

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

AMAZON.COM, INC.,
Petitioner,

v.

VOCALIFE LLC,
Patent Owner.

IPR2021-01331
Patent RE48,371 E

Before MONICA S. ULLAGADDI, AMBER L. HAGY, and
JASON M. REPKO, *Administrative Patent Judges*.

HAGY, *Administrative Patent Judge*.

DECISION
Granting Institution of *Inter Partes* Review
35 U.S.C. § 314

Granting in Part Petitioner's Motion to Strike
37 C.F.R. § 42.20

I. INTRODUCTION

A. Background and Summary

Amazon.com (“Petitioner”) filed a petition for *inter partes* review (Paper 1, “Pet.”) challenging claims 22–41 (“the challenged claims”) of U.S. Patent No. RE48,371 E (Ex. 1001, the “’371 patent”). See 35 U.S.C. § 311. Vocalife LLC (“Patent Owner”) timely filed a Preliminary Response. Paper 6, “Prelim. Resp.” With authorization from the Board, Petitioner filed a Reply to Patent Owner’s Preliminary Response (Paper 7, “Reply”), and Patent Owner filed a Sur-reply to Petitioner’s Reply (Paper 8, “Sur-reply”).

Institution of an *inter partes* review is authorized by statute when “the information presented in the petition . . . and any response . . . shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.” 35 U.S.C. § 314(a) (2012). A decision to institute under § 314 may not institute on fewer than all claims challenged in the petition. *SAS Inst., Inc. v. Iancu*, 138 S. Ct. 1348, 1359–60 (2018). Moreover, in accordance with USPTO Guidance, “[i]f the PTAB institutes a trial, the PTAB will institute on all challenges raised in the petition.” See *Guidance on the Impact of SAS on AIA Trial Proceedings* (April 26, 2018) (available at <https://www.uspto.gov/patents-applicationprocess/patent-trial-and-appeal-board/trials/guidance-impact-sas-aia-trial>)(“USPTO Guidance”); see also *PGS Geophysical AS v. Iancu*, 891 F.3d 1354, 1360 (Fed. Cir. 2018) (interpreting the statute to require “a simple yes-or-no institution choice respecting a petition, embracing all challenges included in the petition”).

Applying those standards, we determine that Petitioner has demonstrated a reasonable likelihood that it would prevail in showing

unpatentability of at least one challenged claim of the '371 patent. We institute review on all challenged claims and on all grounds raised in the Petition.

Our findings of fact and conclusions discussed below are based on the evidentiary record developed thus far. This Decision to institute trial is not a final decision as to the patentability of any challenged claim. Any final decision will be based on the full record developed during trial.

B. Real Parties in Interest

Petitioner identifies the real parties-in-interest as Amazon.com, Inc., and Amazon.com Services, Inc. Pet. 83.

Patent Owner identifies the real party-in-interest as Vocalife LLC. Paper 5, 2.

C. Related Matters

Petitioner identifies as related matters the following district court proceedings, in which Patent Owner has asserted the '371 patent:

(1) *Vocalife LLC v. Amazon.com, Inc. and Amazon.com Services, Inc.*, No. 2:20-cv-00401-JRG-RSP (E.D. Tex.), filed December 29, 2020 (hereafter, “*Vocalife IP*” or “parallel District Court proceeding”);

(2) *Vocalife LLC v. Google LLC*, Case No. 2:21-cv-00124-JRG (E.D. Tex.), filed April 2, 2021;

(3) *Vocalife LLC v. Harman International Industries Inc.*, Case No. 2:21-cv-00123-JRG (E.D. Tex.), filed April 2, 2021;

(4) *Vocalife LLC v. Bose Corporation*, Case No. 2:21-cv-00128-JRG (E.D. Tex.), filed April 8, 2021; and

(5) *Vocalife LLC v. Sonos, Inc.*, Case No. 2:21-cv-00129-JRG (E.D. Tex.), filed April 8, 2021.

Patent Owner identifies the same district court cases as related cases (Paper 5, 2–3), and additionally identifies as related cases the following cases, which involved U.S. Patent RE47,049¹ (*id.*):

Vocalife LLC v. Amazon.com, Inc. and Amazon.com, LLC, 2:19-cv-00123-JRG (E.D. Tex.) (hereafter, “*Vocalife I*”); and

Amazon.com, Inc. v. Vocalife LLC, IPR2020-00864 (institution denied) (hereafter, “’864 IPR”).

Patent Owner also identifies as a related matter the pending appeal in *Vocalife LLC v. Amazon.com, Inc. and Amazon.com LLC*, Case No. 2021-1937, -1984 (Fed. Cir. 2021), which is an appeal from the final judgment in *Vocalife I* (hereafter, “*Vocalife I Appeal*”). Paper 5, 3.

D. The ’371 Patent (Ex. 1001)

The ’371 patent, titled “Microphone Array System,” issued December 29, 2020. Ex. 1001, codes (10), (45), (54). The ’371 patent is a reissue of U.S. Patent No. 8,861,756, which issued on October 14, 2014. *Id.* at code (64).

The ’371 patent generally relates to enhancing a target sound signal, such as a speech signal, while suppressing ambient noise. *See* Ex. 1001, 2:12–18. This enhancement can be applied to signals from a microphone array, like those in mobile phones, for example. *See, e.g., id.* at 18:49–55. According to the patent, conventional microphone arrays are used for radar and sonar. *Id.* at 1:49–53. Narrow-band techniques used by these systems, however, are characterized by the ’371 patent as unsuitable for speech

¹ The ’049 patent (Exhibit 1003) is a reissue of U.S. Patent No. 8,861,756 (Exhibit 1005), from which the ’371 patent is also a reissue. *See* Ex. 1001, code (64); Ex. 1003, code (64).

signals captured by smaller devices because those signals have an extremely wide bandwidth relative to the center frequency, and conventional arrays for broadband speech are too bulky to be used in mobile devices. *Id.* at 1:53–62.

To enhance the target sound signal in broadband-speech applications, the '371 patent uses sound-source localization, adaptive beamforming, and noise reduction. Ex.1001, 2:18–21. Figure 2, below, shows an example system. *Id.* at 4:6–7.

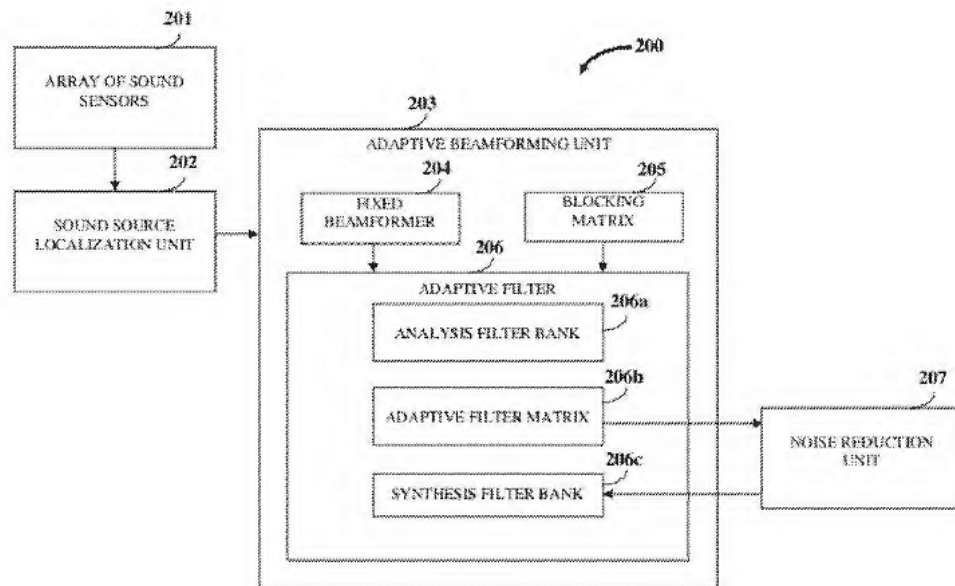


FIG. 2

Figure 2, above, shows system 200 with sound-source localization unit 202, adaptive-beamforming unit 203, and noise-reduction unit 207. Ex. 1001, 6:40–46.

In system 200, array 201 receives the sound signal. Ex. 1001, 6:48–53. Sound source localization unit 202 estimates a target sound signal's location. *Id.* at 6:63–64. Adaptive beamforming unit 203 steers the array's directivity pattern to the target sound signal. *Id.* at 7:1–3. This enhances the target sound signal and partially suppresses ambient noise signals. *Id.*

Noise reduction unit 207 then further suppresses the ambient noise signals.

Id. at 7:17–19. Figure 14, reproduced below, further illustrates the system of the '371 patent.

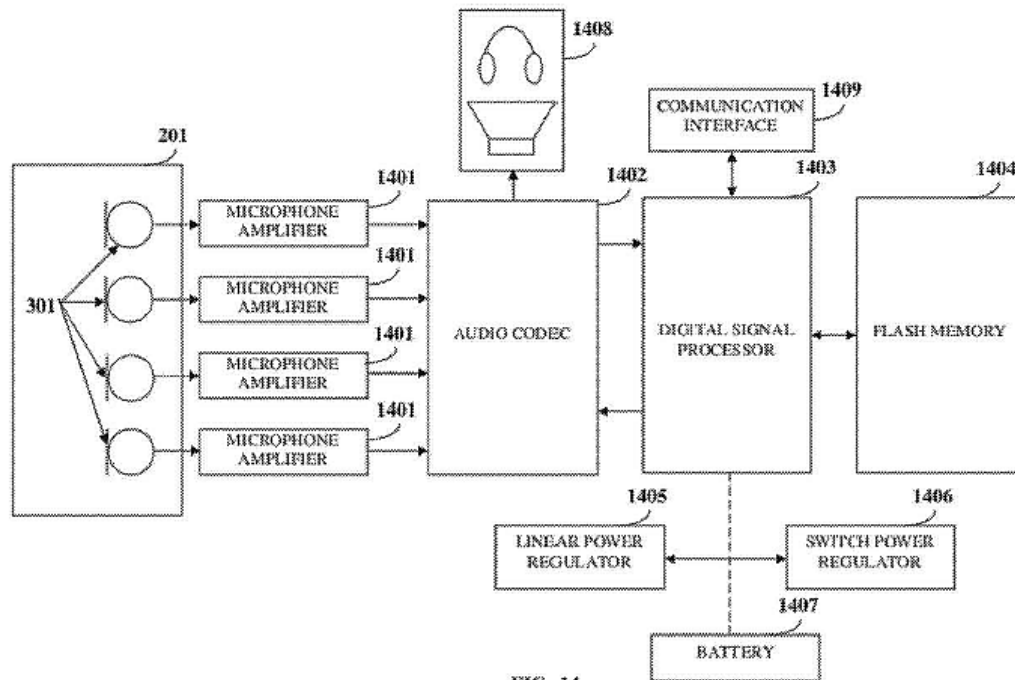


Figure 14 “illustrates a hardware implementation of the microphone array system.” Ex. 1001, 4:57–58.

Figure 14 shows that the hardware implementation of microphone array system 200 disclosed in the detailed description of Figure 2 comprises microphone array 201 “having an arbitrary number of sound sensors 301 positioned in an arbitrary configuration,” multiple microphone amplifiers 1401, one or more audio codecs 1402, digital signal processor (“DSP”) 1403, flash memory 1404, one or more power regulators 1405 and 1406, battery 1407, loudspeaker or a headphone 1408, and communication interface 1409. Ex. 1001, 14:62–15:9. Microphone array 201 comprises, for example, four or eight sound sensors 301 arranged in a linear or a circular microphone array configuration. *Id.* at 15:5–8. DSP 1403 “is programmed

for beamforming, noise reduction, echo cancellation, and USB interfacing according to the method disclosed herein, and fine tuned for optimal performance.” *Id.* at 16:35–38.

E. Illustrative Claim

Of the challenged claims, claims 22, 30, and 38 are independent. Challenged claims 23–29 and 40 depend from claim 22, claims 31–37 and 41 depend from claim 30, and claim 39 depends from claim 38. Claim 38, reproduced below, illustrates the claimed subject matter:

38. A microphone array system for enhancing a target sound signal from a plurality of sound signals, comprising:

- an array of sound sensors, wherein said sound sensors receive said sound signals from a plurality of disparate sound sources, wherein said received sound signals comprise said target sound signal from a target sound source among said disparate sound sources, and ambient noise signals;

- a digital signal processor, said digital signal processor comprising:

- a sound source localization unit that estimates a location of said target sound signal from said received sound signals by determining a delay between each of said sound sensors and a reference point of said array of said sound sensors as a function of distance between each of said sound sensors and said reference point and an angle of each of said sound sensors biased from a reference axis;

- a beamforming unit that enhances said target sound signal and partially suppresses said ambient noise signals;

- an echo cancellation unit that performs echo cancellation and further enhances said target sound signal; and

- a noise reduction unit that suppresses said ambient noise signals and further enhances said target sound signal.

