IN THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF TEXAS
WACO DIVISION

JAWBONE INNOVATIONS, LLC,	§	Case No. 6:21-cv-00984-ADA
Plaintiff,	§	**JURY TRIAL DEMANDED**
v.	§	
APPLE INC.,	§	
Defendant.	§	

FIRST AMENDED COMPLAINT FOR PATENT INFRINGEMENT

Plaintiff Jawbone Innovations, LLC ("Jawbone" or "Plaintiff") for its Amended Complaint against Defendant Apple Inc. ("Apple" or "Defendant") for patent infringement under 35 U.S.C. § 271, alleges as follows:

THE PARTIES

1. Jawbone is a corporation organized and existing under the laws of the State of Texas, with a place of business located at 2226 Washington Avenue, Suite Number 1, Waco, Texas 76701. Jawbone is in the business of developing software products, including products that exploit the technology disclosed in its patent portfolio.

2. Apple is a California corporation and maintains its principal place of business located at One Apple Park Way, Cupertino, California 95014, and may be served with process through its registered agent, CT Corporation System at 1999 Bryan Street, Suite 900, Dallas, Texas 75201.

3. Apple does business in Texas, directly or through intermediaries, and offers its products and/or services, including those accused herein of infringement, to customers and potential customers located in Texas, including in this judicial District.

4. On information and belief, Apple maintains regular and established places of business within this Judicial District including at least the following locations: 12545 Riata Vista Circle, Austin, Texas 78727; 12801 Delcour Drive, Austin, Texas 78727; and 3121 Palm Way, Austin, Texas 78758. Upon information and belief, Defendant employs individuals in this Judicial District involved in the sales and marketing of its products.

JURISDICTION AND VENUE

5. This is an action for patent infringement arising under the patent laws of the United States, 35 U.S.C. §§ 1, *et seq*. This Court has jurisdiction over this action pursuant to 28 U.S.C. §§ 1331 and 1338(a).

6. This Court has personal jurisdiction over Defendant. Defendant regularly conducts business and has committed acts of patent infringement within this Judicial District and the State of Texas that give rise to this action and has established minimum contacts with this forum such that exercise of jurisdiction over Apple would not offend traditional notions of fair play and substantial justice. Apple has committed and continues to commit acts of infringement in this Judicial District and State by, among other things, offering to sell, selling, using, importing, and making products and services that infringe the asserted patents. Apple has further induced acts of patent infringement by others and/or has contributed to patent infringement by others in this Judicial District, the State of Texas, and elsewhere in the United States.

7. Venue is proper in this Judicial District pursuant to 28 U.S.C. §§ 1391 and 1400(b). Apple is registered to do business in Texas and, upon information and belief, Apple has transacted

business in this Judicial District, has committed acts of direct and indirect infringement in this Judicial District, and has regular and established places of business in this Judicial District as set forth above.

8. Apple is subject to this Court's jurisdiction pursuant to due process and the Texas Long Arm Statute due at least to its substantial business in this State and Judicial District, including (a) at least part of its past infringing activities, (b) regularly doing or soliciting business in Texas, and/or (c) engaging in persistent conduct and/or deriving substantial revenue from goods and services provided to customers in Texas.

FACTUAL BACKGROUND

9. On September 13, 2011, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 8,019,091 (the "'091 Patent") entitled "Voice Activity Detector (VAD)-Based Multiple-Microphone Acoustic Noise Suppression." A true and correct copy of the '091 Patent is attached hereto as Exhibit A.

10. On July 17, 2007, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 7,246,058 (the "'058 Patent") entitled "Detecting Voiced and Unvoiced Speech Using Both Acoustic and Nonacoustic Sensors." A true and correct copy of the '058 Patent is attached hereto as Exhibit B.

11. On October 2, 2012, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 8,280,072 (the "'072 Patent") entitled "Microphone Array with Rear Venting." A true and correct copy of the '072 Patent is attached hereto as Exhibit C.

12. On November 27, 2012, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 8,321,213 (the "'213 Patent") entitled "Acoustic Voice Activity

Detection (AVAD) for Electronic Systems." A true and correct copy of the '213 Patent is attached hereto as Exhibit D.

13. On December 4, 2012, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 8,326,611 (the "'611 Patent") entitled "Acoustic Voice Activity Detection (AVAD) for Electronic Systems." A true and correct copy of the '611 Patent is attached hereto as Exhibit E.

14. On September 15, 2020, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 10,779,080 (the "'080 Patent") entitled "Dual Omnidirectional Microphone Array (DOMA)." A true and correct copy of the '080 Patent is attached hereto as Exhibit F.

15. On September 14, 2021, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 11,122,357 (the "'357 Patent") entitled "Forming Virtual Microphone Arrays Using Dual Omnidirectional Microphone Array (DOMA)." A true and correct copy of the '357 Patent is attached hereto as Exhibit G.

16. On June 18, 2013, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 8,467,543 (the "'543 Patent") entitled "Microphone and Voice Activity Detection (VAD) Configurations for Use with Communications Systems." A true and correct copy of the '543 Patent is attached hereto as Exhibit H.

17. On August 6, 2013, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 8,503,691 (the "'691 Patent") entitled "Virtual Microphone Arrays Using Dual Omnidirectional Microphone Array (DOMA)." A true and correct copy of the '691 Patent is attached hereto as Exhibit I.

18. Jawbone is the sole and exclusive owner of all right, title, and interest to and in the '091 Patent, '058 Patent, '072 Patent, '213 Patent, '611 Patent, '080 Patent, '357 Patent,'543 Patent, and '691 Patent (together, the "Patents-in-Suit"), and holds the exclusive right to take all actions necessary to enforce its rights to the Patents-in-Suit, including the filing of this patent infringement lawsuit. Jawbone also has the right to recover all damages for past, present, and future infringement of the Patents-in-Suit and to seek injunctive relief as appropriate under the law.

19. The technology of the Patents-in-Suit was developed by Jawbone, Inc. which was originally founded in 1998 as AliphCom, Inc. ("AliphCom"). AliphCom set out to develop a noise reducing headset that would allow soldiers to communicate better in combat conditions. In 2002, AliphCom won a contract with the Defense Advanced Research Projects Agency to research noise suppression techniques for the United States military.

