

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

LG ELECTRONICS INC.,

Petitioner,

v.

JAWBONE INNOVATIONS, LLC,

Patent Owner.

Patent No. 8,019,091

Filing Date: September 18, 2003

Issue Date: September 13, 2011

Inventors: Gregory C. Burnett and Eric F. Breitfeller

Title: VOICE ACTIVITY DETECTOR (VAD)-BASED
MULTIPLE-MICROPHONE ACOUSTIC NOISE SUPPRESSION

PATENT OWNER'S PRELIMINARY RESPONSE

Case No. IPR2023-01154

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I. INTRODUCTION

On July 5, 2023, LG Electronics Inc. (“Petitioner”) filed a Petition requesting *inter partes* review of claims 1-20 (“Challenged Claims”) of U.S. Patent No. 8,019,091 (the “’091 Patent”) (Ex. 1001). Paper 2 (“Petition” or “Pet.”). The declaration of Richard M. Stern, Ph.D. (Ex. 1002) accompanied the Petition. On July 19, 2023, the Board issued a Notice of Filing Date Accorded for the Petition and set the time for filing patent owner’s preliminary response. Paper 4.

The Board should deny the Petition because its proposed obviousness combinations fail to disclose the key limitations and concepts of the Challenged Claims. Indeed, the combination fails to disclose the key transfer function limitations in the Challenged Claims. Further, a POSITA would not be motivated to combine references as Petitioner suggests because the primary reference, Ikeda, criticizes the use of external sensors included in Petitioner’s combination. Indeed, the inventive concept of Ikeda was specifically to build a system which was not reliant on the external sensors in Petitioner’s combination.

II. THE ’091 PATENT

The ’091 Patent, entitled “Voice Activity Detector (VAD)-Based Multiple-Microphone Acoustic Noise Suppression,” was filed on September 18, 2003, and issued on September 13, 2011. The ’091 Patent discloses inventions for “[a]coustic

noise suppression . . . in multiple-microphone systems using Voice Activity Detectors (VAD).” ’091 Patent, Abstract.

The ’091 Patent teaches, describes, and claims systems and methods for detecting and processing a desired signal in the presence of acoustic noise using a noise removal algorithm. ’091 Patent, 1:16-18; Fig. 2. The ’091 Patent’s claimed invention uses multiple microphones to obtain both: i) signal with some noise and ii) noise with some signal. ’091 Patent, 3:20-38. The ’091 Patent also uses a voice activity detector (VAD) that examines human tissue vibration to determine when the user is speaking. ’091 Patent, 3:39-50. An accurate VAD is essential to the invention. ’091 Patent, 9:1-7.

When the VAD indicates a lack of voicing activity, the system generates one or more transfer functions associated with noise in the environment. ’091 Patent, 4:28-51. In embodiments, the system generates one or more transfer functions when the VAD indicates that voicing activity is present; those functions are associated with the signal. ’091 Patent, 4:52-5:12. The calculated transfer functions are used to remove noise from the received acoustic signals. ’091 Patent, 5:13-37.

III. THE RELEVANT ALLEGED PRIOR ART

A. Ikeda (U.S. Patent No. 5,978,824)

U.S. Patent No. 5,978,824 (Ex. 1003, “Ikeda”) discloses a noise canceler which “includes a signal-to-noise power ratio estimator.” Ex. 1003, Abstract. “The

estimator 10 estimates the signal-to-noise [sic] power ratio of the main signal from the mean power of a desired signal contained in the main signal [sic] and a mean power of a noise signal also contained in the main signal.” *Id.* “In addition, the estimator estimates the signal-to-noise power ratio of the reference signal from the mean power of a desired signal contained in the reference signal and the mean power of a noise signal [sic] also contained in the reference signal.” *Id.* Ikeda uses two microphones, a first microphone for a main signal and a second microphone for a reference signal. Ikeda, 4:48-56.

Ikeda explains that the adaptive filters 3 and 4 of the prior art system are updated when the desired signal component $S(z)$ and the noise component $N(z)$, respectively, are absent or negligible:

the conventional noise canceler updates the coefficient of the adaptive filter 3 and learns the acoustic characteristic of noise in sections where the noise signal $N(z)$ is present and the desired signal component $S(z)$ is absent or negligibly small. Further, the noise canceler updates the coefficient of the adaptive filter 4 and learns a Signal distortion correction filter in sections where the desired signal component $S(z)$ is present and the noise component $N(z)$ is absent or negligibly small. It is therefore necessary to detect the above sections where the desired signal component $S(z)$ is absent (or little) and the sections where the noise signal component $N(z)$ is absent (or little) and to command

the adaptive filters to perform leaning [sic] in such sections from the outside.

