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. 7,246,058
Filing Date: May 30, 2002
Issue Date: July 17, 2007

Inventor: Gregory C. Burnett
Title: DETECTING VOICED AND UNVOICED SPEECH USING BOTH ACOUSTIC AND NONACOUSTIC SENSORS

PATENT OWNER'S PRELIMINARY RESPONSE

Case No. PR2023-01110

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Exhibit No.	Description of Document
2001	Joint Motion to Dismiss, *Jawbone Innovations, LLC v. Apple Inc.,* No. 6:21-cv-00984-ADA, Dkt. 110 (W.D. Tex. Dec. 23, 2022)

I. INTRODUCTION

The Board should deny Petitioner LG Electronics Inc.'s ("LG" or "Petitioner") Petition because the Petition fails to show that any proposed combination discloses or renders obvious the limitation "wherein the at least one processor . . . identifies information of the acoustic signals as noise when the difference parameters are less than the gain threshold." Petitioner's arguments regarding this limitation boil down to an attempt to conflate the ***absence*** of speech detection with affirmative identification of an acoustic signal as noise. Nor could Petitioner's attempt to infer a noise identification based on the absence of some output possibly provide the advantages of the patented invention, which allows calculation of noise suppression functions during periods where the system is confident that only noise is occurring. *See* '058 Patent, 6:37-62. Indeed, lacking any actual disclosure where acoustic signals are identified as noise, the Petition resorts to mischaracterizations and selective quotations of the asserted references. But as discussed in detail *infra* Section VII, none of these references actually discloses "identif[ying] information of the acoustic signals as noise."

Accordingly, the Petition is deficient and the Board should deny institution.

II. THE '058 PATENT

The '058 Patent describes systems and methods for detecting voiced and unvoiced speech in acoustic signals using physiological information. '058 Patent,

Abstract. Previous methods "for classifying voiced and unvoiced speech have relied mainly on the acoustic content of microphone data, which is plagued by problems with noise and the corresponding uncertainties in signal content." *Id.*, 1:34-37.

In contrast to previous methods which rely on acoustic data, the '058 Patent utilizes a voicing sensor which receives non-acoustic physiological information. *Id.*, 3:10-15 (discussing "non-acoustic sensor to enable detection of voiced speech in any environment"). While many different sensors may be usable as the voicing sensor, the invention requires a "sensor that is able to detect human tissue motion associated with speech and is unaffected by environmental acoustic noise." *Id.*, 3:61-63.

In particular, the '058 Patent receives acoustic signals at two microphones. *Id.*, 1:16-19, 2:38-47. The system also receives physiological information from the voicing sensor. *Id.*, 5:26-31, 5:46-65. By correlating the acoustic signals with the physiological information, the system can determine when a signal contains voiced speech. *Id.* The system also determines whether there is unvoiced speech by generating difference parameters between the acoustic signals received at the two microphones. *Id.*, 7:52-8:48. When those parameters exceed a gain threshold, the signal is identified as unvoiced speech. *Id.* And when the parameters are beneath the threshold, the signal is identified as noise. *Id.*

The '058 Patent explains that its "NAVSAD and PSAD systems include an array algorithm for speech detection that uses the difference in frequency content

between two microphones to calculate a relationship between the signals of the two microphones. ***This is in contrast to conventional arrays that attempt to use the time/phase difference of each microphone to remove the noise outside of an 'area of sensitivity'***. The methods described herein provide a significant advantage, as they do not require a specific orientation of the array with respect to the signal." Ex. 1001 (hereinafter "'058 Patent"), 3:29-38 (emphasis added).

