amount of feedback reducing bandwidth consumption" . . . as providing a teaching, suggestion, or motivation for incorporating this technique into Hui.

Id. (quoting Ex. 1008 ¶ 19; citing Ex. 1002 ¶ 101) (first alteration in original).

In response, Patent Owner contends that, because Hui teaches limiting the channel tap to a predetermined delay spread, adding Maltsev's selection method would result only in selecting, for each channel path, most significant rays from the channel taps within Hui's predetermined delay spread. *See* PO Resp. 38–39 (quoting Ex. 2001 ¶ 95).

We do not agree with Patent Owner's argument because, as explained above, Petitioner's arguments are misplaced because they do not address all of the teachings of Hui relied upon by Petitioner. For this same reason we also are not swayed by Patent Owner's contention that a person of ordinary skill in the art would not have been motivated to combine Hui with the selection aspect of Maltsev because Hui already discloses a method of selection by use of the predetermined delay spread. *See* PO Resp. 38–39.

Based on Petitioner's citations to Hui, Maltsev, and Dr. Roy's supporting testimony (Ex. 1002), we are persuaded that Petitioner has set forth sufficient articulated reasoning with rational underpinning to support the conclusion that it would have been obvious to one of ordinary skill in the art to modify Hui teachings to include Maltsev's teaching of selecting only the most significant rays from each channel response because it would have reduced the amount of processing required by the mobile station to provide feedback and reduced the amount of feedback thereby reducing bandwidth consumption. *See* Pet. 39–40; *KSR*, 550 U.S. at 421.

Based on the entire record, we determine Petitioner shows by a preponderance of the evidence that the combination of Hui and Maltsev renders obvious selecting a plurality of channel taps from each of the calculated channel responses to estimate the CSI.

Secondary Considerations

For the same reasons as those explained above in Section III.D.2.a., Patent Owner's evidence of secondary considerations of non-obviousness is entitled to little weight.

Conclusion Regarding the Analysis of Claims 1 and 11

As explained above in Section III.D.2.a., we decline to give Dr. Roy's Declaration testimony (Ex. 1002) no weight. After considering the parties' arguments, the entire record, and weighing the evidence of obviousness and the secondary considerations of nonobviousness of the subject matter of claims 1 and 11, we determine that Petitioner's showing of obviousness is strong and outweighs the minimally weighted evidence of secondary considerations of nonobviousness. Accordingly, based on the entire record,

Petitioner has established by a preponderance of the evidence that claims 1 and 11 are unpatentable under 35 U.S.C. § 103 over Hui and Maltsev.

b. Dependent Claims 2, 12, and 13

Patent Owner does not address substantively Petitioner's patentability challenges to dependent claims 2, 12, and 13. *See generally* PO Resp. Nonetheless, the burden remains on Petitioner to demonstrate unpatentability. *See Dynamic Drinkware*, 800 F.3d at 1378.

We have reviewed Petitioner's contentions and cited supporting evidence addressing how Hui teaches, suggests, and renders obvious the additional limitations of claims 2, 12, and 13. *See* Pet. 34–38. Based on the entire record, Petitioner has established by a preponderance of the evidence that Hui teaches, suggests, and renders obvious the additional limitations of claims 2, 12, and 13. For the reasons presented by Petitioner, in addition to those explained above addressing claims 1 and 11, based on the entire record, Petitioner has established by a preponderance of the evidence that claims 2, 12, and 13 are unpatentable under 35 U.S.C. § 103 over Hui and Maltsev. *See* Pet. 34–38

F. Remaining Unpatentability Challenges

Petitioner also challenges the patentability of claims 1, 2, and 11–13 under 35 U.S.C. §§ 102 and 103 over Döttling alone, Döttling and Maltsev, Koorapaty alone, and Koorapaty and the knowledge of a person of ordinary skill in the art. *See* Pet. 41–69. We need not determine the merits of those challenges because, as explained above, Petitioner has shown by a preponderance of the evidence that claims 1, 2, and 11–13 are unpatentable under 35 U.S.C. § 102 by Hui, and under 35 U.S.C. § 103 over Hui alone and over Hui and Maltsev. *See SAS Inst. Inc. v. Iancu*, 138 S. Ct. 1348,

1359 (2018) (holding that a petitioner "is entitled to a final written decision addressing all of the claims it has challenged"); *Beloit Corp. v. Valmet Oy*, 742 F.2d 1421, 1423 (Fed. Cir. 1984) (finding an administrative agency is at liberty to reach a decision based on a single dispositive issue because doing so "can not only save the parties, the [agency], and [the reviewing] court unnecessary cost and effort," but can "greatly ease the burden on [an agency] faced with a . . . proceeding involving numerous complex issues and required by statute to reach its conclusion within rigid time limits"); *Bos. Sci. Scimed, Inc. v. Cook Grp. Inc.*, 809 F. App'x 984, 990 (Fed. Cir. 2020) (non-precedential) (recognizing that the "Board need not address issues that are not necessary to the resolution of the proceeding" and, thus, agreeing that the Board has "discretion to decline to decide additional instituted grounds once the petitioner has prevailed on all its challenged claims").

