

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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META PLATFORMS, INC.,  
Petitioner,

v.

JAWBONE INNOVATIONS, LLC,  
Patent Owner.

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IPR2024-00350  
Patent 10,779,080 B2

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Before GEORGIANNA W. BRADEN, SHEILA F. McSHANE, and  
JASON M. REPKO, *Administrative Patent Judges*.

BRADEN, *Administrative Patent Judge*.

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

## I. INTRODUCTION

Meta Platforms, Inc. (“Petitioner”) filed a Petition requesting an *inter partes* review of claims 1–20 (the “challenged claims”) of U.S. Patent No. 10,779,080 B2 (Ex. 1001, “the ’080 patent”). Paper 1 (“Pet.”). Jawbone Innovations, LLC (“Patent Owner”) filed a Preliminary Response. Paper 8 (“Prelim. Resp.”). With the Board’s permission (Paper 9), Petitioner filed a Reply to Patent Owner’s Preliminary Response, to address arguments regarding Patent Owner’s reliance on the Board’s intervening institution and rehearing decisions in IPR2023-01130. Paper 10 (“Reply”). Patent Owner filed a Sur-reply. Paper 11 (“Sur-reply”).

We have authority to determine whether to institute an *inter partes* review under 35 U.S.C. § 314 and 37 C.F.R. § 42.4. An *inter partes* review may not be instituted unless it is determined that “the information presented in the petition filed under section 311 and any response filed under section 313 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 (2018); *see also* 37 C.F.R. § 42.4(a) (2022) (“The Board institutes the trial on behalf of the Director.”).

For the reasons provided below and based on the record before us, we determine Petitioner has not demonstrated a reasonable likelihood that it would prevail in showing the unpatentability of at least one of the challenged claims. Accordingly, we do not institute an *inter partes* review of the ’080 patent and the asserted challenges to patentability.

## II. BACKGROUND

### *A. Real Parties in Interest*

Petitioner only lists itself, Meta Platforms, Inc., as a real party-in-interest. Pet. 87. Patent Owner states that it is a real party-in-interest. Paper 5 (Patent Owner’s Mandatory Notice), 2.

### *B. Related Proceedings*

The parties both identify the multiple district court cases and related IPR proceedings. Pet. 87–90; Paper 5, 2–3.<sup>1</sup>

### *C. The ’080 Patent (Ex. 1001)*

The ’080 patent is titled “Dual Omnidirectional Microphone Array (DOMA),” and issued on September 15, 2020. Ex. 1001, codes (45), (54). It is a continuation of a U.S. Patent Application and relies on several provisional applications, the earliest of which was filed on June 13, 2007. *Id.* at codes (60), (63).

#### *1. Written Description*

The ’080 patent relates to the use of a “dual omnidirectional microphone array noise suppression” system to create microphone arrays with enhanced noise suppression.” Ex. 1001, code (57). The ’080 patent explains that the

array of an embodiment is used to form two distinct virtual directional microphones which are configured to have very similar noise responses and very dissimilar speech responses. The only null formed is one used to remove the speech of the user from  $V_2$ . The two virtual microphones may be paired with an adaptive filter algorithm and VAD algorithm to significantly

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<sup>1</sup> Patent Owner specifically identifies IPR2022-01065, which was directed to the ’080 patent, but has since been terminated due to settlement. *See* IPR2023-01065, Paper 20.

reduce the noise without distorting the speech, significantly improving the SNR of the desired speech over conventional noise suppression systems.

*Id.* According to the '080 patent “[t]he only null formed by the DOMA is one used to remove the speech of the user from [the second virtual microphone].” *Id.* at 3:56–57. The similarity of the '080 patent’s virtual microphones’ noise responses, however, allows them to be cancelled while leaving the speech response intact, “resulting in excellent noise suppression performance and minimal speech removal and distortion.” *Id.* at 6:59–62; *see id.* at 9:22–38. The '080 patent discloses that its two virtual microphones can be “paired with an adaptive filter algorithm” to reduce noise. *Id.* at 3:57–62.

In one embodiment, two virtual directional microphones  $V_1$  and  $V_2$  are formed based on two physical omnidirectional microphones  $O_1$  and  $O_2$  according to the following equations expressed in the  $z$  (digital frequency) domain:

$$V_1(z) = O_1(z) \cdot z^{-\gamma} - \beta O_2(z)$$

$$V_2(z) = O_2(z) - z^{-\gamma} \beta O_1(z)$$

where

$$\beta = \frac{d_1}{d_2}$$

$$\gamma_- = \frac{d_2 - d_1}{c} \cdot f_s(\text{samples})$$

$$d_1 = \sqrt{d_s^2 - 2d_{s1}d_0\cos(\theta) + d_0^2}$$

$$d_2 = \sqrt{d_s^2 + 2d_{s1}d_0\cos(\theta) + d_0^2}$$

*Id.* at 4:33–67, 9:46–53, 11:1–2. In the equations  $d_1$  and  $d_2$  “are the distance from  $O_1$  and  $O_2$  to the speech source,” respectively;  $c$  is the speed of sound; and  $f_s$  is a sampling frequency. *Id.* at 9:54–67. The equations for  $V_1$  and  $V_2$  (above) are represented visually in Figure 2, reproduced below.

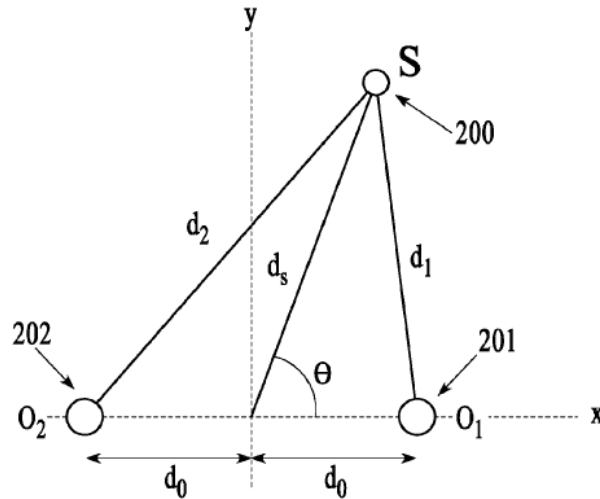


FIG.2

Figure 2 is a diagram illustrating a generalized two-microphone array (DOMA) including array 201/202 and speech source (S) with microphones

separated by a distance approximately equal to  $2d_o$ , and the speech source located a distance  $d_s$  away from the midpoint of the array at an angle  $\theta$ . According to the '080 patent, the system is axially symmetric so only  $d$  and  $\theta$  need be specified. *Id.* at 2:28–33, 7:17–38, Fig. 2.

The result of one embodiment of the '080 patent is shown in Figure 9, reproduced below.

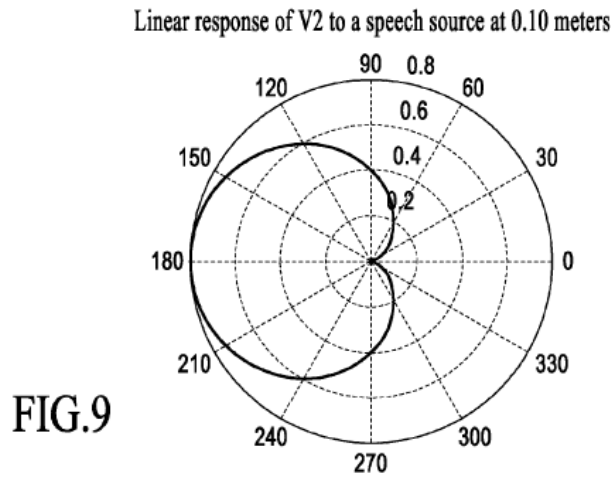
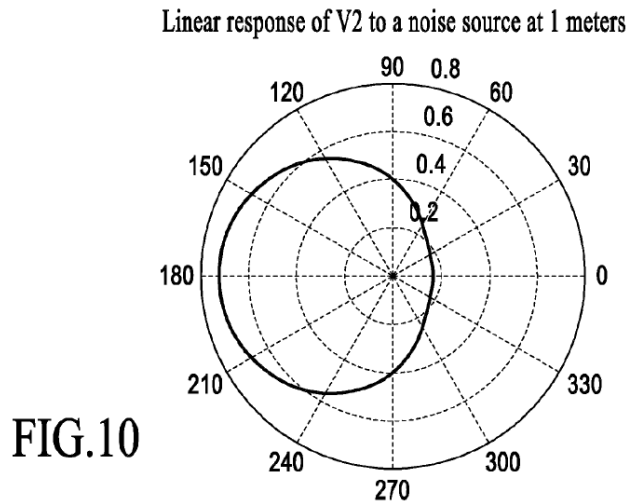


Figure 9 is a plot of linear response of virtual microphone  $V_2$  with  $\beta=0.8$  to a 1 kHz speech source at a distance of 0.1 m. *Id.* at 10:18–20. According to the '080 patent, the null in the linear response of virtual microphone  $V_2$  to speech is located at 0 degrees, where the speech is typically expected to be located. *Id.* at 10:20–22. Figure 10, reproduced below, is another plot of a linear response of virtual microphone  $V_2$  with  $\beta=0.8$  to a 1 kHz noise source, but at a distance of 1.0 m. *Id.* at 10:22–24.



