

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SHURE INCORPORATED,
Petitioner,

v.

CLEARONE, INC.,
Patent Owner.

Case IPR2017-01785
Patent 9,264,553 B2

Before KEVIN F. TURNER, JONI Y. CHANG, and
ARTHUR M. PESLAK, *Administrative Patent Judges*

PESLAK, *Administrative Patent Judge.*

FINAL WRITTEN DECISION

Inter Partes Review

35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

Incorporating Decisions on Motions to Exclude Evidence (Papers 68, 70)

And Patent Owner's Motion for Reconsideration (Paper 82)

I. INTRODUCTION

Petitioner, Shure Incorporated (“Shure”), filed a Petition (Paper 1, “Pet.”) requesting an *inter partes* review of claims 1–20 of U.S. Patent 9,264,553 B2 (Ex. 1001, “the ’553 Patent”). Patent Owner, ClearOne, Inc. (“ClearOne”), timely filed a Preliminary Response (Paper 8, “Prelim. Resp.”). Taking into account the arguments presented in ClearOne’s Preliminary Response, we determined that the information presented in the Petition established that there was a reasonable likelihood that Shure would prevail in challenging claims 1–20 of the ’553 Patent as unpatentable under 35 U.S.C. § 103(a). On January 29, 2018, we instituted this *inter partes* review, as to all of the challenged claims, but not as to all grounds presented by Shure in the Petition. Paper 11 (“DI”).

Subsequent to entry of the DI, the Supreme Court held that a decision to institute under 35 U.S.C. § 314 may not institute on less than all claims challenged in the petition. *SAS Inst. Inc. v. Iancu*, 138 S. Ct. 1348, 1359–60 (2018). After *SAS*, the United States Patent and Trademark Office enacted a policy that a decision granting institution will institute on all of the claims challenged in the petition and all of the grounds presented in the petition.¹ Thereafter, we issued an Order modifying our DI to include review of all claims challenged and all grounds presented in the Petition. Paper 20.

During the course of trial, ClearOne filed a Patent Owner Response (Paper 35, “PO Resp.”), Shure Filed a Reply to the Patent Owner Response

¹ Available at <https://www.uspto.gov/patents-application-process/patent-trial-and-appeal-board/trials/guidance-impact-sas-aia-trial>.

(Paper 53, “Pet. Reply”), and ClearOne filed a Sur-Reply (Paper 75, “PO Sur-Reply”). An oral hearing was held on October 25, 2018, and a transcript of the hearing is included in the record. Paper 88 (“Tr.”).

We have jurisdiction under 35 U.S.C. § 6. This is a Final Written Decision under 35 U.S.C. § 318 (a) as to the patentability of claims 1–20 of the ’553 Patent. For the reasons discussed below, we determine that Shure has not demonstrated by a preponderance of the evidence that any of claims 1–20 are unpatentable under 35 U.S.C. § 103(a).

A. Related Matters

The ’553 Patent is the subject of a pending civil action: *Shure Incorporated v. ClearOne, Inc.*, Case No. 1:17-cv-03078 (N.D. Ill.). Pet. 3; Prelim. Resp. 5. The ’553 Patent “is one of eleven related U.S. patents and applications” that are identified in ClearOne’s Preliminary Response. Prelim. Resp. 3. ClearOne filed an application for reissue of the ’553 Patent on April 16, 2017. *Id.* at 6.

B. The ’553 Patent

The ’553 Patent issued on February 16, 2016, and is entitled “Methods and Apparatuses for Echo Cancellation with Beamforming Microphone Arrays.” Ex. 1001, [54]. The ’553 Patent issued from U.S. Patent Application No. 13/493,921 and claims the benefit of U.S. Provisional Application No. 61/495,961 filed on June 11, 2011, U.S. Provisional Application No. 61/495,968 filed on June 11, 2011, and U.S. Provisional Application No. 61/495,971 filed on June 11, 2011. *Id.* at [21], [22], [60].

The '553 Patent generally relates to teleconferencing and video conferencing using an array of microphones. Ex. 1001, 1:36–37, 43. Microphones in the array “have a beam pattern that selectively picks up acoustic waves in a region of space and rejects others.” *Id.* at 6:33–34.

The '553 Patent discloses two known signal processing techniques. The first technique is beamforming, whereby “signals from the various microphones may be combined such that . . . signals at particular angles experience constructive interference while others experience destructive interference.” *Id.* at 6:50–53. Beamforming allows signals from certain regions to be amplified and others attenuated. *Id.* at 6:53–56. The second technique is Acoustic Echo Cancelation (“AEC”). *Id.* at 8:4–12.

Figure 7 of the '553 Patent is reproduced below.

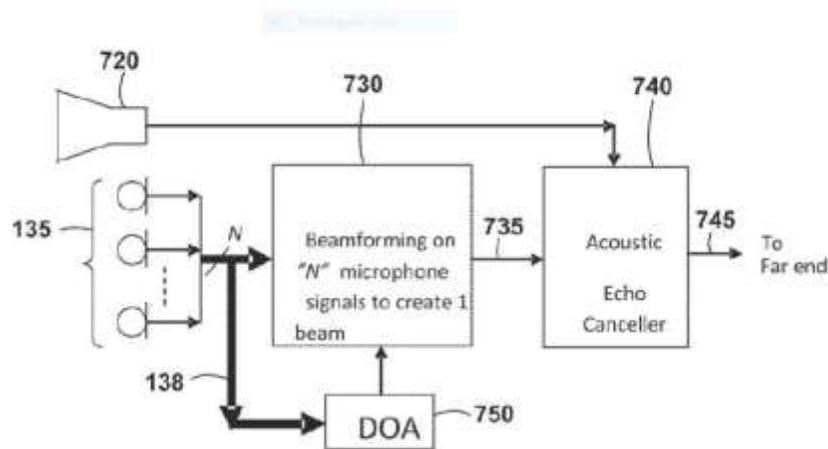


FIG. 7

Figure 7 of the '553 Patent illustrates a process referred to as beamforming first. Ex. 1001, 8:13–22, 9:10–22, Fig. 7. An array of microphones 135 generates N signals that are transmitted to beamformer

730; one signal 735 is generated and sent to Acoustic Echo Canceller 740, which in turn generates a final echo cancelled signal 745. *Id.*

Figure 8 of the '553 Patent is reproduced below.

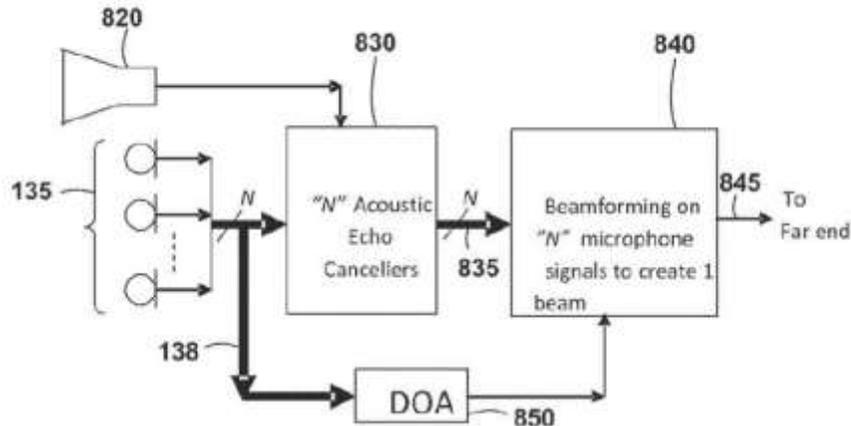


FIG. 8

Figure 8 of the '553 Patent illustrates a process referred to as AEC first. Ex. 1001, 9:24–42, Fig. 8. In this arrangement, an array of microphones 135 generates N signals that are transmitted to Acoustic Echo Canceller 830, where each of the N signals is separately echo cancelled and N signals 835 are sent to beamformer 840. *Id.* at 9:32–33. The N signals are beamformed into a final echo cancelled signal 845. *Id.* at 9:33–36. The “DOA” box in each of Figures 7 and 8 refers to “Direction of Arrival” of the signals and is used in the beamforming process to generate a final vector signal. *See id.* at Fig. 2, 9:18–20.

Figure 9 of the '553 Patent is reproduced below.

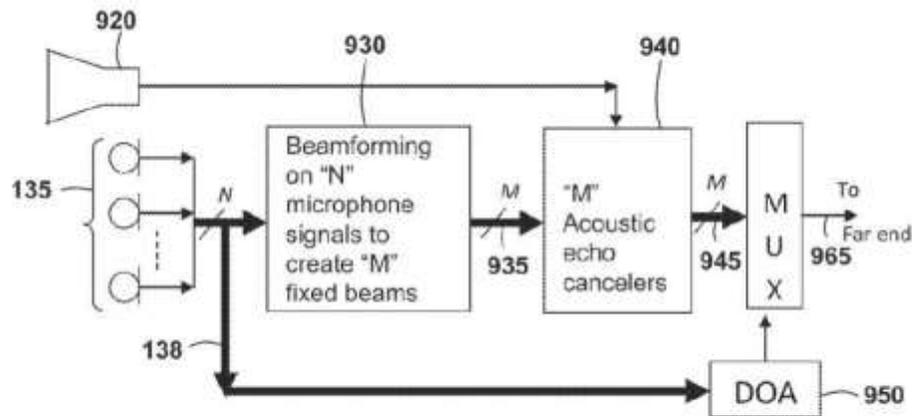


FIG. 9

Figure 9 of the '553 Patent is an illustration of an embodiment of the challenged claimed subject matter. Figure 9 illustrates an array of microphones that generate N signals, which are sent to beamformer 930. Beamformer 930 generates M "fixed beam[]" signals 935, where $M < N$. Ex. 1001, 9:65–10:28. The M signals 935 are sent to the acoustic echo canceller, which performs acoustic echo cancellation on each of the M signals and generates M signals 945. A multiplexor (MUX) selects one or more of the M signals as final output signals based on input from the DOA determination process. *Id.*

C. Challenged Claims

Claims 1, 8, and 15 are independent. Claim 1 is directed to a method of echo cancellation for a conferencing application. Claims 8 and 15 are both directed to a conferencing apparatus. Claims 2–7 depend directly from claim 1, claims 9–14 depend directly from claim 8, claims 16 and 18 depend directly from claim 15, and claims 17, 19, and 20 depend indirectly from

claim 15. Independent claim 1, reproduced below, is illustrative of the challenged claims.

