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. 8,326,611
Filing Date: October 26, 2009
Issue Date: December 4, 2012

Inventor: Nicolas Petit, Gregory Burnett, and Zhinian Jing
Title: ACOUSTIC VOICE ACTIVITY DETECTION (AVAD) FOR ELECTRONIC SYSTEMS

PATENT OWNER'S PRELIMINARY RESPONSE

Case No. IPR2023-01156

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Exhibit No.	Description of Document
2001	Joint Motion to Dismiss, *Jawbone Innovations, LLC v. Amazon.com, Inc.* No. 3:22-cv-06727-TLT, Dkt. 106 (N.D. Cal. July 24, 2023

I. INTRODUCTION

On July 6, 2023, LG Electronics, Inc. ("LG" or "Petitioner") filed a Petition requesting *inter partes* review of claims 29-44 ("Challenged Claims") of U.S. Patent No. 8,326,611 (the "'611 Patent") (Ex. 1001). Paper 2. The Declaration of Dr. Thomas W. Kenny (Ex. 1003) accompanied the Petition. On July 20, 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 institution of the Petition because it fails to show that the key filter limitation would have been obvious. Petitioner identifies a quotient used as a multiplier value as the filter, but as explained below, a filter is more than a simple multiple. Moreover, the quotient was not formed as a ratio of two signals as required by the claims.

Accordingly, the Board should deny institution.

II. THE '611 PATENT

The '611 Patent, entitled Acoustic Voice Activity Detection (AVAD) For Electronic Systems (Ex. 1001), was issued on December 4, 2012, and was filed on October 26, 2009.

The '611 Patent discloses and claims methods for acoustic voice activity detection in microphone arrays. The claimed inventions "use microphones to generate virtual directional microphones which have very similar noise responses

and very dissimilar speech responses." Furthermore, the "ratio of the energies of the virtual microphones is then calculated over a given window size and the ratio can then be used with a variety of methods to generate a VAD signal. The virtual microphones can be constructed using either an adaptive or a fixed filter". '611 Patent Abstract.

Figures 4 and 3 of the '611 Patent provide illustrative embodiments for creating the virtual microphone signals, V_1 and V_2, respectively, from two omnidirectional physical microphone signals (O_1 and O_2).

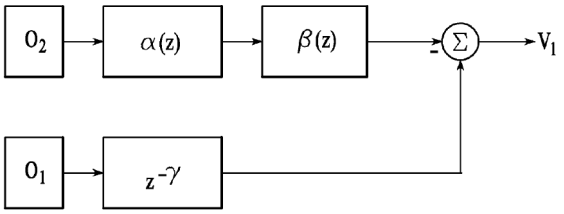


FIG.4

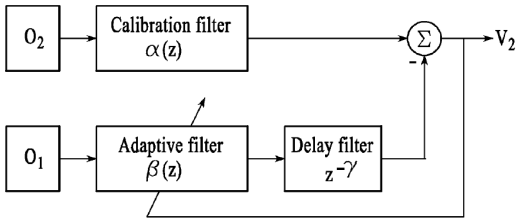


FIG.3

Id., FIGS. 3, 4.

The '611 Patent explains that "[i]t is assumed that O_1 is closer to the speech source (the user's mouth)" *Id*. 4:64-65. In the above Figures α(z) and β(z) represent filters, where β(z) can be fixed or adaptive. *Id*. 6:17-18.

The relationship of V1 and V2 can be described in the digital frequency domain (z variable) as:

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

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

Id. 5:23-35. In the above equations (and FIG. 3 and FIG. 4 from Ex 1001), "α(z) is a calibration filter used to compensate O_2's response so that it is the same as O_1, β(z) is a filter that describes the relationship between O_1 and calibrated O_2 for speech, and Y is a fixed delay that depends on the size of the array" *Id*. 5:29-33.

Ideally the microphones O_1 and O_2 are assumed to be calibrated so that "their response to a source located the same distance away was identical for both amplitude and phase." *Id.*, 28:54-58. However, this is not always feasible in practice and the calibration filter α(z) can be determined using adaptive algorithms, for example, so that in the presence of speech only signals (with no or low levels of noise) the microphone signals O_1 and O_2 satisfy the relationship $O_1(z) = \alpha(z)\, O_2(z)$. *Id.*, 28:58-29:27.

After the calibration filter α(z) is determined, the filter β(z) can be determined, either from the geometry of microphones relative to the target speech source, or, in the claimed embodiments, by using an adaptive filter algorithm to satisfy the relationship:

$$\tilde{\beta}(z) = \frac{a(z)O_2(z)}{z^{-v}O_1(z)}$$

Id., 6:1-11.