Regarding Figure 10, above, the '080 patent states that “[t]he linear response of  $V_2$  to noise is devoid of or includes no null, meaning all noise sources are detected.” *Id.* at 10:25–27.

The '080 patent discloses that the formulation for  $V_2(z)$  has a null at the speech location, and therefore, will exhibit minimal response to the speech. *Id.* at 10:28–30. The '080 patent then explains that the speech null at zero degrees is not present for noise in the far field for the same microphone, as shown in Figure 10, above, with a noise source distance of approximately 1 meter. *Id.* at 10:32–35. The '080 patent states this insures that noise in front of the user will be detected so that it can be removed. *Id.* at 10:35–36. According to the '080 patent, this differs from conventional systems that can have difficulty removing noise in the direction of the mouth of the user. *Id.* at 10:36–38.

The '080 patent further discloses different linear responses for the virtual microphone  $V_1$  and  $V_2$  when exposed to a near-field speech source. *Id.* at 10:18–22, 11:20–24, 11:62–65, 16:4–6. This difference is seen when comparing Figures 9 and 11, both reproduced below.

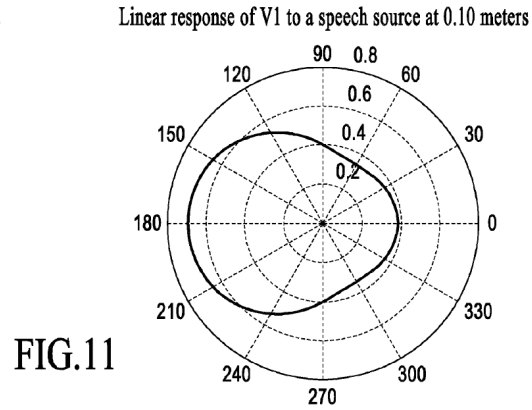
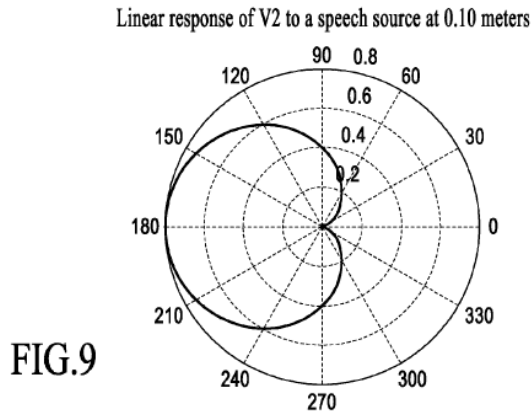


Figure 11 is a plot of linear response of virtual microphone  $V_1$  to a 1 kHz speech source at a distance of 0.1 m. *Id.* at 2:60–62. The '080 patent states that “[t]here is no null and the response for speech is greater than that shown in Figure 9.” *Id.* at 2:62–63.

In contrast, the '080 patent describes similar linear responses for virtual microphones  $V_1$  and  $V_2$ , respectively, to a far-field noise source. *Id.* at 10:22–27, 11:25–29, 11:62–65, 16:4–6. This similarity is seen when comparing Figures 10 and 12, both reproduced below.

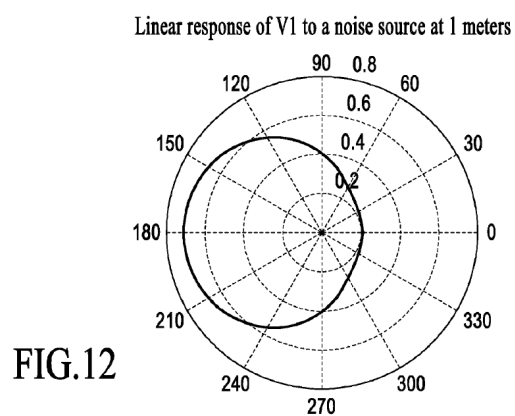
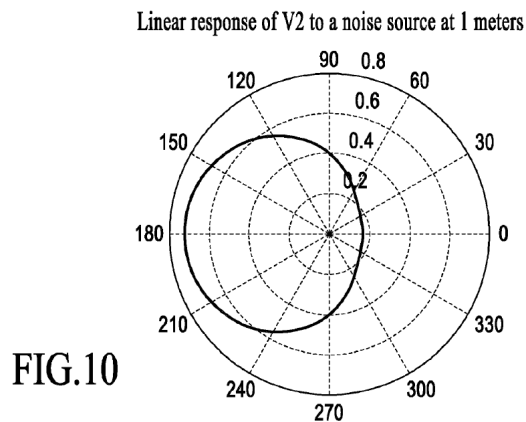


Figure 12, above, is a plot of linear response of virtual microphone  $V_1$  to a 1 kHz noise source at a distance of 1.0 m, under an embodiment. *Id.* at 2:64–66. The '080 patent states that “[t]here is no null and the response is very similar to  $V_2$  shown in Figure 10.” *Id.* at 2:66–67.

The '080 patent contemplates that the linear response of the virtual microphone  $V_1$  is “flat for all frequencies within approximately  $\pm 30$  degrees of the axis of the array,” as shown in Figure 13 (reproduced below). *Id.* at 11:30–35, 11:43–61.

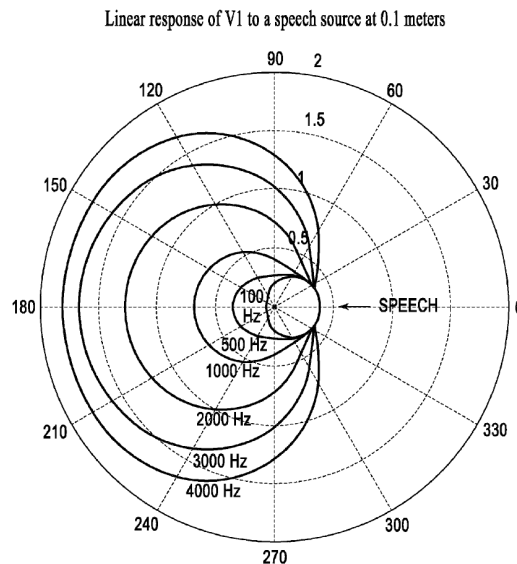


FIG.13

“Figure 13 is a plot of linear response of virtual microphone  $V_1$  to a speech source at a distance of 0.1 m for frequencies of 100, 500, 1000, 2000, 3000, and 4000 Hz.” *Id.* at 3:1–3.

The virtual microphone signals are input to an adaptive noise removal system, which can use “any adaptive filter or noise removal algorithm.” *Id.* at 3:57–62, 6:67–7:3, 8:50–9:3, 9:22–38; *see id.* at 4:52–7:16. In an embodiment, the adaptive noise removal system combines the signals from virtual microphones  $V_1$  and  $V_2$  “by filtering and summing in the time domain.” *Id.* at 7:4–16, 8:50–9:3, 9:22–38. “The adaptive filter generally uses the signal received from a first microphone . . . to remove noise from the speech received from at least one other microphone . . . , which relies on a slowly varying linear transfer function between the two microphones for

sources of noise.” *Id.* at 7:7–12. The system then generates an output signal “in which the noise content is attenuated with respect to the speech content.” *Id.* at 7:12–16.