Ex. 1001, 28:64–29:23.

F. Prior Art and Asserted Grounds

Petitioner asserts that claims 22–41 are unpatentable on the following grounds:

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
38, 39	103(a)	Reuss, ² Dmochowski ³
22, 28, 30, 37, 40, 41	103(a)	Reuss, Dmochowski (and optionally Li ⁴)
23–25, 27, 31–33, 35	103(a)	Reuss, Dmochowski (and optionally Li), Brandstein ⁵
26, 29, 34, 36	103(a)	Reuss, Dmochowski, (and optionally Li), Brandstein, Abutalebi ⁶
38, 39	103(a)	Chen, ⁷ Dmochowski

² Reuss, et al., U.S. Pat. No. 7,359,504 B1, issued April 15, 2008 (Ex. 1009, “Reuss”).

³ J. Dmochowski, J. Benesty, and S. Affes, “Direction of Arrival Estimation Using the Parameterized Spatial Correlation Matrix,” IEEE Trans. Audio, Speech Lang. Proc., vol. 15, no. 4, pp. 1327–1339 (May 2007) (Ex. 1011, “Dmochowski”).

⁴ Q. Li, M. Zhu, and W. Li, “A Portable USB-Based Mi[c]rophone Array Device for Robust Speech Recognition,” 2009 IEEE Int’l Conf. on Acoustics, Speech, and Signal Proc., pp. 1301–1304 (April 2009) (Ex. 1012, “Li”).

⁵ M. Brandstein and D. Ward, MICROPHONE ARRAYS: SIGNAL PROCESSING TECHNIQUES AND APPLICATIONS, 1st ed. (Springer 2001) (Ex. 1015, “Brandstein”).

⁶ Abutalebi et al., US. Pat. App. No. 2004/0071284 A1, published April 15, 2004 (Ex. 1016, “Abutalebi”).

⁷ Chen, U.S. App. No. 2006/0147063 A1, published July 6, 2006 (Ex. 1010, “Chen”).

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
22, 28, 30, 37, 40, 41	103(a)	Chen, Dmochowski (and optionally Li)
23–25, 27, 31–33, 35	103(a)	Chen, Dmochowski (and optionally Li), Brandstein
26, 29, 34, 36	103(a)	Chen, Dmochowski (and optionally Li), Brandstein, Abutalebi

As further support, Petitioner offers the Declaration of John M. Strawn, Ph.D. Ex. 1007 (“Strawn Decl.”).

II. MOTION TO STRIKE

As noted above, Petitioner filed, with authorization from the Board, a reply brief addressing the existence and nature of the recent stay of the co-pending district court litigation in *Vocalife II* pending appeal of the judgment in *Vocalife I*, and the impact of that stay on the § 314(a) analysis. Paper 7 (“Reply”). The Board also authorized Patent Owner “to file a supplemental brief, up to 4 pages, limited to the issue of discretionary denial under § 314(a).” Ex. 3001. Thereafter, Patent Owner filed its Sur-reply, which did not respond to or attempt to rebut anything in Petitioner’s Reply regarding the district court stay; rather, Patent Owner’s Sur-reply reiterated and expounded on Patent Owner’s arguments concerning the merits of the Petition with regard to the Dmochowski reference, and introduced a declaration from Dr. Dmochowski in support of Patent Owner’s arguments. Paper 8; Ex. 2007.⁸

⁸ Declaration of Jacek P. Dmochowski, Ph.D. Ex. 2007.

Petitioner then moved, with authorization from the Board, to strike Patent Owner's Sur-reply and the Dmochowski Declaration. Paper 9 ("Mot. Strike"). In that motion, Petitioner argues:

The Sur-Reply and Declaration should . . . be stricken because they violate the rules regarding the proper scope of sur-replies. A reply brief "may only respond to arguments raised in the corresponding . . . patent owner preliminary response[.]" 37 C.F.R. § 42.23(b). "A sur-reply may only respond to arguments raised in the corresponding reply and may not be accompanied by new evidence" *Id.* Petitioner's Reply complied with this rule. (Paper 7.) But the Sur-Reply did not respond to any arguments, or any of the five *Fintiv* factors, raised in the Reply. Further, it was improperly accompanied by new evidence—the Declaration.

Mot. Strike, 2. Petitioner further argues that the Dmochowski Declaration should be struck as untimely because it was filed *after* Patent Owner's Preliminary Response. *Id.* at 3. Petitioner asserts that allowing such evidence would be prejudicial to Petitioner, who would not be afforded an opportunity to respond prior to institution. *Id.*

In response to the motion, Patent Owner argues: (1) Patent Owner properly addressed the weakness of the merits of the Petition, which is relevant to discretionary denial (Paper 10 ("Opp. Mot. Strike"), 1–2); (2) Patent Owner's arguments in the Sur-reply "are directly responsive to, and consistent with, arguments made in its POPR" (*id.* at 2); and (3) the Board's rules cited by Petitioner (37 C.F.R. §§ 42.23(b) and 42.108(c)) "do not contemplate preliminary sur-replies authorized to respond to replies containing new arguments with new evidence and new exhibits" and thus do not require Patent Owner's Sur-reply to only respond to arguments Petitioner made in its Reply (*id.* at 5).

We agree with Petitioner that Patent Owner's arguments made in its Sur-reply are improper because they (1) exceed the scope of permission extended by the Board; and (2) are not responsive to any arguments made by Petitioner in its Reply. The Board's authorization limited Patent Owner's Sur-reply to "the issue of discretionary denial under § 314(a)." Ex. 3001. Although the merits of a petition are part of the *Fintiv* considerations for discretionary denial, it is not reasonable to interpret the Board's authorization for a sur-reply as an open invitation to rehash and expand the merits arguments made in the Preliminary Response, particularly where such arguments are in no way responsive to anything Petitioner argued in its Reply. Patent Owner does not contend that its Sur-reply is premised on new facts or information not available to Patent Owner at the time of filing its Preliminary Response.

It is also not reasonable to assume that the Board's rule on "Oppositions, replies, and sur-replies" (Rule 42.23) has no relevance to sur-replies filed, with Board authorization, prior to institution. As Petitioner aptly notes, Rule 42.108(c) specifically invokes the constraints of Rule 42.23 in providing that a "petitioner may seek leave to file a reply to the preliminary response *in accordance with* §§ 42.23 and 42.24(c)." 37 C.F.R. § 42.108(c) (emphasis added). Although sur-replies are not explicitly mentioned, patent owners granted leave to respond to such replies should expect similar constraints to apply to their sur-replies.

Nevertheless, we decline to strike Patent Owner's Sur-reply because it is useful to maintain the Sur-reply in the record as evidence of what it does not argue—in particular, as addressed further below, Patent Owner presents no rebuttal to any of the facts or circumstances as stated by Petitioner

regarding the stay of the *Vocalife II* litigation or the impact of such a stay on the § 314(a) analysis. Although the Sur-reply will remain in the record, we note that we decline to give Patent Owner's new arguments any weight in our substantive analysis herein.

We do, however, grant Petitioner's Motion to Strike as to the Dmochowski Declaration on the grounds that the declaration is untimely and not responsive to anything argued in Petitioner's Reply. Our granting this motion is without prejudice to Patent Owner resubmitting such evidence as appropriate according to our rules during trial.

III. ANALYSIS

A. Discretion Under 35 U.S.C. § 314(a)

Patent Owner argues that we should exercise our discretion and deny institution based on the parallel District Court proceeding in *Vocalife LLC v. Amazon.com, Inc. and Amazon.com Services, Inc.*, No. 2:20-cv-00401-JRG-RSP (E.D. Tex.), filed December 29, 2020. *See* Prelim. Resp. 4–9.

Under § 314(a), the Director has discretion to deny institution of an *inter partes* review, and that discretion has been delegated to the Board. *See* 37 C.F.R. § 42.4(a) (“The Board institutes the trial on behalf of the Director.”); *Cuozzo Speed Techs., LLC v. Lee*, 579 U.S. 261, 273 (2016) (“[T]he agency’s decision to deny a petition is a matter committed to the Patent Office’s discretion.”); *SAS Inst.*, 138 S. Ct. at 1356 (“[Section] 314(a) invests the Director with discretion on the question whether to institute review” (emphasis omitted)); *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1367 (Fed. Cir. 2016) (“[T]he PTO is permitted, but never compelled, to institute an IPR proceeding.”).

In *NHK Spring Co. v. Intri-Plex Technologies, Inc.*, the Board denied institution relying in part on § 314(a) because a parallel district court proceeding was scheduled to finish before the Board reached a final decision. IPR2018-00752, Paper 8 (PTAB Sept. 12, 2018) (precedential). Following *NHK*, the Board articulated the following factors for consideration when determining whether to exercise discretion to deny institution in view of a parallel proceeding:

1. whether the court granted a stay or evidence exists that one may be granted if a proceeding is instituted;
2. proximity of the court's trial date to the Board's projected statutory deadline for a final written decision;
3. investment in the parallel proceeding by the court and the parties;
4. overlap between issues raised in the petition and in the parallel proceeding;
5. whether the petitioner and the defendant in the parallel proceeding are the same party; and
6. other circumstances that impact the Board's exercise of discretion, including the merits.

Apple Inc. v. Fintiv, Inc., IPR2020-00019, Paper 11 at 5–6 (PTAB Mar. 20, 2020) (precedential) (“*Fintiv*”). “These factors relate to whether efficiency, fairness, and the merits support the exercise of authority to deny institution in view of an earlier trial date in the parallel proceeding.” *Id.* at 6. In evaluating these factors, we take “a holistic view of whether efficiency and integrity of the system are best served by denying or instituting review.” *Id.* (citing Patent Trial and Appeal Board Consolidated Trial Practice Guide November 2019, 58). We address all of these factors below.

1. Analysis of Fintiv Factors

*a. Whether the court granted a stay and proximity of trial date
(first and second factors)*

Although Petitioner stated in the Petition that it had not requested a stay in the parallel District Court proceeding (*see* Pet. 79; *see also* Prelim. Resp. 9), Petitioner recently informed the Board that “the district court stayed the *Vocalife II* litigation pending the Federal Circuit’s decision in the *Vocalife I* appeal. . . . All discovery has been stayed and the trial date has been vacated.” Reply, 1 (citing Ex. 1044). Petitioner further represents that “[t]he earliest the Federal Circuit could issue its decision is next summer,” and states that both parties have obtained extensions for their briefing in the appeal. *Id.* at 1 & n.1 (citing Exs. 1044, 1045, 1046). Petitioner also notes that the district court, in granting the stay, observed that the appeal may “completely . . . resolve the issues” in *Vocalife II*. *Id.* (quoting Ex. 1044).

Petitioner further states that, to the extent the Federal Circuit’s decision does not resolve the parallel District Court litigation, “Petitioner will move to maintain the stay pending a Final Written Decision in this IPR.” Reply 1–2. Petitioner cites as support a recent decision from the Eastern District of Texas court granting a stay pending IPR once the Board instituted trial. *Id.* at 2 (citing *Arbor Global Strategies LLC v. Samsung Electronics Co.*, C.A. No. 2:19-cv-00333, Dkt. 175 at 1–2 (E.D. Tex. Jan. 7, 2021)).

The granting of a stay pending *inter partes* review allays concerns about inefficiency and duplication of efforts and has weighed strongly against exercising discretion to deny institution. *See Snap, Inc. v. SRK Tech. LLC*, IPR2020-00820, Paper 15 at 9 (PTAB Oct. 21, 2020) (precedential as

to § II.A); *see Fintiv*, Paper 11 at 6. Here, although the reasons for the stay of the parallel District Court proceeding are *unrelated* to Petitioner’s request for *inter partes* review, that stay nonetheless allays such concerns. Accordingly, we find that the consideration of the first *Fintiv* factor weighs against exercising our discretion to deny institution.

According to *Fintiv*, “[i]f the court’s trial date is earlier than the projected statutory deadline, the Board generally has weighed this fact in favor of exercising authority to deny institution under *NHK*.” *Fintiv*, Paper 11 at 9. Because the trial date has been removed from the calendar in the parallel District Court proceeding, consideration of the second *Fintiv* factor also weighs against discretionary denial. *See Snap*, Paper 15 at 9.

b. Investment in the parallel proceeding by the court and the parties

Patent Owner asserts that this factor weighs heavily in favor of discretionary denial of review because the parallel District Court proceeding has already seen substantial activity relevant to patent validity. *See* Prelim. Resp. 8–9. Patent Owner contends that “[b]y March 14, 2022, the parties will have completed all District Court Litigation pretrial deadlines, including: expert discovery, dispositive motion practice, pretrial disclosures, preparation of jury materials, trial witness lists and exhibit lists, and the February 2, 2022 pretrial conference.” *Id.* Patent Owner also faults Petitioner for its “dilatory approach” in waiting seven months to file its Petition after the complaint in the *Vocalife II* litigation was filed. *Id.* at 9.