The '058 Patent further explains that its invention yields advantages over conventional arrays based on its sensitivity to noise of every type and orientation: "Further, the systems described herein are sensitive to noise of every type and every orientation, ***unlike conventional arrays that depend on specific noise orientations***. Consequently, the frequency-based arrays presented herein are unique as they depend only on the relative orientation of the two microphones themselves, with no dependence on the orientation of the noise and signal with respect to the microphones. This results in a robust signal processing system with respect to the type of noise, microphones, and orientation between the noise/signal source and the microphones." *Id.*, 3:39-49 (emphasis added). These advantages are based on, among other things, the invention's ability to confidently identify noise by comparing difference parameters to a gain threshold, and thereby calculate noise suppression functions during periods where only noise is being received:

> However, there is another way to solve for some of the unknowns in Equation 1. Examine the case where the signal is not being generated—that is, where the GEMS signal indicates voicing is not occurring. In this case, s(n)=S(z) =0, and Equation 1 reduces to
>
> $$M_{1n}(z)=N(z)H_1(z)$$
>
> $$M_{2n}(z)=N(z)$$
>
> where the n subscript on the M variables indicate that only noise is being received. This leads to
>
> $$M_{1n}(z) = M_{2n}(z)H_1(z) \qquad (2)$$
>
> $$H_1(z) = \frac{M_{1n}(z)}{M_{2n}(z)}$$
>
> $H_1(z)$ can be calculated using any of the available system identification algorithms and the microphone outputs when only noise is being received. The calculation can be done adaptively, so that if the noise changes significantly $H_1(z)$ can be recalculated quickly.

Id., 6:37-62; *see also id.* at FIG. 10 and 8:49-61.

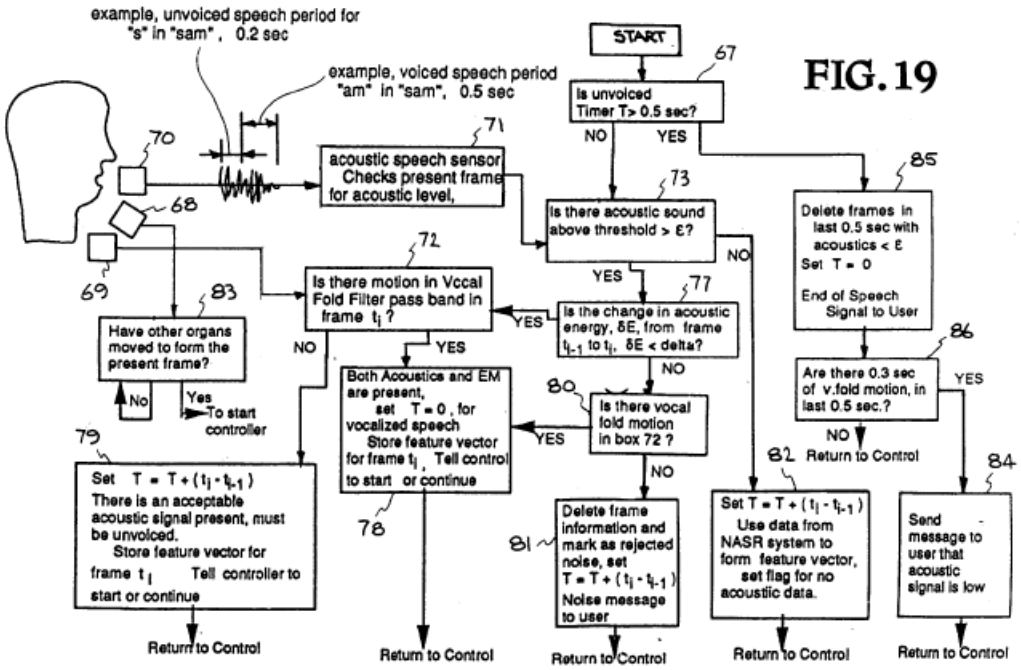
III. THE RELEVANT ALLEGED PRIOR ART

A. Holzrichter (U.S. Patent No. 6,006,175)

U.S. Patent No. 6,006,175 (Ex. 1003, "Holzrichter") is directed to a speech recognition system that uses an EM sensor to measure "the positions and velocities of the speech organs." Holzrichter, Abstract.