## 2. *Illustrative Claims*

As noted previously, Petitioner challenges claims 1–20 of the ’080 patent, of which claims 1, 7, and 14 are independent. Pet. 20; Ex. 1001, 33:39–36:35. Claim 7 is illustrative of the challenged subject matter and is reproduced below.

### 7. A method comprising:

- a first virtual microphone formed from a first combination of a first microphone signal and a second microphone signal, wherein the first microphone signal is generated by a first physical microphone and the second microphone signal is generated by a second physical microphone;
- a second virtual microphone formed from a second combination of the first microphone signal and the second microphone signal, wherein the second combination is different from the first combination, wherein the first virtual microphone has a first linear response to speech and first linear response to noise, the first linear response to speech being substantially similar across a plurality of frequencies for a speech source located within a predetermined angle relative to an axis of the microphone array and devoid of a null, wherein the second virtual microphone has a second linear response to speech that has a single null oriented in a direction toward a source of the speech and a second linear response to noise, wherein the second linear response to noise is substantially similar to the first linear response to noise, one or both of the first linear response to noise and the second linear response to noise being non-zero in a direction toward a source of noise, and the second linear response to speech is substantially dissimilar to the first linear response to speech, wherein the speech is human speech; and

an adaptive noise removal application coupled to the first and second virtual microphones and generating denoised output signals by forming a plurality of combinations of signals output from the first virtual microphone and the second virtual microphone, by filtering and summing the plurality of combinations of signals in the time domain, and by a varying linear transfer function between the plurality of combinations of signals, wherein the denoised output signals include less acoustic noise than acoustic signals received at the first and second physical microphones.

Ex. 1001, 34:16–54.

*D. Asserted Challenges to Patentability and Evidence of Record*

Petitioner challenges the patentability of claims 1–20 of the '080 patent based on the following reference or combination of references:

| <b>Claim(s) Challenged</b> | <b>35 U.S.C. §</b>  | <b>Reference(s)/Basis</b>                    |
|----------------------------|---------------------|----------------------------------------------|
| 1–3, 5–9, 11–14, 16–20     | 103(a) <sup>2</sup> | Brandstein <sup>3</sup> , Ikeda <sup>4</sup> |
| 13, 19, 20                 | 103(a)              | Brandstein, Ikeda, McCowan <sup>5</sup>      |
| 4, 10, 15                  | 103(a)              | Brandstein, Ikeda, Yang <sup>6</sup>         |

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<sup>2</sup> The Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) (“AIA”), included revisions to 35 U.S.C. § 103 that became effective as of March 16, 2013. Although the application for the '080 patent was filed after March 16, 2013, it includes a priority claim to an application filed before this date. Ex. 1001, codes (22), (60), (63). Accordingly, for purposes of institution, we apply the pre-AIA version of 35 U.S.C. § 103.

<sup>3</sup> Michael Brandstein & Darren Ward eds., *Microphone Arrays: Signal Processing Techniques and Applications*, Springer-Verlag (2001) (“Brandstein,” Ex. 1005).

<sup>4</sup> Japanese Unexamined Patent Application Publication No. H11-18186, filed June 25, 1997, published January 22, 1999; (“Ikeda,” Ex. 1008).

<sup>5</sup> Iain A. McCowan et al., *Near-Field Adaptive Beamformer for Robust Speech Recognition*, Digital Signal Processing, Vol. 12, Issue 1 (2002), 87–106 (“McCowan,” Ex. 1009).

<sup>6</sup> US Patent Application Publication No. 2002/0193130, published December 19, 2002 (“Yang,” Ex. 1010).

Petitioner provides evidence that each reference qualifies as prior art under pre-AIA §103. Pet. 20 (citing Ex. 1003 ¶ 60). Patent Owner raises no issue at this time as to the prior art status of the references, and we treat the references as prior art for purposes of this Decision.

In support of its patentability challenge, Petitioner relies on, *inter alia*, the Declaration of Michael T. Johnson, Ph.D. (“Dr. Johnson”). Ex. 1003. Patent Owner contests the challenges to patentability and supports its position with the Declaration of Akbar M. Sayeed, Ph.D. (“Dr. Sayeed”). Ex. 2001.

### III. PRELIMINARY MATTERS

#### *A. Claim Construction*

A claim “shall be construed using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. [§] 282(b).” 37 C.F.R. § 42.100(b). Under that standard, the “words of a claim ‘are generally given their ordinary and customary meaning.’” *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312 (Fed. Cir. 2005) (en banc).

Both parties state that express claim construction is unnecessary at this stage of the proceeding and that all terms are to given their plain and ordinary meaning. Pet. 22; Prelim. Resp. 19. We agree.

Construction is needed only for those terms “that are in controversy, and only to the extent necessary to resolve the controversy.” *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)). There are no claim terms in controversy at

this stage of the proceeding. Consequently, we need not construe any terms for purposes of institution.

*B. Principles of Law Regarding Obviousness*

A claim is unpatentable under 35 U.S.C. § 103 if “the differences between the subject matter sought to be patented 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 skill in the art; and (4) where in evidence, objective evidence of non-obviousness.<sup>7</sup> *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). When evaluating a combination of teachings, we must also “determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue.” *KSR*, 550 U.S. at 418 (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)). Whether a combination of prior art elements would have produced a predictable result is an issue we weigh in the ultimate determination of obviousness. *Id.* at 416–417.

In an *inter partes* review, the petitioner must show with particularity why each challenged claim is unpatentable. *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016); 37 C.F.R. § 42.104(b). The burden of persuasion never shifts to the patent owner. *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015).

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<sup>7</sup> At this stage of the proceeding, Patent Owner has not presented objective evidence of non-obviousness.

We analyze the challenges presented in the Petition in accordance with the above-stated principles.

*C. Level of Ordinary Skill in the Art*

In determining the level of ordinary skill in the art, various factors may be considered, including the “type of problems encountered in the art; prior art solutions to those problems; rapidity with which innovations are made; sophistication of the technology; and educational level of active workers in the field.” *In re GPAC, Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995). Furthermore, the prior art itself can reflect the appropriate level of ordinary skill in the art. *Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001).

Here, Petitioner asserts that a person of ordinary skill in the art by June 27, 2007, would have had “a bachelor’s degree in computer engineering, computer science, electrical engineering, mechanical engineering, or a similar field, and approximately three years of industry or academic experience in a field related to acoustics, speech recognition, speech detection, or signal processing.” Pet. 21 (citing Ex. 1003 ¶¶ 21–26). Dr. Johnson supports Petitioner’s position and further testifies that “work experience could substitute for formal education, and additional formal education can substitute for work experience.” Ex. 1003 ¶ 23.

Patent Owner does not assert a different level of skill in the art at the time of the alleged invention and uses Petitioner’s proposed level of skill. Prelim. Resp. 19 (citing Ex. 2001 ¶ 26).

For the purposes of this Decision, we too adopt Petitioner’s level of ordinary skill in the art because it appears consistent with the problems addressed in the ’080 Patent and the prior art of record.

*D. Overview of Asserted Prior Art of Record*

*1. Brandstein (Ex. 1005)*

Brandstein is a collection of papers presented as book chapters and is titled “Microphone Arrays: Signal Processing Techniques and Applications,” and copyrighted 2001. Ex. 1005. From that collection, Petitioner cites “Superdirective Microphone Arrays” (Pet. 14 (citing Ex. 1005, 25)), “Robust Adaptive Beamforming” (Pet. 5 (citing Ex. 1005, 87)), and “Acoustic Echo Cancellation for Beamforming Microphone Arrays” (Pet. 58 (citing Ex. 1005, 290)). The collected papers do not describe a single system. Rather, the editors organized the collection to be “tutorial in nature with a specific emphasis on recent important results.” Ex. 1005, 8.