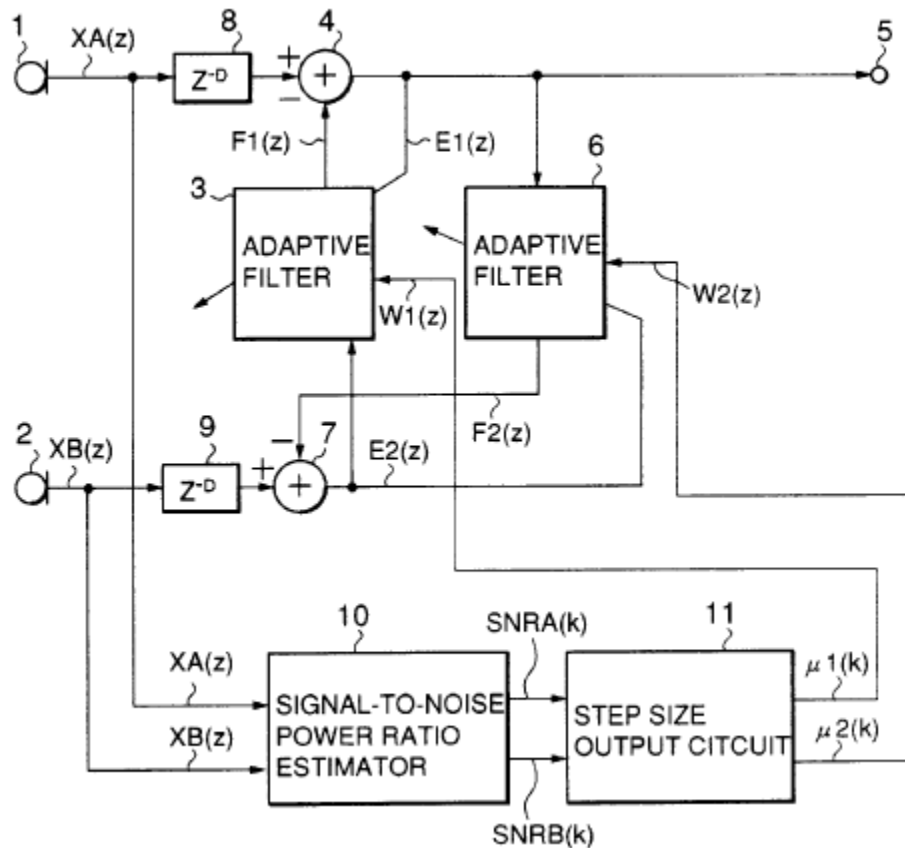
Ikeda, 3:32-45.

Ikeda identifies that the drawback to the prior art conventional system is that

it is, in many cases, difficult to command the adaptive filters to perform learning *from the outside* in accordance with the level of the desired signal and that of the noise signal, depending on the situation in which the noise canceler is located. With the conventional noise canceler, a sufficient noise canceling ability and a sufficient distortion correction characteristic are not achievable unless adequate learning sections are indicated to each adaptive filter for the learning purpose.

Id., 3:46-54. Thus, Ikeda contends that prior art which uses “outside” sensors for obtaining information needed to adjust the adaptive filters for adequate noise cancellation is insufficient.

To solve this problem, Ikeda discloses that “an object of the present invention to provide a noise canceler capable of achieving a sufficient noise canceling ability and reducing signal distortion *even when adequate learning sections cannot be indicated from the outside.*” *Id.*, 3:57-61. To do so, Ikeda uses a Signal To Noise Power Ratio Estimator. Ikeda, Abstract, 3:62-4:25, 7:18-9:10; Fig. 1.



Ikeda, Fig. 1. Ikeda's system estimates the signal to noise ratio for both the main and reference microphones. *Id.*, 7:18-8:12. It then provides that information (as $SNRA(k)$ and $SNRB(k)$) to the step size output circuit, which alters the step size, $\mu_1(k)$ and $\mu_2(k)$, for the adaptive filters 3 and 6, respectively. *Id.*, 8:13-9:10. This enables the filters to adapt based on the strength of the desired signal, and without the use of outside sensors. Ikeda, 9:14-18 ("The noise canceler therefore insures rapid convergence and allows a minimum of signal distortion to occur *without*

resorting to a command customarily input from the outside for commanding the learning operation of filters.” (emphasis added).

Ikeda explains that this use of signal to noise ratios, instead of outside sensors, is its main advance over the prior art.

These advantages are derived from a unique configuration in which a relation in size between a desired signal, which is an interference signal for an adaptive filter used to estimate the noise signal of the main signal from the estimated signal-to-noise power ratio of the main signal, and the noise signal to be canceled is determined. This relation is used to control a step size to be fed to the adaptive filter.