Petitioner responds that Patent Owner’s statement about all pretrial work being done by mid-March is “no longer true” in light of the stay. Reply 3. As Petitioner notes, “[t]he court stayed *Vocalife II* during fact discovery and did not issue a claim construction order. Opening expert

reports were not served. And, no further investments will be made in the litigation before the Board issues its institution decision.” *Id.* As for the alleged delay in filing the Petition, Petitioner relates additional facts that reveal Patent Owner’s characterization as somewhat misleading:

PO also argues that Petitioner delayed in filing the Petition, citing the complaint’s *filing date*. (POPR at 9.) But PO did not *serve* the complaint until 3 months later. PO then waited another month to serve its infringement contentions and identify the asserted claims. Petitioner promptly prepared and served its invalidity contentions on June 23, 2021 (Ex. 1035), and filed this petition less than six weeks later. (Pet. at 81.)

Reply 3–4. Patent Owner provides no substantive rebuttal to these representations. *See generally* Sur-reply.

Fintiv provides the following guidance: “This investment factor is related to the trial date factor, in that more work completed by the parties and court in the parallel proceeding tends to support the arguments that the parallel proceeding is more advanced, a stay may be less likely, and instituting would lead to duplicative costs.” *Fintiv*, Paper 11 at 10. In the circumstances before us, the anticipated remaining investment of time and effort to bring the parallel District Court proceeding to trial appears to be significant, in that discovery remains to be completed, the court has not yet issued its claim construction order, and the parties have not yet served expert reports. Further, to the extent this factor considers the likelihood of stay, the fact that a stay has already issued weighs against exercising our discretion to deny institution.

The third *Fintiv* factor also provides that a petitioner’s diligence or delay in filing a petition may be relevant. *See Fintiv*, Paper 11 at 11–12. If the evidence shows that a petitioner filed its petition expeditiously, such as

promptly after becoming aware of the claims being asserted, this fact has weighed against denying institution. *See id.* at 11 (citing *Intel Corp. v. VLSI Tech. LLC*, IPR2019-01192, Paper 15 at 12–13 (PTAB Jan. 9, 2020); *Illumina Inc. v. Natera, Inc.*, IPR2019-01201, Paper 19 at 8 (PTAB Dec. 18, 2019)). If, however, the evidence shows the petitioner did not file its petition expeditiously, such facts have favored exercising discretion to deny institution. *See id.* at 11–12 (citing *Next Caller, Inc. v TRUSTID, Inc.*, IPR2019-00961, Paper 10 at 16 (PTAB Oct. 16, 2019)).

Here, Petitioner relates facts tending to support the contention that Petitioner acted expeditiously by filing this Petition within roughly four months after it was served with the complaint. *See* Reply 3–4. Petitioner also notes that once it received Patent Owner’s infringement contentions identifying the claims being asserted, Petitioner acted promptly in filing its Petition roughly three months later. Patent Owner provides no substantive response to these representations. *See generally* Sur-reply. We determine that Petitioner did not act in a dilatory manner, as Patent Owner represents in its Preliminary Response; rather, much of the alleged “delay” between the filing of the complaint and the filing of the Petition was due to Patent Owner’s own delays.

The investment of time and effort to date by the parties and the court relative to the anticipated investment remaining to bring the parallel District Court proceeding to trial weighs against exercising discretion to deny institution. In addition, Petitioner’s reasonable assertion that the Petition was filed expeditiously relative to the actual service of the complaint and Patent Owner’s infringement contentions also weighs somewhat against discretionary denial. In sum, the considerations of the third *Fintiv* factor

weigh against discretionary denial.

*c. Overlap between the issues raised in the petition
and in the parallel proceeding*

Petitioner stipulates in the Petition that:

[I]f this IPR is instituted, [Petitioner] will not pursue in *Vocalife II* any invalidity ground that is raised or that could have been reasonably raised in this IPR, i.e., any ground that could have reasonably been raised under §§ 102 or 103 based on prior art patents or printed publications.

Pet. 81. Petitioner reiterates this point in its Reply. Reply 4. Petitioner further notes that, in light of the stay, this stipulation eliminates any potential for overlap because “[i]f this IPR were instituted and then the *Vocalife II* litigation were to resume, Petitioner would forego the overlapping invalidity defenses and would not pursue those invalidity defenses in its expert reports. Thus, no overlap would exist.” *Id.*

Patent Owner does not address Petitioner’s stipulation in either its Preliminary Response or its Sur-reply, but asserts that this factor favors denial of institution because the “Petition is coextensive with Petitioner’s invalidity positions in the District Court Litigation.” Prelim. Resp. 6. Patent Owner further represents that “[t]here is no dispute that both proceedings involve the same invalidity positions regarding the same claims of the ’371 Patent and the identical references.” *Id.*

According to *Fintiv*, “if the petition includes the same or substantially the same claims, grounds, arguments, and evidence as presented in the parallel proceeding, this fact has favored denial” because “concerns of inefficiency and the possibility of conflicting decisions [are] particularly strong.” *Fintiv*, Paper 11 at 12. Based on the arguments and evidence presented, we determine that, especially in light of the stay, Petitioner’s

stipulation mitigates concerns of duplicative efforts between the parallel District Court proceeding and this proceeding, as well as concerns of potentially conflicting decisions. *See Sotera Wireless v. Masimo Corp.*, IPR2020-01019, Paper 12 at 13 (PTAB Dec. 1, 2020) (precedential as to Section II.A)). Accordingly, the considerations of the fourth *Fintiv* factor weigh against exercising discretion to deny institution.

*d. Whether the petitioner and defendant
in the parallel proceeding are the same party*

Neither party disputes that Petitioner and Patent Owner are parties to the parallel District Court proceeding. *See* Pet. 82; Prelim. Resp. 6. In view of the stay, however, no trial date is currently set; therefore, it is uncertain whether the final written decision in this case will come before or after the trial. Under these circumstances, the fact that the Petitioner is a defendant in the district court case weigh against exercising discretion to deny institution. *See MED-EL Elektromedizinische Geräte Ges.m.b.H v. Advanced Bionics AG*, IPR2020-00190, Paper 15 at 14–15 (PTAB June 3, 2020) (Institution Decision) (noting that the overlap of issues and parties, especially with an uncertain trial date, weighs in favor of institution because petitioner would be estopped in district court from raising the same issues upon issuance of the Board’s final written decision). We determine, on the record before us, that this factor weighs against exercising our discretion to deny institution.

e. Other circumstances, including the merits

Petitioner contends “[t]he petition’s merits are particularly strong, which favors institution.” Pet. 82. Patent Owner, on the other hand, asserts that “Petitioner presents a weak case on the merits.” *See* Prelim. Resp. 9.

When considering whether to exercise discretion to deny a petition, we undertake a balanced assessment of all relevant circumstances in the case, including the merits. *Fintiv*, Paper 11 at 14. Although we need not undertake a full merits analysis incident to the *Fintiv* analysis, we consider the strengths and weaknesses of the merits, where stronger merits may favor institution. *See id.* at 15–16. On the other hand, if the merits of the grounds presented in the petition are a closer call, then this fact has favored denying institution when other factors favoring denial are present. *See id.* at 15.

We have reviewed Petitioner’s patentability challenges and Patent Owner’s Preliminary Response. As explained in the detailed analysis below, we determine that, based on the record before us, the merits of Petitioner’s patentability challenges appear to be sufficient to show a reasonable likelihood of prevailing at this stage of the proceeding with respect to at least one asserted ground. *See infra* Section III.F. Therefore, this factor is neutral.

2. Conclusion

We have considered the circumstances and facts before us in view of the *Fintiv* factors. Because our analysis is fact-driven and we take a holistic view of the factors, no single factor is determinative of whether we exercise discretion to deny institution under § 314(a). Based on the record before us,

the considerations underlying the *Fintiv* factors, when viewed holistically, lead us to determine that the efficiency and integrity of the system are best served by not exercising discretion to deny institution of *inter partes* review.

B. Principles of Law

A patent claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, “would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) when in evidence, objective evidence of nonobviousness.⁹ *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

“In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.” *Harmonic*, 815 F.3d at 1363 (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify “with particularity . . . the evidence that supports the grounds for the challenge to each claim”)). This burden of persuasion never shifts to Patent Owner. *See Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) (discussing the burden of proof in *inter partes* review).

⁹ Neither party presents arguments or evidence of secondary considerations at this stage. *See* Pet. 78. Therefore, secondary considerations do not constitute part of our analysis herein.

C. Level of Ordinary Skill in the Art

The level of skill in the art is a factual determination that provides a primary guarantee of objectivity in an obviousness analysis. *Al-Site Corp. v. VSI Int'l Inc.*, 174 F.3d 1308, 1324 (Fed. Cir. 1999) (citing *Graham*, 383 U.S. at 17–18; *Ryko Mfg. Co. v. Nu-Star, Inc.*, 950 F.2d 714, 718 (Fed. Cir. 1991)).

Relying on the declaration testimony of Dr. Strawn, Petitioner asserts:

A [person of ordinary skill in the art (“POSITA”)] in September 2010 would have had a graduate degree in electrical engineering, computer science, or a similar field, with courses in digital signal processing. Alternatively, a POSITA would have had a bachelor’s degree in such a field with 3–4 years of industry experience in digital signal processing.

Pet. 9 (citing Ex. 1007 ¶ 35).

At this stage, Patent Owner does not propose an alternative assessment.

To the extent necessary, and for purposes of this Decision, we accept the assessment offered by Petitioner as it is consistent with the ’371 patent and the asserted prior art.

D. Claim Construction

In interpreting the claims of the ’371 patent, we “us[e] the same claim construction standard that would be used to construe the claim[s] in a civil action under 35 U.S.C. [§] 282(b).” *See* 37 C.F.R. §42.100(b) (2021). The claim construction standard includes construing claims in accordance with the ordinary and customary meaning of such claims as would have been understood by one of ordinary skill in the art in light of the written

description and the prosecution history pertaining to the patent. *See id.*; *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–14 (Fed. Cir. 2005) (en banc).

Petitioner proposes constructions of two terms, purporting to adopt constructions adopted by the district court in *Vocalife I*: (1) “adaptive beamforming,” which the district court construed as “a beamforming process where the directivity pattern of the microphone array is capable of being adaptively steered in the direction of a target sound signal emitted by a target sound source in motion”; and (2) “sound source localization unit,” which the district court construed as “software/hardware in a [digital signal processor (‘DSP’)] that includes functionality for locating a sound source.” Pet. 10 (citing Ex. 1026, 45–46, 54,). Petitioner represents that “[t]he court’s other constructions do not impact obviousness and need not be addressed.” *Id.*

Patent Owner does not, at this stage, challenge Petitioner’s proposed constructions of these terms. Patent Owner notes that the district court in *Vocalife I* also construed “digital signal processor” to mean “a ‘microprocessor that is specialized for processing of digital signals.’” Prelim. Resp. 13. Patent Owner does not explicitly propose or adopt this construction, but asserts that Petitioner “skirts this known and agreed construction.” *Id.*

We determine, at this stage, that no explicit construction of any of these terms is needed to resolve the issues presented by the arguments and evidence of record. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (per curiam) (claim terms need to be construed “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))).

Our claim construction analysis in this Decision is preliminary, and does not preclude the parties from arguing proposed constructions of the claims during trial. Indeed, the parties are hereby given notice that claim construction, in general, is an issue to be addressed at trial. Claim construction will be determined at the close of all the evidence and after any hearing. The parties are expected to assert all their claim construction arguments and evidence in the Petition, Patent Owner's Response, Petitioner's Reply, or otherwise during trial, as permitted by our rules.

E. Overview of Cited References

1. Reuss (Ex. 1009)

Reuss is a United States patent issued on April 15, 2008. Ex. 1009, code (45). Petitioner asserts Reuss is prior art under 35 U.S.C. § 102(b). Pet. 8. Patent Owner does not dispute the prior-art status of Reuss.

Reuss discloses an apparatus and method for reducing acoustic echo and background noise in telecommunications. Ex. 1009, 2:15–16. The apparatus includes a microphone array for receiving an audio signal, the audio signal including a voice signal component and a noise signal component. *Id.* at 2:18–21. The apparatus further includes a voice processing path having an input coupled to the microphone array and a noise processing path having an input coupled to the microphone array. *Id.* at 2:21–24. The voice processing path is adapted to detect voice signals and the noise processing path is adapted to detect noise signals. *Id.* at 2:25–27. A first echo controller is coupled to the voice processing path and a second echo controller is coupled to the noise processing path. *Id.* at 2:27–29. A noise reducer is coupled to the output of the first echo controller and second echo controller. *Id.* at 2:29–30.

Figure 1 of Reuss is reproduced below.