1. A method of echo cancellation for a conferencing application, comprising:

sensing acoustic waves with a plurality of microphones to develop a corresponding plurality of microphone signals;

performing a beamforming operation to combine the plurality of microphone signals to a plurality of combined signals that is greater in number than one and less in number than the plurality of microphone signals, each of the plurality of combined signals corresponding to a different fixed beam;

performing an acoustic echo cancelation operation on the plurality of combined signals to generate a plurality of combined echo-canceled signals; and

selecting one or more of the plurality of combined echo-canceled signals for transmission.

Ex. 1001, 10:57–11:5.

D. Asserted Grounds of Unpatentability

We instituted trial based on the asserted grounds of unpatentability (“grounds”) set forth in the following table.² DI, 30; Paper 20, 2.

² Although the Petition indicates two grounds directed at claims 1–20 generally, a review of Shure’s contentions, Pet. 26–72, reveals the differentiation specified in the table.

Reference(s)	Basis	Claims challenged	
Kellermann 2001 ³	§ 103(a)	1–6, 8–13, and 15–17	
Kellermann 2001 and Chen ⁴	§ 103(a)	7, 14, and 18–20	
Ishibashi ⁵	§ 103(a)	1–3, 6, 8–10, 13, and 15–17	
Ishibashi and Reuss ⁶	§ 103(a)	1–6, 8–13, and 15–17	
Ishibashi and Chen	§ 103(a)	7, 14, and 18–20	

II. ANALYSIS

A. Overview

A 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

³ MICROPHONE ARRAYS: SIGNAL PROCESSING TECHNIQUES AND APPLICATIONS (Michael Brandstein & Darren Ward eds., 2001). The parties refer to this reference as “Kellermann 2001.” (Ex. 1014, “Kellermann 2001”).

⁴ US Pat. Application Pub. No. 2010/0128892 A1, published May 27, 2010 (Ex. 1016, “Chen”).

⁵ US Pat. Application Pub. No. 2009/0052684 A1, published Feb. 26, 2009 (Ex. 1015, “Ishibashi”).

⁶ US Pat. No. 7,359,504 B1, issued April 15, 2008 (Ex. 1017, “Reuss”).

of skill in the art; and (4) when in evidence, objective indicia of non-obviousness (i.e., secondary considerations). *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). We analyze the asserted grounds based on obviousness with these principles in mind.

B. Level of Skill in the Art

Shure, relying on the Declaration of Dr. Walter Kellermann (Ex. 1003), submits that,

[b]ased on the disclosure of the '553 patent, a person having ordinary skill in the art at the relevant time would have had at least a four-year degree in electrical engineering, computer engineering, or a related field of study, or equivalent experience and at least two years of experience in studying or developing signal processing operations such as echo cancellation systems. Ex. 1003, ¶ 36. A person of ordinary skill in the art would also be familiar with beamforming, acoustic echo cancellation and signal processing.

Pet. 14.

ClearOne does not specifically address the level of skill in the art in the Patent Owner Response. *See* PO Resp. With the Patent Owner Response, ClearOne submits a Declaration of Dr. Gareth Loy, in which Dr. Loy provides his opinion of the level of skill in the art. Ex. 2013 ¶¶ 40–41. Dr. Loy submits the following:

40. In my opinion, the relevant art field for the '553 patent is digital audio signal processing. In my experience, those working in this field have one or more of the following skills: Education in acoustics and audio sufficient to understand beamforming microphone arrays (BMAs); digital signal processing (DSP) to understand adaptive echo cancellation, mixing and signal selection, and other audio processing operations; and research and development and/or teaching experience

(lecture + lab) in digital audio signal processing in order to understand how, when possible, to build a physical system that operates in real time based on adequate specifications.

41. Therefore, in my opinion, a POSITA of the '553 patent in June 2011 would have had: At least a bachelor's degree in electrical engineering, computer engineering, DSP, or the equivalent and one or two years of practical industry experience in the field. In my opinion, additional education can compensate for less work experience, and vice versa.

Id.

Shure switches gears in the Petitioner Reply by offering a Declaration from a different expert, Dr. Wilfred Leblanc. Ex. 1021. Dr. Leblanc offers an opinion that the level of skill in the art is either a Bachelor's degree in electrical engineering and at least 7 years of experience or a PhD in electrical engineering and at least two years of post-doctoral research or work directly in the field. *Id.* ¶ 23. Dr. Leblanc disagrees with the level of skill in the art as articulated by Dr. Kellermann and Dr. Loy. *Id.* ¶ 24.

We find that the level of skill in the art as articulated by Dr. Kellermann is the appropriate level of skill in the art because Dr. Kellermann is the author of the primary prior art reference relied on by Shure in its unpatentability challenges and, thus, he is in the best position to know the appropriate level of skill in the art, and because Dr. Loy articulates a substantially similar level of skill in the art. Therefore, we determine that a person of ordinary skill in the art would have a Bachelor's Degree in electrical engineering or a related field or its equivalent and at least two years of experience in digital signal processing techniques and familiarity with acoustic echo cancellation and beamforming.

C. Claim Construction

Because this *inter partes* review is based on a petition filed before November 13, 2018,⁷ claim terms of this unexpired patent are given their broadest reasonable interpretation in light of the specification of the patent in which they appear. 37 C.F.R. § 42.100(b) (2017). Under the broadest reasonable interpretation standard, and absent any special definitions, claim terms are generally given their ordinary and customary meaning, as would be understood by one of ordinary skill in the art, in the context of the entire disclosure. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). Upon reviewing the parties' arguments in the Petition and the Patent Owner Response and the competing constructions of "fixed beam," we determine that, in order to resolve the controversy between the parties, the claim term "fixed beam" must be construed. *See Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) ("only those terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy").

i. *Shure's Proposed Construction*

Shure argues that the '553 Patent does not specifically define the claim term "fixed beam." Pet. 15. Shure argues that during prosecution of the '553 Patent, ClearOne distinguished a prior art reference, Kajala (Ex. 1008), "by noting that Kajala discloses 'filter coefficients of the beamformer

⁷ Changes to the Claim Construction Standard for Interpreting Claims in Trial Proceedings Before the Patent Trial and Appeal Board, 83 Fed. Reg. 51,340, 51,340 (discussing an "Effective Date" and "Applicability Date" of November 13, 2018) (Oct. 11, 2018) (to be codified at 37 C.F.R. pt. 42).

are **not fixed but adjustable**’ and ‘the adjustable filter coefficients enable the system to **continuously and smoothly steer** the look direction of the beamformer.’” *Id.* at 15–16 (citing Ex. 1002, 134–138); *see also* Ex. 1003 ¶¶ 41–43. Based on these statements in the prosecution history, Shure contends that “fixed beam” should be construed to be a “non-adjustable and non-adaptive beam that is focused in a predetermined direction.” *Id.* at 16.

We note that the ’553 Patent does not describe “filter coefficients.” *See* Ex. 1001. Shure’s proposed construction is based on statements made by ClearOne during the prosecution of the application resulting in the ’553 Patent. “The party seeking to invoke prosecution history disclaimer bears the burden of proving the existence of a ‘clear and unmistakable’ disclaimer that would have been evident to one skilled in the art.” *Trivascular, Inc. v. Samuels*, 812 F.3d 1056, 1063–64 (Fed. Cir. 2016) (citing *Elbex Video, Ltd. v. Sensormatic Elecs. Corp.*, 508 F.3d 1366, 1371 (Fed. Cir. 2007)); *see also Sorensen v. Int’l Trade Comm’n*, 427 F.3d 1375, 1378 (Fed. Cir. 2005) (noting that “in order to disavow claim scope, a patent applicant must clearly and unambiguously express surrender of subject matter during prosecution”).

Here, Shure does not adequately explain the relationship between filter coefficients, the proposed construction of “fixed beam,” and the disclosure in the ’553 Patent. In the absence of support in the Specification or other evidence establishing a relationship between the statements in the prosecution history and the disclosure in the ’553 Patent, Shure has not established the existence of a “clear and unmistakable” disclaimer that would have been evident to one skilled in the art.” *Trivascular*, 812 F.3d at

1063–64. Nor has Shure shown that one of ordinary skill in the art would have understood its proposed construction to be the broadest reasonable interpretation consistent with the Specification. *See Phillips v. AWH Corp.*, 415 F.3d 1303, 1315 (The specification is “the single best guide to the meaning of a disputed term” and “[u]sually it is dispositive.”).

Consequently, we do not adopt Shure’s construction of “fixed beam.”

ii. ClearOne’s Proposed Construction

ClearOne contends that “fixed beam” should be construed “to mean a beam ‘defined by parameters determined before a conference.’” PO Resp. 11. ClearOne does not direct us to a specific definition of “fixed beam” in the ’553 Patent, but argues that its proposed construction is consistent with the Specification of the ’553 Patent. *Id.* ClearOne notes this construction of “fixed beam” was adopted by a District Court in co-pending litigation between the parties. *Id.* (citing Ex. 2008, 10). We note that the patent at issue in the District Court litigation is not the ’553 Patent but rather U.S. Patent 9,635,186 (“the ’186 Patent”), which is a continuation of the ’553 Patent. PO Resp. 6. The District Court noted that the ’186 Patent specifically “defines ‘fixed beam’ as ‘a beam that is defined with pre-computed parameters rather than being adaptively steered to look in different directions in real time. The pre-computed parameters are configured *prior to use* of the beamforming microphone array *in a conference.*” Ex. 2008, 8. This definition of fixed beam in the ’186 Patent is not in the ’553 Patent.