Ikeda, 9:18-24.

B. Puthuff (International Patent App. Pub. No. WO2000/021194)

International Patent Application Pub. No. WO2000/021194 (Ex. 1004, “Puthuff”) describes a “pickup system (10) [that] utilizes both sound pressure disturbances sensed by a microphone (20) and bone conduction sensed by a vibration sensor (30) such as an accelerometer, velocity sensor or displacement sensor to pick up and faithfully transmit a talker’s voice despite acoustically noisy ambient environments.” Ex. 1004, Abstract. Puthuff’s system “senses the microphone signal amplitude” and adjusts the system gain and balance to “smoothly fade in the

microphone signal and fade out the vibration sensor signal as ambient noise increases.” *Id.*

C. Alcivar

U.S. Patent No. 3,746,789 (Ex. 1005) (“Alcivar”) is directed to a voice-activated transmit switch for divers. Alcivar, 1:5-20. Alcivar uses a “tissue-conduction microphone 54 to generate a transmitter keying signal.” *Id.* 4:65-67. The tissue-conduction microphone must be placed against the skin of the user, preferably near the larynx. *Id.*, 4:67-5:15. The microphone is further isolated from outside noises by layers of noise-reducing fabric. *Id.* 5:16-5:31.

IV. CLAIM CONSTRUCTION

For the purposes of this Preliminary Response only, Patent Owner agrees that no claim terms require construction.

V. LEVEL OF ORDINARY SKILL IN THE ART

For the purposes of this Preliminary Response only, Patent Owner utilizes Petitioner’s proposed level of skill in the art: “a minimum of 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. Work experience could substitute for formal education and

additional formal education could substitute for work experience. Pet. at 13 (internal citations omitted).

VI. ARGUMENT

A. Legal Standard

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, so called secondary considerations. *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1, 17–18 (1966). A claim is only 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) (quoting 35 U.S.C. § 103).

“An invention is not obvious simply because all of the claimed limitations were known in the prior art at the time of the invention. Instead, we ask ‘whether there is a reason, suggestion, or motivation in the prior art that would lead one of ordinary skill in the art to combine the references, and that would also suggest a reasonable likelihood of success.’” *Forest Lab ’ys, LLC v. Sigmapharm Lab ’ys, LLC*, 918 F.3d 928, 934 (Fed. Cir. 2019). “Of course, concluding that the references are

within the scope and content of the prior art to be considered for obviousness does not end the inquiry. *Graham* makes clear that the obviousness inquiry requires a determination whether the claimed invention would have been obvious to a skilled artisan.” *Apple Inc. v. Samsung Elecs. Co.*, 839 F.3d 1034, 1050 n.14 (Fed. Cir. 2016).

“Although the *KSR* test is flexible, the Board ‘must still be careful not to allow hindsight reconstruction of references . . . without any explanation as to how or why the references would be combined to produce the claimed invention.’” *TriVascular, Inc. v. Samuels*, 812 F.3d 1056, 1066 (Fed. Cir. 2016) (citation omitted). Further, an assertion of obviousness “cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *KSR*, 550 U.S. at 418 (quoting *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)); accord *In re NuVasive, Inc.*, 842 F.3d 1376, 1383 (Fed. Cir. 2016) (stating that “conclusory statements” amount to an “insufficient articulation[] of motivation to combine”; “instead, the finding must be supported by a ‘reasoned explanation’” (citation omitted)); *In re Magnum Oil Tools Int’l, Ltd.*, 829 F.3d 1364, 1380 (Fed. Cir. 2016) (“To satisfy its burden of proving obviousness, a petitioner cannot employ mere conclusory statements. The petitioner must instead articulate specific reasoning, based on evidence of record, to support the legal conclusion of obviousness.”).

B. GROUND 1: Ikeda in View of Puthuff Does Not Render Obvious Claims 1-8, 11-14, 16, and 18-20

1. Petitioner’s Combination Does Not Disclose or Render Obvious “Receiving a Voice Activity Signal that Includes Information on Vibration of Human Tissue Associated with Human Voicing Activity of a User,” as Required by Claim 1 or a “Sensor for Detecting Voice Activity Based on Human Tissue Vibration,” as Required by Claims 11 and 18.

Petitioner admits that Ikeda does not disclose any sensor or detection relating to information on the vibration of human tissue as required by the claims. Pet. at 30, 38, 41. Nevertheless, Petitioner argues that a POSITA would have been motivated to incorporate Puthuff’s motion transducer into Ikeda’s system (in place of Ikeda’s supposed VAD or in addition to it) “so that Ikeda’s system could more accurately determine periods when voicing activity is absent or present.” *Id.* at 32.