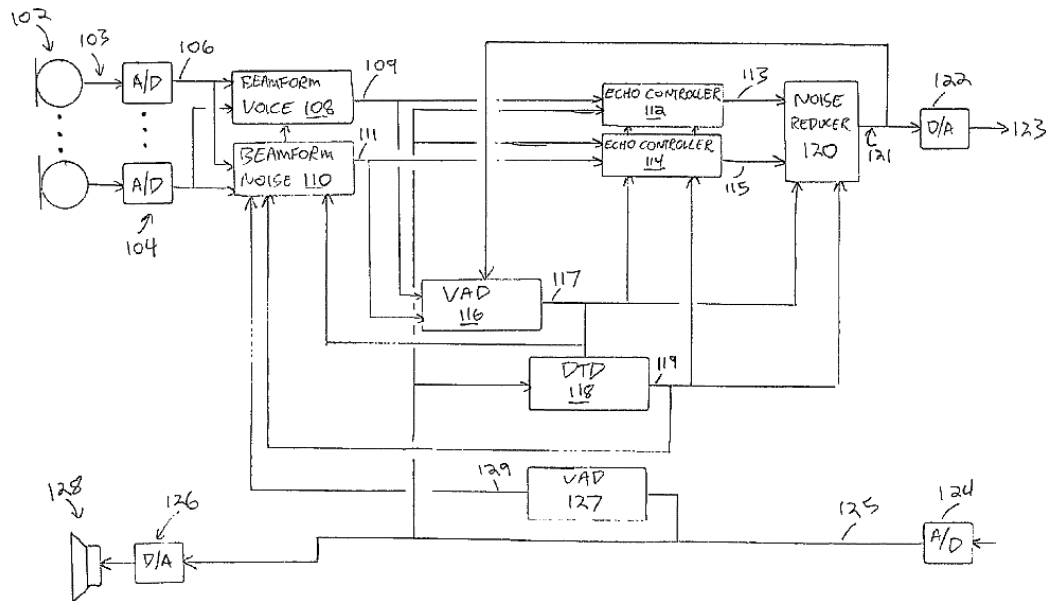


FIGURE 1

Figure 1 of Reuss depicts an apparatus for reduction of acoustic echo and background noise. Ex. 1009, 3:38–40.

As shown in Figure 1, Reuss's system includes multi-element microphone array 102, analog to digital converters (A/D) 106, beamform voice processor 108, beamform noise processor 110, voice echo controller 112, noise echo controller 114, transmit (Tx) voice activity detector (VAD) 116, double talk detector 118, noise reducer 120, transmit output digital to analog (D/A) converter 122, far end receive input A/D 124, and far end receive (Rx) voice activity detector (VAD) 127. Ex. 1009, 3:46–53. Reuss's invention utilizes beamforming techniques on a voice and noise signal together with echo cancellation techniques on a voice and noise signal with noise reduction algorithms. *Id.* at 3:23–26.

2. *Dmochowski (Ex. 1011)*

Dmochowski is an article entitled “Direction of Arrival Estimation Using the Parameterized Spatial Correlation Matrix.” Ex. 1011. Petitioner asserts Dmochowski is prior art under 35 U.S.C. § 102(b) because it was “published at least as early as May 2007.” Pet. 9; *see also* Ex. 1011, 1327 (indicating the article was published in the IEEE Transactions on Audio, Speech, and Language Processing at volume 15, No. 4). Patent Owner does not dispute the prior-art status of Dmochowski.

Petitioner bears the burden at the institution stage “to identify with particularity evidence sufficient to establish a reasonable likelihood that the reference was publicly accessible before the critical date of the challenged patent, and therefore that there is a reasonable likelihood that it qualifies as a printed publication.” *Hulu, LLC v. Sound View Innovations, LLC*, IPR2018-01039, Paper 29 at 16 (PTAB Dec. 20, 2019) (precedential). We determine that, at this point in the case and for purposes of institution, and based on the totality of the evidence to date, Petitioner has submitted sufficient evidence to establish a reasonable likelihood that Dmochowski was publicly accessible before the critical date of the challenged patent, and, thus Petitioner has established a reasonable likelihood that the reference qualifies as a printed publication. In particular, the face of Dmochowski bears a copyright date of 2007, a publication date of May 2007, and a volume number in which it was published in an established journal. Ex. 1011. *See also Hulu* at 19 (noting that Petitioner had met its burden sufficiently for institution by submitting a copy of a reference that bore “a copyright date of 1990, a printing date of November 1992, and an ISBN date of 8/94,” and

was part of “a textbook from an established publisher . . . and a well-known book series”).

Dmochowski discloses a microphone array and adaptive beamforming system that uses an algorithm called Steered Response Power (“SRP”) for estimating “direction-of-arrival (DOA) of one or more acoustic sources.” Ex. 1011, 1327 (emphasis omitted). In particular, Dmochowski describes algorithms for estimating the direction-of-arrival (DOA) of acoustic sources in the presence of significant levels of both noise and reverberation.” *Id.* Figure 1 of Dmochowski is reproduced below.

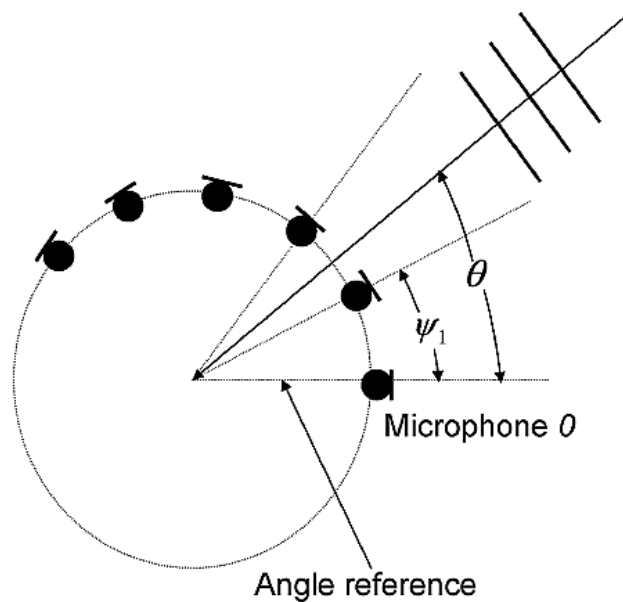


Fig. 1. Circular array geometry.

Figure 1 of Dmochowski illustrates acoustic sources arranged in a circular array geometry. Ex.1011, 1328.

Dmochowski discloses determining delays for a circular array using the distance (radius, r) between each microphone and the array’s center, an angle (ψ_1) between each microphone and a reference axis, and the azimuth angle (θ) between the target sound signal and the reference axis. Ex. 1011,

1328. Using these parameters, Dmochowski discloses determining delays (θ) using the equation:

$$(\theta) = rc^{-1} \cos(\theta - \psi_i)$$

where c is the speed of sound. *Id.* at 1329.

3. *Li (Ex. 1012)*

Li is an article entitled “A Portable USB-Based Mi[c]rophone Array Device for Robust Speech Recognition,” which states on its face that it was presented at the 2009 IEEE International Conference on Acoustics, Speech, and Signal Processing, held in April 2009. Ex. 1012. Petitioner asserts Li is prior art under 35 U.S.C. § 102(b) because it “published at least as early as May 26, 2009.” Pet. 9 (citing Ex. 1012, 1–3; Ex. 1013 ¶ 11, Ex. A; Ex. 1014). Patent Owner does not dispute the prior-art status of Li.

We determine that, at this point in the case and for purposes of institution, and based on the totality of the evidence to date, Petitioner has submitted sufficient evidence to establish a reasonable likelihood that Li was publicly accessible before the critical date of the challenged patent, and, thus Petitioner has established a reasonable likelihood that the reference qualifies as a printed publication. In particular, the face of Li bears a copyright date of 2009, and catalog information (including catalog number, ISBN, and ISSN) of an established organization (Institute of Electrical and Electronics Engineers (IEEE)). Ex. 1012; *see Hulu* at 19.

Li discloses a “highly directional, and portable microphone array device that delivers a crisp, clear and noise-reduced speech signal.” Ex. 1012, 1301. Li’s disclosed device “consists of four linearly distributed microphone sensors and a filter-and-sum beamformer designed using broadband beam-forming algorithm.” *Id.* Li describes its device as having

“a narrow acoustic beam pattern and identical frequency responses for almost all speech bands.” *Id.* Li states that, in addition to using beamforming, the system also uses “an adaptive noise reduction algorithm” to “further reduce the background noise.” *Id.*

Li estimates a location of a sound source in terms of the difference between the signal received by a microphone and the center of the array by measuring delay “by the number of samples[.]” Ex. 1012, 1302. In particular, Li determines a delay τ_n between each n th microphone “and the center of the array.” *Id.* Li determines those delays for a linear array using the equation:

$$\tau_n = f_s d_n \cos \theta / c$$

where d_n is the distance between the microphone and the array’s center and θ is the azimuth angle between a reference axis and the target sound signal. *Id.* at 1302, Fig. 3. Li’s equation includes multiplying by the sampling rate (f_s) to provide the delay in samples. *Id.*

4. *Brandstein (Ex. 1015)*

Brandstein is a book entitled “Microphone Arrays: Signal Processing Techniques and Applications,” and indicates that it was published by Springer in 2001. Ex. 1015. Petitioner asserts Brandstein is prior art under 35 U.S.C. § 102(b) because it was “published in 2001.” Pet. 9. Patent Owner does not dispute the prior-art status of Brandstein.

We determine that, at this point in the case and for purposes of institution, and based on the totality of the evidence to date, Petitioner has submitted sufficient evidence to establish a reasonable likelihood that Brandstein was publicly accessible before the critical date of the challenged patent, and, thus Petitioner has established a reasonable likelihood that the

reference qualifies as a printed publication. In particular, the face of Brandstein bears a copyright date of 2001, and catalog information (including ISBN) of an established publisher (Springer-Verlag Berlin Heidelberg). Ex. 1015. *See Hulu* at 19.

Brandstein describes implementation of microphone arrays, including the issue of sound source localization. Ex. 1015, vi. Brandstein notes:

The ability to locate and track one or more speech sources is an essential requirement of microphone array systems. For speech enhancement applications, an accurate fix on the primary talker, as well as knowledge of any interfering talkers or coherent noise sources, is necessary to effectively steer the array, enhancing a given source while simultaneously attenuating those deemed undesirable. Location data may be used as a guide for discriminating individual speakers in a multisource scenario. With this information available, it would then be possible to automatically focus upon and follow a given source on an extended basis.

Id. Brandstein purports to summarize “various approaches” that “have been explored to accurately locate an individual in a practical acoustic environment.” *Id.* at vi–vii. In particular, Brandstein describes a beamforming-based algorithm, describes as a steered response power-phase transform (“SRP-PHAT”), for use in providing location estimates of sound sources. *Id.* at 164. Brandstein states that SRP-PHAT “perform[s] in a manner similar to the standard SRP-based approaches” but with better results. *Id.* at 171. Brandstein also states that SRP-PHAT provides “more precise location estimates” and is “significantly more robust” than “the traditional localization techniques.” *Id.* at 157, 164, 170–172.

5. *Abutalebi (Ex. 1016)*

Abutalebi is a United States patent application published on April 15, 2004. Ex. 1016, code (43). Petitioner asserts Abutalebi is prior art under 35 U.S.C. § 102(b). Pet. 9. Patent Owner does not dispute the prior-art status of Abutalebi.

Abutalebi discloses sub-band adaptive filter (“SAF”) systems for “adaptive directional signal processing with microphone arrays.” Ex. 1016 ¶ 53, Fig. 20. As depicted in Figure 20 (reproduced below), Abutalebi’s system comprises analysis filterbank (16, 18), subband processing blocks (214₁–214_{K-1}), and synthesis filterbank (132):

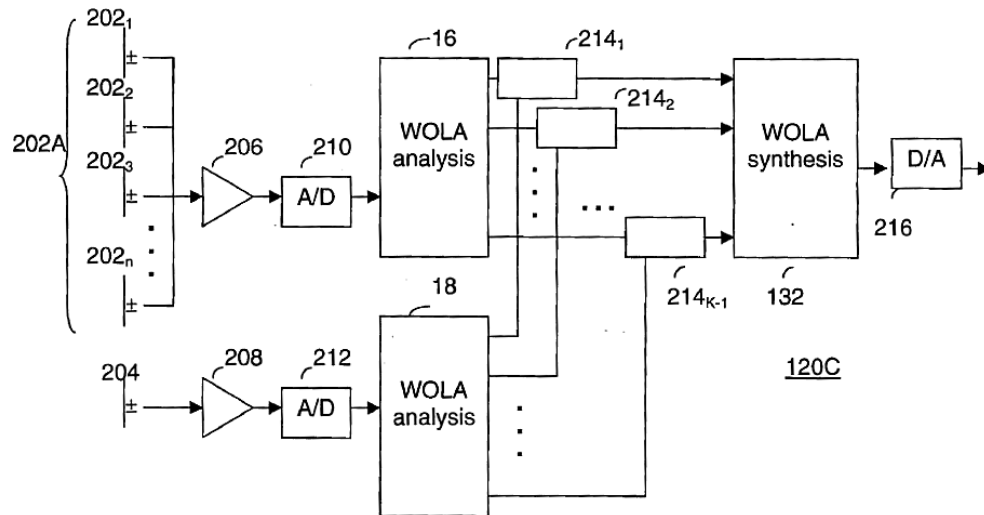


Figure 20

Figure 20 of Abutalebi is a diagram showing an oversampled SAF system. Ex. 1016 ¶ 5.