20. AliphCom launched a mobile headset called the "Jawbone" in 2004. The "Jawbone" included the innovative noise-suppression technology that AliphCom developed for the military.[1] This technology virtually eliminated background noise while increasing the volume of the speakers' voices. AliphCom followed with a Bluetooth version of the "Jawbone" in 2008 which was sold in the Apple Store.

21. On the heels of the success of the "Jawbone" products, AliphCom changed its name to Jawbone, Inc. in 2011 and later expanded its product offerings into Bluetooth speakers and wearables, such as health tracking devices. Unfortunately, due to the intensely competitive marketplace, Jawbone, Inc. was forced into liquidation in 2017.

22. Following Jawbone, Inc.'s liquidation "[a] host of technology companies including Apple, Samsung, Google, LG, and Fitbit [were] identified as potential buyers of Jawbone's US

[1] *See* https://www.wired.com/2004/09/military-headset-reaches-masses/

Patents."[2] Upon information and belief, Envision IP (and other parties) contacted Apple regarding the value of the Patents-in-Suit, including regarding Apple's infringement of the Patents-in-Suit. Upon information and belief, Apple was notified that the Accused Products infringe the Patents-in-Suit, and/or otherwise became aware of the Patents-in-Suit and recognized that the Accused Products infringe the Patents-in-Suit at least as of 2017.

23. Apple is the assignee of U.S. Patent No. 9,313,572 ("the '572 Patent"). On May 15, 2015, during prosecution of the '572 Patent, Apple listed the '091 Patent in an information disclosure statement to the United States Patent Office. Apple, therefore, had knowledge of the '091 Patent since at least as of May 15, 2015.

24. On information and belief, Apple's investigation that discovered the '091 Patent provided it with knowledge of the '072 Patent (which is a continuation-in-part of the '091 Patent) at least as of the same time.

25. On information and belief, Apple, as a sophisticated technology company, upon becoming aware of the '091 and '072 Patents, investigated other patents with common inventors and discovered the '691, '543, '058, and '611 Patents at least as of the same time in May 2015.

26. The '357 Patent is a continuation of the '691 Patent.

27. The '080 Patent claims priority to the same provisional applications as the '691 Patent.

28. On information and belief, Apple, as a sophisticated technology company, upon becoming aware of the '691 Patent, monitored Jawbone's related patent filings and became aware

[2] *See* https://www.worldipreview.com/news/apple-google-and-fitbit-touted-to-acquire-jawbone-patents-14322; https://www.glpi.com.br/en/apple-google-and-fitbit-touted-to-acquire-jawbone-patents/; *see also* http://patentvue.com/2017/07/11/jawbone-patents-could-be-leveraged-by-a-competitor/

of the ’080 and ’357 Patents when they issued on September 15, 2020 and September 14, 2021, respectively.

29. On information and belief, Apple, as a sophisticated technology company, analyzed each of the Patents-in-Suit when it became aware of the patent and determined how its products infringed at that time.

30. Apple has further been aware of the ’091, ’072, ’543, ’058, ’611, ’080, and ’357 Patents at least as early as the filing of the original Complaint in this case on September 23, 2021.

31. Apple has further had notice of how it infringes the ’091, ’072, ’543, ’058, ’611, ’080, and ’357 Patents at least as early as the filing of the original Complaint in this case on September 23, 2021.

INFRINGEMENT ALLEGATIONS

32. The ’091 and ’058 Patents generally describe acoustic noise suppression with a voice activity detector that senses vibration in human tissue associated with voicing activity. The technology of the ’091 was developed by Dr. Gregory C. Burnett and Eric F. Breitfeller. The technology of the ’058 Patent was developed by Dr. Gregory C. Burnett. The ’091 and ’058 Patents also describe techniques for generating transfer functions and cross-correlations representative of acoustic signals when voicing activity is absent, providing improved noise suppression. Some embodiments of the invention include a microphone array with one microphone which primarily captures sound (*e.g.*, speech) and one which primarily captures unwanted noise, both of which provide signals to a noise removal algorithm.

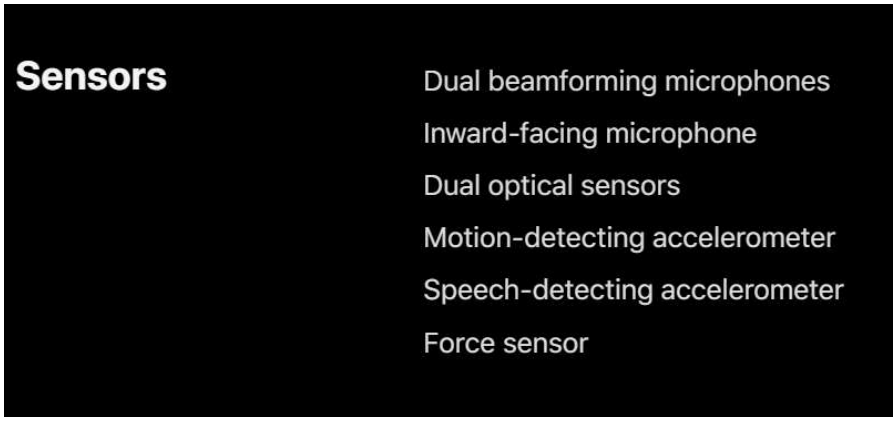
33. The noise removal algorithm may also receive physiological information from a voice activity detector (*e.g.,* an accelerometer) to detect when a user is speaking. Such a voice activity detection signal may be assumed to be perfectly accurate, yielding substantial

improvements when applied to the noise removal algorithm. For example, the noise removal algorithm may remove noise by calculating one transfer function when the system is certain that only noise is being received, and another transfer function when the system is certain that speech is being produced. The noise removal algorithm may further improve noise suppression in situations with multiple noise sources by combining such transfer functions into additional transfer functions representative of a ratio of energies received at different microphones. By taking advantage of perfect voice activity detection and transfer functions representative of a ratio of energies received at different microphones, the noise removal algorithm may effectively remove noise from a signal no matter how many noise sources are present. The invention thereby provides significant advantages for noise suppression systems, particularly in detecting, transmitting, or recording speech.