IV. CONTINGENT MOTION TO AMEND

A. Introduction

Contingent on the determination that claims 1, 2, and 11–13 are unpatentable, Patent Owner requests that we cancel claims 1, 2, and 11–13 of the '204 Patent and replace these claims with proposed substitute claims 29, 30, and 39–41, respectively. *See* Mot. Amend 2, 9–11 (App'x A). As discussed above in Sections III.D. and III.E., Petitioner has established by a preponderance of the evidence that claims 1, 2, and 11–13 are unpatentable under 35 U.S.C. §§ 102, 103. Therefore, we consider Patent Owner's Motion to Amend.

In the proceeding before us, Patent Owner requested preliminary guidance from the Board in its Motion to Amend. *See* Mot. Amend 1–2; Notice Regarding a New Pilot Program Concerning Motion to Amend

Practice and Procedures in Trial Proceedings under the America Invents Act before the Patent Trial and Appeal Board, 84 Fed. Reg. 9497 (Mar. 15, 2019) ("MTA Pilot Program Notice"). After Petitioner filed its Opposition to the Motion to Amend, the Board issued Preliminary Guidance. *See* PG. Patent Owner filed a Reply to Petitioner's Opposition to which Petitioner filed a Sur-reply. *See* PO Reply MTA; Pet. Sur-reply MTA.

B. Principles of Law

In an *inter partes* review, amended claims are not added to a patent as a matter of right, but instead must be proposed as a part of a motion to amend. 35 U.S.C. § 316(d). "Before considering the patentability of any substitute claims, . . . the Board first must determine whether the motion to amend meets the statutory and regulatory requirements set forth in 35 U.S.C. § 316(d) and 37 C.F.R. § 42.121." *Lectrosonics, Inc. v. Zaxcom, Inc.*, IPR2018-01129, Paper 15 at 4 (PTAB Feb. 25, 2019) (precedential). A patent owner bears the burden of persuasion to show: (1) the amendment proposes a reasonable number of substitute claims; (2) the proposed substitute claims are supported in the original disclosure (and any earlier filed disclosure for which the benefit of filing date is sought); (3) the amendment responds to a ground of unpatentability involved in the trial; and (4) the amendment does not seek to enlarge the scope of the claims of the patent or introduce new subject matter. *See* 35 U.S.C. § 316(d); 37 C.F.R. § 42.121(a)(2), (a)(3), (d)(1); *Lectrosonics*, Paper 15 at 4–8. Petitioner, however, "bears the burden of persuasion to show, by a preponderance of the evidence, that any proposed substitute claims are unpatentable." 37 C.F.R. § 42.121(d)(2); *Lectrosonics*, Paper 15 at 4 (citing

Aqua Prods. Inc. v. Matal, 872 F.3d 1290, 1311 (Fed. Cir. 2017); *Bosch Auto. Serv. Sols. LLC v. Iancu*, 878 F.3d 1027, 1040 (Fed. Cir. 2017)).

C. Analysis

Because the Preliminary Guidance issued in this proceeding is not binding on the Board, we consider anew Patent Owner's Motion to Amend and Petitioner's Opposition, along with Patent Owner's Reply and Petitioner's Sur-reply. We begin with an overview of proposed substitute claims 29, 30, and 39–41, followed by a discussion of Patent Owner's compliance with the statutory and regulatory requirements for a motion to amend, and then we address Petitioner's assertions of unpatentability of the proposed substitute claims.

1. Overview of Proposed Substitute Claims 29, 30, and 39–41

Proposed substitute independent claim 29, to replace independent claim 1, is reproduced below with underlined text showing Patent Owner's amendments:

> 29. A method for a mobile station to provide to a base station feedback of channel state information (CSI) regarding a plurality of communication channels between the mobile station and the base station, the method comprising:
>
> estimating the CSI by calculating a plurality of channel responses each for one of the communication channels;
>
> compressing the estimated CSI; and
>
> sending the compressed CSI as the feedback to the base station,
>
> wherein the estimating further comprises selecting a plurality of channel taps from each of the calculated channel responses to estimate the CSI;
>
> <u>wherein estimating further comprises quantizing time delays and phases of the channel taps; and</u>

wherein compressing further comprises generating a plurality of parameters to represent information regarding magnitudes of the selected channel taps, and

quantizing the plurality of parameters.

Mot. Amend 9–10 (App'x A). Proposed substitute independent claim 39, to replace independent claim 11, includes identical added limitations. *Id.* at 10. Proposed substitute claims 30, 40, and 41 are identical to dependent claims 2, 12, and 13, respectively, apart from amendments to change the dependency to proposed substitute claims 29 and 39, respectively. *See id.* at 11.

2. Reasonable Number of Substitute Claims

Patent Owner's proposal to substitute a single claim for each of challenged claims 1, 2, and 11–13 (*see* Mot. Amend 2) meets the requirement for a reasonable number of substitute claims. *See* 37 C.F.R. § 42.121(a)(3) (establishing a rebuttable presumption that only one substitute claim is needed to replace each challenged claim).