The Voice Activity Detection (VAD) is based on computing the ratio R:

$$R = \frac{||V_1(z)||}{||V_2(z)||} = \sqrt{\frac{\left(-\tilde{\beta}(z)\alpha(z)O_2(z) + O_1(z)z^{-v}\right)^2}{\left(\alpha(z)O_2(z) - \tilde{\beta}(z)O_1(z)z^{-v}\right)^2}}$$

where "double bar indicates norm and again any size window may be used. If $\tilde{\beta}(z)$ has been accurately calculated, the ratio for speech should be relatively high (e.g., greater than approximately 2) and the ratio for noise should be relatively low (e.g., less than approximately 1.1)." *Id.*, 6:20-32. If the ratio R is above a threshold, speech is present, otherwise speech is absent. *Id.*, FIG. 5 (510). "Many techniques known to those skilled in the art (e.g., smoothing, etc.) can be used to make R more amenable to use in generating a VAD and the embodiments herein are not so limited." *Id.*, 6:38-41.

III. THE ALLEGED PRIOR ART

A. Avendano '880 (U.S. Patent No. 8,194,880)

U.S. Patent No. 8,194,880 ("Avendano '880") (Ex. 1005) was filed on January 29, 2007, and issued on June 5, 2012.

Avendano '880 describes "[s]ystems and methods for utilizing inter-microphone level differences (ILD) to attenuate noise and enhance speech".

Avendano, Abstract. In exemplary embodiments, "primary and secondary acoustic signals are received by omni-directional microphones, and converted into primary and secondary electric signals". *Id.* Further, "[a] differential microphone array module processes the electric signals to determine a cardioid primary signal and a cardioid secondary signal." *Id.* The cardioid signals are "filtered through a frequency analysis module" and "[e]nergy levels of the signals are then computed, and the results are processed by an ILD module using a non-linear combination to obtain the ILD." In exemplary embodiments, "the non-linear combination comprises dividing the energy level associated with the primary microphone by the energy level associated with the secondary microphone. The ILD is utilized by a noise reduction system to enhance the speech of the primary acoustic signal." *Id.*

FIG. 4a in Avendano '880 represents an illustrative embodiment utilized in the IPR and the Declaration of Dr. Kenny.

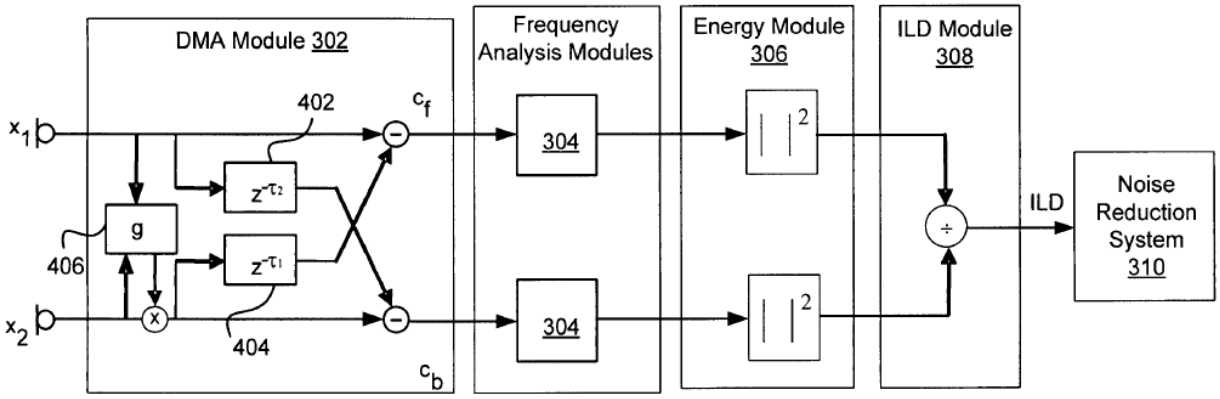


FIG. 4a

Id., FIG. 4a; Pet., 14; Ex. 1003, ¶ 60. In this embodiment, "[t]he gain factor, g, is computed by the gain module 406 to equalize the signal levels." Ex 1005, 5:36-37.

The gain is applied to signal x_2 which is then delayed and subtracted from x_1 in the upper subtraction unit resulting in c_f. Avendano, FIG. 4a, 4:20-39. Signal x_1 is delayed and subtracted from gain-applied x_2 in the lower subtraction unit resulting in c_b. *Id.* Petitioner alleges that c_f represents the "front" direction (the direct of target speech signal) in a "front-to-back cardioid region", and c_b represents the "back" direction. Pet., 11-12, 20.

B. Hou (U.S. Patent No. 7,155,019)

U.S. Patent No. 7,155,019 ("Hou") (Ex. 1008) was filed on March 14, 2001, and issued on December 26, 2006.