34. Apple has manufactured, used, marketed, distributed, sold, offered for sale, exported from, and imported into the United States, products that infringe the '091 and '058 Patents. For example, noise suppression techniques are incorporated into Apple products with voice activity detection devices including, but not limited to, Apple ear buds and smartphones. For example, this functionality is included and utilized in the Apple AirPods Pro. The AirPods Pro includes "dual beamforming microphones" and a "speech-detecting accelerometer."[3] The "speech-detecting accelerometer" of the AirPods Pro detects vibration in human tissue and "works in tandem to attenuate background noise and hone in on relaying your voice to the person on the other end of the call."[4] Upon information and belief, the beamforming microphone array of the AirPods Pro generates transfer functions representative of a ratio of energy of the acoustic signals received

[3] https://www.apple.com/airpods-pro/specs/
[4] https://www.soundguys.com/apple-airpods-pro-vs-airpods-2-27213/

at each microphone. For example, the Apple iPhone 12 Pro Max similarly comprises an accelerometer which, upon information and belief, is used to detect voicing activity. Upon information and belief, the beamforming microphone array of the iPhone 12 Pro Max further generates transfer functions representative of a ratio of energy of the acoustic signals received at each microphone.



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[5] https://www.apple.com/airpods-pro/specs/

35. The ’072 Patent generally describes acoustic noise suppression with an array of physical microphones which forms an array of virtual microphones. The technology was developed by Dr. Gregory C. Burnett. The ’072 Patent also describes noise suppression with physical omnidirectional microphones and virtual directional microphones. In some embodiments of the invention, a greater number of physical microphones may be used to form a smaller number of virtual microphones which are combined into an output signal with less acoustic noise than the received acoustic signals. The resulting virtual microphones may further be combined by applying transfer functions representative of a ratio of energies between physical microphones, outputting a signal with greatly reduced noise. The invention provides significant advantages for noise suppression systems, particularly in detecting, transmitting, or recording speech.

36. Apple has manufactured, used, marketed, distributed, sold, offered for sale, exported from, and imported into the United States, products that infringe the ’072 Patent. For example, this functionality is included and utilized in Apple products with omnidirectional physical MEMS microphones which form virtual beamformed microphones including, but not limited to, Apple ear buds, smart phones, tablets, wearables, and smart home devices. For example, upon information and belief, the Apple AirPods Pro earbuds comprise arrays of at least four physical microphones and two beamformed microphones, the outputs of which are combined to reduce the noise of a signal. On information and belief, the AirPods Pro earbuds combine the outputs, the signals generated by the beamforming microphone array of each earbud to further reduce noise. [6]

37. The ’611 and ’213 Patents generally describe acoustic voice activity detection based on a ratio of energies between virtual microphones formed by an array of physical

[6] https://www.soundguys.com/apple-airpods-pro-vs-airpods-2-27213/

microphones. The technology of the ’611 and ’213 Patents was developed by Dr. Gregory C. Burnett, Nicholas Petit, and Zhinian Jing. In some embodiments of the invention, a first virtual microphone may be generated by summing the outputs of a first physical microphone processed with a delay filter, and a second physical microphone processed with a calibration filter and an adaptive filter, while a second virtual microphone may be generated by summing the outputs of a first physical microphone processed with an adaptive filter and a delay filter, and a second physical microphone processed with a calibration filter. Accordingly, the invention provides virtual microphones with similar noise response magnitudes, but very dissimilar speech response magnitudes. A ratio of energies between the virtual microphones may further be compared to a threshold to detect when voicing activity is occurring. The invention of the ’611 and ’213 Patents provides significant improvements in noise suppression, including by enabling accurate voice activity detection with a microphone array.

38. Apple has manufactured, used, marketed, distributed, sold, offered for sale, exported from, and imported into the United States, products that infringe the ’213 and ’611 Patents. For example, this functionality is included and utilized in Apple products which use virtual microphones formed by physical microphones to detect a wake word including, but not limited to, Apple ear buds, smart phones, tablets, wearables, and smart home devices. For example, upon information and belief, the iPhone 12 Pro Max forms an array of virtual microphones using an array of physical microphones. For example, upon information and belief, the Apple HomePod forms an array of virtual microphones, such as by beamforming. Upon information and belief, the iPhone 12 Pro Max and the HomePod detect user speech, such as a “Hey Siri” wake word, by comparing a ratio of energies (*e.g.*, amplitudes), of the beamformed microphones to a threshold.[7]

[7] *See e.g.* https://support.apple.com/en-us/HT204389

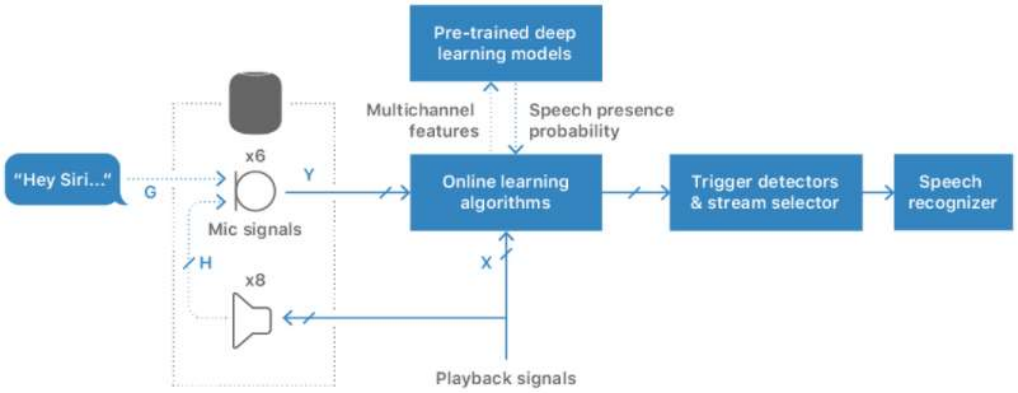

Figure 1. Block diagram of the online multichannel signal processing chain on HomePod for Siri.