The Petition fails to set out why a POSITA would have been motivated to include Puthuff’s transducer into Ikeda’s system under either of Petitioner’s rationales. Ikeda teaches against including “outside” sensors and is specifically tailored for the case where “adequate learning sections cannot be indicated from the outside.” Ikeda, 3:57-61.¹ As Ikeda explains, “it is, in many cases, difficult to command the adaptive filters to perform learning from the outside in accordance

¹ Petitioner states that Ikeda’s use of “outside” refers to “using a sensor other than the physical microphones.” Pet., 12.

with the level of desired signal and that of the noise signal, depending on the situation in which the noise canceler is located.” *Id.*, 3:46-50. Ikeda’s invention, therefore, uses its “signal-to-noise power ratio estimator” to estimate the signal-to-noise power ratio of both the main and reference signals. *Id.*, 8:6-12. Those ratios are fed to the step size output circuit, which outputs $\mu_1(k)$ and $\mu_2(k)$, which represent the step sizes of Ikeda’s adaptive filters. *Id.*, 8:13-9:3, Fig. 1. By using the ratios, Ikeda avoids the need for an outside sensor.

Ikeda thus specifically teaches against using outside sensors such as Puthuff’s transducer. Ikeda, 9:14-18 (“The noise canceler therefore insures rapid convergence and allows a minimum of signal distortion to occur ***without resorting to a command customarily input from the outside*** for commanding the learning operation of filters.” (emphasis added)). Indeed, this lack of reliance on outside sensors is the specific inventive concept behind Ikeda. *Id.*, 9:18-29; *see also id.*, Abstract, 3:56-4:25. A POSITA would not have been motivated to contradict Ikeda’s inventive concept of updating its adaptive filters without using outside sensors by adding Puthuff’s outside sensor as Petitioner teaches. *Trivascular, Inc. v. Samuels*, 812 F.3d 1056, 1068 (Fed. Cir. 2016) (finding insufficient motivation to combine two references by “substitut[ing] the recessed barbs of [one reference] with the protuberances of [another reference], since [the petitioner’s] proposed substitution would destroy the basic objective of the barbs”); *Chemours Co. FC, LLC v. Daikin*

Indus., Ltd., 4 F.4th 1370, 1376-77 (Fed. Cir. 2021) (finding insufficient motivation to “increase [a prior art reference’s] melt flow rate to the claimed range,” in part because the reference “includes numerous examples of processing techniques that are typically used to increase melt flow rate, which [the reference] cautions should not be used due to the risk of obtaining a broader molecular weight distribution”); *Google LLC v. Singular Computing LLC*, IPR2021-00155, Paper No. 57 at 75 (P.T.A.B. May 11, 2022) (citing *Chemours* and *Trivascular* and finding no motivation to combine where the combination would create “concerns that [the prior art] explicitly counsels against”).

Petitioner does not address Ikeda’s explicit teaching away from using outside sensors. Rather, Petitioner relies on Ikeda’s disclosure *of the prior art* (a “conventional” noise canceller) to argue that Ikeda *teaches*, rather than teaches away, from using an outside sensor such as a VAD for training its adaptive filters. Pet., 21. Petitioner deceptively argues that “Ikeda teaches using a VAD to determine when voicing activity is absent. Ikeda discloses that one way to control when $W1(z)$ is calculated is by determining from ‘outside,’ e.g., using a sensor other than the physical microphones, whether $S(z)$ is absent. (Ex. 1003, 3:32-61, 9:11-18; Ex. 1002 ¶70.).” Pet., 21. The opposite is true. To the extent that Ikeda acknowledges that outside sensors, one of which may be a VAD, are available in the prior art, Ikeda teaches that its system improves over the prior art by using *internal* circuitry for

training the adaptive filter. The Petition does not address why a POSITA would add an outside sensor to an Ikeda system which is designed to render a VAD superfluous with its novel internal circuitry.

This is not a case where the prior art simply teaches multiple alternative options. Ikeda criticizes the use of outside sensors for providing inputs for training adaptive filters because their effectiveness is dependent on the location of the apparatus. *Id.*, 3:46-50. The internal circuitry proposed by Ikeda is advantageous over the prior art because it “insures rapid convergence and allows a minimum of signal distortion to occur *without resorting to a command customarily input from the outside* for commanding the learning operation of filters.” *Id.*, 9:14-18. Far from a mere alternative, Ikeda criticizes the prior art as inferior to its solution.