Shure contends that ClearOne’s proposed construction is improper because it is based on “a district court’s preliminary injunction opinion

concerning a later-filed patent” and “adds an unsupported limitation, and is indefinite.” Pet. Reply 3. Shure argues, based on the deposition testimony of ClearOne’s expert Dr. Loy, that the phrase “determined before a conference” is indefinite. *Id.* at 3–4 (citing Ex. 1030, 149:25–153:10). Shure, however, submits that Kellermann 2001 discloses “fixed beams” under either Shure’s construction or ClearOne’s construction of the term. *Id.* at 3; Tr., 16:12–17.

iii. Analysis

We begin our analysis with the claim language. *In re Power Integrations, Inc.*, 884 F.3d 1370, 1376 (Fed. Cir. 2018) (“Claim construction must begin with the words of the claims themselves.”). Claim 1 recites “performing a beamforming operation to combine the plurality of microphone signals to a plurality of combined signals . . . each of the plurality of combined signals corresponding to a different fixed beam.” Ex. 1001, 10:62–68. Independent claims 8 and 15 contain substantially similar limitations. *See id.* at 11:36–41, 12:23–28. Although the claims recite that fixed beams result from the beamforming operation, the claims do not otherwise provide any limitations that define a “fixed beam.” In order to construe this term, we must first determine the characteristics of a beam and then which of those characteristics must be fixed according to the ’553 Patent.

The term “fixed beam” appears in the ’553 Patent in two places. At column 8, lines 35–44, the ’553 Patent provides:

Embodiments of the present disclosure implement a conferencing solution with beamformer and echo canceler in a hybrid configuration

with a “beamformer first” configuration to generate a number of fixed beams followed by echo cancelers for each fixed beam. This hybrid configuration allows an increase in the number of microphones for better beamforming without the need for additional echo cancellers as the number of microphones is increased. Also, the echo cancelers do not need to continually adapt because [as] the number of fixed beams may be held constant.

The '553 Patent also provides:

Fig. 9 illustrates processing involved in sensing acoustic waves wherein a subset of signals from the microphones are combined, then acoustic echo cancellation is performed one or more of the combined signals. The beamforming microphone array 135 generates a set of N microphone signals 138. In this hybrid configuration, a beamforming process 930 forms M fixed beams 935 from N microphone signals 138. An acoustic echo cancel process 940 performed acoustic echo cancellation on each of the M fixed beams 935 separately.

Id. at 9:65–10:6.

These passages describe the generation of “fixed beams” by the beamformer and the subsequent acoustic echo cancellation performed on the fixed beam signals as illustrated in Figure 9 of the '553 Patent. Neither passage, however, provides any meaningful information regarding the characteristics of a “beam,” or which of those characteristics must be “fixed” so that a particular beam constitutes a “fixed beam.” Other parts of the '553 Patent offer some guidance as to these parameters. The '553 Patent provides that

FIG. 2 illustrates geometrical representations of a beam for a microphone. A direction vector 210 of the beam extends from the microphone. The beam pattern for a microphone is usually specified with an azimuth angle 220, an elevation angle 230, and a beamwidth 240. Of course, the beamwidth 240 will have a three-dimensional

quality to it and FIG. 2 illustrates a projection of the beam width 240 onto the X-Y plane.

Id. at 6:35–42.

From this disclosure, we discern that the relevant characteristics of a “beam” are an azimuth angle, an elevation angle, and a beam width.⁸ The ’553 Patent also provides that “the azimuth angles and beamwidths [of the beams shown in Figs. 3–5] may be *fixed* to cover desired regions. As a non-limiting example, the six beams illustrated in FIG. 3 and FIG. 4 can each be configured with beamwidths of 60 degrees . . . [and] an elevation angle of 30 degrees.” *Id.* at 7:47–53 (emphasis added). In addition, “[e]mbodiments of the present disclosure include a beamforming microphone array, where *elevation angle of the beam* can be programmed with software default settings or automatically *adapted* for an application.” *Id.* at 7:11–14 (emphasis added). “While these default elevation angles may be defined for each of the orientations [in Figs. 3–5], the user, installer, or both, have flexibility to change the elevation angle with software settings at the time of installation, before a conference, or *during a conference.*” *Id.* at 7:60–64 (emphasis added). From these passages of the ’553 Patent, we discern that the ’553 Patent does not require each of the identified characteristics of a beam to be “fixed” in the sense that the parameter does not change or

⁸There may be other characteristics of a beam but there is no disclosure in the ’553 Patent of other characteristics and we make no finding as to whether other characteristics, not disclosed, would affect whether or not a beam is “fixed.”

fluctuate during a conference.⁹ Rather, the azimuth angle and beamwidth are “fixed to cover desired regions” but the elevation angle of the beams can be “adapted for an application” and can be changed “before a conference, or during a conference.” *Id.* We note that the testimony of ClearOne’s expert, Dr. Loy, supports our understanding of the characteristics of a fixed beam. He testified that the ’553 Patent “calls for adjusting the elevation of beams, never the azimuth or beamwidth.” Ex. 2013 ¶¶ 69, 83.

Based on the foregoing, we determine that one of ordinary skill in the art, after reviewing the Specification of the ’553 Patent, would have reasonably understood a “fixed beam” as a beam in which the azimuth angle and beam width are fixed before the conference, because the Specification specifically discloses that these parameters “may be *fixed* to cover desired regions.” Ex. 1001 at 7:47–53. However, both parties’ proposed constructions require that the elevation angle, in addition to the beam width and azimuth angle, be fixed. *See* PO Sur-Reply 3 (proposed construction “excludes . . . change of elevation angle during a conference”); Pet. 16 (“non-adjustable and non-adaptive beam that is *focused in a predetermined direction*” (emphasis added)).

We also note that the definition of “fixed beam” in the ’186 Patent referred to by the District Court indicates that a fixed beam requires elevation angle as well as beam width and azimuth angle be fixed. *See* Ex.

⁹ An ordinary meaning of fixed is “not subject to change or fluctuation.” <https://www.merriam-webster.com/dictionary/fixed> (last accessed November 28, 2018).

2008, 9 (“a beam that is defined with pre-computed parameters rather than being adaptively steered to look in different directions in real time”). The District Court apparently concluded that elevation angle must be fixed in addition to beam width and azimuth angle because from “the perspective of a skilled artisan . . . [t]he point of using fixed beams is to reduce the workload for the echo cancellers. With adjustable beams, the echo cancellers would need to constantly adjust to changes in the beamformer.” *Id.* at 7–8. We have reviewed this determination by the District Court and determine that it is consistent with the disclosure of the ’553 Patent. *See Ex.* 1001, 10:29–44, Fig. 10.

Because ClearOne and Shure both propose a construction where all three beam characteristics are fixed, we adopt ClearOne’s construction for the purposes of this Decision and specify that the parameters to be fixed before a conference are azimuth angle, beam width, and elevation angle. Further, we do not agree with Shure that the phrase “before a conference” is indefinite. The breadth of a claim is not to be equated with indefiniteness. *See e.g., In re Miller*, 441 F.2d 689, 693 (CCPA 1971). Although the phrase is broad, it does not fail to “inform those skilled in the art about the scope of the invention with reasonable clarity,” nor is it unclear. *Nautilus, Inc. v. Biosig Instruments, Inc.*, 572 U.S. 898, 910 (2014); *In re Packard*, 751, F.3d 1307, 1314 (Fed. Cir. 2014). The phrase “before a conference” means just that the parameters are fixed at a point in time before the conference begins.

D. Obviousness over Kellermann 2001 alone or in Combination with Chen

Shure contends that claims 1–6, 8–13, and 15–17 are unpatentable under 35 U.S.C. § 103(a) over Kellermann 2001 alone and claims 7, 14, and 18–20 are unpatentable over the combined teachings of Kellermann 2001 and Chen. Pet. 26–49. We begin our analysis with brief overviews of Kellermann 2001 and Chen. We then address the parties’ respective contentions with respect to the challenged claims in this asserted ground.

1. Overview of Kellermann 2001

Kellermann 2001 is a book by Michael Brandstein and Darren Ward, bearing a copyright date of 2001, entitled “Microphone Arrays.” Ex. 1014, 1–4. Shure’s expert, Dr. Kellermann, authored Chapter 13 of Kellermann 2001. *Id.* at 288; Ex. 1003 ¶ 47.

Chapter 13 of Kellermann 2001 is entitled “Acoustic Echo Cancellation for Beamforming Microphone Arrays.” Ex. 1014, 288. Kellermann 2001 discloses two types of beamforming. First, there is “time-invariant beamforming,” which is described as “mostly signal-independent.” *Id.* at 297. Kellermann 2001 discloses that “fixed beams” may be formed based on time-invariant beamforming. *Id.* at 307. Second, there is “[t]ime-varying beamforming,” which tracks “the time-variance of the signal characteristics and the spatial arrangement of the interfering sources” and uses “adaptive beamforming methods.” *Id.* at 298. “[A]daptive beamforming can be used to identify fixed beamformers for typical interference scenarios.” *Id.* at 307.