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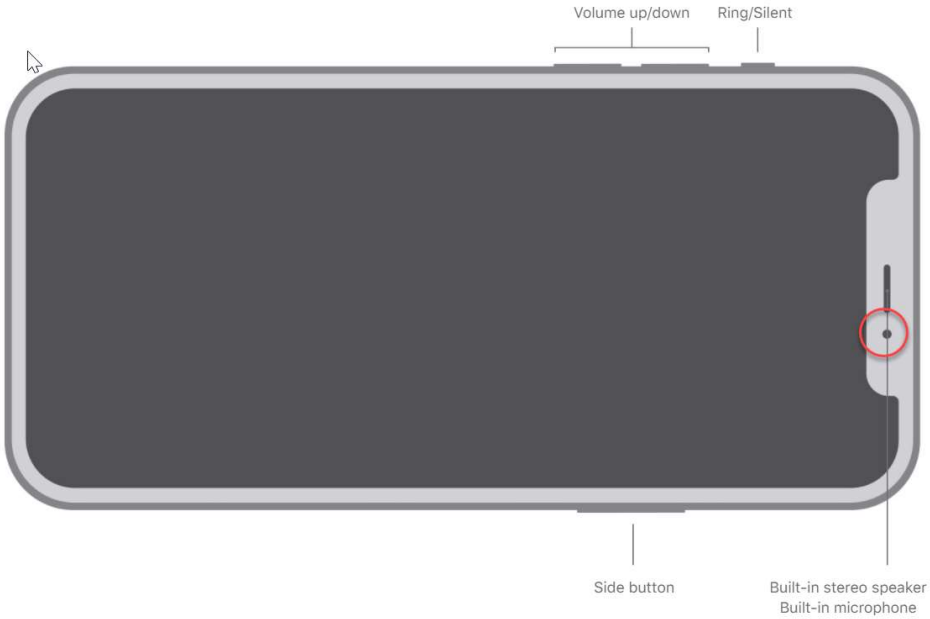
[8] https://machinelearning.apple.com/research/optimizing-siri-on-homepod-in-far-field-settings



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39. The ’080 Patent generally describes noise suppression with an array of omnidirectional microphones that form virtual microphones with a similar noise response and a dissimilar speech response. The technology of the ’080 Patent was developed by Dr. Gregory C. Burnett. The ’080 Patent also describes a dual omnidirectional microphone array that forms two distinct virtual microphones that can be paired with an adaptive filter and/or VAD algorithm to significantly reduce noise without distorting speech, thereby improving the signal-to-noise ratio of the desired speech. In some embodiments, output of each physical microphone can be delayed, multiplied by a gain, and summed with the other in order to form at least one virtual microphone, which may be paired with an adaptive filter and/or VAD algorithm to suppress noise. The invention

[9] https://www.apple.com/iphone-12/specs/

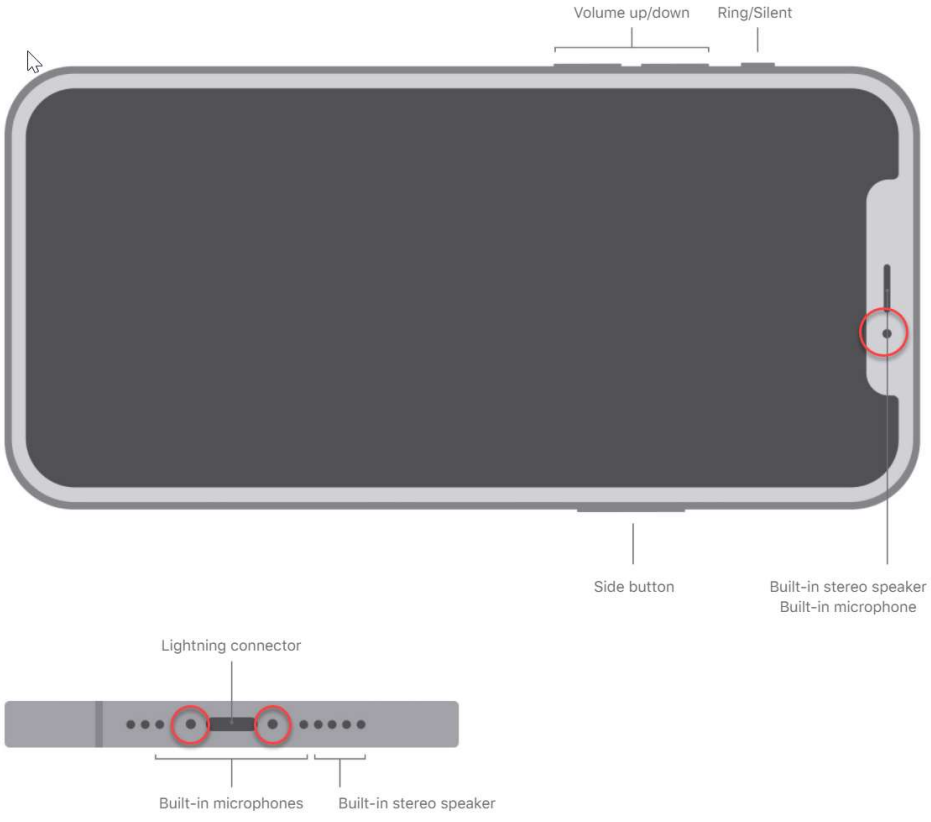
of the ’080 Patent provides substantial advantages for noise suppression systems, particularly in detecting, transmitting, or recording speech.

40. Apple has manufactured, used, marketed, distributed, sold, offered for sale, exported from, and imported into the United States, products that infringe the ’080 Patent. For example, this functionality is included and utilized in Apple products with omnidirectional physical MEMS microphones which form virtual beamformed microphones including, but not limited to, Apple ear buds, smart phones, tablets, wearables, and smart home devices. For example, upon information and belief, each Apple AirPods Pro comprises two physical omnidirectional microphones, and a processing component coupled to the microphone array generating two beamformed virtual microphones. On information and belief, the processing component generates beamformed microphones with different first and second combinations of output signals from the physical microphone array, wherein the virtual microphones have a similar noise response and a dissimilar speech response.

41. The ’357 and ’691 Patents generally describe acoustic noise suppression with an array of physical microphones which forms an array of virtual microphones. The technology was developed by Dr. Gregory C. Burnett. The ’357 and ’691 Patents also describe noise suppression with physical omnidirectional microphones and virtual directional microphones. The physical and/or virtual microphone signals may be combined by filtering and summing in the time domain to apply a varying linear transfer function, suppressing noise in the output signal. The invention provides significant advantages for noise suppression systems, particularly in detecting, transmitting, or recording speech.