Hou teaches "[i]mproved approaches to matching sensitivities of microphones in multi-microphone directional processing systems." The approaches "adaptively

match microphone sensitivities so that directional noise suppression is robust" and particularly useful for "hearing aid applications in which directional noise suppression is important." Ex. 1008, Abstract.

A specific embodiment in Fig. 5 of Hou is emphasized in the IPR and the Declaration of Dr. Kenny and shown below (with some additional markings relevant to this document)

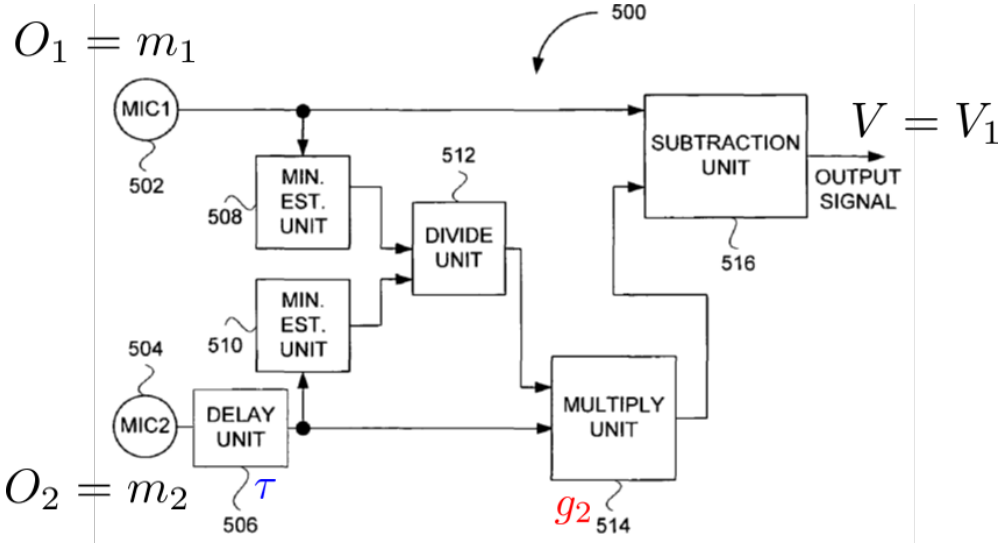


FIG. 5

Since the focus of Hou is on "calibration" of m_1 (MIC 1) and m_2 (MIC 2) signals, there is only one output signal, labeled as V. The delay unit 506 introduces a delay τ in the m_2=O_2 signal, which is then multiplied by the gain (annotated as g_2 above) by the multiply unit 514 and the resultant signal is then subtracted from the m_1=O_1 signal by the subtraction unit 518 to yield the output virtual signal V. The

min. est. units 508 and 510 and the divide unit 512 are utilized in computing the multiplication gain g_2 in FIG. 5 of Hou.

C. The Proposed Avendano/Hou Combination

Petitioner proposes combining "aspects of Hou's system 500" "into Avendano '880's DMA module 302." Pet., 21. Petitioner provides two examples of its proposed combination.

1. "First example modification"

In its first example, Petitioner proposes incorporating Hou's delay unit 506, first minimum estimate unit 508, second minimum estimate unit 510, divide unit 512, multiplication unit 514, and subtraction unit 516 into the Avendano '880 system. Pet. 23. Petitioner illustrates its combination in the below Figures:

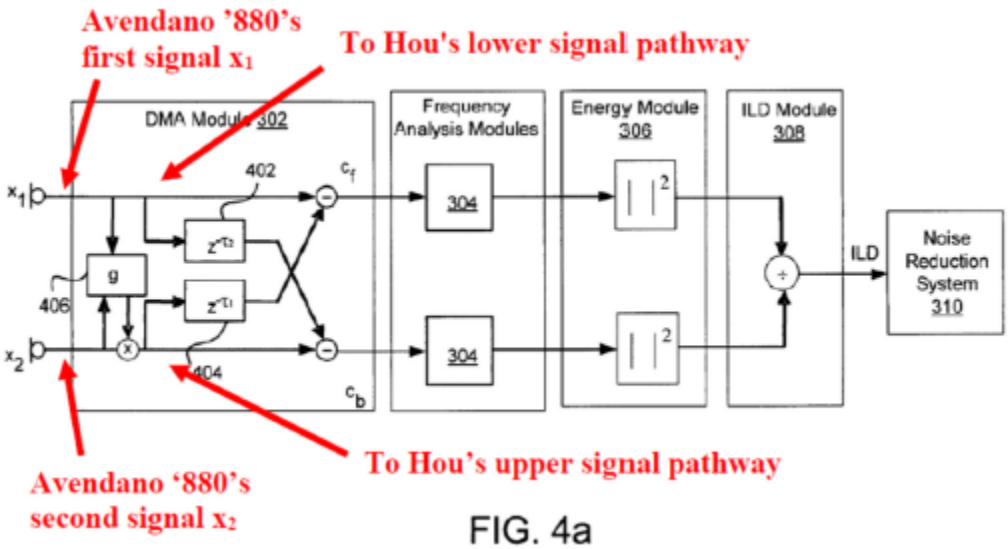


FIG. 4a

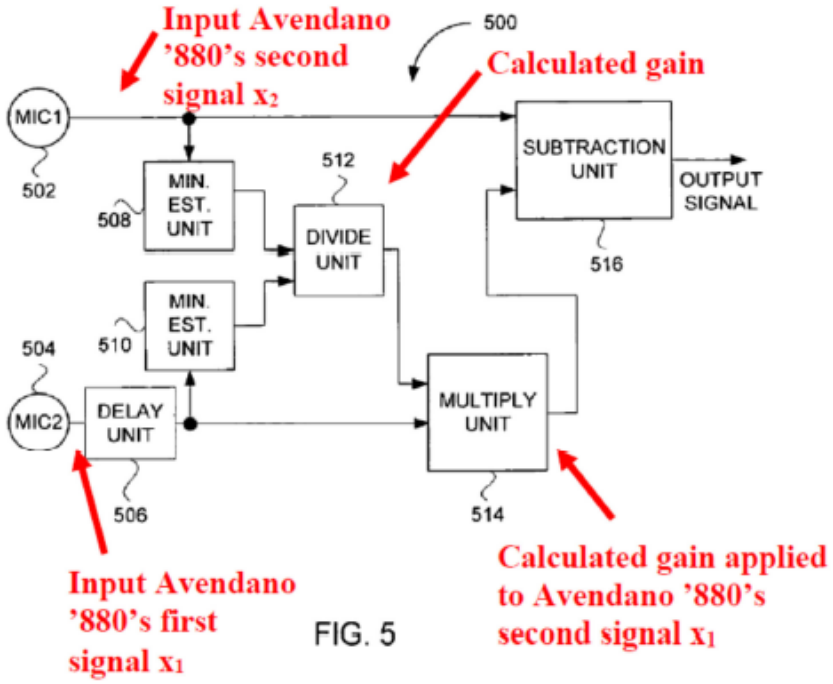


FIG. 5

Pet., 24-25. Accordingly, the primary difference between Avendano '880 and the combination is the addition of a gain applied to the x_1 signal by multiplication unit 514.

2. "second example modification"

Petitioner's second example modification utilizes Hou to "enhance the signal equalization functionality of Avendano '880's system." Pet., 28.

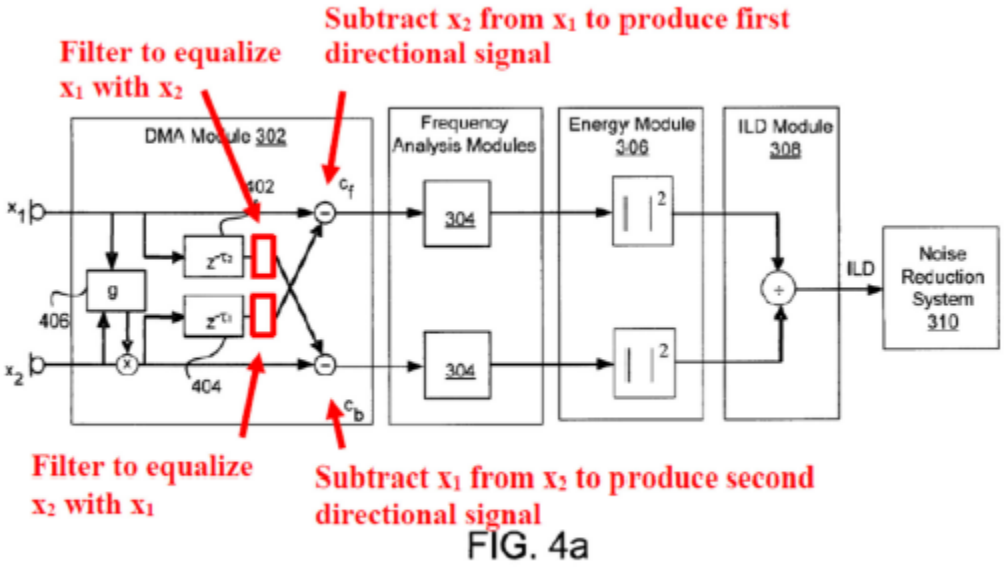


FIG. 4a

EX. 1005, FIG. 4a (modified)