Oversampled SAF system 120C includes microphone array 202A for a primary signal, which has a plurality of microphones 202 and microphone 204 for a reference signal. Ex. 1016 ¶ 108. The output of microphone array 202A is provided to pre-amplifier 206, and the output of microphone 204 is

provided to pre-amplifier 208. *Id.* The output of pre-amplifier 206 is converted by analog-to-digital (A/D) converter 210, and then provided to WOLA analysis filterbank 16. The output of pre-amplifier 208 is converted by A/D converter 212, and then provided to WOLA analysis filterbank 18. Subband processing block 214, takes, as its input, the oversampled subband signals in subband *i* from WOLA analysis filterbanks 16 and 18. The outputs of subband processing block 214 (*i*=0, 1, . . . , *n*) are combined by WOLA synthesis filterbank 132, and digital-to-analog (D/A) converter 216 converts the output of WOLA synthesis filterbank 132. *Id.* ¶ 109. Each “subband processing block” can implement an adaptive processing block (“APB”) (*id.* ¶ 108), which includes an “adaptive filter” for each subband. *Id.* ¶¶ 42, 48, 50, 82, Fig. 12.

6. *Chen (Ex. 1010)*

Chen is a United States patent application published on July 6, 2006. Ex. 1010, code (43). Petitioner asserts Chen is prior art under 35 U.S.C. § 102(b). Pet. 9. Patent Owner does not dispute the prior-art status of Chen.

Chen describes a telephone system equipped with multiple microphones that “can be configured as an adaptive microphone array and used to reduce the effects of (i) room reverberation, when a near-end user is speaking, and/or (ii) acoustic echo, when a far-end user is speaking.”

Ex. 1010, Abs.

Figure 24 of Chen is reproduced below.

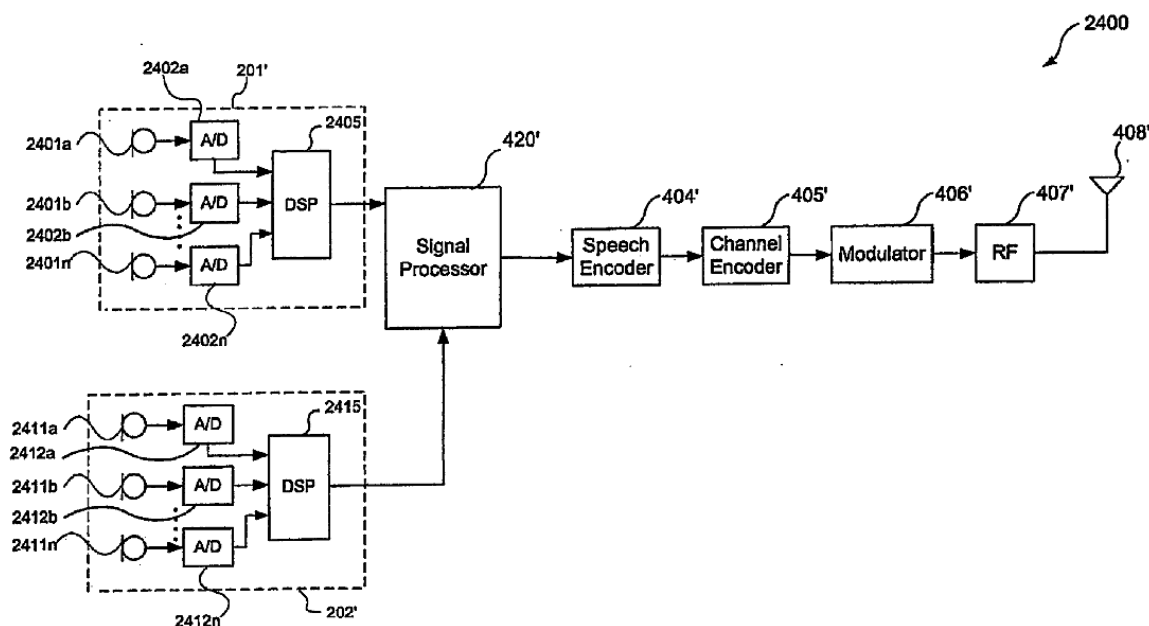


FIG. 24

Figure 24 of Chen “is a functional block diagram of a transmit path of a wireless telephone.” Ex. 1010 ¶ 44.

Figure 24 shows microphone arrays 2401 and 2411, which convert audio signals into digital audio signals that are then input into DSPs 2405 and 2415. Ex. 1010 ¶ 143. DSP 2405, using adaptive beam forming techniques, determines a DOA of a voice of a user of a wireless telephone based on the digital audio signals received from A/D converters 2402a-n. *Id.* ¶ 145. DSP 2405 then adaptively combines the digital audio signals to effectively steer a maximum sensitivity angle of microphone array 201' so that the mouth of the user is within the maximum sensitivity angle. *Id.* Chen explains that, “[i]n this way, the single audio signal output by DSP 2405 will tend to include a cleaner version of the user’s voice, as compared to an audio signal output from a single microphone (e.g., micro-phone 201).” *Id.* The audio signal output by DSP 2405 is then received by signal processor 420' and processed. *Id.*

Although Chen depicts discrete DSPs, Chen also states:

It is to be appreciated that the term “digital signal processor,” “signal processor” or “DSP” used above and below can mean a single DSP, multiple DSPs, a single DSP algorithm, multiple DSP algorithms, or combinations thereof. For example, DSP 2405, DSP 2415 and/or signal processor 420' (FIG. 24) can represent different DSP algorithms that function within a single DSP. Additionally or alternatively, various combinations of DSP 2405, DSP 2415 and/or signal processor 420' can be implemented in a single DSP or multiple DSPs as is known by a person skilled in the relevant art(s).

Ex. 1010 ¶ 150 (bolding omitted).

F. Asserted Obviousness

1. Ground 1: Obviousness of Claims 38 and 39 over Reuss and Dmochowski

Petitioner contends claims 38 and 39 are unpatentable under 35 U.S.C. § 103(a) over the combination of Reuss and Dmochowski. Pet. 11–27. For the reasons explained herein, we are persuaded that Petitioner has established a reasonable likelihood of establishing unpatentability of at least one of these claims on this basis.

Patent Owner does not address Petitioner’s arguments on a claim-by-claim basis, but presents two main arguments against institution as to all claims and all grounds: (1) the Board should exercise its discretion to deny institution in view of the co-pending district court litigation (*Vocalife II*) (Prelim. Resp. 4–10); and (2) the Petition fails to show that the prior art taught or suggested that all four claimed “units” (a “sound source localization unit,” a “beamforming unit,” an “echo cancellation unit,” and a “noise reduction unit”) are implemented in a single DSP (*id.* at 11–15). We have addressed Patent Owner’s arguments with regard to discretionary denial of review *supra* in Section III.A. We address the remainder of Patent

Owner's arguments herein in the context of evaluating the sufficiency of Petitioner's showing as to each claim element.

a. Claim 38

(1) Preamble: “[a] microphone array system for enhancing a target sound signal from a plurality of sound signals”

Petitioner contends Reuss discloses the subject matter of the preamble by disclosing “a system comprising a microphone array (e.g., 102, 202) for enhancing a target sound signal (e.g., voice 212) from a plurality of sound signals (voice, noise sources, echo).” Pet. 11 (citing Ex. 1009, 2:50–67, 12:25–29 (device “provide[s] an optimal voice output with minimal microphone background noise and minimal acoustic echo”), 1:49–55, 2:19–21, 3:21–27, 4:14–18 (array detects voice signal, speaker output, and background noise), 6:37–42, claim 18)).

Petitioner's arguments and evidence as to Reuss are persuasive on this record. Patent Owner does not, at this stage, present evidence or arguments addressing Petitioner's showing as to the preamble.

Based on the current record, for the purposes of this Decision, we are persuaded Petitioner has demonstrated sufficiently that Reuss teaches “[a] microphone array system for enhancing a target sound signal from a plurality of sound signals,” as recited in the preamble of claim 38.¹⁰

¹⁰ Neither party takes a position at this stage as to whether the preamble is limiting. As Petitioner persuasively shows that Reuss teaches the subject matter of the preamble, we need not determine whether the preamble is limiting.

(2) “array of sound sensors”

Claim 38 also recites “an array of sound sensors, wherein said sound sensors receive said sound signals from a plurality of disparate sound sources, wherein said received sound signals comprise said target sound signal from a target sound source among said disparate sound sources, and ambient noise signals.” Ex. 1001, 28:64–29:4.

Petitioner contends that this limitation is taught by Reuss, arguing this limitation by reference to Figures 1 and 2 of Reuss, reproduced below as annotated by Petitioner. See Pet. 12.

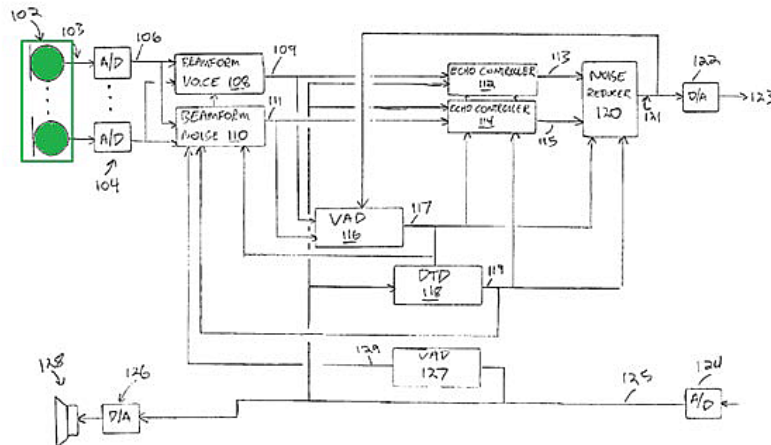


Figure 1 of Reuss, as annotated by Petitioner, depicts a “diagram of a basic configuration utilizing an embodiment of the apparatus for reduction of acoustic echo and background noise.” Ex. 1009, 3:38–49.

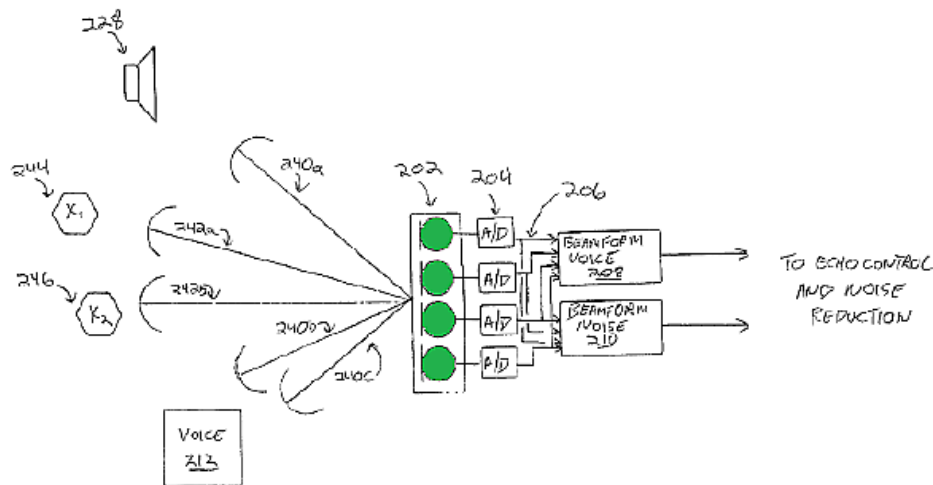


Figure 2 of Reuss, as annotated by Petitioner, depicts a “diagram illustrating an embodiment of a beamformer.” Ex. 1009, 3:9–10.

Petitioner asserts that Reuss discloses in Figure 1 a “multi-element microphone array 102,” which Petitioner has annotated in green. Pet. 12 (citing Ex. 1009, Fig. 1, 3:45–46, claim 1). Petitioner also asserts that Reuss discloses a “four microphone beamformer,” as depicted in Figure 2, that “includes a microphone array 202,” which Petitioner has annotated in green. *Id.* (citing Ex. 1009, Fig. 2, 5:66–67, 4:34–43). Petitioner contends that Reuss’s sensors receive sound signals from a plurality of disparate sound sources, and “[t]hose received signals comprise the target sound signal (e.g., voice 212) from a target sound source among the disparate sound sources (e.g., X1, X2, 228) and ambient noise signals.” *Id.* at 13; *see also id.* at 11 (citing Ex. 1009, 1:49–55, 2:19–21, 2:50–67, 3:21–27, 4:14–18, 12:25–29).

Petitioner’s arguments and evidence as to Reuss are persuasive on this record. Patent Owner does not, at this stage, particularly challenge Petitioner’s showing as to this limitation.