Figure 13.8 of Kellermann 2001 is reproduced below:

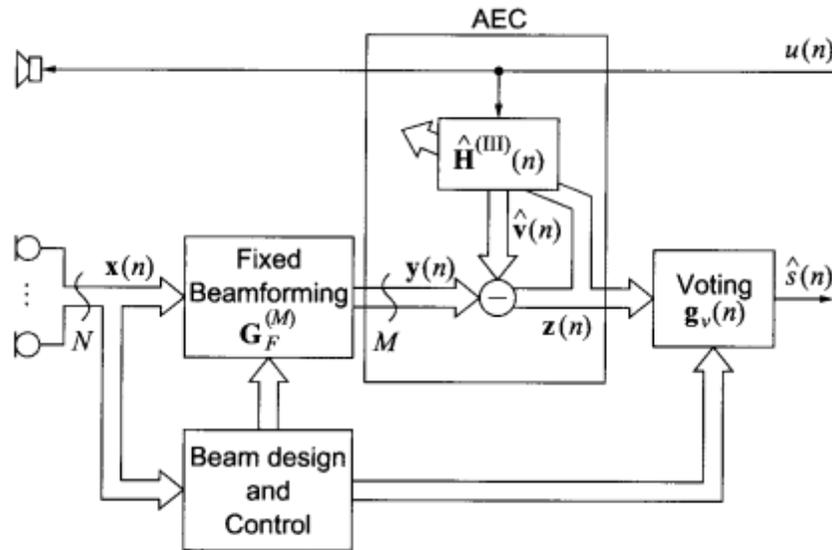


Fig. 13.8. AEC integrated into cascaded beamforming.

Figure 13.8 of Kellermann 2001 discloses a microphone array with N microphones, which sense acoustic waves and develop corresponding microphone signals. Ex. 1014, 306; Ex. 1003 ¶ 69. A signal from each of the N microphones is transmitted to the block labelled “Fixed Beamforming $G_F^{(M)}$.” Ex. 1014, 306; Ex. 1003 ¶ 49. In this block, the N signals $x(n)$ are combined and M combined signals are transmitted as $y(n)$ signals. *Id.* Each of the M combined signals $y(n)$ undergoes AEC or acoustic echo cancellation. *Id.* The resulting acoustic echo cancelled signals $z(n)$ are then transmitted to a voting process $g_v(n)$ where a signal $\hat{s}(n)$ is selected. *Id.* Kellermann 2001 also describes “the beamformer is decomposed into a time-invariant part and a time-varying part in the sequel, with AEC acting only on the output of the time-invariant part.” *Id.* at 304. Kellermann 2001 also discloses that the determination of “optimum beamformers for deciding

upon $G_F^{(M)}$ can be carried out during an initial training phase only, or continuously.” *Id.* at 307.

2. Overview of Chen

Chen is a United States Patent Application Publication entitled “Stabilizing Directional Audio Input from a Moving Microphone Array” and published on May 27, 2010. Ex. 1016, [54]. Chen discloses a microphone array that may be used to perform beamforming. *Id.* at Abstract. Chen discloses using an orientation sensor 22 that provides an orientation signal “for adjusting the aim of the audio beamforming to maintain the selected direction of the beamforming.” *Id.* ¶ 16, Figs. 1A, 1B.

3. Claims 1–6, 8–13, and 15–17

Shure contends that Kellermann 2001 expressly or inherently discloses all the limitations of claims 1–6, 8–13, and 15–17. Pet. 26. Despite the contention that Kellermann 2001 discloses all claim limitations, Shure challenges the claims on obviousness grounds rather than anticipation grounds. *Id.* In support of its contentions, Shure directs us to section 13.5 of Kellermann 2001 and in particular to Figure 13.8. *Id.* at 28.

The primary thrust of ClearOne’s contentions is that Kellermann 2001 does not unambiguously disclose a beamformer generating “fixed beams” as required by independent claims 1, 8, and 15. PO Resp. 14–33. Shure supports its contention that Kellermann 2001 discloses fixed beams by directing our attention to the Fixed Beamforming block in Figure 13.8 of Kellermann 2001 and Dr. Kellermann’s Declaration at paragraphs 73 and 75–76. Pet. 28–29 (citing Ex. 1014, 304, 307; Ex. 1003 ¶¶ 73, 75–76).

In the Reply, Shure attempts to provide further evidentiary support for the contention that Kellermann 2001 discloses “fixed beams” by relying on the Declaration of Dr. Leblanc. Pet. Reply 4–9 (citing Ex. 1021 *passim*). Dr. Leblanc’s opinion that Kellermann 2001 discloses “fixed beams” is from the perspective of one of ordinary skill in the art as he defines it. *See e.g.*, Ex. 1021 ¶ 59. Because, as discussed above, Dr. Leblanc opines that the level of ordinary skill in the art is significantly different than the level of ordinary skill in the art we found to be appropriate for this case, we give Dr. Leblanc’s declaration testimony little or no weight on the issue of whether one of ordinary skill in the art would have understood that Kellermann 2001 discloses “fixed beams.” *See Yorkey v Diab*, 601 F.3d 1279, 1284 (2010) (Board has discretion to assign weight to be accorded expert testimony.). Shure’s arguments in the Reply are based almost entirely on Dr. Leblanc’s declaration and consequently amount to essentially unsupported attorney argument. *See* Pet Reply 4–9.

Dr. Kellermann offers the following opinion regarding whether Kellermann 2001 discloses fixed beams:

77. Section 13.3 discusses beamforming and shows that the N microphone signals are processed to form different beams, which can be fixed or dynamic depending on the application. As Brandstein discloses, fixed beams (*i.e.*, time-invariant beamforming) would be particularly suitable when knowledge about long-term statistics of the noise field can be accounted for. In my opinion, teleconferencing applications within known or expected speaker positions would be suitable for fixed beam use. Therefore, one skilled in the art would be motivated to select fixed beams for use in teleconferencing applications.

Ex. 1003 ¶ 77.

In his deposition, Dr. Kellermann testified that “there is a clear definition of ‘fixed beams,’ which means that *it’s fixed in time, for a certain time interval*. So the characteristics of this beamforming technique are *kept time-invariant for a certain period of time*.” Ex. 2022, 28:17–21 (emphasis added). Dr. Kellermann also testified that “adaptive beamforming” is used “for learning the fixed beams.” *Id.* at 84:2–4. According to Dr. Kellermann, the reference to “initial training phase” in Kellermann 2001 means that adaptive beamforming is utilized to learn optimum beamformers in “a setup phase in a – in a conferencing environment.” *Id.* at 97:15–98:3. Dr. Kellermann also explains that “you can continuously learn optimum beamformers by adaptive beamformer—by adaptive beamforming. It does not imply that you continuously change the fixed beamforming. You just learn it continuously. And then the control unit may decide whether it uses it on – for the fixed beamforming stage or not.” *Id.* at 98:14–21.

ClearOne contends that one of ordinary skill in the art “would likely conclude that the word ‘Fixed’ in Figure 13.8 means over a much shorter time interval” because the “input audio signals $x(n)$ are functions of discrete time n .” PO Resp. 16–17 (citing Ex. 2013 ¶ 119–122). ClearOne further contends Dr. Kellermann’s deposition testimony confirms that Dr. Kellermann’s use of “fixed” is with reference to “a short observation interval” but that the beams may be “time-varying over a longer observation interval.” *Id.* at 26–27 (citing Ex. 2020, 66:17–67:7). In order to resolve the question of whether Kellermann 2001 discloses “fixed beams,” we turn to the description of Figure 13.8 provided in the text of Kellermann 2001. *See*

Ex. 1021 ¶ 87 (“Block diagrams do not necessarily stand on their own, it is important to read the accompanying text.”).

Figure 13.8 of Kellermann 2001 contains a block labeled “Fixed Beamforming.” Ex. 1014, 306. The text following Figure 13.8 starts with a paragraph titled “Fixed beamformer design.” *Id.* This paragraph provides that, “[f]or the actual design of $G_{F,\mu}$, techniques based on *both time-invariant or time varying beamforming* can be applied. *Updating* may be attractive to allow for long-term flexibility.” *Id.* at 306–307 (emphasis added). We infer from the reference to “updating” in this paragraph that time varying beamforming may occur based on the input to the “Fixed Beamforming” block from the “Beam design and control” block in Figure 13.8. This inference is supported by Dr. Kellermann’s testimony that “you can continuously learn optimum beamformers And then the control unit may decide whether it uses it on – for the fixed beamforming stage or not.” Ex. 2022, 98:14–21.

The next paragraph is titled “ $G_F^{(M)}$ based on time-invariant beamforming.” Ex. 1014, 307. This paragraph uses the term “fixed beams” and describes that “[t]he output of these M_0 beamformers is monitored and a subset of M beamformers is used for $G_F^{(M)}(n)$ to produce potentially desired signals $y(n)$.” *Id.* The signals $y(n)$ are the output of the Fixed Beamforming block in Figure 13.8. *See id.* at 306. As a practical matter, the beamformers must be operating in order to monitor the output of the M_0 beamformers and thus, selection of a subset of M beamformers is dependent on time as noted by the parenthetical (n) in $G_F^{(M)}(n)$ in this paragraph. *Id.* at 307. In addition,

this paragraph discloses selecting “ $M=3$ beams” based on “three local participants being present,” indicating that the selection is made after a conference begins. *Id.* This disclosure contradicts the earlier statement in Kellermann 2001 that “the beamformer is decomposed into a time-invariant part and a time-varying part in the sequel, with AEC acting only on the output of the time-invariant part” because there is at least some time dependency in the beamformer output due to selection of a subset of M beamformers after the conference begins. *See id.* at 304.¹⁰ The selection referred to in this paragraph is separate from the “voting” block, which occurs after the acoustic echo cancellation block. *See id.* at 307–308 (“**Voting**”).

The next paragraph is titled “ $G_F^{(M)}$ based on adaptive beamforming.” *Id.* at 307. This paragraph describes using “[s]ignal-dependent adaptive beamforming . . . to identify fixed beamformers for typical interference scenarios. To this end, an adaptive beamformer operates at a normal adaptation rate with its filter coefficients acting as a training sequence for finding M representative fixed beamformers.” *Id.*

The next paragraph is titled “*Initializing and updating $G_F^{(M)}$.*” *Id.* This paragraph is also directed to using adaptive beamforming to learn

¹⁰ As Shure noted (Pet. Reply 5), we relied on this statement from Kellermann 2001 in our Institution Decision for our preliminary finding that the AEC in Kellermann 2001 acts only the fixed beamforming signal. *See* DI 13. Based on the entire record developed during trial, we have reconsidered our original finding.