Pet., 29. Petitioner proposes that "to generate a filter to equalize Avendano '880's signal x_2 with Avendano '880's signal x_1," the x_2 signal "would be input into Hou's system 500 along the upper signal pathway." *Id.*, 29-30. Further, as with the first example, "Avendano '880's signal x_1 would be input into Hou's system 500 along the lower signal pathway." *Id.*, 30. Petitioner illustrates this example with similar diagrams:

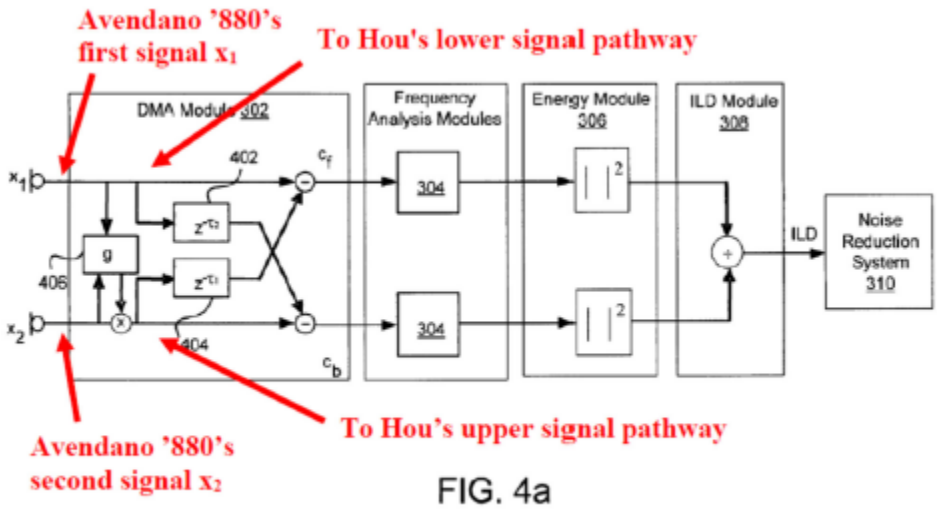


FIG. 4a

EX. 1005, FIG. 4a

Pet., 31.

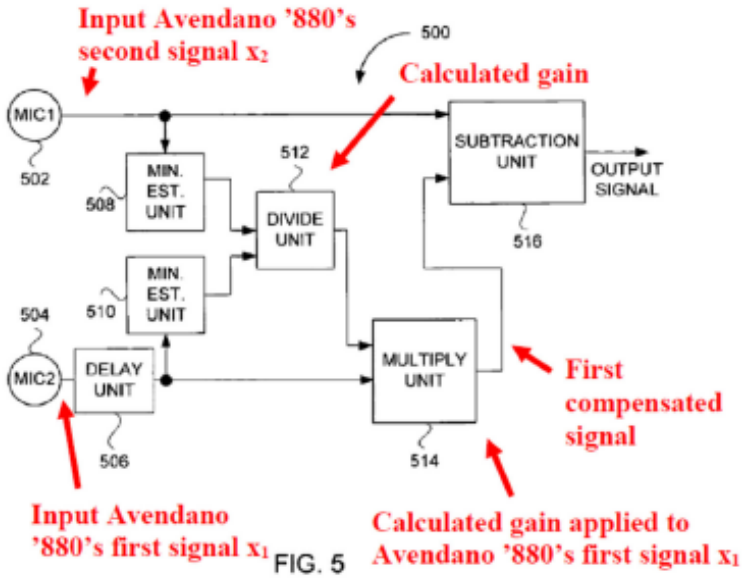


FIG. 5

EX. 1008, FIG. 5

Pet., 31-32. Petitioner further states "that the inverse of the calculated gain could be used to generate a filter to equalize Avendano '880's signal x_1 with Avendano '880's signal x_2." Pet., 32.

IV. CLAIM CONSTRUCTION

Term	Jawbone's Construction	Petitioner's Construction
"forming a filter"	"forming an adaptive filter comprising a signal ratio"	No construction necessary

The Board should construe "filter" as used in Claims 29 and 44 as "adaptive filter comprising a signal ratio."

The claim term "filter" as recited in Claims 29 and 44 requires the filter to be formed as the ratio of a calibrated signal to the delayed first signal. The claim language makes this clear; it recites "forming a filter by generating a first quantity by applying a calibration to a second signal of a second physical microphone, generating a second quantity by applying the delay to a first signal of a first physical microphone, and forming the filter as a ratio of the first quantity to the second quantity." *E.g.*, '611 Patent, Claim 29. This language requires that the filter be formed by taking a ratio of two ***signals***: a calibrated signal and a delayed first signal. *Id.* The specification further explains that applying the claimed filter results in a virtual microphone V_2 with minimal response to speech—in other words the filter eliminates speech from the input signal. *Id.*, 4:13-30.