Based on the current record, for the purposes of this Decision, we are persuaded Petitioner has demonstrated sufficiently that Reuss teaches “an

array of sound sensors, wherein said sound sensors receive said sound signals from a plurality of disparate sound sources, wherein said received sound signals comprise said target sound signal from a target sound source among said disparate sound sources, and ambient noise signals,” as recited in claim 38.

(3) *“a digital signal processor comprising” four “unit[s]”*

Claim 38 next recites a DSP comprising four units, namely a “sound source localization unit,” a “beamforming unit,” an “echo cancellation unit,” and a “noise reduction unit.” Ex. 1001, 29:7–23. Petitioner contends that Reuss discloses a “digital signal processor” that implements the four units. Pet. 13–27. Petitioner further contends that, to the extent Reuss does not teach or suggest the “sound source localization unit” as recited, Reuss combined with Dmochowski discloses that limitation. *See id.* at 17–24.

(a) *“beamforming unit”*

Claim 38 recites, as part of the digital signal processor, “a beamforming unit that enhances said target sound signal and partially suppresses said ambient noise signals.” Ex. 1001, 29:15–17. Petitioner contends Reuss teaches this limitation by disclosing a “beamform voice processor” (108, 208) that is used to “emphasize sounds from a particular location and to de-emphasize sounds from other locations.” Pet. 13 (citing Ex. 1009, 5:18–27, 5:57–60, 6:17–43). Petitioner further notes that Reuss’s beamform voice processor “may be an adaptive beamformer where the ‘directional sensitivity can be dynamically changed depending on the changing locations or conditions associated with a target source, such as a user voice, and undesired sources, such as acoustic echo or background noise.’” *Id.* (citing Ex. 1009, 5:39–45, 6:19–21). This beamforming “makes

it possible to electronically ‘steer’ an array by emphasizing and/or de-emphasizing voice or noise sounds from objects as they move from location to location.” *Id.* at 14 (citing Ex. 1009, 5:46–57). Petitioner further contends that “Reuss’s adaptive beamformer ‘improve[s] the voice signal to noise ratio by forming a composite antenna pattern beam in the direction of the voice,’” and therefore “the portion of Reuss’s beamform voice processor that steers the array’s directivity pattern is an adaptive beamforming unit that enhances the target sound signal and partially suppresses ambient noise signals as claimed.” *Id.* at 15 (citing Ex. 1009, 5:57–61).

Petitioner’s arguments and evidence as to Reuss are persuasive on this record. Patent Owner does not, at this stage, particularly challenge Petitioner’s showing as to this limitation.

Based on the current record, for the purposes of this Decision, we are persuaded Petitioner has demonstrated sufficiently that Reuss teaches “a beamforming unit that enhances said target sound signal and partially suppresses said ambient noise signals,” as recited in claim 38.

(b) “echo cancellation unit”

Claim 38 also recites, as part of the digital signal processor, “an echo cancellation unit that performs echo cancellation and further enhances said target sound signal.” Ex. 1001, 29:18–20.

Petitioner contends Reuss teaches this limitation by disclosing “an ‘echo controller’ . . . that operates like ‘acoustic echo cancellers’ known in the art.” Pet. 15 (citing Ex. 1009, 9:34–39, Figs. 1, 2). Reuss’s echo controller is “configured in digital signal processor form” to “cancel the echo signal component[.]” *Id.* at 16 (citing Ex. 1009, 3:21–26, 4:56–58, 7:2–3, 9:40–42, 9:53–54). The output is an “echo controlled voice signal

113 with reduced echo[.]” *Id.* (citing 9:41–10:20, 10:36–38, claims 1, 12, 18).

Petitioner’s arguments and evidence as to Reuss are persuasive on this record. Patent Owner does not, at this stage, particularly challenge Petitioner’s showing as to this limitation.

Based on the current record, for the purposes of this Decision, we are persuaded Petitioner has demonstrated sufficiently that Reuss teaches “an echo cancellation unit that performs echo cancellation and further enhances said target sound signal,” as recited in claim 38.

(c) “noise reduction unit”

Claim 38 also recites, as part of the digital signal processor, “a noise reduction unit that suppresses said ambient noise signals and further enhances said target sound signal.” Ex. 1001, 29:21–23.

Petitioner contends Reuss teaches this limitation by disclosing a “noise reducer” that comprises “noise reduction algorithms to ‘enhance the vocal to non-vocal signal quality.’” Pet. 16 (citing Ex. 1009, Fig. 1 (noise reducer 120), 4:58–61 (noting that background noise is “suppressed by a noise reduction algorithm”), 10:51–54, 10:60–11:18 (describing noise reduction techniques, including “spectral subtraction”), 11:27–12:24 (describing techniques for noise reduction), claims 1, 10–12, 17, 18, Fig. 2).

Petitioner’s arguments and evidence as to Reuss are persuasive on this record. Patent Owner does not, at this stage, particularly challenge Petitioner’s showing as to this limitation.

Based on the current record, for the purposes of this Decision, we are persuaded Petitioner has demonstrated sufficiently that Reuss teaches “a

noise reduction unit that suppresses said ambient noise signals and further enhances said target sound signal,” as recited in claim 38.

(d) “sound source localization unit”

Claim 38 also recites, as part of the digital signal processor,
a sound source localization unit that estimates a location of said target sound signal from said received sound signals by determining a delay between each of said sound sensors and a reference point of said array of said sound sensors as a function of distance between each of said sound sensors and said reference point and an angle of each of said sound sensors biased from a reference axis[.]

Ex. 1001, 29:7–17.

Petitioner contends this limitation is taught by Reuss’s disclosure, expressly or inherently; alternatively, Petitioner contends this limitation is taught by the combined teachings of Dmochowski and Reuss. *See* Pet. 17–24.

As Petitioner notes, and we agree, the “sound source localization” (SSL) unit limitation has two parts: (1) estimating a location of a target sound signal, by (2) determining a delay between each of the sound sensors and a reference point as a function of distance between the sensors and the reference point and an angle of each of the sensors from a reference axis. *See* Pet. 17, 22; *see also* Ex. 1001, 29:7–14. We address Petitioner’s showing as to each of these parts, along with Patent Owner’s contentions.

With regard to estimating a location of a target sound signal, Petitioner contends that the ’371 patent discloses that the SSL unit is software or hardware that runs a “conventional algorithm,” such as the steered response power (“SRP”), steered response power-phase transform (“SRP-PHAT”), or time difference of arrival (“TDOA”) algorithms. Pet. 17

(citing Ex. 1001, 6:14–20, 11:25–55; Ex. 1026, 45 (*Vocalife I* Claim Construction Order construing “sound source localization unit” as “software/hardware in a DSP that includes functionality for locating a sound source”)).

Petitioner contends that Reuss teaches an SSL unit as claimed by disclosing a beamform voice processors that emphasizes sounds “from a particular location and [] de-emphasize sounds from other locations.” Pet. 18 (citing Ex. 1009, 5:18–27). Petitioner reasons that “Reuss discloses adaptive beamformers where the ‘directional sensitivity can be dynamically changed *depending on the changing locations* or conditions associated with a target source, such as a user voice.’” *Id.* (citing Ex. 1009, 5:39–45). In particular, Reuss’s adaptive beamformer processor forms a beam “in the direction of the voice.” Ex. 1009, 5:57–61, 6:17–42, 6:58–7:9, Fig. 2. Reuss further discloses that determining the DOA can be implemented “as part of the function of the beamform voice processor.” *Id.* at 7:24–42. Based on this disclosure, Petitioner contends that the portion of Reuss’s beamform voice processor that determines the voice’s DOA is an SSL unit that estimates the target sound signal’s location, as recited in claim 38. Pet. 18 (citing Ex. 1009, Figs. 1, 2).

Petitioner further contends that, even if the foregoing disclosure in Reuss does not directly disclose estimating a target sound signal’s location, Reuss inherently teaches this limitation. Pet. 19. In particular, Reuss discloses “dynamically chang[ing]” the beamformer’s directional sensitivity depending on “changing locations” of the target source, which Petitioner contends requires Reuss’s processor to necessarily estimate the voice signal’s location. *Id.* (citing Ex. 1009, 5:39–45). That is, Petitioner

contends that “Reuss’s system necessarily includes a SSL unit for estimating the target sound signal’s location because that is the only way for the voice beamformer to steer the array’s directivity pattern ‘to follow a moving talker.’” *Id.* (citing Ex. 1007 ¶ 110; Ex. 1011, 1327; Ex. 1015, 161; Ex. 1027, 2–3; Ex. 1022, 242).

Petitioner alternatively contends that “[e]ven if Reuss did not expressly or inherently disclose a SSL unit, Dmochowski renders it obvious.” Pet. 19. In particular, Petitioner contends “Dmochowski discloses that the ‘location of a signal source is of much interest’ and that there exists a ‘large and increasing need to locate and track sound sources.’” *Id.* (citing Ex. 1011, 1327). Petitioner then contends that “Dmochowski uses the SRP algorithm to determine the DOA and thereby estimate the target sound signal’s location.” *Id.* (citing Ex. 1011, 1330; Ex. 1007 ¶ 111). With regard to the recitation in claim 38 that the SSL unit estimates the target sound signal’s location by determining a delay, Petitioner contends that Dmochowski discloses determining a delay as recited. *Id.* at 22–24 (citing Ex. 1011, 1327–1330; Ex. 1007 ¶¶ 121–127).

As for the motivation for the ordinarily skilled artisan to have combined the teachings of Reuss and Dmochowski by incorporating Dmochowski’s SSL algorithm (SRP) into Reuss’s DSP, Petitioner argues, relying in part on the testimony of Dr. Strawn, that: (1) both Reuss and Dmochowski address the same problem of determining a target signal’s DOA, including use in adaptive beamforming for teleconferencing (Pet. 19–21 (citing Ex. 1009, 5:39–65, 7:34–35; Ex. 1011, 1327)); (2) both Reuss and Dmochowski discuss non-linear (e.g., circular) microphone arrays (*id.* at 21 (citing Ex. 1009, 4:34–38; Ex. 1011, 1328)); (3) Reuss does not require a

specific algorithm for beamforming but notes that the beamformer uses “any one of several common DSP algorithms” for determining DOA (*id.* at 20 (citing Ex. 1009, 6:43–50)); (4) Dmochowski’s algorithm was known by 2001 and was touted as outperforming other SSL algorithms (*id.* (citing Ex. 1011, 1337; Ex. 1007 ¶ 113)); (5) the combination of Dmochowski’s algorithm with Reuss’s system “represents using a known element in a known system to yield predictable results (e.g., continuously determining source location for adaptive beamforming)” (*id.* (citing Ex. 1007 ¶ 115)); and (6) the ordinarily skilled artisan would have expected success in combining Dmochowski’s SRP algorithm with Reuss’s system because “Dmochowski’s simulations demonstrate that the SRP algorithm was well understood, predictable, and performed well in reverberant conditions like those in Reuss,” and “Reuss discloses using DSPs capable of running the SRP algorithm and the other identified algorithms” (*id.* at 22, 24 (citing Ex. 1011, 1337; Ex. 1009, 5:9–12, 6:43–49, 12:41–46, 12:63–67, claims 7, 16; Ex. 1007 ¶¶ 40–43, 48–53, 119–120, 127)).

Patent Owner argues that Petitioner’s reliance on Dmochowski “misses the mark for two reasons.” Prelim. Resp. 12. First, Patent Owner argues

Dmochowski does not recite or describe any “digital signal processor” or “DSP” in the reference. Apart from four-unit DSP requirement, implementing a sound source localization unit in a DSP is an express requirement of the claim. Neither Reuss nor Dmochowski teach this requirement, as Reuss fails to disclose “sound source localization unit” and Dmochowski fails to disclose any of its abstract calculations implemented in a digital signal processor.

Id. Second, Patent Owner notes that the district court in *Vocalife I* construed

“digital signal processor” to mean “a microprocessor that is specialized for processing of digital signals.” *Id.* at 13 (citing Ex. 2006). Patent Owner contends that Petitioner’s showing “skirts this known and agreed construction” and fails to “support mapping Dmochowski’s abstract calculations in another type of circuit to meet the claimed limitation of a sound source localization unit implemented in a digital signal processor (as opposed to some other prior art circuit).” *Id.* (emphasis omitted).

Patent Owner’s arguments are unavailing, as they fail to address the combination as argued by Petitioner. The question in an obviousness inquiry is . . . not whether each individual reference discloses all of the necessary elements.” *Game & Tech Co. v. Wargaming Grp. Ltd.*, 942 F.3d 1343, 1352 (Fed. Cir. 2019). “Rather, the test is what the *combined teachings* of the references would have suggested to those of ordinary skill in the art.” *In re Keller*, 642 F.2d 413, 425 (CCPA 1981) (citations omitted) (emphasis added). As discussed above, Petitioner does not rely on Dmochowski as teaching a DSP, but relies on Reuss for that teaching, and relies on Dmochowski as supplying the algorithm for use in Reuss’s DSP to perform the functionality of the SSL unit, as claimed. *See* Pet. 19–24. As also noted above, Petitioner’s arguments and evidence are persuasive on this record.