42. Apple has manufactured, used, marketed, distributed, sold, offered for sale, exported from, and imported into the United States, products that infringe the ’357 and ’691

Patents. For example, this functionality is included and utilized in Apple products with physical MEMS microphones which form virtual beamformed microphones including, but not limited to, Apple ear buds, smart phones, tablets, wearables, and smart home devices. For example, upon information and belief, the Apple AirPods Pro earbuds comprise arrays of physical microphones, the outputs of which are combined into beamformed microphones to reduce the noise of a signal. On information and belief, the AirPods Pro earbuds combine the outputs, the signals generated by the beamforming microphone array of each earbud, to further reduce noise. Similarly, the iPhone 12 Pro Max comprises an array of physical microphones, the outputs of which are, upon information and belief, combined into beamformed microphones to reduce the noise of a signal.



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[10] https://www.apple.com/iphone-12/specs/

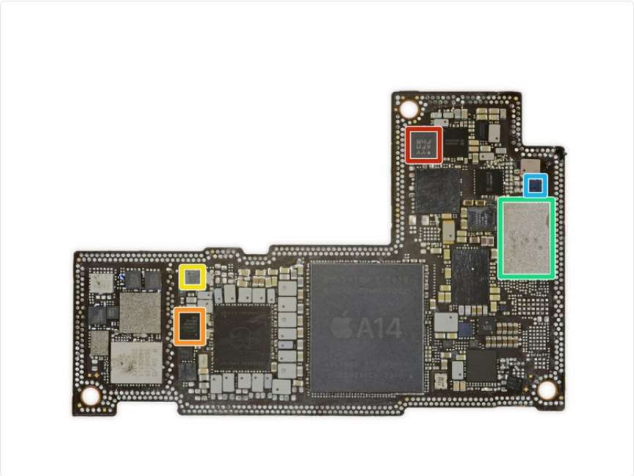
43. The ’543 Patent generally describes communications systems comprising a voice detection subsystem and a denoising subsystem. The technology of the ’543 Patent was developed by Dr. Gregory C. Burnett, Nicholas Petit, Alexander M. Asseily, and Andrew E. Einaudi. The ’543 Patent also describes microphone configurations wherein a first microphone is oriented toward a talker’s mouth, and a second microphone is oriented away from a talker’s mouth, such that the denoising subsystem may subtract noise associated with noise from an acoustic signal that includes speech and noise. In some embodiments of the invention, the denoising system selects a denoising method appropriate to data of at least one frequency subband of acoustic signals, generates noise waveform estimate, and subtracts the noise waveform estimate from signals including speech and noise when the voice detection subsystem indicates voicing activity is occurring. The invention provides significant advantages for noise suppression systems, particularly in detecting, transmitting, or recording speech.

44. Apple has manufactured, used, marketed, distributed, sold, offered for sale, exported from, and imported into the United States, products that infringe the ’543 Patent. For example, noise suppression techniques are incorporated into Apple products with voice activity detection devices including, but not limited to, Apple ear buds and smartphones. For example, this functionality is included and utilized in the Apple AirPods Pro and the iPhone 12 Pro Max. The AirPods Pro include “dual beamforming microphones” and a “speech-detecting accelerometer.”[11] At least one microphone of the AirPods Pro (*e.g.* the lower microphone) is oriented towards a user’s mouth, while at least one microphone is oriented away from a user’s mouth. Similarly, the Apple iPhone 12 Pro Max comprises multiple beamforming microphones and an accelerometer

[11] https://www.apple.com/airpods-pro/specs/

which, upon information and belief, is utilized for speech detection.[12] At least one microphone of the iPhone 12 Pro Max is oriented towards the user's mouth, while at least one microphone is oriented away from the user's mouth. On information and belief, the accelerometers of the Accused Products detect vibration in human tissue, and "work[] in tandem to attenuate background noise and hone in on relaying your voice to the person on the other end of the call."[13]

Step 12



- And a few more chips on the same side:
  - Possibly a Bosch Sensortec accelerometer
  - NXP Semiconductor CBTL1614A1 display port multiplexer
  - Possibly a Maxim Integrated MAX8559 300 mA LDO regulator
  - Apple/USI U1 ultra-wideband chip
  - Texas Instruments LM3562A1, probably an LED driver

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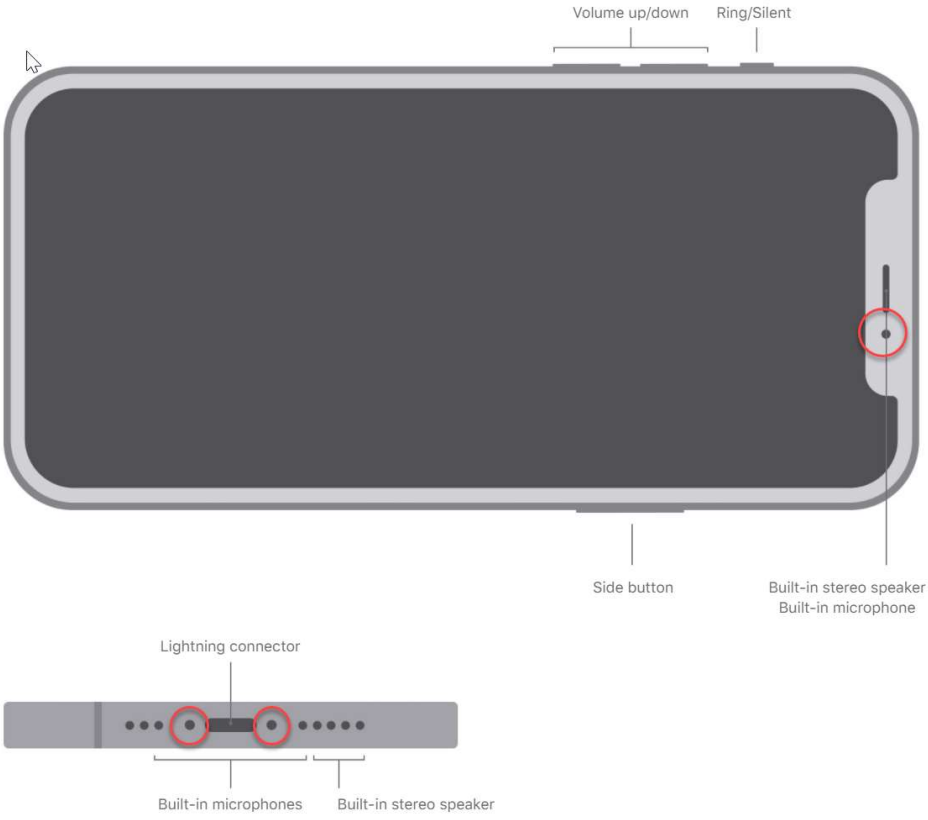
[12] *See e.g.* https://developer.apple.com/documentation/avfaudio/avaudiosessiondatasourcedescription
[13] https://www.soundguys.com/apple-airpods-pro-vs-airpods-2-27213/
[14] https://www.ifixit.com/Teardown/iPhone+12+Pro+Max+Teardown/138640



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[15] https://www.apple.com/iphone-12/specs/

 [16]

45. Apple has infringed and is continuing to infringe the Patents-in-Suit by making, using, selling, offering to sell, and/or importing, and by actively inducing others to make, use, sell, offer to sell and/or importing, Accused Products that comprise and utilize infringing microphone and/or wireless proximity sensing functionality. The Accused Products include, but are not limited to, all versions and variants of Apple iPhone, iPad, AirPods Pro, and HomePod products.