By using one microphone and one EM sensor, such as a microwave impulse radar, Holzrichter is able to discern whether a sound is voiced speech, unvoiced speech, or noise. *Id.*, 6:12-7:19. "Accordingly, it is an object of the invention to provide method and apparatus for speech recognition using nonacoustic information in combination with acoustic information." *Id.*, 7:21-24.

Holzrichter provides a detailed description of its process:



Id., FIG. 19. *See also id.*, 31:23-32:54. When a noise is received, the system determines whether the sound is above a threshold but less than a load noise threshold. *Id.*, 32:1-4. If so, and if vocal fold motion is detected by the EM sensor, then voiced speech has occurred. *Id.*, 32:4-7. If no vocal fold motion is detected,

then noise is detected. *Id.*, Fig. 19. If there is acoustic signal, but no vocal fold motion, then unvoiced speech is detected. *Id.*

B. Takano (Japanese Unexamined Patent Application H11-305792)

Japanese Unexamined Patent Application H11-305792 (Ex. 1005, "Takano") is directed to a two-microphone system. Takano, Abstract. Takano determines level differences between the two received signals, and performs voice recognition on voiced sections, as determined by a bone conduction microphone. *Id.*

C. Kinsler

Fundamentals of Acoustics (Ex. 1004, "Kinsler") is a textbook on acoustics. The relevant portion Kinsler describes using cross correlation when a "signal is known exactly." Kinsler, 256. In such cases, cross correlation is useful for searching "for a facsimile of the known signal." *Id.*

D. Torick

"An Interphone System for 'Hands-Free' Operation in High Ambient Noise" (Ex. 1006, "Torick") is a 1966 paper describing a voice-actuated switch for use in high noise environments.

IV. CLAIM CONSTRUCTION

For the purposes of this Preliminary Response only, Patent Owner believes that claim construction is not required to resolve any issues.

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—"would have had 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 can substitute for formal education and additional formal education can substitute for work experience." Pet. at 165-17.

VI. 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. Telefex 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 of 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).

VII. ARGUMENT

A. GROUND 1A: The Combination of Holzrichter, Takano, and Kinsler Does Not Render Obvious Claims 1-5

1. Petitioner's Combination Does Not Disclose or Render Obvious "wherein the at least one processor … identifies information of the acoustic signals as noise when the difference parameters are less than the gain threshold."

Petitioner asserts that "Holzrichter combined with Takano" discloses this limitation, but its arguments for disclosure of this limitation rely solely on Takano. However, Petitioner fails to show any disclosure of this limitation in Takano. At most, Petitioner conflates the ***absence*** of a speech signal being identified as

"dominant" with an identification of noise. But that does not constitute an identification of acoustic signals as noise – indeed, Takano could just as easily determine that a target signal is "not dominant" in the presence of silence. Nor could the absence of an identification possibly provide the advantages of the patented invention, which allows calculation of noise suppression functions during periods where the system is confident that only noise is occurring. *See* '058 Patent, 6:37-62. The Petition should be denied.

Petitioner's entire argument for disclosure of this limitation states that "Takano discloses that, when the level difference is lower than the threshold, 'the target signal is not dominant,' meaning that the signal is identified as noise instead of speech." (Ex. 1005, [0025], [0022] ("the level difference in the outputs from the microphones 1 and 2 due to noise is zero or minimal"), [0014]-[0015], [0029], [0040]-[0042] [0049]-[0051], FIGS. 1, 6, 7, 16, 17, 18A; Ex. 1002 ¶ 108.)" Pet. at 39-40.

At the outset, Petitioner's editorialized quotation mischaracterizes Takano's actual disclosure. Takano does ***not*** disclose that a "signal is identified as noise instead of speech" when the target signal is not dominant. Rather, Takano's determination of whether a target signal is dominant merely relates to whether a target signal is selected "[i]n a voice frequency component selection part 6" or whether "[i]n a sound source frequency component extraction part 7 . . . [a frequency

component] is extracted with respect to a frequency selected by the sound source frequency component selection part 6." *Id.*, [0025]. Takano further explains that its "target signal source" is the mouth of the user (not a noise source, as the Petition suggests). *Id.*, [0026] ("The threshold value Th(ωi) can be determined experimentally from the correlation between the microphones 1 and 2 and the target signal sound source (for example, the mouth of the user of the microphones 1 and 2).") Takano's determination that a target signal is "dominant" is therefore a determination that speech is present, or that speech is louder than ambient noise. *See id.* at [0024]-[0026]; *see also id.* at [0015].