The '611 Patent sets out explicitly that the filter formed as a ratio of the delayed first signal and calibrated second signal is an adaptive filter:

$$\tilde{\beta}(z) = \frac{a(z)O_2(z)}{z^{-\nu}O_1(z)}$$

'611 Patent, 6:1-11. As shown above, the filter is composed of the ratio of $\alpha(z)O_2(z)$—the calibrated signal—to $z^{-\gamma}O_1(z)$—the delayed signal. *See id.*, 5:29-33 (defining $\alpha(z)$ as the calibration filter and $z^{-\gamma}$ as the fixed delay). The specification does not provide any embodiments where the filter is formed as a ratio of two scalars (such as estimated minima) derived from the calibrated and delayed signals.

The '611 Patent sets out a different embodiment where the $\beta(z)$ filter is derived from the ratio of two scalars:

$$\beta(z) = \frac{d_1}{d_2} = \frac{d_1}{d_1 + d}$$

'611 Patent, 5:53-59. This $\beta(z)$ is based on the distances between the two microphones and corrects for the differing responses to speech by decreasing the magnitude of the signal received at the closer microphone. *Id.* Claims 29 and 44, by requiring the filter to be formed by taking the ratio of the calibrated and delayed signals, explicitly does not claim this second embodiment. Instead, it is claimed in Claim 1 (reciting a "forming a filter that describes a relationship for speech between the first physical microphone and the second physical microphone").

The Petition, while claiming no construction is necessary, apparently conflates the claimed filter with a fixed gain. *E.g.*, Pet. 34-41 (identifying a calculated gain as the claimed filter). Accordingly, if the Board determines that construction is necessary, the filter of Claim 1 should be given its meaning as read in the context of the specification: adaptive filter comprising a signal ratio. *Thorner v. Sony Comput. Ent. Am. LLC*, 669 F.3d 1362, 1365 (Fed. Cir. 2012) ("The words of a claim are generally given their ordinary and customary meaning as understood by a person of ordinary skill in the art when read in the context of the specification and prosecution history. There are only two exceptions to this general rule: 1) when a patentee sets out a definition and acts as his own lexicographer, or 2) when the patentee disavows the full scope of a claim term either in the specification or during prosecution." (internal citation omitted)).

V. LEVEL OF ORDINARY SKILL IN THE ART

A person of ordinary skill in the art ("POSITA") would have a bachelor's degree in computer engineering, computer science, electrical engineering, mechanical engineering, or a similar field, and three years of industry or academic experience in a field related to acoustics, speech recognition, speech detection, or signal processing. Work experience can substitute for formal education and additional formal education can substitute for work experience. Petitioner generally agrees with this level of skill in the art. *See* Pet. at 10; Ex. 1003, ¶¶ 22-23.

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: The Combination of Avendano '880 and Hou Does Not Render Claims 29-31, 33-37, and 41-44 Obvious

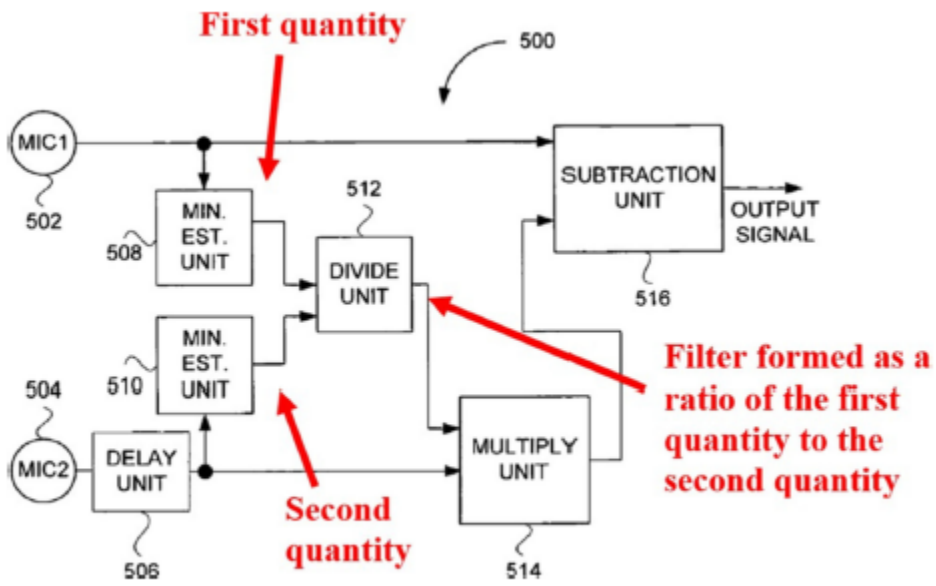
The Petition should not be instituted because it fails to show that the combination of Avendano '880 and Hou renders the claims of the '611 Patent obvious.