3. Enlargement of Claim Scope

Patent Owner asserts that proposed substitute claims 29 and 39 do not seek to enlarge the scope of claims 1 and 11 because proposed substitute claims 29 and 39 are narrower than claims 1 and 11 with the addition of a claim element. *See* Mot. Amend 3–4. Petitioner does not dispute Patent Owner's contention that proposed substitute claims 29 and 39 do not seek to enlarge the scope of the claims of the '204 Patent. *See generally* Pet Opp. MTA. Based on the entire record, we determine that proposed substitute claims 29, 30, and 39–41 do not enlarge the scope of the claims of the '204 Patent and do not introduce new matter. *See* 37 C.F.R. § 42.121(a)(2)(ii)

("A motion to amend may be denied where . . . [t]he amendment seeks to enlarge the scope of the claims of the patent . . . .").

4. Support for Proposed Substitute Claims / New Matter

Patent Owner asserts that the narrowing limitations of proposed substitute claims 29 and 39 are supported by the '204 Patent and the original disclosure of Application 12/339,000 (Ex. 1004, "'000 Application"), from which the '204 Patent issued. *See* Mot. Amend 4–5; *see also* PO Reply MTA (similar arguments). In particular, Patent Owner contends that "wherein estimating further comprises quantizing time delays and phases of the channel taps" finds support in the written description of the '204 Patent based on the following disclosures: (1) "Estimated CSI for the communication channel may include the time delays P_1, P_2, . . . , P_6, the magnitudes, and the phases of the channel taps 202-1, 202-2, . . . , 202-6, and (2) "The mobile station 104 may quantize information regarding time delays and phases of the selected channel taps." *See* Mot. Amend. 4–5 (quoting Ex. 1001, 3:66–4:2, 4:12–15; citing Ex. 1001, 4:19–22, 5:66–6:4, 6:36–41, 6:50–55, 8:4–10, 8:40–49; Ex. 1004 ¶¶ 28, 29, 38, 41, 42, 47, 50); *see* PO Reply MTA 8–9 (similar argument). Patent Owner also asserts that "wherein compressing further comprises generating a plurality of parameters to represent information regarding magnitudes of the selected channel taps; and quantizing the plurality of parameters" find support finds support in the written description of the '204 Patent based on the disclosure that "the mobile station 104 may further compress the estimated CSI by generating a plurality of parameters to represent information regarding magnitudes of the selected channel taps . . . and quantize the generated parameters." Mot. Amend 5 (quoting Ex. 1001, 4:14–19; citing Ex. 1004 ¶ 29); *see* PO Reply

MTA 9 (similar argument). Patent Owner asserts that providing written description support from Provisional Application 61/079,980 is irrelevant at this time because all of the applied prior art predates the '204 Patent filing date and the Provisional Application filing date. *See* Mot. Amend 5.

Petitioner contends that Patent Owner's Motion to Amend should be denied because it does not comply with the requirement of 37 C.F.R. § 42.121(b) to show support for the entirety of the proposed amended claims. *See* Pet. Opp. MTA 1–4; *see also* 37 C.F.R. § 42.121(a)(2)(ii) ("A motion to amend may be denied where . . . [t]he amendment seeks to . . . introduce new subject matter."). Petitioner points out that the *Lectrosonics* precedential order makes clear that to meet the statutory requirement the motion must set forth written description support for each proposed substitute claim as a whole, not just the features added by amendment. *See id.* at 3 (quoting *Lectrosonics*, Paper 15 at 8). Petitioner contends that Patent Owner's Motion does not attempt to satisfy this requirement, but only purports to show support for the element added by the amendments. *See id.* (citing Mot. Amend. 4–6).

In the Preliminary Guidance, we found preliminarily that Patent Owner did not satisfy its burden of establishing that the amendment does not introduce new matter because Patent Owner does not identify sufficient written description support in the originally filed disclosure of the '204 Patent for all of the limitations of the proposed substitute claims. *See* PG 6.

In the Reply to the Opposition, Patent Owner supplements its Motion to Amend by asserting the '000 Application provides written description support for each of the limitations of proposed substitute claims 29, 30, and 39–41 by providing, for each limitation, citations to numerous

paragraphs of the '000 Application, and in many cases parenthetical quotations and information addressing the specific disclosures relied upon in the respective cited paragraphs. *See* PO Reply MTA 6–13 (quoting Ex. 1004 ¶¶ 7–10, 21, 24, 58, 27–29, 31, 43, 51, 52; citing Ex. 1004 ¶¶ 15, 16, 24–27, 32, Figs. 1, 2, 3A–3C, 4A–4B, 9A–9C).

In the Sur-reply, Petitioner contends that Patent Owner's attempt to provide a showing of written description support for the original limitations of the proposed substitute claims comes too late. *See* Pet. Sur-reply MTA 1–2. Petitioner contends that under the controlling rules and precedent, Patent Owner was obligated to present all of its arguments and evidence showing written description support for each limitation of the proposed substitute claims in the Motion to Amend. *See id.* at 2–3 (quoting 37 CF.R. § 42.23(b); *Lectrosonics*, Paper 15 at 8; Trial Practice Guide, 77 Fed. Reg. 48,756, 48,767, (Aug. 14, 2012) ("TPG")). Petitioner asserts that it is well-established that a reply paper is too late for a patent owner to set forth written description support. *See id.* at 3–4 (quoting *Lippert Components, Inc. v Days Corp.*, IPR2018-00777, Paper 28 at 51 (PTAB Sept. 24, 2019)).