Of relevance to the analysis that follows, Chapter 5 discloses techniques for beamforming in microphone arrays with the “goal of speech enhancement . . . to remove undesirable signals such as noise and reverberation.” *Id.* at 87. Figure 5.1 is block diagram reproduced below.

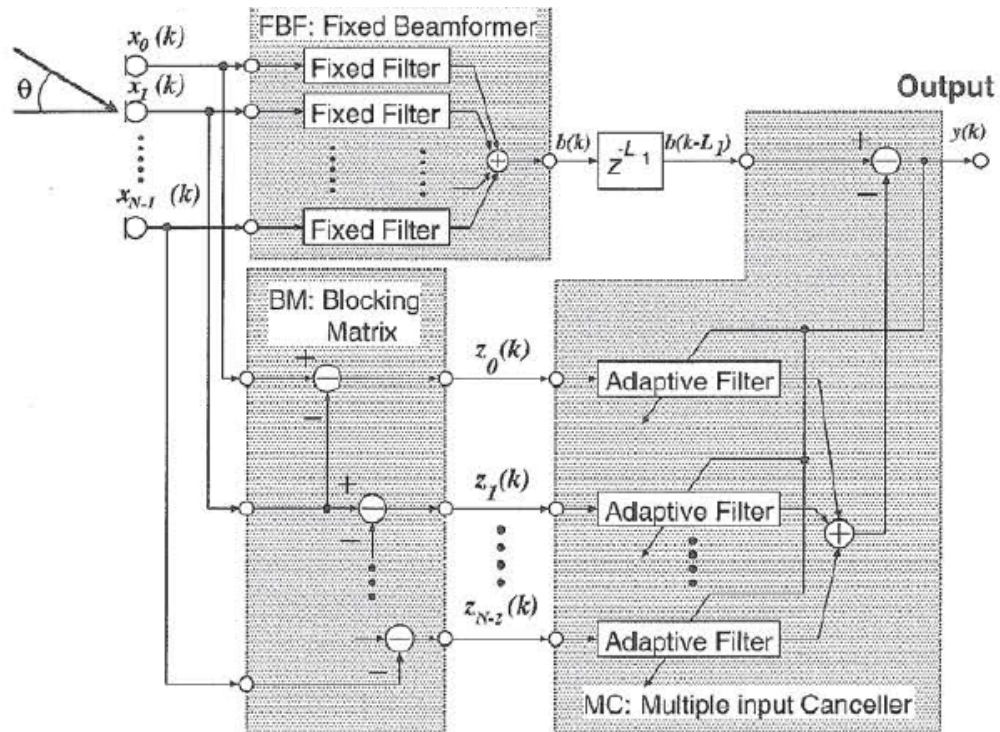


**Fig. 5.1.** Griffiths-Jim beamformer. It comprises a fixed beamformer (FBF), a multiple-input canceller (MC), and a blocking matrix (BM).

As indicated in the caption, Figure 5.1 is a “Griffiths-Jim beamformer,” which is a reference to a January 1982 paper by Griffiths and Jim titled “An Alternative Approach to Linear Constrained Adaptive Beamforming.” *Id.* at 89, 108. The upper portion of the figure depicts a fixed beamformer that filters and sums inputs from microphone array  $x_0(k)$ – $x_{N-1}(k)$  to generate an output representing a speech source (indicated as an arrow directed to the array at angle theta ( $\theta$ )). *Id.* at 88. The lower portion of the figure depicts a blocking matrix and multiple input canceller that form a signal with a null in the direction of the speech so that speech is suppressed and noise signals are passed through. *Id.* The output of the lower portion is subtracted for that of the upper portion to produce  $y(k)$ , in which speech “is enhanced and undesirable signals such as ambient noise and interferences are suppressed.” *Id.* at 88–89.

2. Ikeda (Ex. 1008)

Ikeda is an unexamined Japanese Patent Application Publication No. H11-18186, published on January 22, 1999, titled “Primary Pressure Gradient Microphone.” Ex. 1008,<sup>8</sup> codes (11), (43), (54). Ikeda discloses a microphone apparatus including an adaptive noise suppression with “three omnidirectional microphone units” M1, M2, and M3. *Id.* ¶¶ 8, 11–13, 16–18, 27–29, 31, 36, Fig. 8.

One embodiment of Ikeda is illustrated in Figure 1, reproduced below.

FIG. 1

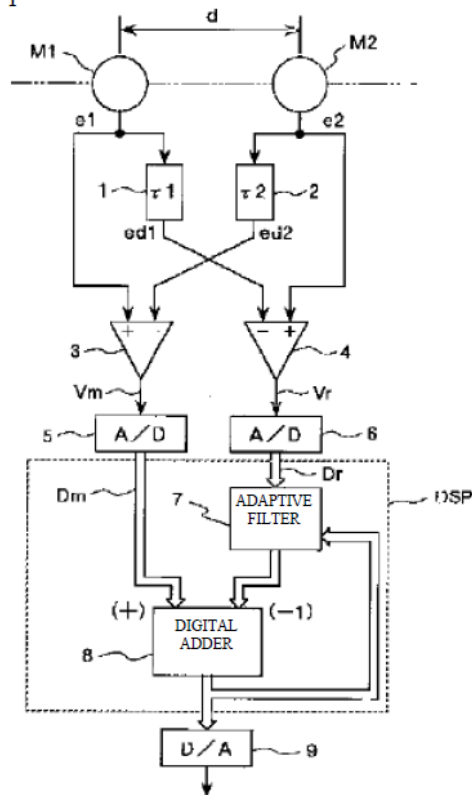


Figure 1 of Ikeda, above, is a circuit diagram of a primary pressure gradient microphone using two omnidirectional microphone units. *Id.* ¶ 11.

According to Figure 1, the output “of the microphone unit M2 is delayed . . .

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<sup>8</sup> In this Decision we will refer to Ex. 1008, which is a certified translation of the original Japanese publication found at Ex. 1007.

by a delay circuit 2,” and an inversion adding circuit 3 outputs a main signal  $V_m$  by “calculating the difference between the output . . . of the microphone unit M1 and the output . . . of the delay circuit 2.” *Id.* ¶¶ 18, 20, 31. Ikeda discloses that main signal  $V_m$  is generated by subtracting the output signal of microphone M2, as delayed by delay circuit 2, from the output signal of microphone M1. *Id.* ¶¶ 18, 21. Ikeda further discloses a signal system constructed using microphones M1 and M2, delay circuit 2, and inversion adding circuit 3 for outputting main signal  $V_m$  functions as a main microphone. *Id.* ¶¶ 12, 20–22, Fig. 2. According to Ikeda, the main microphone has directional characteristics. *Id.* ¶¶ 2–4, 21, 22, Fig. 3.

Another embodiment of Ikeda illustrated in Figure 8, reproduced below.

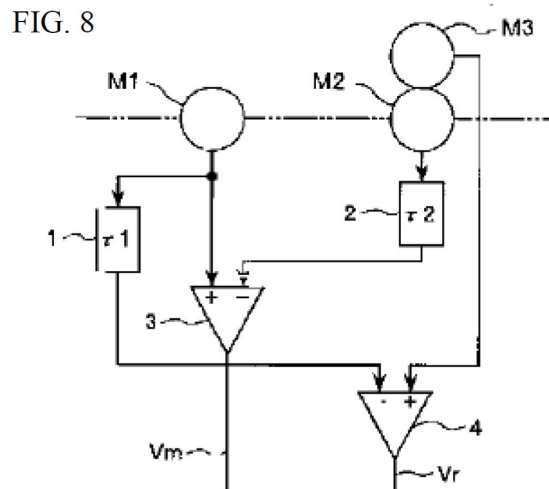


Figure 8 of Ikeda, above, is a circuit diagram of a primary pressure gradient microphone using three omnidirectional microphone units. *Id.* ¶ 42.