Petitioner’s expert argues that a POSITA “would have been motivated to look to other voice activity detection methods” because “Ikeda discloses the need for accurately determining periods when a desired signal (e.g., voicing activity) is present and periods when a desired signal is absent for an adaptive noise canceler to function optimally.” Ex. 1003, ¶ 91 (citing Ikeda, 3:32-54 and Puthuff, 3:19-24). Petitioner’s expert, however, is merely referring to Ikeda’s criticism of the prior art and identification of the problem that Ikeda solves by incorporating *internal circuitry* rather than an outside sensor, such as Puthuff’s, for training the adaptive filters. Petitioner does not explain how Ikeda’s motivation to invent internal circuitry

for training adaptive filters, in lieu of outside sensors, can motivate a POSITA to combine Ikeda with an outside sensor.

Additionally, Petitioner does not articulate any problem with Ikeda, or potential benefit, that would have directed a POSITA to include a Puthuff transducer. Pet. at 32-36. Instead, with respect to its theory of replacing Ikeda's inventive functionality with Puthuff's transducer, Petitioner first states that Ikeda and Puthuff "address the same problem—accurately detecting voice activity in noisy environments." Pet. at 32. However, unlike Puthuff, which discusses "high acoustic noise environments," Ikeda does not mention high noise levels. *Compare* Ex. 1004, 4:13-15 *with* Ex. 1003, 3:32-61.

Petitioner next states that "Ikeda discloses the need for accurately determining periods when a desired signal (e.g., voicing activity) is present and periods when a desired signal is absent for an adaptive noise canceler to function optimally." Pet. at 32. According to Petitioner, "[t]hus, a POSITA would have been motivated to look to other VAD methods." *Id.* at 33. This conclusory statement is supported by no evidence, and utterly ignores that Ikeda already includes a solution for determining when signals are present and not present. Petitioner's remaining statements describe portions of Puthuff but provide no motivation to combine. *Id.* at 33-34.

Petitioner alternatively argues that a POSITA would have been motivated to incorporate Puthuff's "vibration sensor and transition circuit into Ikeda such that the

output of Ikeda's microphone 1, $XA(z)$, was used in Puthuff's system as the output of the microphone 20." *Id.* at 34. According to Petitioner, "[t]he output signal 40 from Puthuff's system would be input into Ikeda's signal-to-noise power ratio generator in place of the original microphone-only signal $XA(z)$." *Id.* at 35. Petitioner relies on the same insufficient motivation as described directly above. *Id.* Petitioner again ignores Ikeda's express teachings against an "outside" sensor and thus provides no evidence or argument in support of destroying Ikeda's objectives.

Accordingly, a POSITA would not be motivated to combine Ikeda and Puthuff, and Petitioner has not shown that this limitation is disclosed or rendered obvious.

2. Petitioner's Combination Does Not Disclose or Render Obvious "generating a voice activity detection (VAD) signal using the voice activity signal;" as Required by Claim 1

Claim 1 recites the limitation "generating a voice activity detection (VAD) signal using the voice activity signal." As discussed above, Petitioner fails to show that the "voice activity signal" limitation would have been obvious.

Petitioner further argues that Ikeda discloses this limitation and that the "signals output by the signal-to-noise power ratio estimator and/or the step size output circuit comprise a 'voice detection (VAD) signal' because they contain information about whether a desired signal (*e.g.*, a voice signal) is present. Pet. at

41-42. Petitioner's argument is flawed. Critically, the VAD signal must be generated "us[ing] the voice activity signal", and the voice activity signal must include information on vibration of human tissue. '091 Patent, cl. 1. As discussed above, and as Petitioner tacitly admits, Ikeda contains no signal that includes information on vibration of human tissue. *See* Pet. at 41.

Petitioner further argues that Ikeda, modified to include Puthuff, would disclose this limitation. Pet. at 42-43. As discussed above, however, a POSITA would not be motivated to include Puthuff's "outside" sensor in Ikeda's system that was designed to obviate the need for such a sensor.