Petitioner contends that "*Lippert Components* further explained that the procedural requirement that a patent owner set forth the required written description support in its motion to amend, rather than in reply, is necessary to give a petitioner a full and fair opportunity to respond to the written description arguments." Pet. Sur-reply MTA 4 (citing *Lippert*, Paper 28 at 51–52). According to Petitioner,

> only an opposition paper affords Petitioner a full and fair opportunity to respond to P[atent Owner]'s written description theories, as it is the only paper in the motion-to-amend briefing

> in which Petitioner is entitled to submit new evidence, including a declaration from its expert, to explain why P[atent Owner]'s alleged written description support is deficient.

Id. (quoting MTA Pilot Program Notice 9500). Petitioner contends that Patent Owner, by waiting until the Reply to present its written description theories, has deprived Petitioner of a fair opportunity to respond to those theories, particularly because Petitioner is unable to present new evidence in a sur-reply. *See id.* at 5 (quoting MTA Pilot Program Notice 9500; *Lippert*, Paper 28 at 51). Petitioner asserts that *Respironics, Inc. v. Zoll Med. Corp.*, IPR2013–00322, Paper 46 (PTAB Sept. 17, 2014) is consistent with *Lippert*. *See id.* at 5–6 (quoting *Respironics*, Paper 46 at 25). Petitioner contends that, "for the same reasons as explained in *Lippert Components* and *Respironics*, P[atent Owner]'s attempt to provide the missing written description support on reply is too late, and [the] motion to amend should be denied." *Id.* at 7 (quoting *Lippert*, Paper 28 at 52, *Respironics*, Paper 46 at 25–26).

Petitioner further contends that the MTA Pilot Program does not alter the PTAB Rules and precedent that prohibit new written description theories on reply. *See* Pet. Sur-reply MTA 1, 7 (citing 37 C.F.R. §§ 42.23(b), 42.121; TPG 48,767; *Lectrosonics*; *Lippert*; *Respironics*). According to Petitioner, Patent Owner "has presented no argument for . . . why the controlling rules and precedent should not be followed." *Id.* at 7 (citing PO Reply MTA 5–13). Petitioner contends that nothing in the MTA Pilot Program Notice alters or suggests an intent to deviate from this well-established precedent on motion to amend practice. *See id.* Petitioner asserts that the MTA Pilot Program Notice cites 37 C.F.R. § 42.121 and *Lectrosonics* and reiterates that a motion to amend must set forth written

description support for each substitute claim. *See id.* at 7–8. Petitioner further contends that the MTA Pilot Program Notice does not include any language authorizing or permitting a patent owner to present on reply "new arguments" following the issuance of preliminary guidance. *See id.* at 8 (citing MTA Pilot Program Notice 9497). Petitioner, however, contends that the MTA Pilot Program Notice includes language authorizing new arguments if, instead of a reply, the patent owner opts to pursue a revised motion to amend. *See id.* (quoting MTA Pilot Program Notice 9498). According to Petitioner,

> [b]y permitting new arguments only if a patent owner files a revised motion to amend following preliminary guidance, and not if a patent owner files a reply, the Pilot Program Notice makes clear that new arguments, including entirely new written description theories necessary to set forth a prima facie case for written description support, are not permitted on reply.

Id.

We do not agree with Petitioner's arguments that Patent Owner is foreclosed from supplementing its showing that the Motion to Amend meets the statutory and regulatory requirements in the Reply. Petitioner's Opposition and the Preliminary Guidance raised the issue of an insufficiency of Patent Owner's showing of support for the proposed amended claims. *See* Pet. Opp. MTA 2–5. As set forth in the MTA Pilot Program Notice, a reply may respond to the preliminary guidance and to the opposition to the motion to amend. *See* MTA Pilot Program Notice 9501. A patent owner also is permitted to file new evidence, including declarations, with its reply. *See id.* In practical application, a patent owner is permitted to supplement its showing that there is support for the proposed substitute claims in a reply.

See, e.g., *Orthofix Med. Inc. v. Spine Holdings, LLC*, IPR2020–01411, Paper 41 at 72–73 (PTAB Feb. 22, 2022).

Petitioner also argues that the Reply does not meet Patent Owner's burden because Patent Owner's "showing of written description consists exclusively of string citations, with either minimal parenthetical or no further explanation as to [how] the cited materials supports the claims." Pet. Sur-Reply MTA 13 (citing PO Reply MTA 5–13). Petitioner contends that merely providing string citations, without any further explanation as to how the cited material supports the claims as a whole, fails to satisfy Patent Owner's burden. *See id.* at 13–14 (quoting *Intel Corp. v. Alacritech, Inc.*, IPR2017-01392, Paper 81 at 64–65 (PTAB Nov. 26, 2018); *Lippert*, Paper 28 at 52, *Greene's Energy Grp., LLC v. Oil States Energy Servs., LLC*, No. IPR2014-00216, Paper 53 at 26 (PTAB May 1, 2015); *Respironics*, Paper 46 at 24; citing *B.E. Tech., L.L.C. v. Google, Inc.*, No. 2015-1827, 2016 U.S. App. LEXIS 20591, *21–22 (Fed. Cir. Nov. 17, 2017)).

We do not agree with Petitioner's arguments. Patent Owner provides citations for each limitation of the proposed substitute claims with parenthetical quotations providing sufficient explanation of support in the '000 Application for each claim limitation. *See* PO Reply MTA 6–13. We have reviewed Patent Owner's citations to the '000 Application for the limitations of proposed substitute claims 29, 30, and 39–41 and find that the '000 Application provides sufficient support for the limitations of proposed substitute claims 29, 30, and 39–41.