According to Figure 8, the output “of the microphone unit M1 is delayed . . . by a delay circuit 1.” *Id.* ¶¶ 18, 31. Ikeda discloses that reference signal  $V_r$  “is generated by obtaining the difference between the output of third microphone unit M3 and the output of delay circuit 1 with inversion adding

circuit 4.” *Id.* ¶ 31, Fig. 8. Ikeda further discloses that reference signal  $V_r$  is generated by subtracting the output signal of microphone M1, as delayed by delay circuit 1, from the output signal of microphone M3. *Id.* ¶¶ 18, 23, 31, Fig. 8. According to Ikeda, the signal system constructed using microphones M1 and M3, delay circuit 1, and inversion adding circuit 4 for outputting reference signal  $V_r$  functions as a reference microphone. *Id.* ¶¶ 12, 20, 23–24, 31, Fig. 4.

Ikeda states that the “reference microphone has directional characteristics on the back surface side.” *Id.* ¶¶ 23–24, Fig. 5. Ikeda explains that the main microphone is configured to pick up a target sound and noise, and the reference microphone is configured to pick up noise. *Id.* ¶¶ 21, 23. The main signal  $V_m$  (as converted to a digital signal  $D_m$ ) and the reference signal  $V_r$  (as converted to a digital signal  $D_r$ ) in Ikeda are input to the adaptive noise cancellation system including an adaptive filter 7 and a digital adder 8. *Id.* ¶¶ 12–13, 27–29, 31, Fig. 1. Ikeda states “[m]ain [sic Reference] signal data  $D_r$  outputted from the A/D converter 6 is supplied to an adaptive filter 7 . . . , and the difference between the filter output of the adaptive filter 7 and the main signal data  $D_m$  outputted from the A/D converter 5 is calculated by a digital adder 8.” *Id.* ¶ 27, Fig. 1. Ikeda then discloses that the filter response characteristics of adaptive filter 7 “are determined so as to cancel the respective noise components contained in the main signal data  $D_m$  and the reference signal data  $D_r$ .” *Id.* ¶ 28. Ikeda further discloses

[a]s a result of the response characteristics of the adaptive filter 7 being determined successively in this way, the noise component contained in the main signal  $V_m$  is cancelled by the noise component contained in the reference signal  $V_r$  due to

subtraction by digital adder 8. The output of the digital adder 8 is converted to an analog signal by a D/A converter 9. A signal primarily consisting of the target sound component can be acquired from the D/A converter 9.

*Id.* ¶ 29; *see id.* ¶¶ 12, 13, 31.

### 3. *McCowan (Ex. 1009)*

McCowan is an article titled “Near-Field Adaptive Beamformer for Robust Speech Recognition” published in the Digital Signal Processing Review Journal. Ex. 1009, 87.<sup>9</sup> McCowan discloses an adaptive noise cancellation system for near-field speech sources with a near-field adaptive beamformer that is “implemented using the standard generalized sidelobe canceler (GSC) system structure.” *Id.* McCowan uses a “near-field compensation unit” and “a standard generalized sidelobe canceling blocking matrix and adaptive filters.” *Id.* at 90–91.

One embodiment of McCowan is shown in Figure 3, reproduced below.

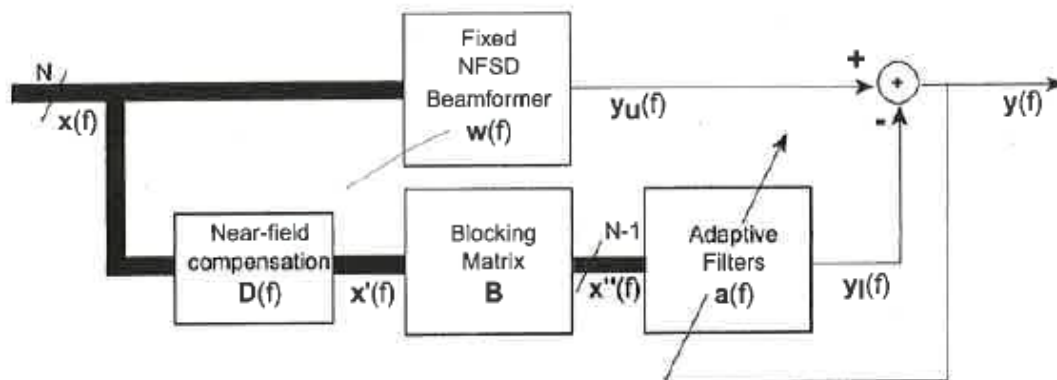


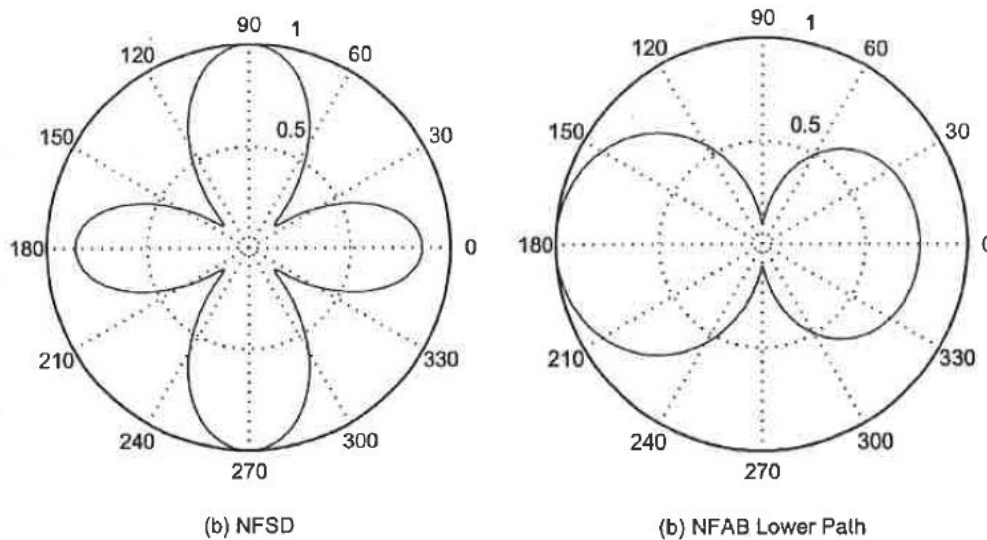
FIG. 3. Near-field adaptive beamformer.

<sup>9</sup> To avoid confusion, the page citations are based on the numbers printed in the upper corners of McCowan.

Figure 3, above, illustrates a block diagram of McCowan's adaptive noise cancellation system with a near-field adaptive beamformer. *Id.* at 91.

McCowan discloses that input  $x(f)$  including signals from multiple microphones is processed via two signal paths. *Id.* at 90, 93 (equation 15), 95–96. McCowan's Figure 3 shows that the lower path includes a near-field compensation, a blocking matrix, and adaptive filters. *Id.* McCowan explains that the lower path generates a noise estimate, which is used to cancel, at a subtraction component, noise in the output signal of a fixed NFSD (near-field superdirective) beamformer in the upper path. *Id.* at 87–91, 93–96.

McCowan's Figures 6(b) and 7(b) (reproduced below) show that the upper path includes a near-field adaptive beamformer ("NFAB"), that includes at least four nulls, while its lower path NFAB includes at least two nulls, and many more at higher frequencies:



*Id.* at 99–100. The “[o]verall beamformer directivity pattern” of McCowan's NFAB also includes four nulls. *Id.* at 100.

McCowan discloses that the blocking matrix “block[s] the desired signal from the adaptive noise estimate” by subtracting one microphone signal from another. *Id.* at 93, 95 (equations 18, 19). McCowan states that “[t]o ensure complete blocking, the desired signal must both be time aligned and have equal amplitudes across all channels.” *Id.* at 93. McCowan discloses that for a near-field sound source, phase misalignment across microphones results from “[t]he difference in propagation time to [the *i*th] microphone with respect to the reference microphone (*i*=1),” defined as:

$$\tau_i = \frac{d_i - d_1}{c}$$

where  $d_i$  is the distance between the source and the *i*th microphone and  $c$  is the speed of sound. *Id.* at 89–90. Additionally, according to McCowan, amplitude differences across microphones are “negligible for far-field sources, but can be significant in the near-field case.” *Id.* at 90. McCowan discloses that the attenuation factor of wave amplitude on the *i*th microphone, with respect to the amplitude on the reference microphone (*i*=1), is defined as:

$$\alpha_i = \frac{d_1}{d_i}$$

McCowan explains that “[f]or a near-field desired source, to align the desired signal on all channels, a near-field compensation must first be applied to the input channels prior to blocking.” *Id.* at 93; *see id.* at 87. According to McCowan, the near-field compensation unit “compensate[s] for both phase misalignment and amplitude scaling of the desired signal across sensors.” *Id.* at 93. With the near-field compensation, McCowan

teaches multiplying microphone 2's signal by  $d_2/d_1$ , delaying by  $(d_1-d_2)/c$ , and subtracting the result from microphone 1's signal to create "a true null . . . in the beam-pattern . . . in the direction *and* distance corresponding to the desired source." *Id.* at 90, 93–95.