(e) DSP comprising all four claimed units

The parties agree that claim 38 requires that all four units recited in the claim be implemented in a single DSP, but they dispute whether the prior art teaches or suggests this implementation. *See* Pet. 25–27; Prelim. Resp. 11–13.

Petitioner argues that this requirement is met by Reuss's disclosure. Pet. 25. In particular, Petitioner contends that Reuss discloses and claims that the "beamform voice processor" (which Petitioner asserts includes both a SSL unit and an adaptive beamforming unit), the "echo controller" (echo cancellation unit), and the "noise reducer" (noise reduction unit) are "implemented by *a* digital signal processor." *Id.* (citing Ex. 1009, claims 7, 16, 6:43–49) (emphasis added). Petitioner also notes that Reuss further discloses that "[b]eamformers, echo controllers and noise reducers can be implemented as separate stages *or convolved together in any combination as a single stage[.]*" *Id.* (citing Ex. 1009, 12:55–67). As Petitioner further notes, Reuss explains that convolving the units together as a single stage "has the advantage of reducing the amount of processing required in the implementation, which reduces the cost, and it can reduce the end-to-end delay, also known as latency, of the implementation" which Reuss states is "useful for user comfort." *Id.* (citing Ex. 1009, 12:55–67). Petitioner also relies on the testimony of its expert, Dr. Strawn, who states that Reuss identifies commercially available DSPs that can implement the required signal processing as a single stage. *Id.* (citing Ex. 1007 ¶ 129; Ex. 1009, 5:9–12, 6:43–49, 9:40–42, 12:41–46, 12:63–67).

Petitioner alternatively contends that, even if Reuss does not disclose implementing the four algorithms in a single DSP, such implementation would have been obvious. Pet. 25–26. As support, Petitioner relies on the same language of Reuss as noted above, asserting that at minimum Reuss *suggests* implementing all four units as "a single-stage algorithm in one DSP." *Id.* at 26. Petitioner further asserts, relying in part on the testimony of Dr. Strawn, that the ordinarily skilled artisan would have been motivated

to use a “single DSP implementation” (that is, a single DSP) in Reuss’s system and would have expected success in doing so because (1) it would reduce cost and power consumption by reducing circuit elements; (2) it would save circuit board space and avoid the need to program multiple DSPs; (3) combining multiple prior-art algorithms into a single DSP was the predictable implementation of known elements according to known methods; and (4) ordinarily skilled artisans “frequently used one DSP to implement multiple algorithms,” and doing so was within the ordinarily skilled artisan’s skill set and “a simple design choice.” *Id.* (citing Ex. 1007 ¶¶ 57–62, 130; Ex. 1030, 66; Ex. 1034, 54; Ex. 1020, 4:29–35; Ex. 1017, 2; Ex. 1012, 1302; Ex. 1041).

Patent Owner, on the other hand, insists that Reuss does not disclose that all four units are embodied in a single DSP, but instead discloses that they are implemented in multiple discrete DSPs. Prelim. Resp. 11. In particular, Patent Owner relies on a statement in Reuss that the apparatus of the invention described therein “may be constructed using discrete components, such as microphones and digital signal processing (DSP) chips.” *Id.* (citing Ex. 1009, 3:41–44). Patent Owner asserts that this “may mean that there are multiple discrete DSPs,” but acknowledges that “it is unclear” and contends that Reuss’s “disclosure is ambiguous at best.” *Id.* at 11–12. Patent Owner also contends that “Petitioner does not sufficiently explain how these multiple components are applied to teach a single DSP with the four claimed units implemented in the single DSP.” *Id.* at 12. Patent Owner also asserts that “Petitioner attempts to mislead the Board by misconstruing Reuss to contain a ‘beamform voice processor [] which includes both a SSL unit and an adaptive beamforming unit,’ but that is not

what Reuss discloses.” *Id.* Patent Owner also asserts that “Petitioner’s back-up obviousness argument is based on this misinterpretation of the Reuss reference and thus also fails.” *Id.*

On this record, and for purposes of this decision, we are persuaded that Petitioner’s arguments and evidence demonstrate a reasonable likelihood that Reuss at least teaches or suggests implementing all four claimed “unit[s]” in a single DSP. We base this conclusion in part on Reuss’s description of convolving the several units into a single “stage”:

Beamformers, echo controllers and noise reducers can be implemented as separate stages or convolved together in any combination as a single stage when implemented as linear processes. Convolving them together has the advantage of reducing the amount of processing required in the implementation, which reduces the cost, and it can reduce the end-to-end delay, also known as latency, of the implementation.

Ex. 1009, 12:55–62. We further credit, at this stage and for purposes of this decision, the testimony of Dr. Strawn, who testifies that implementing these units as a “single stage” means that they would be in a single DSP, which could have been implemented by any one of several models of DSP disclosed in Reuss, and doing so would have been within the skill set of the ordinarily skilled artisan at the relevant time. Ex. 1007 ¶¶ 129–130 (citing Ex. 1009, 5:9–12, 12:41–46, 12:63–67; Ex. 1017, 1–2; Ex. 1012, 1301–1303; Ex. 1020, 4:29–39, Figs. 2–5, 7; Ex. 1041, 4, 10, 12, 26; Ex. 1030, 66; Ex. 1034, 54).

We note, however, that the record could benefit from further development on what the ordinarily skilled artisan would have understood from Reuss’s disclosure of implementing multiple functionalities in a “single

stage”—that is, whether implementation in a “single stage” in fact means in a single DSP.

(4) Claim 38: Conclusion

In sum, based on the record before us and the application of the reasonable likelihood standard, we are satisfied that Petitioner establishes a reasonable likelihood that it would prevail in showing that claim 38 is unpatentable.

b. Claim 39

Dependent claim 39 recites that the system of claim 38 is implemented in one of devices with speech acquisition capability, hands-free devices, handheld devices, conference phones and video conferencing applications, wherein said handheld devices comprise smart phones, tablet computers and laptop computers, and wherein said array of said sound sensors is one of a linear array of said sound sensors, a circular array of said sound sensors, and other types of array of said sound sensors.

Ex. 1001, 30:1–9.

Petitioner contends that the subject matter of this claim is taught by Reuss’s disclosure of a device for teleconferences and other situations “where hands-free speech acquisition is desired[.]” Pet. 27 (citing Ex. 1009, 4:4–11, 5:49–54, claim 8 (“a hands-free communication device”), claim 9 (“a mobile communication device”). Petitioner further notes that “Reuss discloses both linear and non-linear arrays.” *Id.* (citing Ex. 1009, 3:45–46, 4:29–44, Figs. 1, 2). Petitioner relies on Dmochowski as disclosing circular arrays. *Id.* (citing Ex. 1011, Fig. 1, 1328).

Petitioner's arguments and evidence as to Reuss and Dmochowski are persuasive on this record. Patent Owner does not, at this stage, particularly challenge Petitioner's showing as to this claim.

Based on the record before us and the application of the reasonable likelihood standard, we are satisfied that Petitioner establishes a reasonable likelihood that it would prevail in showing that claim 39 is unpatentable.

c. Ground 1: Conclusion

For the foregoing reasons, based on the current record, we determine that Petitioner has established a reasonable likelihood of prevailing in showing that at least claims 38 and 39 are unpatentable over the combination of Reuss and Dmochowski.

2. Ground 2: Claims 22, 28, 30, 37, 40, and 41 over Reuss, Dmochowski (and optionally Li)

In Ground 2, Petitioner presents arguments and evidence that independent claims 22 and 30, and dependent claims 28, 37, 40, and 41, are unpatentable over the combination of Reuss, Dmochowski, and, optionally, Li. Pet. 28–37.

Claim 22 is a method claim that recites “providing” a system comprising a microphone array and a DSP having the four units recited in claim 38. Ex. 1001, 25:38–26:15. Claim 22 also recites several functions similar to those recited in claim 38, e.g., determining a delay, estimating the target sound signal location, performing adaptive beamforming, performing echo cancellation, and suppressing noise signals. *See id.* In presenting its arguments and evidence for such overlapping limitations and functionality in claim 22, Petitioner incorporates its analysis of claim 38. *See* Pet. 28–35. Petitioner also presents arguments and evidence for the non-overlapping

limitations: (1) “determining a delay” (*id.* at 30–31 (citing Ex. 1011, 1328–29; Ex. 1007 ¶¶ 146–149)); (2) “delay is represented in terms of number of samples” (*id.* at 31–34 (citing Ex. 1011, 1328; Ex. 1007 ¶¶ 150–158; Ex. 1012 (Li), 1302)); (3) “determining a delay . . . enables beamforming for said array of said sound sensors in a plurality of configurations” (*id.* at 34 (citing Ex. 1011, 1328, 1330; Ex. 1007 ¶¶ 159–161)); and (4) “performing adaptive beamforming” (*id.* at 35 (citing Ex. 1009, 5:46–62, 6:17–26, 6:53–55, 6:58–7:9; Ex. 1007 ¶ 163)).

For independent claim 30, Petitioner asserts that it is “similar to claim 22, except it expressly recites that the SSL unit determines the delay as in claim 38. Thus, claim 30 is obvious for the same reasons as claims 22 and 38.” Pet. 36.

Petitioner also presents arguments and evidence for dependent claims 28 and 37, asserting that Reuss discloses those limitations. Pet. 36–37 (citing Ex. 1009, 10:36–11:22 (claim 28); Ex. 1009, 3:6–66, 4:44–46, 4:66–5:9, 12:18–24, Fig. 2, claims 3, 14 (claim 37)). As for dependent claims 40 and 41, Petitioner asserts that they depend from claims 22, and 30, respectively, and recite the same limitation as claim 39, and hence are unpatentable for the same reasons as expressed for claims 22, 30, and 39. *Id.* at 37.

Petitioner’s contentions are supported by the cited evidence and are persuasive on this record. At this stage, Patent Owner’s arguments against Petitioner’s showing are limited to those we have addressed above in connection with Ground 1. Patent Owner does not, at this stage, present separate arguments particularly against Petitioner’s showing on this ground.

For purposes of this Decision, based on the record presented, we are persuaded that Petitioner has cited sufficient evidence and provided sufficient articulated reasoning to explain why, at the time of the filing of the '371 patent, one of ordinary skill would have been motivated to combine the teachings of Reuss, Dmochowski, and Li in the manner recited in claims 22, 28, 30, 37, and 40–41.

Based on the record before us, we determine Petitioner's arguments, evidence, and supporting testimony establish a reasonable likelihood that Petitioner would prevail in showing that one or more of claims 22, 28, 30, 37, 40, and 41 are unpatentable over the combination of Reuss, Dmochowski, and Li.

3. Ground 3: Claims 23–25, 27, 31–33, and 35 over Reuss, Dmochowski, Li, and Brandstein

In Ground 3, Petitioner presents arguments and evidence that claims 23–25, 27, 31–33, and 35 are unpatentable over the combination of Reuss, Dmochowski, Li, and Brandstein. Pet. 38–48.

With regard to claims 23 and 31, Petitioner asserts that “[t]hese claims recite that the SSL unit estimates the target sound signal’s location using SRP-PHAT,” which Petitioner contends is taught or suggested by Brandstein. Pet. 38–40 (citing Ex. 1015, 157–164, 170–178). Petitioner also contends, relying in part on the testimony of Dr. Strawn, that the ordinarily skilled artisan would have been motivated to integrate the SRP-PHAT algorithm, as disclosed by Brandstein, into Reuss’s system because, *inter alia*, “the combination represents nothing more than using a known technique (SRP-PHAT) to improve a similar device in the same way (determining source location),” and also “reflects applying a known

technique to a device ready for improvement to yield predictable results (DOA estimation).” *Id.* at 39 (citing Ex. 1007 ¶¶ 52–53, 183). Petitioner also contends that the ordinarily skilled artisan “would have reasonably expected success in integrating SRP-PHAT into Reuss’s system given Brandstein’s comprehensive discussion of SRP-PHAT.” *Id.* (citing Ex. 1007 ¶¶ 172–178, 184). With regard to determining a delay, Petitioner contends that “[i]mplementing SRP-PHAT instead of SRP would still use Dmochowski’s delay determination.” *Id.* (citing Ex. 1007 ¶ 185).