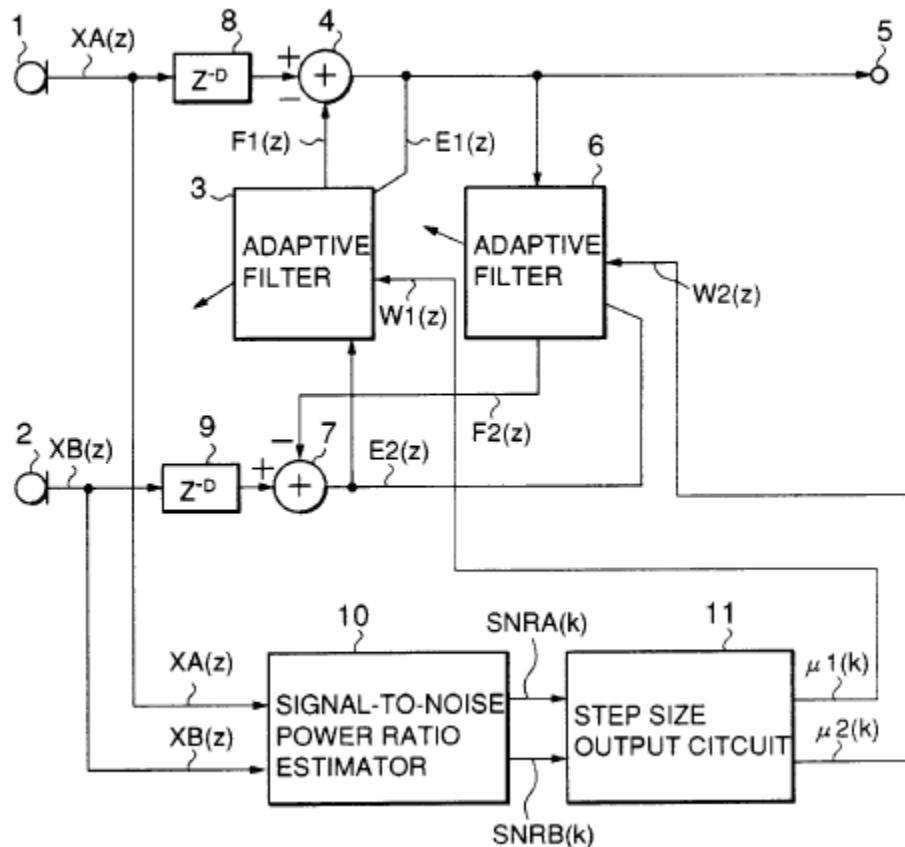
Accordingly, Petitioner has failed to show that this limitation is disclosed or rendered obvious.

3. Petitioner's Combination Does Not Disclose or Render Obvious "wherein the First Transfer Function Is Generated in Response to a Determination That Voicing Activity Is Absent from the Acoustic Signals for a Period of Time," as Required by Claims 11 and 18

Petitioner fails to show that its combination discloses or renders obvious generating the first transfer function in response to a determination that voicing activity is absent for a period of time, as required by Claims 11 and 18. Petitioner argues that Ikeda alone discloses this limitation. Pet. at 19-25, 38. However, Ikeda does not generate $W1(z)$ "in response to a determination that voicing activity is

absent from the acoustic signals” as required. Indeed, Ikeda does not make any determination that voicing activity is absent.

Petitioner identifies $W1(z)$ as the alleged first transfer function. Pet. at 21. As discussed above, Ikeda determines the signal-to-noise ratios of both its primary and reference microphones through the Signal-to-Noise Power Ratio estimator. Ikeda, Fig. 1; 7:6-9:10. Those outputs are fed to the Step Size Output Circuit, which determines the step sizes, $\mu 1(k)$ and $\mu 2(k)$, used in the adaptive filter. *Id.*, 8:13-9:10.



Ikeda, Fig. 1.

The step sizes are “fed to the adaptive filter[s]” to control the adaptation rate. *Id.*, 8:64-9:3. In an alternative arrangement, the step size for either adaptive filter might be set to 0, if the step size for the other filter is higher. *Id.*, 9:4-10.

The Petition fails to show that $W1(z)$ is generated in response to any determination that voicing activity is ***absent***. Indeed, as Petitioner admits, Ikeda, at most, “updates $W1(z)$ by a relatively larger amount” when its desired signal of the main signal is smaller than the noise signal. Pet. at 23. To the extent that Ikeda makes a determination regarding the level of voicing activity, that determination is only that the ***voicing activity is less than the noise signal***.

Petitioner does not point to any evidence in Ikeda that a determination that the main signal is smaller than the noise signal means that voicing activity is absent. Rather, Petitioner merely infers the absence of voicing activity without evidence. For instance, the Petition states, “[t]hus, when voicing activity is absent (e.g., when $SNRA(k)$ and $SNRB(k)$ are small or zero), step size $\mu1(k)$ ‘is increased’ while $\mu2(k)$ ‘is decreased.’ (Ex. 1003, 8:36-63; *id.*, 7:54-63, 8:13-35; Ex. 1002 ¶72.)” None of the cited portions of Ikeda disclose that voicing activity is absent. Indeed, given that the absence of voicing activity is not necessary for generating $W1(z)$, a POSITA would understand that Ikeda teaches no such determination.