Based on the entire record, Patent Owner has sufficiently shown support in the '000 Application for each of the proposed amended claims. *See* Mot. Amend 4–5; PO Reply MTA 6–13.

5. Responding to a Ground of Unpatentability

Patent Owner contends that proposed substitute claims 29, 30, and 39–41 respond to Petitioner's unpatentability challenge to claims 1, 2, and 11–13 based on Hui alone and Hui in view of Maltsev because the additional claim element of proposed substitute claims 29 and 39 responds to this ground of unpatentability. *See* Mot. Amend 2–3. Petitioner does not dispute Patent Owner's contentions that proposed substitute claims 29, 30, and 39–41 are responsive to the grounds of unpatentability in the Petition. *See generally* Pet. Opp. MTA. Based on the entire record, Patent Owner has sufficiently articulated its position for why the proposed substitute claims are responsive to the grounds of unpatentability raised in the Petition. *See* Mot. Amend 2–3.

6. Patentability of Proposed Substitute Claims

Petitioner contends that Hui discloses, teaches, suggests, and renders obvious all the limitations recited in proposed substitute independent claims 29 and 39, and dependent claims 30, 40, and 41. *See id.* at 10–19. Petitioner also contends that the combination of Hui and Maltsev teaches, suggests, and renders obvious all the limitations recited in proposed substitute independent claims 29 and 39, and dependent claims 30, 40, and 41. *See id.* at 19–20. For the reasons that follow, we are persuaded that Petitioner has established by a preponderance of the evidence that proposed substitute claims 29, 30, and 39–41 are unpatentable.

Petitioner asserts that "[f]or the reasons presented in the Petition and the Reply, Hui teaches all of the elements in the proposed substitute claims that are identical to those in original claims 1–2 and 11–13." Pet. Opp. MTA 10 (citing Pet. 22–41; Reply 2–16, 18–20; Ex. 1002 ¶¶ 58–68, 83–113). Petitioner specifically addresses the new limitations recited in proposed substitute claims 29 and 39. *See* Pet. Opp. MTA 11–19. We address below, in turn, Petitioner's contentions that Hui discloses, teaches, or suggests "wherein estimating further comprises quantizing time delays and phases of the channel taps" and "wherein compressing further comprises generating a plurality of parameters to represent information regarding magnitudes of the selected channel taps, and quantizing the plurality of parameters."

a. "wherein estimating further comprises quantizing time delays and phases of the channel taps

Petitioner asserts that Hui discloses the "wherein estimating further comprises quantizing time delays . . . of the channel taps," as recited in proposed substitute claims 29 and 39 based on Hui's disclosure that T_s is the sampling interval used to quantize the delays τ_k of the estimated channel response $\hat{g}_m(t)$. *See* Pet. Opp. MTA 11–12 (reproducing Ex. 1006, 4:20–30 (including Eq. 3); quoting Ex. 1006, 3:62–4:1, 4:19–20; citing Ex. 1002 ¶¶ 88–94; Ex. 1032 ¶ 38).

In Reply, Patent Owner contends that Petitioner's argument is wrong because "*Hui* only discloses that 'T_s is a sampling interval used to quantize the delays τ_k.'" PO Reply MTA 14 (reproducing Pet. Opp. MTA 11–12). Patent Owner asserts that sampling alone is not quantization, and the '204 Patent distinguishes between these two concepts. *See id.* Patent Owner

asserts that the sampling described at column 4, lines 11–30 of Hui is different from quantization of time delays disclosed in the '204 patent. *Id.* (quoting Ex. 2014 ¶ 47). According to Patent Owner, a person of ordinary skill in the art "would understand that sampling at regular intervals Ts apart is simply *discretization* in time, not quantization." *Id.* (quoting Ex. 2014 ¶ 47). Patent Owner contends that the '204 Patent explicitly discloses a sampling step apart from a quantizing step, specifically asserting that "the '204 Patent [] teaches 'sampling' of a channel response, where each sample (*i.e.*, channel tap) corresponds to a time delay and a complex value," and "the '204 Patent discloses quantization of the samples collected in the first step." *Id.* at 15–16 (quoting Ex. 1001, 3:55–59, 4:3–14). According to Patent Owner, "this [sampling] step is referred to in the art as 'discretization' of the channel impulse response." *Id.* at 15 (citing Ex. 2014 ¶ 47). Patent Owner asserts that Hui does not disclose quantization after sampling. *See id.* at 16.

In the Sur-reply, Petitioner contends that there is no meaningful difference between Hui's disclosure of quantizing the delays τ_k and the '204 Patent disclosure regarding quantizing time delays. *See* Pet. Sur-reply MTA 17. Petitioner asserts that nothing in the '204 Patent supports a distinction and nothing in the '204 Patent nor the proposed substitute claims requires that quantization be performed separate from sampling. *See id.* at 17–18. Petitioner contends that the plain and ordinary meaning of the claims and the '204 Patent do not support a construction "that requires quantizing the time delays to be performed separately from sampling." *Id.* at 18. Petitioner asserts that Patent Owner's reliance on Dr. Vojcic's

testimony to try to alter the plain and ordinary meaning of the claim language should be rejected. *See id.* at 17–18.