46. Jawbone has at all times complied with the marking provisions of 35 U.S.C. § 287 with respect to the Patents-in-Suit. On information and belief, prior assignees and licensees have also complied with the marking provisions of 35 U.S.C. § 287.

[16] https://www.dxomark.com/apple-iphone-12-pro-max-audio-review-a-reliable-and-consistent-audio-performer/

COUNT I
(Infringement of the '091 Patent)

47. Paragraphs 1 through 46 are incorporated by reference as if fully set forth herein.

48. Jawbone has not licensed or otherwise authorized Apple to make, use, offer for sale, sell, or import any products that embody the inventions of the '091 Patent.

49. Defendant has and continues to directly infringe the '091 Patent, either literally or under the doctrine of equivalents, without authority and in violation of 35 U.S.C. § 271, by making, using, offering to sell, selling, and/or importing into the United States products that satisfy each and every limitation of one or more claims of the '091 Patent. Upon information and belief, these products include at least the Accused Products, such as those which comprise a microphone array and a voice activity detector. The Accused Products include at least all versions and variants of Apple iPhone and AirPods.

50. For example, Defendant has and continues to directly infringe at least claim 11 of the '091 Patent by making, using, offering to sell, selling, and/or importing into the United States products that comprise a system for removing acoustic noise from the acoustic signals, comprising: a receiver that receives at least two acoustic signals via at least two acoustic microphones positioned in a plurality of locations; at least one sensor that receives human tissue vibration information associated with human voicing activity of a user; a processor coupled among the receiver and the at least one sensor that generates a plurality of transfer functions, wherein the plurality of transfer functions includes a first transfer function representative of a ratio of energy of acoustic signals received using at least two different acoustic microphones of the at least two acoustic microphones, 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, wherein the plurality of transfer functions includes a second transfer function representative of the acoustic

signals, 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, wherein acoustic noise is removed from the acoustic signals using the first transfer function and at least one combination of the first transfer function and the second transfer function to produce the denoised acoustic data stream.

51. The Accused Products comprise a system for removing acoustic noise from acoustic signals. For example, the Apple AirPods Pro and iPhone 12 Pro Max each use beamforming microphones in tandem with a voice detecting accelerometer to reduce noise in voice signals.

52. The Accused Products further comprise a receiver that receives at least two acoustic signals via at least two acoustic microphones positioned in a plurality of locations. For example, upon information and belief, the AirPods Pro and iPhone 12 Pro Max each comprise a receiver that receives signals via a microphone array, with at least two microphones positioned in a plurality of locations.[17]

53. The Accused Products further comprise at least one sensor that receives human tissue vibration information associated with human voicing activity of a user. For example, the Apple AirPods Pro comprises an accelerometer which, upon information and belief, receives human tissue vibration associated with voicing activity. For example, the iPhone 12 Pro Max similarly includes an accelerometer which, upon information and belief, is used for speech detection, and/or receives a speech detection signals from any paired AirPods.

54. The Accused Products further comprise a processor coupled among the receiver and the at least one sensor that generates a plurality of transfer functions, wherein the plurality of

[17] https://www.apple.com/airpods-pro/specs/

transfer functions includes a first transfer function representative of a ratio of energy of acoustic signals received using at least two different acoustic microphones of the at least two acoustic microphones. For example, on information and belief the AirPods Pro comprises a H1-based system in package with a processor.[18] For example, on information and belief, the iPhone 12 Pro Max comprises an A14 Bionic SoC with a processor. Upon information and belief, each processor utilizes a microphone array to detect speech with a beamformed microphone which, upon information and belief, includes the generation of at least a plurality of transfer functions, including a first transfer function representative of a ratio of energy of acoustic signals received at different microphones in the microphone array.

55. The Accused Products further comprise a system 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. For example, upon information and belief, the AirPods Pro and iPhone 12 Pro Max each generate the first transfer function when the voice detecting accelerometer indicates that voicing activity is absent.

56. The Accused Products further comprise a system wherein the plurality of transfer functions includes a second transfer function representative of the acoustic signals, 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. For example, upon information and belief, the AirPods Pro and iPhone 12 Pro Max each generate a second transfer function in response to a determination that voicing activity is present, such as based on detection of human tissue vibrations

[18] https://www.apple.com/airpods-pro/specs/

by the voice detecting accelerometer. For example, AirPods Pro have voice detecting accelerometer which detects vibration in human tissue. [19]

57. The Accused Products further comprise a system wherein acoustic noise is removed from the acoustic signals using the first transfer function and at least one combination of the first transfer function and the second transfer function to produce the denoised acoustic data stream. For example, upon information and belief, the AirPods Pro and iPhone 12 Pro Max each remove noise from acoustic signals by applying at least a first transfer function generated when voicing activity is absent, and a transfer function generated by combining the first transfer function generated when voicing activity is absent and a second transfer function generated when voicing activity is detected. For example, upon information and belief, the Apple AirPods Pro and iPhone 12 Pro Max each utilize a least mean squares method to suppress acoustic noise.

58. Defendant has and continues to indirectly infringe one or more claims of the ’091 Patent by knowingly and intentionally inducing others, including Apple’s customers and end-users of the Accused Products, to directly infringe, either literally or under the doctrine of equivalents, by making, using, offering to sell, selling, and/or importing into the United States products that include infringing technology, such as the Apple AirPods Pro and iPhone 12 Pro Max. On information and belief, Defendant has been aware of how it and its customers and end-users infringe the ’091 Patent since around the time it first became aware of the ’091 Patent. Defendant has further been aware of how it and its customers and end-users infringe the ’091 Patent at least since the filing of the original Complaint in this case. As a sophisticated technology company, to

[19] *See* https://appleinsider.com/articles/14/04/03/apples-voice-recognizing-headphones-feature-built-in-accelerometer-beamforming-mics

the extent Defendant failed to investigate its infringement upon learning of the '091 Patent, it has been willfully blind.