Moreover, Petitioner admits elsewhere that $W1(z)$ is updated when voicing activity is present. Pet. at 43 (“Ikeda discloses that the first transfer function $W1(z)$

is updated by an increasing amount when voice is absent *and by a reduced amount when voice is present.*”) (emphasis added). While Petitioner relies on Ikeda’s alternative arrangement that sets step sizes to 0 if one step size is greater than the other, it does not show that this arrangement necessarily—or ever—is a result of voicing activity being absent. Pet. at 24.

Accordingly, Petitioner has failed to show that this limitation is disclosed or rendered obvious.

4. Petitioner’s Combination Does Not Disclose or Render Obvious “Generating at Least Two Transfer Functions Representative of a Ratio of Energy of the Acoustic Signal Received Using at Least Two Different Acoustic Microphones of the at Least Two Acoustic Microphones When the VAD Indicates That User Voicing Activity Is Absent, Wherein the at Least Two Transfer Functions Comprise a First Transfer Function and a Second Transfer Function,” as Required by Claim 1

Petitioner’s combination fails to disclose generating at least two transfer functions when the VAD indicates that user voicing activity is absent, as required by Claim 1.²

² Petitioner argues, without evidence, that Patent Owner has asserted Claim 1 “by applying it in the same way as Claims 11 and 18.” Pet. at 43. This statement is false; in any event, it provides no basis to depart from the language of Claim 1.

Petitioner relies largely on its arguments with respect to Claim 11, except that it further argues that both $W1(z)$ and $W2(z)$ are updated while the VAD indicates that voicing activity is both present and not present. Pet. at 43-44. First, as discussed above, Ikeda does not include a VAD, and its signal-to-noise or step signals do not meet the VAD limitation as claimed (which requires information about human tissue vibration). Thus, Ikeda cannot disclose “when the VAD indicates that user voicing activity is absent” as claimed.

Moreover, the signal-to-noise ratios or step signals do not indicate whether voicing activity is present. They merely indicate the relative strengths of the signal and noise signals. Ikeda, 7:19-8:12, 8:13-9:3. Even if, in some cases, a high signal-to-noise ratio is correlated with voicing activity, Petitioner has not shown that the signals indicate voicing activity.

Finally, Petitioner relies on the combination of Ikeda and Puthuff. Pet. at 44. As discussed above, a POSITA would not combine the two.

5. Petitioner’s Combination Does Not Disclose or Render Obvious “Wherein the Second Transfer Function is Generated in Response to a Determination that Voicing Activity is Present in the Acoustic Signals for the Period of Time,” as Required by Claim 11 and “Wherein a Second Transfer Function Representative of the Acoustic Signals is Generated in Response to a Determination that Voicing Activity is Present in the Acoustic Signals for a Specified Period of Time,” as Required by Claim 18

Petitioner fails to show that its combination discloses or renders obvious generating the second transfer function in response to a determination that voicing activity is present for a period of time, as required by Claim 11 and Claim 18. Petitioner argues that Ikeda alone discloses this limitation. Pet. at 25-28, 38. However, Ikeda does not generate $W2(z)$ “in response to a determination that voicing activity is present from the acoustic signals” as required. Indeed, Ikeda does not make any determination that voicing activity is present.

Petitioner relies on $W2(z)$ as the alleged second transfer function. Pet. at 26. As with the “first transfer function” limitation, however, Petitioner fails to show that Ikeda makes any determination as to whether voicing activity is present. Instead, Ikeda simply adjusts the step sizes applied to the adaptive filters. Petitioner ignores this deficiency, and simply relies on Ikeda’s discussion of problems with the prior art that required “learn[ing] a signal filter in sections where the desired signal component is present and the noise component is absent or negligibly small.” Pet. at

26 (citing Ikeda, 3:36-40). Indeed, as discussed above, Ikeda’s entire invention avoids such a determination by setting the step sizes based on the signal-to-noise ratios of the microphone signals.

Petitioner makes no further arguments as to the “determination.” Accordingly, the Petition fails to show that this limitation is disclosed or rendered obvious.

C. GROUND 2: Ikeda in View of Alcivar Does Not Render Obvious Claims 1-8, 11-14, 16, and 18-20

With respect to Ground 2, “Petitioner incorporates its discussion of Ikeda and how it discloses or renders obvious each claim and limitation from Ground 1.” Pet. at 48. As such, Patent Owner incorporates its arguments with respect to Ground 1 into Ground 2. Petitioner’s argument regarding the use of Alcivar’s tissue-conduction microphone is addressed below.