With regard to claims 24, 25, 27, 32, 33, and 35, Petitioner contends that these claims “recite additional limitations of the ‘adaptive beamforming unit’” as recited in independent claims 22 and 30. *Id.* at 40. First, with regard to claims 24 and 32, Petitioner presents arguments and evidence that Brandstein discloses these limitations. *Id.* at 40–43 (citing Ex. 1015, 87–89, 91, 97–99, Fig. 5.1; Ex. 1007 ¶¶ 188–199). Next, with regard to claims 25 and 33, Petitioner also provides arguments and evidence that Brandstein discloses these limitations. *Id.* at 44 (citing Ex. 1015, 89, 98, Figs. 5.1, 5.8; Ex. 1007 ¶ 202). Petitioner also relies on Brandstein as teaching or suggesting the limitations of claims 27 and 35. *Id.* at 45–46 (citing Ex. 1015, 93, 96–99, Fig. 5.8, Eq. (5.12); Ex. 1007 ¶¶ 203–210). With regard to a motivation to combine the teachings of Brandstein’s adaptive beamformer with Reuss’s system, Petitioner presents arguments and evidence (including the testimony of Dr. Strawn) that, *inter alia*, Reuss discloses using adaptive beamforming techniques “well known to those of ordinary skill in the art” and that Brandstein’s adaptive beamformer was one such known technique. *Id.* at 47 (citing Ex. 1009, 6:19–21, 6:29–31, 6:43–49; Ex. 1007 ¶¶ 46, 211–215).

Petitioner's contentions are supported by the cited evidence and are persuasive on this record. At this stage, Patent Owner's arguments against Petitioner's showing are limited to those we have addressed above in connection with Ground 1. Patent Owner does not, at this stage, present separate arguments particularly against Petitioner's showing on this ground.

For purposes of this Decision, based on the record presented, we are persuaded that Petitioner has cited sufficient evidence and provided sufficient articulated reasoning to explain why, at the time of the filing of the '371 patent, one of ordinary skill would have been motivated to combine the teachings of Reuss, Dmochowski, Li, and Brandstein in the manner recited in claims 23–25, 27, 31–33, and 35.

Based on the record before us, we determine Petitioner's arguments, evidence, and supporting testimony establish a reasonable likelihood that Petitioner would prevail in showing that one or more of claims 23–25, 27, 31–33, and 35 are unpatentable over the combination of Reuss, Dmochowski, Li, and Brandstein.

4. Ground 4: Claims 26, 29, 34, and 36 over Reuss, Dmochowski (and optionally Li), Brandstein, and Abutalebi

In Ground 4, Petitioner presents arguments and evidence that claims 26, 29, 34, and 36 are unpatentable over the combination of Reuss, Dmochowski, Li, Brandstein, and Abutalebi. Pet. 48–56.

Petitioner contends that claims 26, 29, 34, and 36 add to their respective independent claims various “sub-band” processing limitations. Pet. 48. Petitioner presents arguments and evidence that Abutalebi teaches or suggests these limitations. *Id.* at 49–50 (“sub-band adaptive filtering”) (citing Ex. 1016 ¶¶ 37, 42, 48, 50, 53, 80, 82, 108, Fig. 20); *id.* at 50–51

(“splitting said enhanced target sound signal from said fixed beamformer and said ambient noise signals”) (citing Ex. 1016 ¶¶ 36–37, 39–41, 50, 54, 108); *id.* at 51–52 (“adaptively filtering said ambient noise signals in each of said frequency sub-bands”) (citing Ex. 1016 ¶¶ 82, 108); *id.* at 52–54 (“synthesizing a full-band sound signal”) (citing Ex. 1016 ¶¶ 11, 37, 109); *id.* at 53–54 (“sub-band noise reduction”) (citing Ex. 1016 ¶¶ 101–103, 108, Fig. 18); *id.* at 54 (“delay (τ)”). Petitioner also presents arguments and evidence that the combination of Dmochowski and Li renders obvious the limitations of claims 29 and 36, which recite that the delay is calculated based on a time delay and sample frequency. *Id.* at 54 (citing Ex. 1011, 1329; Ex. 1007 ¶¶ 237–239). Relying in part on the testimony of Dr. Strawn, Petitioner also presents arguments and evidence regarding a motivation for the ordinarily skilled artisan to have combined Reuss, Dmochowski, and Brandstein with Abutalebi’s sub-band processing. *Id.* at 55–56 (citing Ex. 1007 ¶¶ 240–243; Ex. 1016 ¶¶ 5, 53, 54, 108–110, Figs. 20–21; Ex. 1015, 88, 91, 96, 97).

Petitioner’s contentions are supported by the cited evidence and are persuasive on this record. At this stage, Patent Owner’s arguments against Petitioner’s showing are limited to those we have addressed above in connection with Ground 1. Patent Owner does not, at this stage, present separate arguments particularly against Petitioner’s showing on this ground.

For purposes of this Decision, based on the record presented, we are persuaded that Petitioner has cited sufficient evidence and provided sufficient articulated reasoning to explain why, at the time of the filing of the ’371 patent, one of ordinary skill would have been motivated to combine the

teachings of Reuss, Dmochowski, Li, Brandstein, and Abutalebi in the manner recited in claims 26, 29, 34, and 36.

Based on the record before us, we determine Petitioner’s arguments, evidence, and supporting testimony establish a reasonable likelihood that Petitioner would prevail in showing that one or more of claims 26, 29, 34, and 36 are unpatentable over the combination of Reuss, Dmochowski, Li, Brandstein, and Abutalebi.

5. Grounds 5–8: Obviousness Based on Combinations with Chen

In Grounds 5–8, Petitioner contends that the challenged claims are unpatentable over the same combinations as Grounds 1–4, except with Chen substituted for Reuss. Pet. 57–78. Although our decision to institute on Grounds 1–4 requires us to institute on all grounds, we provide a brief discussion of the parties’ arguments as to Chen to potentially guide the parties in further developing these additional grounds at trial.

The central point of contention between the parties at this stage is essentially the same as with Grounds 1–4: namely, whether Petitioner’s primary reference (here, Chen) teaches or suggests all four claimed “units” implemented in a single DSP. See Pet. 68–69; Prelim. Resp. 13–15.

Petitioner argues that Chen discloses “all four units are implemented in a DSP.” Pet. 68 (citing Ex. 1007 ¶ 283). In particular, Petitioner contends that the “beamforming unit” is implemented in DSP 2405 and also in DSP 2925. *Id.* at 59–60 (citing Ex. 1010 ¶¶ 12, 139, 145, 160, 189, claims 11, 12, 24, 25). Petitioner contends that the “echo cancellation unit” is implemented in DSP 2925, which Petitioner contends operates like DSP 2405 and 2105. *Id.* at 60–61 (citing Ex. 1010 ¶¶ 129, 143, 186, 202, Fig. 28). Petitioner contends that the “noise reduction unit” is “noise suppressor

1007,” which is implemented in signal processor 420'. *Id.* at 62–64 (citing Ex. 1010, Figs. 10, 24, ¶¶ 76, 84, 143–146). Petitioner also contends that the SSL unit in Chen is the portion of the DSP that determines a DOA of a voice of the user, which is implemented in DSP 2405 and DSP 2925. *Id.* at 64 (citing Ex. 1010 ¶¶ 12, 145, 188, 189). Petitioner also relies on Chen's disclosure that the DSP and signal processor algorithms may be implemented within a single DSP:

In particular, it is to be appreciated that the term “digital signal processor,” “signal processor” or “DSP” used above and below can mean a single DSP, multiple DSPs, a single DSP algorithm, multiple DSP algorithms, or combinations thereof. For example, DSP 2405, DSP 2415 and/or signal processor 420' (FIG. 24) can represent different DSP algorithms that function within a single DSP. Additionally or alternatively, various combinations of DSP 2405, DSP 2415 and/or signal processor 420' can be implemented in a single DSP or multiple DSPs as is known by a person skilled in the relevant art(s).

Ex. 1010 ¶ 150; *see* Pet. 68–69. Although DSP 2105 and DSP 2925 are not specifically mentioned in this passage, Petitioner contends that this passage applies to them as well. *See* Ex. 1010 ¶ 186 (describing DSP 2925 as “similar to DSP 2105”).

Patent Owner disputes Petitioner's characterization of Chen. Patent Owner contends that “Chen discloses multiple DSPs and non-DSPs for implementing each of the claimed units.” Prelim. Resp. 13. In particular, Patent Owner notes that the Petition “identifies one DSP that processes a ‘beamforming technique’ (Pet. at 59), while another DSP performs other techniques, and another separate ‘signal processor’ performs noise suppression as depicted below (2 separate DSPs and one separate signal

processor).” *Id.* Figure 24 of Chen, as annotated by Patent Owner (*id.* at 14), is reproduced below.

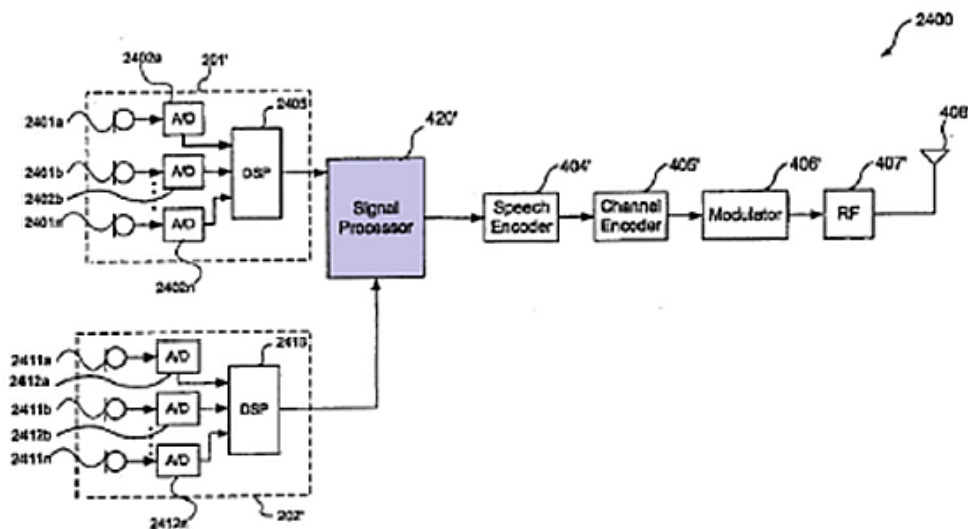


FIG. 24

Figure 24 of Chen depicts a “functional block diagram of a transmit path of a wireless telephone.” Ex. 1010 ¶ 44.

As shown in Figure 24 of Chen, two different DSPs (DSP 2405 and DSP 2415) both feed into signal processor 420', annotated in purple by Patent Owner.

Patent Owner further argues that

Petitioner relies on a completely different implementation, which does not include the DSP 2405 or separate signal processor 420 above, to show that a different echo canceller can be configured in a telephone. Ex. 1010, Chen at 0186. This implementation does not contain the same components of the previous implementation and there is no description on how the two can be useable together. Moreover, Chen's noise suppression is still performed on a separate signal processor circuit, not on a single DSP.

Prelim. Resp. 14. Patent Owner then asserts that Petitioner “does not offer any other construction to support mapping Chen's alleged echo cancellers

and noise suppression in other types of circuits to meet the claimed limitation *in a digital signal processor*.” *Id.* at 14–15.

Perhaps anticipating this argument, Petitioner contends that the ordinarily skilled artisan “would have been motivated to include the [acoustic echo canceller] in signal processor 420’ because Chen discloses that ‘acoustic echo may be an issue’ when ‘using a telephone in a speaker-phone mode.’” Pet. 61–62 (citing Ex. 1010 ¶¶ 5–6). Petitioner further contends that “Chen discloses that an ‘echo canceller can potentially reduce the volume of an echo to make it less annoying and/or distracting.’” *Id.* at 62 (citing Ex. 1010 ¶ 172). Petitioner argues that “a POSITA would have been motivated to include the [acoustic echo canceller] (known technique) to improve Figure 24’s speakerphone (known device) to reduce the acoustic echo (known problem).” *Id.* (citing Ex. 1007 ¶ 258).

It appears from Petitioner’s arguments that Petitioner advocates combining the teachings of Chen with regard to *different embodiments* disclosed therein (one of which includes an echo cancellation unit) to result in a system that has all of the units recited in the ’371 patent claims. *See* Pet. 60–62, 68–69. Petitioner also appears to contend that including an echo canceller in Chen’s signal processor 420’ would be an implementation of the echo canceller *in a DSP*, which could, in turn, be implemented with the other units *in a single DSP*. *Id.* at 60–62.

As noted above, a decision to institute under § 314 may not institute on fewer than all claims challenged in the petition. *SAS Inst.*, 138 S. Ct. at 1359–60. Therefore, at this stage and for purposes of this decision, we need not determine whether Petitioner has a reasonable likelihood of prevailing on these grounds. However, we note that the record would benefit from

clarification and/or further analysis of these grounds, including how and why an ordinarily skilled artisan would have implemented all four claimed units in a single DSP in light of the teachings of Chen.

IV. ORDER

For the reasons given, it is:

ORDERED that, pursuant to 35 U.S.C. § 314(a), an *inter partes* review is *instituted* on all challenged claims with respect to all grounds set forth in the Petition; and

FURTHER ORDERED that, pursuant to 35 U.S.C. § 314(a), *inter partes* review of the '371 patent is instituted commencing on the entry date of this Order, and pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is given of the institution of a trial.

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Patent RE48,371 E

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