1. Petitioner's Combination Does Not Disclose or Render Obvious "forming a filter by generating a first quantity by applying a calibration to a second signal of a second physical microphone, generating a second quantity by applying the delay to a first signal of a first physical microphone, and forming the filter as a ratio of the first quantity to the second quantity"

The Petition does not show that the combination of Avendano '880 and Hou discloses forming a filter as claimed because, at best, the combination applies a gain that is calculated by dividing two scalar numbers, not signals.

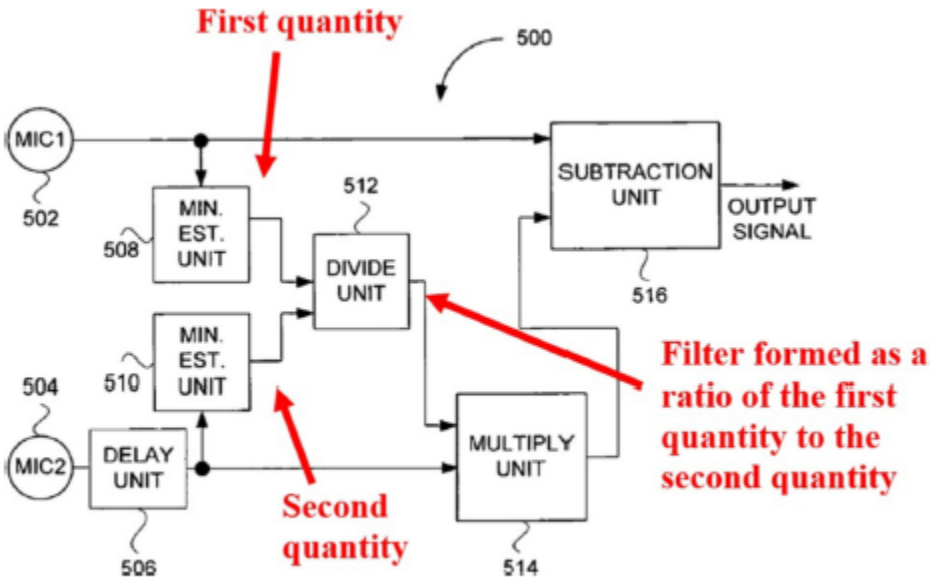
For both of its example modifications, Petitioner identifies the quotient output from the Hou's Divide Unit as the filter of the claims. Pet., 35-41. The quotient is not the filter of the claims, nor is it formed as a ratio of quantities that were formed by applying a calibration to a signal and applying a delay to a signal. The quotient is, instead, a gain that is calculated by dividing two scalars.

Petitioner's contentions with respect to its first example modification are shown in relevant part in its annotated FIG. 5 from Hou.



EX. 1008, FIG. 5

Pet., 41 In Petitioner's combination, Avendano's x_2 signal enters Min. Est. Unit (minimum estimation unit) 508. Pet., 37-38. The Min. Est. Unit outputs a scalar value of the estimated minimum of the x_2 signal. Hou, 5:33-39; 7:16-8:13. Similarly, the second minimum estimation unit outputs a scalar value of the estimated minimum of the x_1 signal. *Id.* These two values are then divided, resulting in a quotient that "represents a ***scaling amount*** that is sent to a multiplication unit 514." Hou, 5:42-45 (emphasis added). Petitioner argues, with respect to both examples, that the scaling amount is the "filter" of the claims. Pet., 40 ("Specifically, Hou's 'divide unit 512 produces a quotient by dividing the first minimum estimate by the second minimum estimate,' '[t]he quotient represent[ing] a scaling amount that is sent to a multiplication unit 514.'").



EX. 1008, FIG. 5

Pet., 41.

i. The "scaling amount" is not the claimed filter

The "scaling amount" is not the claimed filter. As Petitioner acknowledges, the scaling amount is, instead, a gain. *E.g.*, Pet., 24 ("Hou's system would calculate a gain based on the received signals and generate a compensated signal using the calculated gain."); 30 ("Further, Hou's 'divide unit 512' would calculate a gain as the quotient of the output of 'first minimum estimate unit 508' and the output of 'second minimum estimate unit 510.'"). The calculated gain, however, is applied by a multiplier, and is neither adaptive nor the ratio of two signals as required by the claim. In contrast, the filter formed in Claims 29 and 44 is the adaptive filter disclosed in the '611 Patent. Tellingly, neither Avendano nor Hou describe their gain and multiplication units, respectively, as filters.

The scaling amount that Petitioner casts as the filter is not composed of the ratio of two signals; it is simply used to multiply a signal by a constant amount. *E.g.*, Pet., 24-25, 31-32. Such a scalar multiplication does not meet the claimed filter, which must be the adaptive filter formed as the ratio of two signals, as discussed above.