We do not agree with Patent Owner's arguments. Dr. Vojcic's testimony, relied upon by Patent Owner is not supported by a sufficient underlying factual basis. For example, Dr. Vojcic does not provide objective evidence to support the assertion that sampling is discretization in time, not quantization. *See* Ex. 2014 ¶¶ 47–48; C.F.R. § 42.65(a) ("Expert testimony that does not disclose the underlying facts or data on which the opinion is based is entitled to little or no weight."). We also do not agree with Patent Owner's suggestion that the term "quantizing" excludes "sampling" based on the '204 Patent Specification. The '204 Patent does include an express definition for the term "quantizing," and we decline to import limitations into the claim from the Specification.

The preponderance of the evidence supports Petitioner's position that Hui discloses, teaches, or suggests quantizing time delays of the channel taps based on Hui's disclosure that "T_s is the sampling interval used to quantize the delays τ_k" for the equation for the estimated channel response $\hat{g}_m(t)$.

Petitioner further asserts that Hui discloses the "wherein estimating further comprises quantizing . . . phases of the channel taps," as recited in proposed substitute claims 29 and 39, based on Hui's disclosure of quantizing the complex-valued estimated channel tap coefficients $\hat{a}_{m,k}$ where $\hat{a}_{m,k}^R$ and $\hat{a}_{m,k}^I$ denote the real and imaginary parts of the estimated channel tap $\hat{a}_{m,k}$ respectively. *See* Pet. Opp. MTA 12 (quoting Ex. 1006, 2:5–6, 5:65–6:9; citing Ex. 1032 ¶ 39). According to Petitioner, a person of ordinary skill in the art "would have understood that Hui's complex-valued channel tap coefficients necessarily comprise a magnitude and a phase." *Id.*

(citing Ex. 1032 ¶ 40); *see also id.* at 12–13 (explaining the real and imaginary components of a complex number represent the magnitude and the phase, quoting Ex. 1019, 6; citing Ex. 1019, 7; Ex. 1032 ¶ 40). Petitioner asserts that Dr. Vojcic's testimony and the '204 Patent Specification is consistent with the real and imaginary components of a complex number representing the magnitude and the phase. *See id.* at 13–14 (quoting Ex. 1001, 3:55–56; citing Ex. 1031, 35:14–37:1, 39:7–22, 41:10–21). According to Petitioner,

> [b]ecause Hui discloses that estimating comprises quantizing complex-valued estimated channel tap coefficients, and each complex-valued estimated channel tap coefficient necessarily comprises a magnitude and a phase, a [person of ordinary skill in the art] would have understood that Hui necessarily discloses quantizing both the magnitude and phase of each complex-valued estimated channel tap coefficient.

Id. at 14–15 (citing Ex. 1032 ¶ 41; Ex. 1006, 6:2–9). Petitioner further asserts "in view of Hui's disclosure to quantize the complex-valued estimated channel tap coefficients . . . , it would have been obvious to a [person of ordinary skill in the art] to quantize both the magnitude and the phase of the complex–valued estimated channel tap coefficients. *Id.* at 15 (citing Ex. 1006, 2:5–6, 4:32–38, 6:2–9; Ex. 1032 ¶ 42).

Patent Owner does not dispute Petitioner's assertions addressing "wherein estimating further comprises quantizing . . . phases of the channel taps." *See generally* PO Reply MTA. Nonetheless, the burden remains on Petitioner to demonstrate unpatentability. *See Dynamic Drinkware*, 800 F.3d at 1378.

Based on the entire record, we find that Hui discloses, teaches, or suggests "wherein estimating further comprises quantizing time delays and phases of the channel taps." *See* Pet. Opp. MTA 11–15.

b. "wherein compressing further comprises generating a plurality of parameters to represent information regarding magnitudes of the selected channel taps, and quantizing the plurality of parameters"

Petitioner asserts that Hui discloses that the mobile station generates complex-valued channel tap coefficients $\hat{a}_{m,k}$ by calculating an estimated channel response $\hat{g}_m(t)$ for each of M communication channels. *See* Pet. Opp. MTA 15–17 (reproducing Ex. 1006, 4:20–30 (including Eq. 3); quoting Ex. 1006, 2:5–6, 3:30–31, 5:65–6:9, 6:2–3; citing Ex. 1006, 4:11–19; Ex. 1032 ¶¶ 43–44). Petitioner contends that "Hui discloses selecting a plurality of Q channel tap coefficients (complex coefficients $\hat{a}_{m,k}$) from each estimated channel response $\hat{g}_m(t)$." *Id.* at 17 (reproducing Ex. 1006, 4:19–49 (including Eqs. 3, 4)). According to Petitioner, "[t]hese channel tap coefficients correspond to multiple samples of the larger channel response $\hat{g}_m(t)$ at different 'sampling intervals' (*i.e.,* time delays) and satisfy the *Apple* construction of 'a plurality of channel taps.'" *Id.*; *see* Pet. 20; Ex. 1005, 1. Petitioner asserts that "Hui [] discloses that 'estimating the CSI' involved 'selecting a plurality of the channel taps,' *i.e.*, the Q channel taps from each estimated channel response $\hat{g}_m(t)$." *Id.* at 17–18 (citing Ex. 1002 ¶¶ 96–100; Dec. 28–30). Petitioner further asserts that "by disclosing that 'Q in Eq. 3 is not necessarily equal to K in Eq. 2,' . . . , Hui confirms that the Q channel taps in $\hat{g}_m(t)$ are selected." *Id.* at 18 (quoting Ex. 1006, 3:30–31; citing Ex. 1032 ¶ 45).