“optimum beamformers for deciding upon $G_F^{(M)}$. . . during an initial training phase only, or continuously.” *Id.* Further, “[g]enerally, as long as updating of $G_F^{(M)}$ occurs less frequently than significant changes in the acoustic path, the model of time-invariant beamforming is justified with respect to AEC behavior.” *Id.*

Shure’s burden is to establish by a preponderance of the evidence that Kellermann 2001 discloses “fixed beams” as we have construed that term. All of the paragraphs describing the Fixed Beamforming block and the Beam design and Control block in Figure 13.8 contain some reference to adaptive or time-variant beamforming. The paragraph titled “Fixed beamformer design” specifically contemplates the use of time varying beamforming and touts the attractiveness of “updating” filter coefficients. Ex. 1014 306–307. The next paragraph, “ $G_F^{(M)}$ based on time-invariant beamforming,” specifically uses the term “fixed beam” and contemplates at least some time dependence after a conference starts, in connection with monitoring and selecting a subset of M beamformers. *Id.* at 307. The succeeding paragraphs specifically disclose time-varying beamforming and using time-varying beamforming for “*Initializing and updating $G_F^{(M)}$.*” *Id.* Finally, we discern from the statement in Kellermann 2001 that “the model of time-invariant beamforming is justified” (*id.*) if the updating “occurs less frequently than significant changes in the acoustic path” that the beams are not “fixed” but may appear to be fixed if the updating occurs after a relatively long time interval. *See also* Ex. 2022, 28:17–21 (“[T]he

characteristics of this beamforming technique are *kept time-invariant for a certain period of time.*") (emphasis added).

Shure argues, based on the two paragraphs discussing time varying beamforming, that “Kellermann-2001 discloses a system able to monitor and update the beamforming coefficients during use. But it also discloses a system that initializes the beam coefficients and then leaves them fixed.” Pet. Reply 9. Leaving the beam coefficients fixed produces “fixed beams.” Shure does not direct us to a specific disclosure in Kellermann 2001 in support of the argument that Kellermann 2001 discloses leaving the beam coefficients fixed after initializing. Rather, Shure bases this argument on the opinion of Dr. Leblanc that a person of ordinary skill in the art “would recognize this, and would recognize the latter system is most appropriate in a typical teleconference scenario.” *Id.* (citing Ex. 1021 ¶¶ 63–64, 69–74, 77, 135; Ex. 2023, 1255–127:9). Likewise, Dr. Kellermann’s declaration states that “one skilled in the art would be motivated to select fixed beams for use in teleconferencing applications.” Ex. 1003 ¶ 77. However, regardless of whether one of ordinary skill in the art would have been motivated to select “fixed beams” for teleconferencing or “would recognize the latter system is most appropriate in a typical teleconference scenario,” as Dr. Kellermann and Dr. Leblanc assert, Shure’s burden is to establish by a preponderance of the evidence that Kellermann 2001 discloses the use of fixed beams. *See* 35 U.S.C. § 311(b). Expert testimony cannot substitute for disclosure of “fixed beams” in the prior art references relied upon by Shure. *See* PTAB Trial Practice Guide Update, 4–5 (Aug. 2018).

Although it is possible that the “training phase” referred to in Kellermann 2001 could occur prior to a conference, Shure’s counsel admitted during oral argument that Kellermann 2001 “does not explicitly say when a training phase occurs.” Tr., 23:21–22. Even if we were to assume that the training phase occurs prior to the start of a conference, there is no disclosure in Kellermann 2001 that the system “initializes the beam coefficients” prior to a conference “and then leaves them fixed” during the conference as Shure asserts. See Pet. Reply 9. Dr. Kellermann’s testimony that beams remain fixed for the length of an observation interval undercuts Shure’s position that the beams remain fixed during the conference unless the observation interval is the entire length of the conference. However, we discern no support in Kellermann 2001 for the proposition that an observation interval for the determination of fixed beam coefficients is the length of a conference. Rather, Kellermann 2001 discloses *continuous* monitoring described in the paragraph of Kellermann 2001 titled “*Initializing and updating $G_F^{(M)}$.*” Dr. Kellermann testified that the control unit in the system disclosed in Kellermann 2001 decides whether to change the fixed beamformer coefficients based on the continuous monitoring. See Ex. 2022, 98:14–21. This testimony further undercuts Shure’s contention that the system described in Kellermann 2001 leaves the coefficients fixed after a conference begins because the control unit in Kellermann 2001, which corresponds to the processor recited in claim 8 (Pet. 40–41), can in fact change the beam coefficients according to Dr. Kellermann. See also

Tr., 23:2–5 (Beams are not fixed if they could change size or direction in the middle of a conference.).

For all of the foregoing reasons, we determine that Shure fails to establish by a preponderance of the evidence that Kellermann 2001 discloses “fixed beams” as required by claims 1, 8, and 15. Consequently, we determine that Shure fails to establish that claims 1–6, 8–13, and 15–17 are unpatentable over Kellermann 2001. With respect to claims 7, 14, and 18–20, Shure does not rely Chen for the disclosure of “fixed beams.” Pet. 26, 34–35, 43–44, 47–49. Therefore, Shure also fails to establish that claims 7, 14, and 18–20 are unpatentable over the combined teachings of Kellermann 2001 and Chen.

E. Obviousness over the Teachings of Ishibashi alone or Ishibashi in Combination with Reuss or Chen

1. Claims 1–6, 8–13, and 15–17

Shure contends that claims 1–6, 8–13, and 15–17 are unpatentable under 35 U.S.C. § 103(a) over Ishibashi alone or Ishibashi in combination with Reuss. *See* Pet. 49–58. We begin our analysis with brief overviews of Ishibashi and Reuss. We then address the parties’ respective contentions with respect to the challenged claims in this asserted ground.

2. Overview of Ishibashi

Ishibashi “relates to an audio conferencing apparatus for conducting an audio conference between plural points through a network.” Ex. 1015 ¶

1. Figure 3 of Ishibashi is reproduced below.

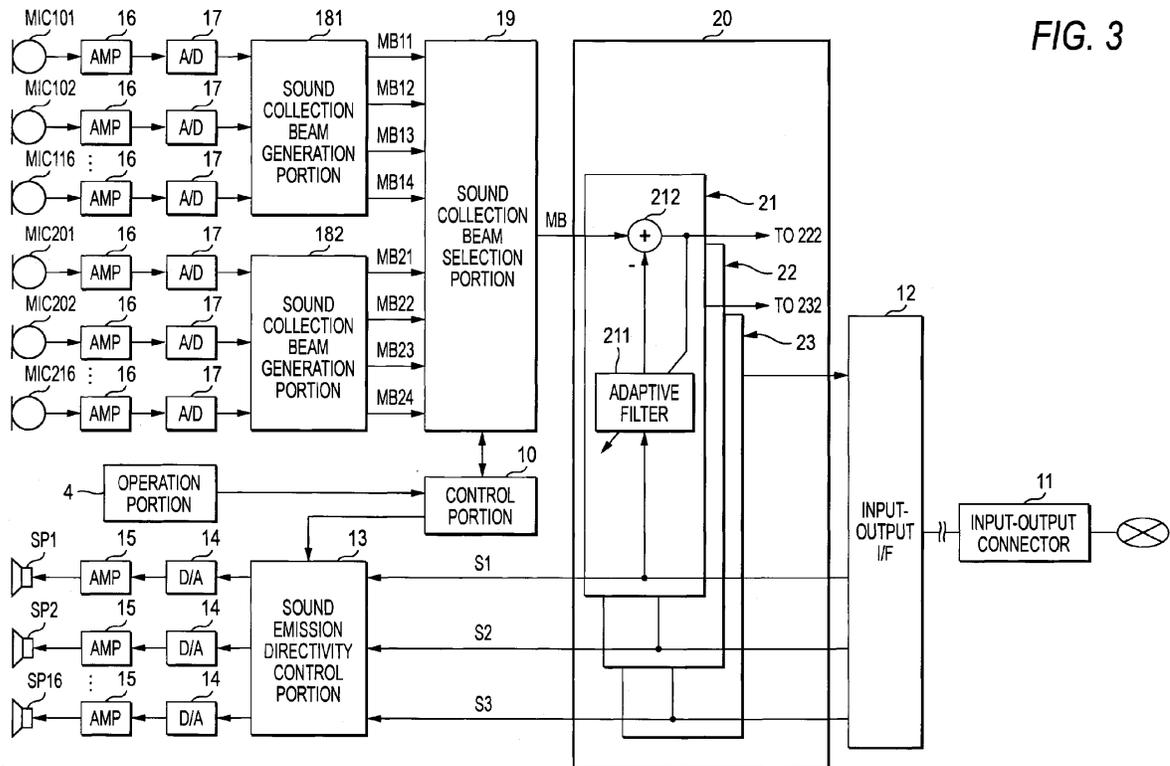


FIG. 3

Figure 3 discloses an array of 32 microphones MIC101–MIC116 and MIC201–MIC216. Ex. 1015, Fig. 3, ¶¶ 54–55. The microphone arrays transmit signals to “sound collection beam generation portions” 181 and 182, which perform “predetermined delay processing” on the signals. *Id.* ¶¶ 55, 57–58. The Sound Collection Beam Generation Portions combine the 32 signals from the microphones and produce 8 sound collection beam signals MB11–MB14 and MB21–MB24. *Id.* The 8 signals are transmitted to Sound Collection Beam Selection Portion 19. *Id.* ¶¶ 58–59. One signal, identified as MB in Figure 3, is selected for echo cancellation in an echo

cancellation portion 20. *Id.* ¶ 59. Ishibashi teaches three cases where the operation of the disclosed apparatus is different. First, there is “[t]he Case where the Number of Other Audio Conferencing Apparatuses Connected through a Network is One” meaning the “audio conference is conducted in a one-to-one correspondence between the audio conferencing apparatuses.” *Id.* ¶¶ 67–77. Second is “[t]he Case where the Number of Other Audio Conferencing Apparatuses Connected Through a Network is Plural.” *Id.* ¶¶ 78–82. Third, there is “[t]he Case of Simultaneously Conducting Plural Different Conferences.” *Id.* ¶¶ 83–87.