4. *Yang (Ex. 1010)*

Yang is a U.S. Patent Application Publication, published on December 19, 2001, titled "Noise Suppression for a Wireless Communication Device." Ex. 1010, codes (12), (43), (54). Yang discloses an adaptive noise reduction system with "[t]echniques to suppress noise from a signal comprised of speech plus noise." *Id.* at code (57), ¶¶ 58–62. One embodiment of Yang is shown in Figure 4, reproduced below.

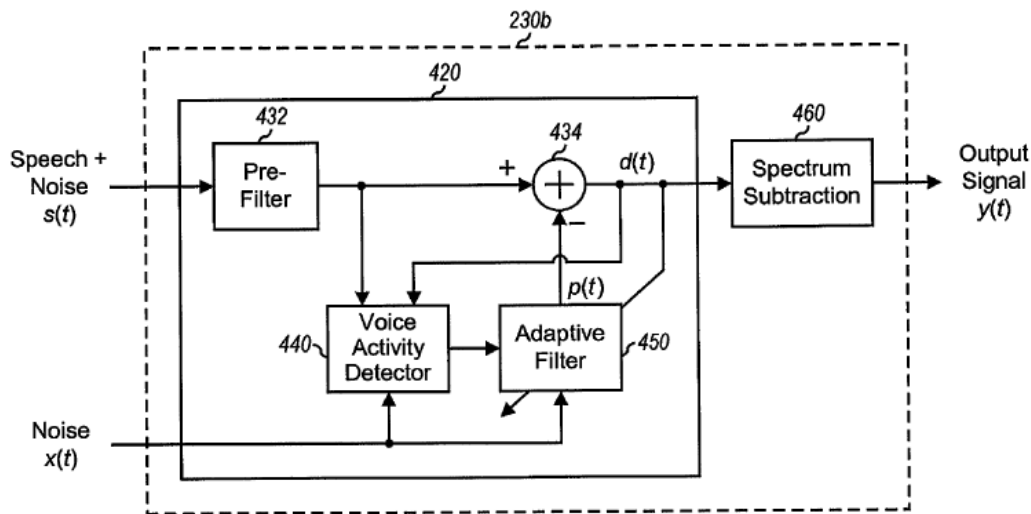


**FIG. 4**

Figure 4 is a block diagram of Yang's noise suppression unit 230b. *Id.* ¶¶ 18, 58. Yang discloses that noise suppression unit 230b capable of removing background noise from a speech-plus-noise signal and it achieves the noise reduction/suppression in the time domain. *Id.* ¶ 58.

Yang states:

The mostly noise signal  $x(t)$  is provided to an adaptive filter 450, which filters the noise with a particular transfer function  $h(t)$ . The filtered noise *[sic]*  $p(t)$  is then provided to summer 434 and subtracted from the filtered speech plus noise signal to provide an intermediate signal  $d(t)$  having predominantly speech and some amount of noise.

*Id.* ¶ 59. According to Yang, adaptive filter 450 “is adapted during periods of non-speech activity.” *Id.* ¶¶ 60–61. Yang discloses that voice activity detector 440 “detects the presence of speech activity . . . and provides a control signal that enables the adaptation of the coefficients of [adaptive filter 450] when no speech activity is detected.” *Id.*

#### IV. ANALYSIS

##### *A. Alleged Obviousness of Claims 1–3, 5–9, 11–14, and 16–20 in view of Brandstein and Ikeda*

Petitioner contends claims 1–3, 5–9, 11–14, and 16–20 would have been obvious to person of ordinary skill in the art in view of the combined teachings of Brandstein and Ikeda. Pet. 2, 19–79; Reply 1. Patent Owner disputes Petitioner’s contentions for one specific limitation, as well as Petitioner’s proffered reasons to combine embodiments and references within Brandstein. Prelim. Resp. 10–23. We only address the limitation disputed by Patent Owner because it is dispositive.<sup>10</sup> For the reasons

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<sup>10</sup> In this Decision, we focus on the specific disputed limitation of the ’080 patent, because this limitation is dispositive for purposes of this Decision for all challenges presented by Petitioner. Petitioner has provided contentions for the remaining limitations. Because we determine that Petitioner has not sufficiently established that the asserted references teach the disputed limitation in all challenges, we do not address or take any position on these additional contentions and arguments. Additionally, we do not address or take any position on Petitioner’s arguments regarding 35 U.S.C. §§ 314(a), 325(d) or Patent Owner’s objective indicia of non-obviousness.

discussed below, we are not persuaded Petitioner has established a reasonable likelihood of success on this challenge.

*1. Independent Claims 1, 7, and 14*

Independent claim 1 recites “wherein the first virtual microphone and the second virtual microphone have substantially similar responses to noise and substantially dissimilar responses to speech.” Ex. 1001, 33:39–67. Independent claims 7 and 14 similarly recite “wherein the second linear response to noise is/being substantially similar to the first linear response to noise,” and “the second linear response to speech is/being substantially dissimilar to the first linear response to speech.” *Id.* at 34:16–54, 35:12–36:10.

*2. The Parties’ Contentions Regarding Claims 1, 7, and 14*

Petitioner contends that Brandstein discloses or renders the limitation obvious. Pet. 43 (citing Ex. 1003 ¶¶ 117–122). According to Petitioner, Brandstein’s “two virtual microphones also have essentially the same (meeting *substantially similar*) responses to noise, so that the noise responses cancel out in the GJBF’s final subtraction.” *Id.* at 44 (citing Ex. 1003 ¶ 119).

Petitioner specifically cites to Figures 5.2 and 5.3 of Brandstein, which are reproduced below with Petitioner’s annotation.

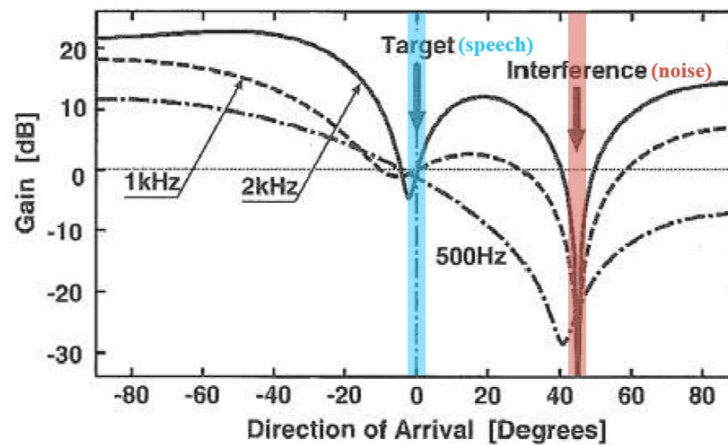


**Fig. 5.2.** Example directivity pattern of the Griffiths-Jim beamformer.

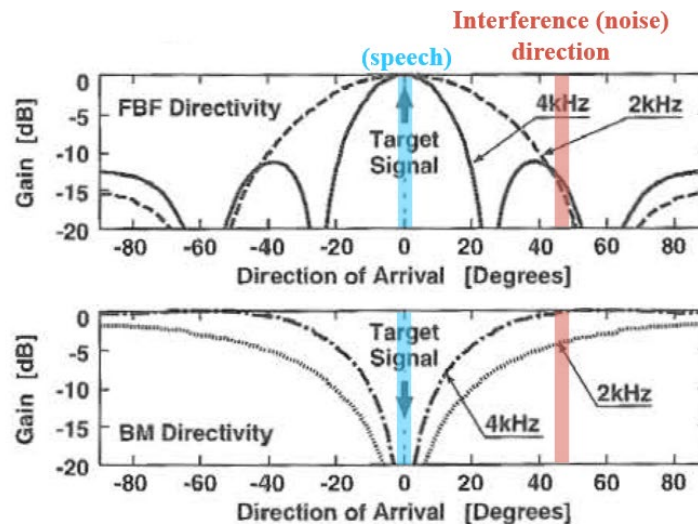


**Fig. 5.3.** Directivity pattern of a fixed beamformer (FBF) and a blocking matrix (BM).

*Id.* at 44–45 (citing Ex. 1005, Fig. 5.2, Fig. 5.3, 88–90, 101; Ex. 1003

¶¶ 119–121). Petitioner relies on its declarant, Dr. Johnson, to support its position.