But a determination that speech is ***not present,*** or quieter than noise, does not amount to an identification noise. An initial matter, a determination that speech is "not dominant" does not affirmatively "identif[y] information of the acoustic signals" as anything, let alone identify them as noise. The fact that there may be noise mixed with speech when Takano identifies the target signal as "not dominant" does not somehow make that determination an identification of signals as noise – particularly given that Takano's target signal could just as easily be "not dominant" during periods of silence.

Moreover, even if Takano's determination that a target signal is "not dominant" were an identification of noise (it is not), it does not identify any particular "acoustic signals as noise." To the contrary, Takano touts its ability to

suppress noise based on a determination as to whether a target signal is dominant ***without*** ever having to identify a signal as noise. For example, Takano explains that its "frequency component extraction process enables a noise suppression process does ***not*** require the accurate estimation of a noise spectrum." *Id.*, [0015]. In other words, Takano simply applies noise suppression when the "target signal" is "not dominant" – it is not concerned with whether noise is actually occurring during that time, or which signals (or portions of signals) during those times are noise. *See e.g. id.* at [0026] ("In the first mode, frequency components for which it is not determined that the target signal is dominant are completely removed"; *id* at [0027] (applying noise suppression in the context of "a value obtained by applying a weighting factor w(ωi) set externally to a frequency component ***for which it is determined by the sound source frequency component selection part 6 that the target signal is not dominant***") (emphasis added). In no event does Takano's determination of whether a target signal is "dominant" or not yield the same advantages of the patented invention in allowing the calculation of noise suppression functions during periods when the system knows that only noise is occurring. *See '*058 Patent, 6:37-62.

Finally, while petitioner cites to the Declaration of Dr. Richard Stern for support, the Stern Declaration merely parrots the Petition, and relies on the same mischaracterizations of Takano's disclosure as the Petition. *Compare* Pet. at 39-40 *with* Ex. 1002, ¶¶ 107-108. Dr. Stern does not defend Petitioner's attempts to

conflate the absence of speech detection with the identification of noise. Nor does Dr. Stern substantively address a POSITA's understanding of the claim terms at issue (let alone in the context of the '058 Patent's requirements for an identification of noise that allows the system to calculate functions while receiving only noise). Accordingly, Dr. Stern's Declaration fails to provide any credible support for the Petition with respect to this limitation beyond the text of the references themselves.

Petitioner has failed to show that the combination of Holzrichter and Takano disclose this limitation, and the Petition should therefore be denied.

B. GROUND 1B: The Combination of Holzrichter, Takano, and Kinsler Does Not Render Obvious Claim 3

Ground 1B is directed solely to dependent Claim 3. Petitioner's Ground 1B arguments do not address the independent claims at all, and therefore do not remedy the deficiencies of Ground 1A. *See* Pet. at 43-46.

C. GROUND 2A: The Combination of Holzrichter, Torick, Kaneda, and Kinsler Does Not Render Obvious Claims 1, 2, 4, 5

1. Petitioner's Combination Does Not Disclose or Render Obvious "wherein the at least one processor … identifies information of the acoustic signals as noise when the difference parameters are less than the gain threshold."

Petitioner asserts that this limitation is obvious and argues that it is disclosed in each of Torick, Kaneda, and Holzrichter. Petitioner does not otherwise argue that this limitation is inherent, nor does it argue for any modification of the disclosure of

the three references beyond their incorporation in the combination. But Petitioner fails to show that any of its three references disclose this limitation, and its combination does not somehow remedy that deficiency. As with Ground 1A discussed above, Petitioner's arguments boil down to conflating the ***absence*** of an identification of speech with an identification of acoustic signals as noise. These arguments fail for largely the same reasons, and the Petition should be denied.