3. Overview of Reuss

Figure 1 of Reuss is reproduced below.

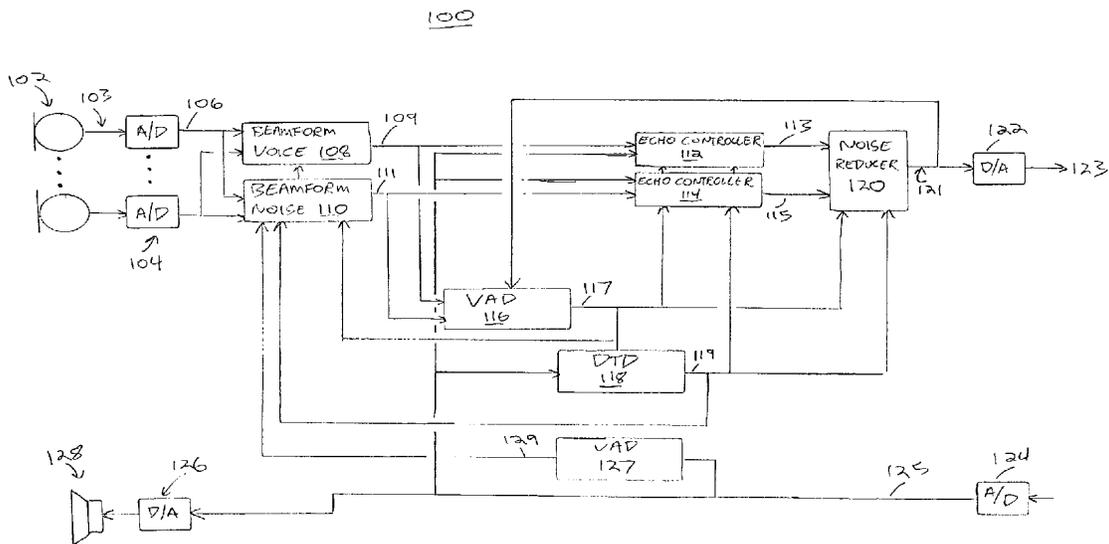


FIGURE 1.

Figure 1 of Reuss discloses a microphone array 102 with two or more microphones. Ex. 1017, 4:29–30. Each microphone in the array 102 is

coupled to an analog/digital converter 104, which outputs digitized signal 106 comprising a voice component and a noise component. *Id.* at 4:44–65. The voice and noise components of signals 106 are input to beam former 108 for the voice component and a second beam former 110 for the noise component. *Id.* at 5:18–27. Each of the beam formers 108 and 110 generates a signal that is transmitted to separate echo cancellers 112, 114 followed by a noise reducer 120, which transmits one output signal 121. *See id.* at Fig. 3.

4. Claim Construction

Shure requests that we construe the limitation in claim 1 of “performing an acoustic echo cancelation operation on the plurality of combined signals to generate a plurality of combined echo-canceled signals” to include performing AEC “on two or more beamformed signals delivered either simultaneously or sequentially.” Pet. 16–17. Shure does not direct our attention to any portion of the specification or the prosecution history of the ’553 Patent to support the construction. Rather, the basis for this construction is that “[t]he specification and file histories are silent as to whether the two or more beamformed signals are delivered to the echo canceller simultaneously or sequentially.” *Id.* at 17. ClearOne contends that the language “should be interpreted identically, according to its plain meaning.” PO Resp. 14. As explained below, it is not necessary for us to determine whether this claim limitation includes both sequential and simultaneous transmission of the beam formed signals in order to resolve this challenge because Ishibashi discloses neither sequential nor simultaneous transmission of “the plurality of signals” for echo cancellation.

5. *Claims 1–3, 6, 8–10, 13, and 15–17*

Claim 1 requires performing a sequence of steps starting with sensing acoustic waves with a plurality of microphones that develop a plurality of microphone signals, performing a beam forming operation to combine the plurality of microphone signals resulting in a plurality of combined signals corresponding to a different fixed beam, performing acoustic echo cancellation on the plurality of combined signals resulting from the beamforming operation, generating a plurality of combined echo cancelled signals, and then selecting one or more of the plurality of combined echo cancelled signals. Ex. 1001, 10:57–11:5. Independent claims 8 and 15 contain substantially the same limitations except claim 15 does not recite the selection of one or more of the echo cancelled signals. *Id.* at 11:30–46, 12:12–32.

Ishibashi discloses that one signal MB is transmitted to block 20 for echo cancellation, not a “plurality of combined signals” as required in claims 1, 8, and 15. Ex. 1015, Fig. 3; *see also* PO Resp. 43; Ex. 2013 ¶92. Shure does not dispute that Ishibashi discloses that only one signal MB, not a plurality of signals transmitted simultaneously, is transmitted for acoustic echo cancellation at block 20. Pet. 54 (“[E]liminates echo from *the signal* (MB) output from the sound collection beam selection portion.”) (emphasis added). In the Petition, Shure provides two alternative arguments in an attempt to cure this defect in Ishibashi’s disclosure. First, Shure argues, based on Ishibashi alone, that “Ishibashi explicitly discloses this limitation under the proposed [claim] construction when the multiple beamformed signals can be transmitted sequentially.” *Id.* at 55. Second, Shure argues

that Ishibashi in combination with Reuss “renders this limitation obvious.” *Id.* In the Reply, Shure presents a new argument under the guise of providing an alternate characterization of the first argument. Pet. Reply 13. Shure states that “[a]n alternate way of characterizing this concept of a sequentially delivered signal is that signal MB is a time-multiplexed signal, which is a plurality of signals.” *Id.* (citing Ex. 1021 ¶¶ 115–116). Shure does not, in the Petition, contend that Ishibashi’s signal MB corresponds to “the plurality of signals” recited in claims 1, 8, and 15. *See* Pet. 49–72. We analyze each argument separately.

i. Ishibashi Alone

Shure’s analysis of why claim 1 is unpatentable over Ishibashi begins with the assertion that Ishibashi discloses a plurality of microphones MIC101 to MIC 116 and MIC201 to MIC 216 (Pet. 50–51) “located along each of two longitudinal side surfaces of the housing of the teleconferencing apparatus of Ishibashi.” Ex. 1003 ¶ 161. In support of the first argument that Ishibashi discloses a plurality of *sequentially* transmitted beamformed signals, Shure directs us to paragraph 171 of Dr. Kellermann’s Declaration. Pet. 54. Dr. Kellermann, relying on paragraph 59 of Ishibashi, states that

under certain circumstances multiple sound collection beam signals are sequentially selected and each of the respective sound collection beam signals are output to the echo cancellation portion 20 as individual particular sound collection beam signals Accordingly, Ishibashi discloses more than one sound collection beam being transmitted to the echo cancellation portion.

Ex. 1003 ¶ 171.

ClearOne argues that

[e]ven in the case of sequentially selecting plural combined signals, the processing is done one at time, and nothing in Ishibashi discloses a circumstance in which all eight of the combined signals would be sequentially echo cancelled. Indeed, nothing in Ishibashi supports the petition's contention "that each of the respective sound collection beam signals are output to the echo cancellation portion 20 as individual particular sound collection beam signals MB."

Prelim. Resp. 38 (citing Pet. 54); PO Resp. 44(citing Ex. 2013 ¶ 92).

Paragraph 59 of Ishibashi provides, in part,

For example, when only a sound from one talker is sent to another audio conferencing apparatus, the sound collection beam selection portion 19 selects a sound collection beam signal with the highest signal intensity and outputs the beam signal to the echo cancellation portion 20 as a particular sound collection beam signal MB. When plural sound collection beam signals are required in the case of conducting plural audio conferences in parallel, sound collection beam signals according to its situation are sequentially selected and the respective sound collection beam signals are output to the echo cancellation portion 20 as individual particular sound collection beam signals MB.

Ex. 1015 ¶ 59.

The first sentence quoted from paragraph 59 refers to the first case of operation of Ishibashi, discussed above, with a one-to-one correspondence between the audio conferencing apparatuses. *See. id.* ¶ 67. The reference in paragraph 59 to "sequentially selected" signals refers to conducting conferences using plural audio conferencing apparatuses in parallel and is an apparent reference to the second and/or third cases of operation of Ishibashi. *See id.* ¶¶ 78, 83. Paragraph 59, thus, refers to sequential selection only in connection with plural audio conference apparatuses in parallel not a

conference with a one-to-one correspondence of audio conference apparatuses.