Petitioner further asserts that "[t]he estimated channel response $\hat{g}_m(t)$ includes a plurality of parameters that represent information regarding magnitudes of the selected channel taps." Pet. Opp. MTA 18 (citing Ex. 1032 ¶ 46). According to Petitioner, "[t]he estimated channel response $\hat{g}_m(t)$, as indicated by Eq. 3 of Hui, is based on a sum of a plurality of parameters, $\hat{a}_{m,k}$ at different time delays. . . . The plurality of parameters represent information regarding magnitudes of the selected channel taps." *Id.* at 18 (citing Ex. 1006, 4:20–30; Ex. 1032 ¶ 46). Petitioner further contends

> the $\hat{a}_{m,k}$ values on which the estimated channel response $\hat{g}_m(t)$ is based are complex numbers. . . . Because complex numbers necessarily comprise a magnitude and a phase, as discussed above . . . the estimated channel response $\hat{g}_m(t)$ likewise necessarily represents information regarding the magnitudes of the selected channel taps.

Id. (citing Ex. 1006, 2:5–6, 5:65–6:9; Ex. 1019, 6–7; Ex. 1031, 35:14–37:1, 39:7–22, 41:10–21; Ex. 1032 ¶¶ 39–46).

Petitioner further asserts that Hui discloses "wherein compressing further comprises . . . quantizing the plurality of parameters," as recited in proposed substitute claims 29 and 39, based on Hui's disclosure of quantizing the complex-valued estimated channel tap coefficients. *See* Pet. Opp. MTA 18–19 (quoting Ex. 1006, 2:4–6, 4:31–38, 5:65–6:9; citing Ex. 1032 ¶¶ 43–48; Dec. 17–22; Pet. Reply 2–16).

In Reply, Patent Owner argues that Hui does not teach or suggest "generating a plurality of parameters to represent information regarding magnitudes of the selected channel taps," as recited in proposed substitute claims 29 and 39. *See* PO Reply MTA 16 (citing Pet Opp. MTA 15–19). Patent Owner asserts that Petitioner's argument fails because Petitioner

points to the same $\hat{a}_{m,k}$ variable for both the magnitudes of the selected channel taps as well as the plurality of parameters to represent information regarding magnitudes of the selected channel taps that is generated as part of the compression step. *See* PO Reply MTA 16–18 (reproducing Ex. 1032 ¶¶ 43, 44, 46). According to Patent Owner, "Petitioner so obfuscates the basis of its argument which is that '$\mathbf{\hat{a}_{m,k}}$ are the channel coefficients of the channel from the mth antenna' and $\mathbf{\hat{a}_{m,k}}$ are [the] plurality of parameters [that] represent information regarding magnitudes of the selected channel taps." *Id.* at 17–18; *see id.* at 17 (arguing Petitioner's argument relying on Dr. Roy's cited testimony is flawed for the same reasons; quoting Ex. 1032 ¶ 46).

In the Sur-reply, Petitioner asserts that Patent Owner misunderstands Petitioner's arguments, the claim limitation, or both because, Patent Owner appears to contend that "information that includes 'the magnitudes of the selected channel taps' cannot read on 'information regarding magnitudes of the selected channel taps.'" Pet. Sur-reply MTA 19 (citing PO Reply MTA 16–18). Petitioner contends that "Hui discloses that the channel coefficients $a_{m,k}$ are complex-valued numbers that represent information regarding magnitudes of the selected channel taps." *Id.* (citing Ex. 1032 ¶¶ 40, 44, 46). Petitioner reiterates that "channel coefficients $a_{m,k}$ represented as a combination of real and imaginary numbers represents information regarding magnitudes of the selected channel taps using mathematical relationships that would have been well-known to a [person of ordinary skill in the art.]" *Id.* at 19–20 (citing Ex. 1032 ¶ 40). According to Petitioner, "[l]ikewise, channel coefficients $a_{m,k}$ represented as a

combination of magnitude and phase numbers directly represents information regarding magnitudes of the selected channel taps." *Id.* at 20.

We do not agree with Patent Owner's arguments. The preponderance of the evidence supports Petitioner's contentions that Hui's "channel coefficients $\hat{a}_{m,k}[,]$ represented as a combination of magnitude and phase numbers[,] directly represents information regarding magnitudes of the selected channel taps," and Hui's "channel coefficients $\hat{a}_{m,k}$ are complex-valued numbers that represent information regarding magnitudes of the selected channel taps." *See, e.g.*, Ex. 1032 ¶ 40 (disclosing $C = a+bj$ = complex number = $r(\cos\theta + j\sin\theta) = re^{j\theta}$, where r = magnitude, and θ = phase). In other words, the preponderance of the evidence supports Petitioner's position that r and θ numbers directly represent information regarding magnitudes and phases of the selected channel taps, and coefficients $\hat{a}_{m,k}$ represent information regarding magnitudes and phases of the selected channel taps.