First, Petitioner argues that "Torick [] discloses that it does not 'detect[] speech sounds' (*i.e.*, it detects noise) when the output of the speech microphone is the same as the noise sensing microphone. (Ex. 1006, 169; Ex. 1002 ¶ 150.)" Pet at 54. As an initial matter, Petitioner appears to misquote Torick. The reference to "speech sounds" on page 169 is in the context of Torick's explanation that "[t]he outputs of both microphones are then continuously compared. When the rectified signals are equal, the switching circuit is inactive. However, when ***speech sounds*** are present at the appropriate microphone, the switching circuit energizes." Ex. 1006, 169 (emphasis added). Nothing in this statement supports Petitioner's assertion that Torick "detects noise" when it does not detect speech sounds. Torick merely states that a "switching circuit energizes" when "speech sounds are present at the appropriate microphone." But the ***absence*** of activity due to speech not being present in a microphone cannot constitute an identification of a signal as noise –

indeed, Torick does not disclose identifying *any* signal as anything when its switching circuit is inactive.

Moreover, there is no indication that noise (as opposed to silence) is even present when Torick's switching circuit is not energized. Even if noise *were* present when the switching circuit is inactive, nothing about that inactive state constitutes an identification of any acoustic signals as noise. This sharply contrasts with the invention of the '058 Patent in which an identification of noise allows calculation of noise suppression functions during periods when the system is confident that only noise is occurring. Petitioner fails to show any disclosure of this limitation in Torick.

Second, Petitioner argues that "Kaneda similarly discloses [] a portion of a signal as noise when the power difference PD is lower than a threshold. (*See* Ex. 1007, 1:51-68, 2:1-22, Fig. 3(a)-3(c); Ex. 1002 ¶ 150.)" Pet. at 54. Petitioner is wrong, and the discussion in Kaneda does not support its assertion. Kaneda first explains that a "[signal to noise] ratio difference in outputs of the two microphones occurs" based on a "speech power level" and a "noise power level." Ex. 1007, 1:51-68. Kaneda next discusses calculation of a power difference, stating that "[w]hen the power difference PD is larger than a given threshold value Pth17, a corresponding time period 18 is detected as a speech period . . . as is apparent from FIG. 3(c) the unstationary noise period having a high power is not detected as a speech period." *Id.* at 2:1-22. In other words, Kaneda discloses a system that detects a "speech

period" if a power difference is larger than a threshold – it does ***not*** disclose detecting any equivalent "noise period," let alone identifying an acoustic signal as noise.

As with its other references, Petitioner attempts to conflate the ***absence*** of a speech detection in Kaneda with an identification of noise. But as discussed with respect to Torick and Takano above, the absence of an identification as speech does not constitute an identification as noise. While noise may be present during periods when speech is not detected, it is both equally likely that there is silence during those periods, and irrelevant because Kaneda does not disclose any function of its system to actually identify an acoustic signal during those periods as noise.

The Petition also argues that "it would be obvious to use the mathematical methods disclosed in Kaneda to detect speech using the microphones of Torick," but does not argue that its combination of Kaneda and Torick would impact the disclosure of either reference that it relies on for this limitation. Pet. at 54. The proposed combination of Kaneda and Torick therefore fails to remedy the deficiencies of either reference with respect to this limitation.

Third, Petitioner asserts that "Holzrichter similarly discloses identifying a signal as noise when it 'exceeds a preset threshold 73, but when it is less than a loud noise threshold 77.' (Ex. 1003, 31:61-32:27; Ex. 1002 ¶ 151." Pet. at 54-55. Petitioner mischaracterizes Holzrichter's disclosure while carefully omitting

surrounding language. [1] In context, the cited portion of Holzrichter explains that a sound can be processed as ***voiced or nonvoiced*** speech (not as noise) depending on the "preset threshold 73" and "loud noise threshold 77."