Dr. Johnson testifies that “a gain of zero dB” indicated for the “target signal” (i.e., speech, highlighted in blue) compared to the “deep null” that is formed “in the direction of the interference,” discloses that the two virtual microphones are distinct, that they have different responses to the target

signal, while their responses to responses to interference (i.e., noise, highlighted in red) is essentially the same. Ex. 1003 ¶¶ 37–38, 118–121 (citing Ex. 1005, Fig. 5.2). Dr. Johnson further explains that a person of ordinary skill in the art at the critical time “would have known that the deep null reflects that subtracting the two virtual microphones’ outputs cancels the interference.” *Id.* ¶ 121.

Dr. Johnson then testifies that Figure 5.3 in Brandstein demonstrates “the individual directivity pattern for the FBF and BM components of the GJBF.” *Id.* ¶ 39 (citing Ex. 1005, Fig. 5.3). According to Dr. Johnson, “[t]hese directivity patterns show non-zero responses to the interference (noise) in the direction of the interference” and “[t]he directivity patterns also show that BM response has a null in the direction of the target (speech) while the FBF response has a non-zero response to the target in that direction.” *Id.*

Patent Owner disputes Petitioner’s contentions arguing that the noise responses of the FBF and BM in Brandstein are not substantially similar. Prelim. Resp. 10–19. Patent Owner argues that Brandstein’s own disclosure demonstrates that “Meta’s argument wrongly assumes that all systems that suppress noise with virtual microphones necessarily have ‘substantially similar’ noise responses.” *Id.* at 10. Patent Owner notes that Figure 5.2 of Brandstein, which depicts the overall directivity pattern of a Griffiths-Jim beamformer, shows a large negative gain in the direction of arrival of interference. *Id.* at 11–12 (citing IPR2023-01130, Paper 10 at 24–25), 16 (citing Ex. 2001 ¶ 43).

Patent Owner then argues that Petitioner incorrectly contends that “as highlighted in red in Fig. 5.2, ‘in the direction of the interference, a deep null

is formed’ . . . [[reflecting] that subtracting the bottom branch from the top branch cancels the interference, confirming that the virtual microphones’ responses to the interference are essentially the same.” *Id.* at 15 (citing Pet. 34) (second and third alterations in original). Rather, according to Patent Owner, the assumption that Figure 5.2 shows that the virtual microphones have similar responses to noise is unwarranted, because Figure 5.2 shows the “overall directivity of an exemplary GJBF at three different frequencies (*i.e.*, the combination of both the top and bottom path), not the directivity of either virtual microphone individually.” *Id.* at 16. Patent Owner argues that the “directivity merely has an area of significantly reduced gain in the direction of an interference (*i.e.*, a noise source).” *Id.* (citing Ex. 2001 ¶ 43). Patent Owner relies on its declarant, Dr. Sayeed, to support its position.

Dr. Sayeed testifies that Figure 5.2 “reflects the overall result of the system in attenuating noise; it discloses nothing about the comparative responses to noise of the top or bottom path within that system (which are not even depicted in the Figure).” Ex. 2001 ¶ 43. Dr. Sayeed further testifies that “Brandstein contemplates this result based on subtracting elements of noise (generated by a multiple input canceller by taking ‘replicas of components correlated with the interferences’) from an FBF signal that already has as little noise as possible, **not** based on any ‘substantially similar’ noise response.” *Id.*

Additionally, Patent Owner cites Brandstein’s Figure 5.3, which is reproduced below with Patent Owner’s annotations, to refute Petitioner’s position:

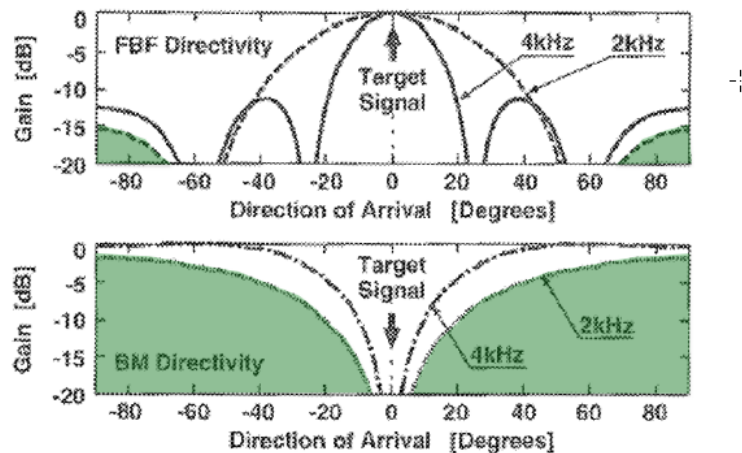


Fig. 5.3. Directivity pattern of a fixed beamformer (FBF) and a blocking matrix (BM).

Patent Owner contends that Figure 5.3 illustrates “very different noise responses in the context of the ‘noise response.’” Prelim. Resp. 12. Patent Owner argues that “[u]nlike Figure 5.2, Figure 5.3 actually does depict the directivity of the fixed beamformer (top path) and blocking matrix (bottom path) in relation to a target signal (*i.e.*, speech).” *Id.* at 17 (citing Ex. 2001 ¶ 44). According to Patent Owner, a person of ordinary skill at the critical time would have understood “that their noise responses (highlighted in green) are **not** substantially similar.” *Id.* (citing Ex. 1005, 90, annotated Fig. 5.3; Ex. 2001 ¶ 44). Patent Owner further argues that “Brandstein’s Chapter 5 does not disclose any equations with which to determine the responses of its top and bottom branches, Fig. 5.3 is the **only** disclosure of those responses outside the above-cited discussion that noise in the FBF (top branch) is attenuated compared to the BM (bottom branch).” *Id.* (citing Ex. 2001 ¶ 46).

In its Reply, Petitioner contends that the present case is different from that in IPR2023-01130 and, therefore, it would be improper for the Board to rely on that decision here. Reply 2. Specifically, Petitioner argues that (1)

the claims are different, (2) the prior art combinations are different, (3) the prior art mapping is different, (4) cited prior art disclosures are different, and (5) different experts were relied upon by Petitioner. *Id.* at 2–5.

Patent Owner contends, however, that the cases present indistinguishable differences. Sur-reply 1. According to Patent Owner, (1) the relevant portions of the claims are identical and Petitioner copies exact arguments wholesale from IPR2023-01130, (2) the presence or absence of other references from IPR2023-01130 “is irrelevant because Petitioner (both here and in -01130) relies *only* on Brandsein for the similar/dissimilar limitation,” (3) Petitioner’s different mapping makes no difference in the analysis or application of the prior art, (4) Petitioner relies on the same disclosures of Brandstein to support its arguments, and (5) Petitioner’s expert in the present case submits identical statements as the previous expert with regards to the disputed claim limitation. *Id.* at 2–4.

3. *Analysis of Petitioner’s Challenge to Independent Claims 1, 7, and 14*

We agree with Patent Owner that the record does not support Petitioner’s assertion that Brandstein teaches or suggests the requirement, “wherein the second linear response to noise is/being substantially similar to the first linear response to noise,” and “the second linear response to speech is/being substantially dissimilar to the first linear response to speech” as recited in claim 7 and 14, or “wherein the first virtual microphone and the second virtual microphone have substantially similar responses to noise and substantially dissimilar responses to speech” as recited in claim 1.