In Reply, Patent Owner also directs attention to the '204 Patent disclosure of collecting channel taps and using a compression model to generate parameters such that the channel tap magnitudes are represented by two parameters defining a line determined by a least squares curve fitting of the magnitudes of the channel taps. *See* PO Reply MTA 18–19 (quoting Ex. 1001, 3:55–59, 5:40–52; Ex. 2014 ¶ 54). According Patent Owner,

> *Hui* differs from the invention of the '204 Patent because it does not teach compressing the magnitudes of the channel taps, and therefore does not disclose the claim element "wherein compressing further comprises generating a plurality of parameters to represent information regarding magnitudes of the selected channel taps, and quantizing the plurality of parameters."

Id. at 19.

In the Sur-reply, Petitioner contends that Patent Owner argues that "generating a plurality of parameters to represent information regarding magnitudes" should be construed to import the embodiment from the '204 Patent discussed by Patent Owner. *See* Pet Sur-reply MTA 20. Petitioner asserts that the claim language is not so limited. *See id.* (quoting *Superguide Corp. v. DirecTV Enterprises, Inc.*, 358 F.3d 870, 875 (Fed. Cir. 2004)). Petitioner contends that the Board should decline to import this embodiment into the claims, and "generating a plurality of parameters to represent information regarding magnitudes of the selected channel taps" should be given its plain and ordinary meaning. *See id.* at 21.

We do not agree with Patent Owner's arguments because they are not commensurate in scope with the claim limitations. Proposed substitute claims 29 and 39 do not recite "compressing the magnitudes of the channel taps," which Patent Owner asserts is the invention of the '204 Patent.

Based on the entire record, we find that Hui discloses, teaches, or suggests "wherein compressing further comprises generating a plurality of parameters to represent information regarding magnitudes of the selected channel taps, and quantizing the plurality of parameters." *See* Pet. Opp. MTA 15–19.

c. Patentability Conclusion

Based on the entire record, including the reasons discussed above addressing the patentability of claims 1 and 11, Petitioner has established by a preponderance of the evidence that independent claims 29 and 39, and claims 30, 40, and 41, dependent therefrom, are unpatentable under

35 U.S.C. §§ 102 and 103 over Hui alone and over the combination of Hui and Maltsev.

7. Conclusion

Based on the entire record, Patent Owner has shown: (1) the amendment proposes a reasonable number of substitute claims; (2) the proposed substitute claims are supported in the original disclosure; (3) the amendment responds to a ground of unpatentability involved in the trial; and (4) the amendment does not seek to enlarge the scope of the claims of the patent or introduce new subject matter. Based on the entire record, however, Petitioner has shown, by a preponderance of the evidence, that proposed substitute claims 29, 30, and 39–41 are unpatentable over the prior art. Accordingly, Patent Owner's Motion to Amend is *denied*.

V. CONCLUSION[15]

For the foregoing reasons, and after having analyzed the entire record and assigning appropriate weight to the cited supporting evidence, we conclude that Petitioner has established by a preponderance of the evidence that claims 1, 2, and 11–13 of the '204 Patent are unpatentable. In addition, for the foregoing reasons, and after having analyzed the entire record and

[15] Should Patent Owner wish to pursue amendment of the challenged claims 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).

assigning appropriate weight to the cited supporting evidence, we conclude that Petitioner has established by a preponderance of the evidence that proposed substitute claims 29, 30, and 39–41 are unpatentable, and, therefore, the Motion to Amend is *denied*.

VI. ORDER

Accordingly, it is

ORDERED that, Petitioner has shown by a preponderance of the evidence that claims 1, 2, and 11–13 are unpatentable;

FURTHER ORDERED that Patent Owner's Motion to Amend is *denied*;

FURTHER ORDERED that Patent Owner's Motion to Exclude is *denied* in-part and *dismissed* in-part; and

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

In summary:

Claims	35 U.S.C. §	Reference(s)/Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1, 2, 11–13	102	Hui	1, 2, 11–13	
1, 2, 11–13	103	Hui	1, 2, 11–13	
1, 2, 11–13	102	Hui, Maltsev	1, 2, 11–13	
1, 2, 11–13	102	Döttling[16]		
1, 2, 11–13	103	Döttling[17]		
1, 2, 11–13	103	Döttling, Maltsev[18]		

[16] As explained above in Section III.F., we do not reach this challenge.
[17] As explained above in Section III.F., we do not reach this challenge.
[18] As explained above in Section III.F., we do not reach this challenge.

1, 2, 11–13	102	Koorapaty[19]		
1, 2, 11–13	103	Koorapaty[20]		
1, 2, 11, 13	103	Koorapaty and the knowledge of a person of ordinary skill in the art[21]		
Overall Outcome			1, 2, 11–13	

Motion to Amend Outcome	**Claim(s)**
Original Claims Cancelled by Amendment	
Substitute Claims Proposed in the Amendment	29, 30, 39–41
Substitute Claims: Motion to Amend Granted	
Substitute Claims: Motion to Amend Denied	29, 30, 39–41
Substitute Claims: Not Reached	

[19] As explained above in Section III.F., we do not reach this challenge.
[20] As explained above in Section III.F., we do not reach this challenge.
[21] As explained above in Section III.F., we do not reach this challenge.

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