Dependent Claim 40 further makes clear that the filter of Claim 29 cannot be a simple quotient value. Claim 40 recites "[t]he method of claim 37, comprising ***generating coefficients of the filter*** during a period when only speech is being received by the first physical microphone and the second physical microphone." '611 Patent, Claim 40 (emphasis added). Viewed in context, Claim 40 demonstrates that the filter of Claim 29 consists of coefficients, which are not present in the quotient value. Both Petitioner and its expert ignore this contradiction. Pet., 88-91; Ex. 1003, ¶¶ 257-64.

Petitioner and its expert make no effort to show that the quotient value is a filter. They simply describe it as such. *E.g.*, Pet., 40-41; Ex. 1003, ¶¶ 130-37. Indeed, Petitioner does not explain the difference between a filter and any other component (such as a multiplier or adder) in the combination. Allowing Petitioner's broad usage would effectively and impermissibly read "filter" out of the claims. *Bicon, Inc. v. Straumann Co.,* 441 F.3d 945, 950-51 (Fed. Cir. 2006) (rejecting construction that

rendered claim terms meaningless and noting that "claims are interpreted with an eye toward giving effect to all terms in the claim").

Accordingly, the Petition is deficient because it does not show that the combination would disclose or render obvious the claimed "filter."

ii. The filter is not formed as claimed

Claims 29 and 44 of the '611 Patent requires the filter to be formed in a specific fashion:

> forming a filter by generating a first quantity by applying a calibration to a second signal of a second physical microphone, generating a second quantity by applying the delay to a first signal of a first physical microphone, and forming the filter as a ratio of the first quantity to the second quantity;

Even if the calculated gain were the claimed filter—it is not—it is not ***formed*** as claimed. The claim recites that the first quantity must be generated "by applying a calibration to at least one of the first signal and the second signal." Applying a calibration to a signal results in a calibrated signal, not a scalar number. *E.g.*, '611 Patent, 5:20-35 (defining virtual microphone output signal $V_2(z)$ by subtracting $\beta(z)O_1(z)$ from calibrated signal $\alpha(z)O_2(z)$). Similarly, the second quantity is also a signal: specifically, the first signal after being delayed. Accordingly, a POSITA would recognize that both quantities are signals.

Petitioner alleges that "a calibration would be applied to the second signal x_2 using Avendano '880's 'gain factor, g' and/or multiplexer." Pet., 37. Then, ***subsequent*** processing results in the "first quantity." *Id.* But the subsequent processing is the use of Hou's minimum estimate unit 508. *Id.* As explained above, that unit outputs a scalar value, not a signal. Similarly, Petitioner identifies the second quantity as the output of minimum estimation unit 510, another scalar. Pet., 40. Petitioner then argues that the resulting quotient is the filter.

The '611 Patent's specification consistently explains that the filter is formed by a ratio of two signals, not two scalars. '611 Patent, 6:1-9. Indeed, the claimed filter $\beta(z)$ is explicitly defined as the ratio of calibrated $O_2(z)$[1] to delayed $O_1(z)$:

$$\tilde{\beta}(z) = \frac{a(z)O_2(z)}{z^{-v}O_1(z)}$$

The '611 Patent contains no embodiments where the filter $\beta(z)$ is formed by dividing two scalar values. Moreover, while the specification makes a reference to a

[1] The equation is printed with an "a(z)" filter; however, the prosecution history makes clear that the equation refers to the $\alpha(z)$ calibration filter. Ex. 1002, 12.

fixed filter β(z) (*see* '611 Patent, 8:39-56), the fixed filter is an unclaimed embodiment as it is not "formed" with respect to the signals.

Accordingly, even if the quotient value used to apply a gain to the signals were a filter, it is not "formed" as claimed. Petitioner makes no obviousness arguments to overcome this deficiency. The Petition is therefore deficient and the Board should deny institution.

C. GROUND 2: The Combination of Avendano '880, Hou, and Avendano '252 Does Not Render Obvious Claims 32, 38-40

As discussed in Ground 1, the combination of Avendano '880 and Hou fails to render obvious independent Claim 29, from which Claims 32 and 38-40 depend. Petitioner does not argue that Avendano '252 remedies these deficiencies. *See* Pet. at 70-91. Accordingly, no claims are rendered obvious under Ground 2 and the Petition should not be instituted.

VII. CONCLUSION

As discussed above, the Petition is deficient because it fails to show that the "filter" of Claims 29 and 44 would be rendered obvious by Petitioner's combination. The Board should therefore deny institution of the Petition.

Respectfully submitted,

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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 3,804 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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