The quoted sentence states in full that "[i]f the duration of testing is shorter than 0.5 sec, then if the acoustic microphone 70 output signal exceeds a preset threshold 73, but when it is less than a loud noise threshold 77, ***then the algorithm looks for vocal fold motion to occur within the same speech time period in box 79***." Ex. 1003, 31:67-32:4 (emphasis added). Nothing about Holzrichter's statement that "the algorithm looks for vocal fold motion to occur within the same speech time period" discloses identifying any acoustic signal as noise. To the contrary, Holzrichter explains that if "no vocal fold motion occurs in box 72, the sound in frame ti is labeled as ***nonvoiced speech*** in box 79" (as opposed to noise). On the other hand "[i]f the acoustic signal is too loud in box 77, and vocal fold motion is detected at box 80, the signal is processed as ***loud voiced speech***." Finally, "[i]f acoustic speech is below a threshold box 73 … the non-voiced or silence counter T is increased at box 82." *Id.,* 32:7-37 (emphases added). In other words, Holzrichter describes a "preset threshold 73" and "loud noise threshold 77" for detecting types

[1] It is telling that Petitioner relies on Holzrichter for this limitation in Ground 2A, but not 1A where Holzrichter was also asserted as the primary reference.

of speech, not for identifying any acoustic signal as noise. Indeed, nothing in the cited portion of Holzrichter contemplates receiving noise at all.

Petitioner also argues that "it would have been obvious to a POSITA to incorporate this feature of Torick into the system of Holzrichter. . . . Based on these diclsoures [sic], a POSITA would have found it obvious that that the system [sic] could identify acoustic signals as noise when the difference parameters are less than the gain threshold." Pet. at 54-55. But petitioner's proposed combination does not address the deficiencies in the disclosure of either reference, whether or not they are combined. Neither Torick nor Holzrichter disclose this limitation, and merely incorporating the features of Torick in Holzrichter does not somehow teach the limitation.

Finally, Petitioner relies on the Declaration of Dr. Richard Stern throughout its arguments on this limitation. *See* Pet. at 54-55. But the Stern Declaration merely parrots Petitioner's arguments, including its mischaracterizations of the references' disclosure. *Compare id. with* Ex. 1002, ¶¶ 149-151. Dr. Stern does not defend Petitioner's attempts to conflate the absence of speech detection with the identification of noise. Nor does Dr. Stern substantively address a POSITA's understanding of the claim term at issue (let alone in the context of the '058 Patent's requirements for an identification of noise that allows the system to calculate functions while receiving only noise). Accordingly, Dr. Stern's Declaration fails to

provide any credible support for the Petition with respect to this limitation beyond the text of the references themselves.

Petitioner fails to show that the proposed combination discloses this limitation or renders it obvious, and the Petition should be denied.

D. GROUND 2B: The Combination of Holzrichter, Torick, Kaneda, Kinsler, and Lyons Does Not Render Obvious Claim 3

Ground 2B is directed solely to dependent Claim 3. Petitioner's Ground 2B arguments do not address the independent claims at all, and therefore do not remedy the deficiencies of Ground 2A. *See* Pet. at 56.

VIII. CONCLUSION

As discussed above, the Petition fails to show that any ground discloses or renders obvious the limitation "wherein the at least one processor … identifies information of the acoustic signals as noise when the difference parameters are less than the gain threshold," and is therefore deficient. The Board should, therefore, deny the Petition.

Respectfully submitted,

Dated: October 12, 2023 By: */ Peter Lambrianakos /*

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CERTIFICATE OF WORD COUNT

The undersigned hereby certifies that the portions of the above-captioned JAWBONE INNOVATIONS, LLC'S PRELIMINARY RESPONSE specified in 37 C.F.R. § 42.24 has 3,831 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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A copy of the foregoing Patent Owner's Preliminary Response has been served on Petitioner's counsel of record as follows:

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