59. Defendant, with knowledge that these products, or the use thereof, infringe the '091 Patent at least as of the date of the original Complaint, knowingly and intentionally induced, and continues to knowingly and intentionally induce, direct infringement of the '091 Patent by providing these products to customers and ultimately to end-users for use in an infringing manner in the United States including, but not limited to, products that include infringing technology, such as the AirPods Pro and iPhone 12 Pro Max. For example, Apple's instruction manuals, websites, promotional materials, advertisements, and other information demonstrate to others, including customers, prospective customers, and distributors, how to use the Accused Products in an infringing manner. Upon information and belief, Apple is aware that the normal and customary use of the Accused Products by customers, distributors, and others would infringe the Patents-in-Suit.

60. Defendant has induced infringement by others, including end-users, with the intent to cause infringing acts by others or, in the alternative, with the belief that there was a high probability that others, including end-users, infringe the '091 Patent, but while remaining willfully blind to the infringement.

61. Defendant has willfully infringed, and continues to willfully infringe, the '091 Patent by intentionally and deliberately carrying out acts of direct and indirect infringement, while knowing, or taking deliberate steps to avoid learning, that those acts infringe. For example, upon information and belief, Defendant has known of Jawbone's patents, including the '091 Patent, at least since May 2015, but has not ceased infringement.

62. Jawbone has suffered damages as a result of Defendant's direct and indirect infringement of the '091 Patent in an amount to be proved at trial.

63. Jawbone has suffered, and will continue to suffer, irreparable harm as a result of Defendant's infringement of the '091 Patent, for which there is no adequate remedy at law, unless Defendant's infringement is enjoined by this Court. Accordingly, Jawbone seeks a preliminary and permanent injunction enjoining Apple from making, using, importing, offering to sell, and/or selling the Accused Products, including at least all versions and variants of Apple iPhone and AirPods products.

COUNT II
(Infringement of the '058 Patent)

64. Paragraphs 1 through 46 are incorporated by reference as if fully set forth herein.

65. Jawbone has not licensed or otherwise authorized Apple to make, use, offer for sale, sell, or import any products that embody the inventions of the '058 Patent.

66. Defendant has and continues to directly infringe the '058 Patent, either literally or under the doctrine of equivalents, without authority and in violation of 35 U.S.C. § 271, by making, using, offering to sell, selling, and/or importing into the United States products that satisfy each and every limitation of one or more claims of the '058 Patent. Upon information and belief, these products include at least the Accused Products, such as those which comprise a microphone array and a voice activity detector. The Accused Products include at least all versions and variants of Apple iPhone and AirPods.

67. For example, Defendant has and continues to directly infringe at least claim 1 of the '058 Patent by making, using, offering to sell, selling, and/or importing into the United States products that comprise a system for detecting voiced and unvoiced speech in acoustic signals having varying levels of background noise, comprising: at least two microphones that receive the

acoustic signals; at least one voicing sensor that receives physiological information associated with human voicing activity; and at least one processor coupled among the microphones and the voicing sensor, wherein the at least one processor; generates cross correlation data between the physiological information and an acoustic signal received at one of the two microphones; identifies information of the acoustic signals as voiced speech when the cross correlation data corresponding to a portion of the acoustic signal received at the one receiver exceeds a correlation threshold; generates difference parameters between the acoustic signals received at each of the two receivers, wherein the difference parameters are representative of the relative difference in signal gain between portions of the received acoustic signals; identifies information of the acoustic signals as unvoiced speech when the difference parameters exceed a gain threshold; and identifies information of the acoustic signals as noise when the difference parameters are less than the gain threshold.

68. The Accused Products comprise at least two microphones that receive the acoustic signals. For example, each earbud of the AirPods Pro comprises at least two MEMS microphones that receive acoustic signals.[20] For example, the iPhone 12 Pro Max comprises at least two microphones that receive acoustic signals.

69. The Accused Products further comprise at least one voicing sensor that receives physiological information associated with human voicing activity. For example, the Apple AirPods Pro comprise an accelerometer which, upon information and belief, receives human tissue vibration associated with voicing activity. For example, the iPhone 12 Pro Max similarly includes an accelerometer which, upon information and belief, is used for speech detection, and/or receives a speech detection signal from any paired AirPods.

[20] *See* https://www.ifixit.com/Teardown/AirPods+Pro+Teardown/127551

70. The Accused Products further comprise at least one processor coupled among the microphones and the voicing sensor. For example, the AirPods Pro comprises an H1 system-in-package coupled between the microphones and accelerometers. For example, the iPhone 12 Pro Max comprises an A14 Bionic SoC coupled between the microphones and accelerometer, and/or accelerometer signal received from any paired AirPods Pro earbuds.

71. The Accused Products further comprise a processor which generates cross-correlation data between the physiological information and an acoustic signal received at one of the two microphones. For example, upon information and belief, the H1 system-in-package of the AirPods Pro generates cross-correlation data between the physiological information (*e.g.* tissue vibration) and an acoustic signal received at one of the two microphones *(e.g.* an acoustic signal including speech). For example, upon information and belief, the A14 Bionic SoC of the iPhone 12 Pro Max similarly generates cross-correlation data between the physiological information (*e.g.* tissue vibration) and an acoustic signal received at one of the two microphones *(e.g.* an acoustic signal including speech).

72. The Accused Products further comprise a processor which identifies information of the acoustic signals as voiced speech when the cross-correlation data corresponding to a portion of the acoustic signal received at the one receiver exceeds a correlation threshold. For example, upon information and belief, the H1 system-in-package of the AirPods Pro identifies the acoustic signals as speech when the cross-correlation data corresponding to a portion of the acoustic signal received at the microphone exceeds a correlation threshold (*e.g.* a threshold based on vibration and/or acoustic signals). For example, upon information and belief, the A14 Bionic SoC of the iPhone 12 Pro Max similarly identifies the acoustic signals as speech when the cross-correlation

data corresponding to a portion of the acoustic signal received at the microphone exceeds a correlation threshold (*e.g.* a threshold based on vibration and/or acoustic signals).