Dr. Kellermann's analysis begins with the microphone arrays shown in Figure 2A and Figure 2C of Ishibashi that generate signals to be combined in the beamformer at block 19 in Figure 3 of Ishibashi and then generate fixed beams MB11 to MB14 and MB21 to MB24. Ex. 1003 ¶¶ 166–167. Dr. Kellermann's testimony is that these microphone arrays are located on “the housing of *the* teleconferencing apparatus of Ishibashi.” *Id.* ¶ 161 (emphasis added). Next, Dr. Kellermann asserts that Ishibashi's single signal, MB, from the signal selection block 19 corresponds to “*the* plurality of combined signals” from the beamformer recited in claims 1, 8, and 15 because of the sequential processing of signals in plural audio conferences based on paragraph 59 of Ishibashi. *Id.* ¶¶ 169–171. Paragraphs 78 and 83 of Ishibashi both disclose that plural audio conferences require plural audio conference apparatuses. Ex. 1015 ¶¶ 78, 83. Dr. Kellermann does not persuasively explain why the reference in paragraph 59 to sequential selection applies to a case where only one conference apparatus is used. Further, he does not persuasively explain, and we do not discern from Ishibashi, how the microphone signals from each of the plural parallel conferencing apparatuses are processed prior to being sequentially selected and how those signals result in “the plurality of signals” for echo cancellation. If the plural conferences are conducted in parallel, the signals that are sequentially selected for echo cancellation from different conference apparatuses do not result from the same microphone signals but from different microphone signals in each of the plural conferencing apparatuses.

Shure, thus, fails to establish by a preponderance of the evidence that the sequential processing of signals from plural audio conference apparatuses results from a plurality of microphone signals collected from the same plurality of microphones, as required by claims 1, 8, and 15. Given that Dr. Kellermann’s testimony (Ex. 1003 ¶¶ 160–171) is conclusory and not supported by objective evidence, his testimony is given little or no weight. *See Velandier v. Garner*, 348 F.3d 1359, 1371 (Fed. Cir. 2003) (“[W]hat the [PTAB] consistently did was accord little weight to broad conclusory statements that it determined were unsupported by corroborating references. It is within the discretion of the trier of fact to give each item of evidence such weight as it feels appropriate.” (citation omitted)); *see also In re Am. Acad. of Sci. Tech Ctr.*, 367 F.3d 1359, 1368 (Fed. Cir. 2004) (“[T]he [PTAB] is entitled to weigh the declarations and conclude that the lack of factual corroboration warrants discounting the opinions expressed in the declarations” (citations omitted)). Therefore, even if we were to adopt Shure’s claim construction that acoustic echo cancellation is performed on two or more beamformed signals delivered either simultaneously or sequentially, Shure has not established by a preponderance of the evidence that Ishibashi discloses performing echo cancellation on the plurality of combined signals delivered either sequentially or simultaneously.

Shure’s new argument in the Reply is based on the opinion of Dr. Leblanc that the single “signal MB can be a plurality of beamformed signals because it is a time-multiplexed signal. A time-multiplexed signal simply designates that the signal(s) can be delivered sequentially to the AEC portion 20.” Ex. 1021 ¶ 115. ClearOne contends that “block 19 [in Ishibashi Fig. 3]

is not a time-multiplexed collection of each of MB11, . . . , MB24 . . . At best, it is only a possibility that the signal MB might correspond to each of MB11, . . . , MB24 at different times, but that is not necessarily true so as to support a finding of inherent disclosure, had the petition made such a claim.” PO Sur-Reply 17–18. ClearOne also argues that Dr. Kellermann acknowledged in his deposition “the possibility that not all of the eight signals MB11, . . . , MB24 may be echo cancelled.” *Id.* at 18 (citing Ex. 2002, 44:19–45:1).

We are not persuaded by Shure’s new reply argument, for the following reasons. First, there was no argument or evidence presented in the Petition or in Dr. Kellermann’s Declaration (Ex. 1003) that signal MB is a time-multiplexed signal and by itself corresponds to the limitation of “the plurality of signals.” In fact, Shure’s argument for sequential selection of signals from plural audio conference apparatuses in the Petition implicitly concedes that the signal MB does not correspond to “the plurality of signals” recited in claims 1, 8, and 15. Second, Shure does not contend that its new reply argument responds to arguments raised in the Patent Owner response. *See* 37 C.F.R. § 42.23(b). Third, Dr. Leblanc offers this alternate argument and, as discussed above, due to his definition of one of ordinary skill in the art, we give his opinion little weight. Fourth, Shure does not direct our attention to disclosure in Ishibashi sufficient to support a finding, apart from Dr. Leblanc’s testimony, that signal MB can be a “plurality of beamformed signals” because it is “a time-multiplexed signal.” Consequently, we determine that the argument is not proper in a Reply under 37 C.F.R. § 42.23(b) and even if the argument had been made in the Petition, it is not

supported by the disclosure in Ishibashi or other evidence of sufficient weight.

ii. Ishibashi and Reuss

In support of its argument based on Ishibashi and Reuss, Shure directs us to paragraph 173 of Dr. Kellermann’s Declaration. Pet. 55–56. As explained above, Reuss discloses separation of the microphone signals into voice and noise components, separately beamforming the noise and voice signals in parallel, and transmitting the beamformed noise and voice signals in parallel to separate echo cancellers. Dr. Kellermann interprets Reuss’s parallel processing of voice and noise components as “the transmission of multiple beamformed signals to the echo cancellation units and multiple beamformed echo cancelled signals delivered to the noise reducer.” Ex. 1003 ¶ 173. Dr. Kellermann submits that it would have been obvious to combine Ishibashi and Reuss “to arrive at this limitation . . . because both references disclose performing beamforming operations and echo cancellation operations on microphone signals for optimization in telecommunications.” *Id.*; *see also* Pet. 56.

ClearOne argues that the Petition does not specify how the systems of Reuss and Ishibashi would have been combined. PO Resp. 46. ClearOne contends that the Petition “fails to specify how these disparate systems would have been combined.” *Id.* ClearOne further contends that it is not “clear how parallel paths would fit within the teachings of Ishibashi whose design is fundamentally based on a selection of one combined signal for echo cancellation.” *Id.* (citing Ex. 2013 ¶ 93). ClearOne further contends that Shure fails to explain “how the teachings of Reuss could be applied to

Ishibashi, what that combined system would look like.” *Id.* In Reply, Shure’s only contention is “that there is no need to physically incorporate Ishibashi and Reuss. Reuss merely teaches a POSITA that multiple beamformed signals can be delivered simultaneously to AEC’s.” Pet. Reply 14 (citing Ex. 1021 ¶¶ 123–126).

We acknowledge Shure’s argument that there is no requirement for bodily incorporation of Reuss’s device into Ishibashi’s device. *See In re Keller*, 642 F.2d 413, 415 (CCPA 1981) (“The test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference. . . . Rather, the test is what the combined teachings of those references would have suggested to those of ordinary skill in the art.”). We cannot, however, make a determination of unpatentability “where the record lacks ‘explanation as to *how or why* the references would be combined to produce the claimed invention.’” *Trivascular*, 812 F.3d at 1066 (emphasis added). For the following reasons, we determine that Shure fails to provide a sufficient evidence or explanation of how or why it contends Ishibashi would be modified by the teachings of Reuss in a manner that satisfies the claim limitation.

Claims 1, 8, and 15 require that the plurality of signals result from “a beamforming operation.” In Reuss, the “multiple beamformed signals” that Shure and Dr. Kellermann refer to (Reply 14; Ex. 1003 ¶ 173) result from beamforming operations in separate beamformers 108 and 110 performed on voice and noise signals respectively. Ex. 1017, Fig. 1. Neither Shure nor Dr. Kellermann persuasively explains why Reuss’s teaching of separate beamformers for voice and noise signals would have led one of ordinary

skill in the art to modify Ishibashi's teaching of selecting one of 8 signals for echo cancellation so that "the plurality of signals" (MB11–MB14, MB21–MB24) are transmitted for acoustic echo cancellation. Nor does Shure persuasively explain how Ishibashi and Reuss would have been combined to produce the claimed invention. Obviousness cannot be established "by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." *KSR*, 550 U.S. at 418 (quotations and citation omitted). Therefore, in the absence of an adequate explanation by Shure as to how it contends one of ordinary skill in the art would have combined the teachings of Ishibashi and Reuss to satisfy the claim limitation, we determine that Shure has not established that independent claim 1 is unpatentable over Ishibashi alone or in combination with Reuss because it has not established that the limitation "performing an acoustic echo cancelation operation on *the plurality of combined signals* to generate a plurality of combined echo-canceled signals" is disclosed by Ishibashi or suggested by the combined teachings of Ishibashi and Reuss.

Independent claims 8 and 15 contain substantially the same claim limitation just discussed. Ex. 1001, 11:30–46, 12:12–32. Shure relies on the same arguments to establish this limitation in claims 8 and 15. Pet. 65, 70. We, therefore, likewise determine that Shure has not established that independent claims 8 and 15 are unpatentable over Ishibashi alone or in combination with Reuss. We have also reviewed Shure's explanations for the alleged unpatentability of dependent claims 2–6, 8–13, and 15–17 based on Ishibashi alone or in combination with Reuss and because none of the

additional citations to Ishibashi and/or Reuss cure the defects in the challenge to independent claims 1, 8, and 15 stated above, we determine that Shure has not established that claims 2–6, 8–13, and 15–17 are unpatentable.

6. Dependent Claims, 7, 14, and 18–20

We have reviewed Shure’s explanations for the alleged unpatentability of dependent claims 7, 14, and 18–20. Because none of the additional citations to Ishibashi or Chen cure the defects in the challenge to independent claims 1, 8, and 15 stated above, we determine that Shure has not established that dependent claims 7, 14, and 18–20 are unpatentable.

7. Conclusion

In view of the foregoing, we determine that Shure has not demonstrated by a preponderance of the evidence that claims 1–20 of the ’553 Patent are unpatentable over Kellermann 2001 alone, Kellermann 2001 in combination with Chen, Ishibashi alone and/or in combination with Reuss and/or Chen.

II. Petitioner’s Motion to Exclude (Paper 68)

Shure filed a Motion to Exclude Exhibits 2058–2069, 2072–2075, and 2077–2091. Paper 68. ClearOne opposes the motion. Paper 80.