Contrary to Petitioner’s interpretation of Brandstein’s Figure 5.2, we are not persuaded that the figure and its accompanying text would have

rendered it obvious to an ordinarily skilled artisan that the individual microphone responses have similar responses to noise. *See Prelim.*

Resp. 14–16. As stated in IPR2023-01130, and which equally applies here:

In effect, Petitioner is arguing that knowing that the sum of two numbers is equal to “2” necessarily means that each number is “1”, as opposed, for example, to one number being “2” and the other “0”.

IPR2023-01130, Paper 10 at 24. Likewise, Figure 5.3 of Brandstein undermines Petitioner’s contention that the virtual microphone noise responses are substantially similar. *See Prelim. Resp. 17.* We credit the testimony of Dr. Sayeed, who explains

Brandstein’s Figure 5.3, which actually depicts the directivity of the cited GJBF’s top and bottom path unlike Figure 5.2, further shows that their responses to noise are not substantially similar. Ex. 1005 at [90]. I have highlighted the noise response of each plot in green. A POSITA would plainly understand that these responses are not substantially similar.

Ex. 2001 ¶ 44. Dr. Sayeed provides an additional annotated version of Brandstein’s Figure 5.3, reproduced below, which illustrates the speech direction and the noise direction as shown in green.

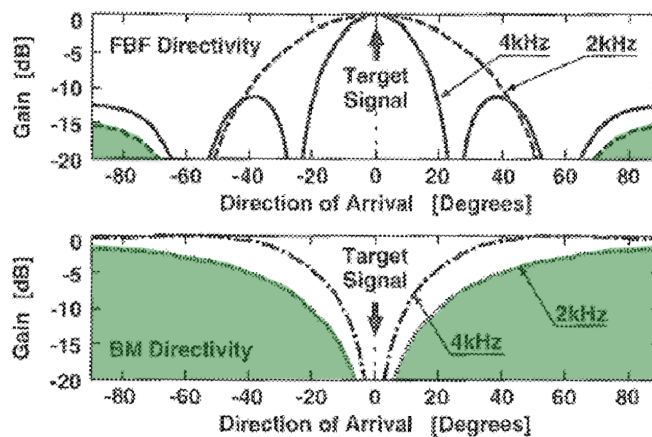


Fig. 5.3. Directivity pattern of a fixed beamformer (FBF) and a blocking matrix (BM).

We credit Dr. Sayeed's testimony that with respect to Figure 5.3 above, the noise responses of the FBF and the BM (shown in green) are different. *See id.* ¶ 45. We also are persuaded by Dr. Sayeed's testimony regarding Brandstein's disclosure that:

As Chapter 5 does not disclose equations for the GJBF discussed in section 5.2, Fig. 5.3 would provide a POSITA's *only* understanding of the actual noise responses of its FBF and BM outside of the above-cited disclosure that noise is attenuated in its FBF and not in its BM. This would further support a POSITA's understanding that the top and bottom branches of Brandstein's GJBF do not have substantially similar responses to noise.

*Id.* ¶ 46.

Additionally, because Petitioner's fails to meet its burden of proof in the instant case, we need not consider the implications of the IPR2023-01130 case or decide whether the Board must rely on its previous decision to deny the Petition here.

Accordingly, we determine that the Petition fails to demonstrate a reasonable likelihood that Petitioner would prevail in establishing that independent claims 1, 7, and 14 are unpatentable under 35 U.S.C. § 103(a) over the combination of Brandstein<sup>11</sup> and Ikeda.

4. *Analysis of Petitioner's Challenge to Dependent Claims 2, 3, 5, 6, 8, 9, 11–13, and 16–20*

Claims 1, 7, and 14 are independent claims having similar limitations, while claims 2, 3, 5, 6, 8, 9, 11–13, and 16–19 depend directly or indirectly from independent claims 1, 7, or 14. Ex. 1001, 33:39–36:35. Petitioner has

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<sup>11</sup> We need not address Patent Owner's argument that Petitioner's reliance on different chapters of Brandstein is unjustified.

provided additional explanation for the manner by which the combination of Brandstein and Ikeda is asserted to disclose each limitation not found in the independent claims. Pet. 54–60 (citing Ex. 1003 ¶¶ 145–162), 63–69 (citing Ex. 1003 ¶¶ 178–191), 71–72 (citing Ex. 1003 ¶¶ 203–204). Patent Owner has not provided separate arguments regarding Brandstein and Ikeda in regards to these challenged claims. *See generally* Prelim. Resp. Nonetheless, the burden remains on Petitioner to demonstrate unpatentability. *See Dynamic Drinkware*, 800 F.3d at 1378.

Having reviewed Petitioner’s arguments and supporting evidence in this present record, including the arguments summarized above for claims 1, 7, and 14, we find that the arguments do not address the deficiencies in the analysis of the independent claims. Thus, we determine Petitioner has not established adequately for purposes of this Decision that the Brandstein and Ikeda disclose the limitations of claims 2, 3, 5, 6, 8, 9, 11–13, and 16–19. Accordingly, for the reasons discussed in the Board’s analysis of the challenge to claims 1, 7, and 14 (*see* § II.A.3 *supra*), we determine Petitioner has not demonstrated a reasonable likelihood that these claims would have been rendered obvious to a person of ordinary skill in the art by the combined teachings of Brandstein and Ikeda.

*B. Alleged Obviousness of Claims 13, 19, and 20 in view of Brandstein, Ikeda, and McCowan*

Petitioner contends claims 13, 19, and 20 would have been obvious to person of ordinary skill in the art in view of the combined teachings of Brandstein, Ikeda, and McCowan. Pet. 20, 72–78 (citing Ex. 1003 ¶¶ 205–219). Claim 13 recites limitations directed to ratio of a third distance to a fourth distance, while claim 19 recites limitations directed to a power that is

proportional to a time difference between arrival of the speech at the first and the second virtual microphones, and claim 20 recite limitations directed to a power that is proportional to a sampling frequency multiplied by a quantity equal to a third distance subtracted from a fourth distance. *See* Ex. 1001, 35:6–11, 36:24–35.

Patent Owner disputes Petitioner’s contentions for the same reasons it disputes Petitioner’s challenged based on Brandstein and Ikeda. Prelim. Resp. 23.

Having reviewed Petitioner’s arguments and supporting evidence in this present record, including the arguments summarized above regarding Brandstein, we find that McCowan does not remedy the deficiencies of Brandstein and Ikeda. Accordingly, we are not persuaded that Petitioner has established a reasonable likelihood of success on this challenge.

*C. Alleged Obviousness of Claims 4, 10, and 15 in view of Brandstein, Ikeda, and Yang*

Petitioner contends that claims 4, 10, and 15 would have been obvious to person of ordinary skill in the art in view of the combined teachings of Brandstein, Ikeda, and Yang. Pet. 20, 78–80 (citing Ex. 1003 ¶¶ 220–230). Claims 4, 10, and 15 recite limitations directed to voice activity signals. Ex. 1001, 34:6–8, 34:63–65, 36:12–14. Petitioner argues that Yang discloses using a voice activity detector that detects voice activity so is operative to generate voice activity signals. Pet. 80–81 (citing Ex. 1010 ¶¶ 58–62; Ex. 1003 ¶¶ 227–230).

Patent Owner disputes Petitioner’s contentions for the same reasons it disputes Petitioner’s challenged based on Brandstein and Ikeda. Prelim. Resp. 23. Having reviewed Petitioner’s arguments and supporting evidence

in this present record, including the arguments summarized above regarding Brandstein, we find that Yang does not remedy the deficiencies of Brandstein and Ikeda. Accordingly, we are not persuaded that Petitioner has established a reasonable likelihood of success on this challenge.

## V. CONCLUSION

After consideration of the Petition, the Preliminary Response, and the evidence of record, we are not persuaded that Petitioner has demonstrated a reasonable likelihood of prevailing in showing that any of claims 1–20 of the '080 Patent is unpatentable on any asserted challenge. On this record, we decline to institute *inter partes* review of 1–20 of the '080 Patent.

## VI. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that an *inter partes* is not instituted.

IPR2024-00350  
Patent 10,779,080 B2

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