1. Petitioners’ Combination Does Not Disclose or Render Obvious “Receiving a Voice Activity Signal that Includes Information on Vibration of Human Tissue Associated with Human Voicing Activity of a User,” as Required by Claim 1 or “a Sensor for Detecting Voice Activity Based on Human Tissue Vibration,” as Required by Claims 11 and 18

As discussed with respect to Ground 1, Petitioner admits that Ikeda does not disclose using a VAD signal that includes information on the vibration of human tissue, as required by the claims. Pet. at 48-49. Instead, for this Ground, Petitioner relies on Alcivar’s tissue conduction microphone. *Id.* However, Petitioner largely

repeats its arguments for combining Ikeda with Puthuff and fails to show that a POSITA would have been motivated to combine Alcivar with Ikeda. Pet. at 50-52.

Petitioner first repeats its flawed statement that Ikeda is directed to detecting voice activity in “noisy environments.” Pet. at 50. As discussed above, Ikeda says nothing about noisy environments; in contrast, Alcivar is directed to extremely noisy environments, such as in underwater communications. Alcivar, 1:5-8, 1:15-20.

Petitioner next states that Alcivar suggests the combination. Pet. at 50. But as discussed above, Ikeda’s entire purpose and inventive concept is to avoid using outside sensors. Moreover, Petitioner identifies no part of Alcivar that suggests (or could benefit from) combination with Ikeda. *Id.* Instead, Petitioner argues that a POSITA would use Alcivar’s tissue-conduction microphone as a “cheaper, simpler option than Ikeda’s acoustic microphone-based VAD.” *Id.* Petitioner cites no evidence, other than its expert’s parroting of the same statement, that Alcivar’s tissue-conduction microphone is cheaper than Ikeda’s system. *Id.*; *see also* Ex. 1002, ¶ 150. Petitioner provides no reason that a POSITA would discard Ikeda’s invention to use Alcivar’s.

Petitioner’s other arguments are mere conclusions that a POSITA would replace Ikeda’s signal-to-noise based system with Alcivar. Pet. at 51-52. In particular, Petitioner relies only on its expert’s unsupported opinion that Alcivar’s system was more accurate or less susceptible to interference than Ikeda’s system;

especially as Ikeda was specifically designed to work without Alcivar-type sensors. *See* Ex. 1002, ¶¶ 151-52. Petitioner’s remaining argument was only that vibration sensors were known, which does not show obviousness.

As discussed above, Ikeda was designed to solve the problem of canceling noise without outside sensors. Ikeda, 9:14-18 (“The noise canceler therefore insures rapid convergence and allows a minimum of signal distortion to occur *without resorting to a command customarily input from the outside* for commanding the learning operation of filters.” (emphasis added)). Petitioner provides no reason, other than a hindsight-based desire to meet the claim elements, that a POSITA would combine Alcivar with Ikeda. Indeed, Alcivar is particularly incompatible with Ikeda’s stated aims because it requires precise placement of the tissue-conduction microphone, which requires trial and error (Alcivar, 5:16-20), and also must be insulated from outside sounds “by a layer of sound-absorbing material.” *Id.*, 5:21-23.

Accordingly, Petitioner has failed to show that this limitation is obvious.

2. Petitioner’s Combination Does Not Disclose or Render Obvious “Generating a Voice Activity Detection (VAD) Signal Using the Voice Activity Signal”

As discussed above, a POSITA would not combine Alcivar with Ikeda; accordingly, Petitioner has failed to show that this limitation is obvious.

D. GROUND 3: Ikeda, Puthuff or Alcivar, and Hussain Do Not Render Obvious Claims 3, 9, and 15

Ground 3 is directed to dependent claims. Petitioners' Ground 3 arguments do not address the deficiencies within its Ground 1 and Ground 2 arguments discussed above. Pet at 56-64. Accordingly, Petitioner has not shown a reasonable probability of success with respect to Ground 3.

E. GROUND 4: Ikeda, Puthuff or Alcivar, and Sasaki Do Not Render Obvious Claims 10 and 17

Ground 4 is directed to dependent claims. Petitioner's Ground 4 arguments do not address the deficiencies within its Ground 1 and Ground 2 arguments discussed above. Pet at 64-69. Accordingly, Petitioner has not shown a reasonable probability of success with respect to Ground 4.

VII. CONCLUSION

As discussed above, Petitioner's combinations fail to disclose key limitations of each claim of the '091 Patent and, therefore, do not render obvious any claims. The Board should, therefore, deny the Petition.

Respectfully submitted,

Dated: October 11, 2023

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CERTIFICATE OF WORD COUNT

The undersigned hereby certifies that the portions of the above-captioned PATENT OWNER'S PRELIMINARY RESPONSE specified in 37 C.F.R. § 42.24 has 5,255 words in compliance with the 14,000 word limit set forth in 37 C.F.R. § 42.24. This word count was prepared using Microsoft Word for Office 365.

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CERTIFICATE OF SERVICE

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