Shure first moves to exclude Exhibits 2058–2069 and 2077–2090 under Federal Rules of Evidence 402 and 403. Paper 68, 1–2. Shure characterizes these exhibits as “reports from Frost & Sullivan relating to what it characterizes as ‘the installed audio conferencing market.’” *Id.* at 1. Shure notes that ClearOne submits these exhibits “in support of its secondary considerations argument.” *Id.* at 2 (citing PO Resp. 57–58). We

do not reach the question of secondary considerations of nonobviousness because of our disposition of Shure's patentability challenges discussed above, and do not rely on any of these exhibits in this Decision. Shure's motion to exclude Exhibits 2058–2069 and 2077–2090 is, thus, *dismissed* as moot.

Shure next moves to exclude Exhibits 2072 and 2073 under Federal Rules of Evidence 402 and 403. *Id.* at 2. Exhibit 2072 is U.S. Design Patent No. D784,299 and Exhibit 2073 is U.S. Patent 9,565,493 both of which are assigned to Shure Acquisition Holdings, Inc. *Id.* Shure notes that “ClearOne relies on these exhibits on page 65 of its Response to ‘infer’ ‘Shure’s copying’ of the claimed technology.” *Id.* at 3. We do not reach the question of copying by Shure because of our disposition of Shure's patentability challenges discussed above and do not rely on this exhibit in this Decision. Shure's motion to exclude Exhibits 2072 and 2073 is, thus, *dismissed* as moot.

Shure next moves to exclude Exhibits 2074 and 2075 under Federal Rules of Evidence 106 and 801. *Id.* at 3. These exhibits are “claim charts comparing the claim language of claim 7 of the '186 Patent (Ex. 1018) with the alleged product features of ClearOne's BMA and Shure's MXA910.” *Id.* ClearOne relies on Exhibits 2074 and 2075 to establish nexus in connection with its contentions concerning the secondary consideration of commercial success. *See id.* (citing PO Resp. 59, 63). We do not reach the question of commercial success because of our disposition of Shure's patentability challenges discussed above and do not rely on these exhibits in this

Decision. Shure's motion to exclude Exhibits 2074 and 2075 is, thus, *dismissed* as moot.

Shure next moves to exclude Exhibit 2091 under Federal Rules of Evidence 402 and 403. *Id.* at 4. Exhibit 2091 is "an internet printout of an article posted January 6, 2008 on ProSound Web." *Id.* ClearOne submits this exhibit "to support its showing of long-felt need." Paper 80, 6. We do not reach the question of long felt need because of our disposition of Shure's patentability challenges discussed above and do not rely on this exhibit in this Decision. Shure's motion to exclude Exhibit 2091 is, thus, *dismissed* as moot.

III. Patent Owner's Motion to Exclude Evidence (Paper 70)

ClearOne moves to exclude Exhibits 1023 and 1126. Paper 70, i. Shure opposes the motion. Paper 79.

ClearOne moves to exclude Exhibit 1023, a declaration of Dr. William Oxford, under Federal Rules of Evidence 702 and 703. Paper 70, 1–6. Shure relies on Dr. Oxford's declaration to rebut ClearOne's contention that the invention claimed in the '553 Patent satisfies a long felt need. *See* Pet. Reply 24. We do not reach the question of long felt need because of our disposition of Shure's patentability challenges discussed above and do not rely on this exhibit in this Decision. ClearOne's motion to exclude Exhibit 1023 is, thus, *dismissed* as moot.

ClearOne moves to exclude Exhibit 1126, a copy of a LinkedIn Discussion group, under Federal Rules of Evidence 901 and 802. Paper 70, 6–7. Shure relies on Exhibit 1126 to support its assertion that any alleged

commercial success of ClearOne’s claimed invention is due “to features wholly unrelated to the challenged claims.” *See* Pet. Reply 17. We do not reach the question of commercial success because of our disposition of Shure’s patentability challenges discussed above and do not rely on this exhibit in this Decision. ClearOne’s motion to exclude Exhibit 1126 is, thus, *dismissed* as moot.

IV. Patent Owner’s Request for Rehearing of Decision Denying Motion to Strike Leblanc Declaration (Paper 82)

ClearOne requests rehearing of our Order (Paper 65 (“Decision”)) denying Patent Owner’s Motion to Strike the Declaration of Wilfred Leblanc. Paper 82 (“Req.”). A request for rehearing “must specifically identify all matters the party believes the Board misapprehended or overlooked, and the place where each matter was previously addressed in a motion, an opposition, or a reply.” 37 C.F.R. § 42.71(d).

ClearOne first contends that there is no appreciable difference between the definitions of one of ordinary skill in the art provided by Dr. Kellermann and Dr. Loy. Req. 2–4. The only matter specifically identified by ClearOne in this contention is “the Board’s decision misapprehended the record when it found (erroneously) that “[t]he present record reflects that Dr. Kellermann and Dr. Loy, apart from Dr. Leblanc, have offered different opinions of the definition of a person of ordinary skill in the art.” *Id.* at 4 (citing Paper 65, 5–6). In the Decision, the Board specifically quoted the different levels of skill in the art set forth by Dr. Kellermann and Dr. Loy. *See* Paper 65, 3. Consequently, this contention is not persuasive because, as noted in the Decision, Dr. Kellermann and Dr. Loy do, in fact, offer

differing levels of skill in the art and the Board did not misapprehend the record. *Id.*

ClearOne next contends that Dr. Leblanc’s definition of one of ordinary skill in the art is “considerably higher than – the Kellermann/Loy level.” Req. 4. ClearOne contends that the Board was “misled by the petitioner’s incorrect characterization of Dr. Loy’s testimony, [and] misapprehended the record in this regard.” *Id.* at 7. This contention is not persuasive because the Board did not misapprehend the record and specifically found that “Patent Owner is correct that the level of ordinary skill in the art according to Dr. Leblanc is ‘higher’ than the level of ordinary skill in the art according to Dr. Kellermann.” Paper 65, 6.

ClearOne also contends that the Board must determine the appropriate level of skill in the art without reliance on Kellermann 2001. Req. 8–9. This contention is not persuasive because the Board did not make a determination of the level of ordinary skill in the art in the Decision and there is, thus, no issue for which rehearing could be granted. *See* Paper 65, 6 (Determination of level of ordinary skill in the art “will be made in connection with the Final Written Decision.”).

ClearOne next contends that the Board overlooked its “New-Direction, New-Approach Argument.” Req. 10. ClearOne contends that, because the Decision, *inter alia*, noted that Dr. Leblanc “offers opinions in rebuttal to issues raised in the Patent Owner response,” the Board applied the wrong standard to the motion to strike. *Id.* ClearOne contends that the Board should have decided whether the Declaration embarks “in a new direction with a new approach as compared to positions taken in a prior

filing” to determine if the reply is “legitimate.” *Id.* This contention is not persuasive for the following reasons. First, the Decision specifically acknowledged ClearOne’s argument. *See* Dec. 7 (“Patent Owner essentially argues that the rebuttal evidence offered by Petitioner is not ‘legitimate’ because it is based on a ‘new lens analysis’ of the patentability challenges.”). Second, the Decision specifically noted that ClearOne has not addressed why the portions of Dr. Leblanc’s declaration where he “offered facts to rebut Patent Owner’s secondary consideration contentions . . . are not ‘legitimate reply to’ Patent Owner’s evidence regardless of Dr. Leblanc’s definition of a person of ordinary skill in the art.” *Id.* ClearOne requested that we strike the entirety of Dr. Leblanc’s declaration, not merely the parts based on his definition of the level of ordinary skill in the art, and thus, we denied the motion to strike rather than sort proper from improper portions of the reply when ClearOne chose not to do so in its motion. *Id.* at 8 (citing PTAB Trial Practice Guide Update at 15); *see also Intelligent Bio-Systems, Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1369 (Fed. Cir. 2016) (“[N]either this court nor the Board must parse the reply brief to determine which, if any, parts of that brief are responsive and which are improper.”).

ClearOne also contends that the Board overlooked its judicial estoppel argument. Req. 11. The only authority cited in ClearOne’s motion to strike in support of applying judicial estoppel is *Intelligent Bio-Systems*, 821 F.3d at 1369. Paper 63, 4. Our review of the cited portion of *Intelligent Bio-Systems* reveals that judicial estoppel is not discussed by the Federal Circuit in that case. We note that “[t]he doctrine of judicial estoppel is that where a party successfully urges a particular position in a legal proceeding, it is

estopped from taking a contrary position *in a subsequent proceeding* where its interests have changed.” *Data Gen. Corp. v. Johnson*, 78 F.3d 1556, 1565 (Fed. Cir. 1996) (emphasis added) (citations omitted). Because Shure submits Dr. Leblanc’s declaration in the same proceeding in which the Petition was filed, not a subsequent proceeding, judicial estoppel does not apply here.

ClearOne next contends that the only appropriate remedy is to strike Dr. Leblanc’s declaration. Req. 11–13. ClearOne does not specifically identify any matters that the Board misapprehended or overlooked but rather, just reargues the motion. *Id.* This contention is, thus, not persuasive for the foregoing reason.

ClearOne finally contends that no excuse justifies admitting Dr. Leblanc’s declaration. Req. 14. ClearOne does not specifically identify any matters that the Board misapprehended or overlooked but rather, just reargues the motion. *Id.* This contention is, thus, not persuasive for the foregoing reason.

For all the foregoing reasons, we *deny* ClearOne’s motion for rehearing and do not modify our prior order.

V. ORDER

For the foregoing reasons, it is hereby:

ORDERED that Shure has not established that claims 1–20 of the ’553 Patent are unpatentable;

FURTHER ORDERED that Shure's Motion to Exclude Exhibits 2058–2069, 2072–2075, and 2077–2091 (Paper 68) is *dismissed as moot*;

FURTHER ORDERED that ClearOne's Motion to Exclude (Paper 70) is *dismissed as moot*;

FURTHER ORDERED that ClearOne's Request for Rehearing of Decision Denying Motion to Strike the Leblanc Declaration (Paper 82) is *denied*;

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

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