73. The Accused Products further comprise a processor which generates difference parameters between the acoustic signals received at each of the two receivers, wherein the difference parameters are representative of the relative difference in signal gain between portions of the received acoustic signals. For example, upon information and belief, the H1 system-in-package of the AirPods Pro generates difference parameters between the acoustic signals received at each MEMS microphone representative of the relative difference in signal gain between portions of the received acoustic signals. For example, upon information and belief, the A14 Bionic SoC of the iPhone 12 Pro Max similarly generates difference parameters between the acoustic signals received at each MEMS microphone representative of the relative difference in signal gain between portions of the received acoustic signals.

74. The Accused Products further comprise a processor which identifies information of the acoustic signals as unvoiced speech when the difference parameters exceed a gain threshold. For example, the H1 system-in-package of the AirPods Pro identifies information of the acoustic signals as unvoiced speech (*e.g.* speech which normally does not cause significant vibration in human tissue) when the difference parameter exceeds a gain threshold. For example, upon information and belief, the A14 Bionic SoC of the iPhone 12 Pro Max similarly identifies information of the acoustic signals as unvoiced speech (*e.g.* speech which normally does not cause significant vibration in human tissue) when the difference parameter exceeds a gain threshold.

75. The Accused Products further comprise a processor which identifies information of the acoustic signals as noise when the difference parameters are less than the gain threshold. For example, the H1 system-in-package of the AirPods Pro identifies acoustic signals as noise (*e.g.*

unwanted background noise) when the difference parameters are less than the gain threshold. For example, upon information and belief, the A14 Bionic SoC of the iPhone 12 Pro Max similarly identifies acoustic signals as noise (*e.g.*, unwanted background noise) when the difference parameters are less than the gain threshold.

76. Defendant has and continues to indirectly infringe one or more claims of the '058 Patent by knowingly and intentionally inducing others, including Apple's customers and end-users of the Accused Products, to directly infringe, either literally or under the doctrine of equivalents, by making, using, offering to sell, selling, and/or importing into the United States products that include infringing technology, such as the Apple AirPods Pro and iPhone 12 Pro Max. On information and belief, Defendant has been aware of how it and its customers and end-users infringe the '058 Patent since around the time it first became aware of the '058 Patent. Defendant has further been aware of how it and its customers and end-users infringe the '058 Patent at least since the filing of the original Complaint in this case. As a sophisticated technology company, to the extent Defendant failed to investigate its infringement upon learning of the '058 Patent, it has been willfully blind.

77. Defendant, with knowledge that these products, or the use thereof, infringe the '058 Patent at least as of the date of the original Complaint, knowingly and intentionally induced, and continues to knowingly and intentionally induce, direct infringement of the '058 Patent by providing these products to customers and ultimately to end-users for use in an infringing manner in the United States including, but not limited to, products that include infringing technology, such as the AirPods Pro and iPhone 12 Pro Max. For example, Apple's instruction manuals, websites, promotional materials, advertisements, and other information demonstrate to others, including customers, prospective customers, and distributors, how to use the Accused Products in an

infringing manner. Upon information and belief, Apple is aware that the normal and customary use of the Accused Products by customers, distributors, and others would infringe the Asserted Patents.

78. Defendant has induced infringement by others, including end-users, with the intent to cause infringing acts by others or, in the alternative, with the belief that there was a high probability that others, including end-users, infringe the '058 Patent, but while remaining willfully blind to the infringement.

79. Defendant has willfully infringed, and continues to willfully infringe, the '058 Patent by intentionally and deliberately carrying out acts of direct and indirect infringement, while knowing, or taking deliberate steps to avoid learning, that those acts infringe. For example, upon information and belief, Defendant has known of Jawbone's patents, including the '058 Patent, at least since May 2015, but has not ceased infringement.

80. Jawbone has suffered damages as a result of Defendant's direct and indirect infringement of the '058 Patent in an amount to be proved at trial.

81. Jawbone has suffered, and will continue to suffer, irreparable harm as a result of Defendant's infringement of the '058 Patent, for which there is no adequate remedy at law, unless Defendant's infringement is enjoined by this Court. Accordingly, Jawbone seeks a preliminary and permanent injunction enjoining Apple from making, using, importing, offering to sell, and/or selling the Accused Products, including at least all versions and variants of Apple iPhone and AirPods products.

COUNT III
(Infringement of the '072 Patent)

82. Paragraphs 1 through 46 are incorporated by reference as if fully set forth herein.

83. Jawbone has not licensed or otherwise authorized Apple to make, use, offer for sale, sell, or import any products that embody the inventions of the '072 Patent.

84. Defendant has and continues to directly infringe the '072 Patent, either literally or under the doctrine of equivalents, without authority and in violation of 35 U.S.C. § 271, by making, using, offering to sell, selling, and/or importing into the United States products that satisfy each and every limitation of one or more claims of the '072 Patent. Upon information and belief, these products include at least the Accused Products, such as those which comprise physical and virtual microphone arrays. The Accused Products include at least all versions and variants of Apple iPhone, AirPods, iPad, and HomePod.

85. For example, Defendant has and continues to directly infringe at least claim 1 of the '072 Patent by making, using, offering to sell, selling, and/or importing into the United States products that practice a method comprising receiving acoustic signals at a physical microphone array and in response outputting a plurality of microphone signals from the physical microphone array; forming a virtual microphone array by generating a plurality of different signal combinations from the plurality of microphone signals, wherein a number of physical microphones of the physical microphone array is larger than a number of virtual microphones of the virtual microphone array; and generating output signals by combining signals output from the virtual microphone array, the output signals including less acoustic noise than the received acoustic signals.

86. Each Accused Product practices a method comprising receiving acoustic signals at a physical microphone array and in response outputting a plurality of microphone signals from the physical microphone array. For example, the Apple AirPods Pro receives signals at a microphone array of each earbud and, in response, outputs a plurality of microphone signals.

87. Each Accused Product practices a method of forming a virtual microphone array by generating a plurality of different signal combinations from the plurality of microphone signals, wherein a number of physical microphones of the physical microphone array is larger than a number of virtual microphones of the virtual microphone array. For example, upon information and belief, the Apple AirPods Pro forms a virtual beamformed microphone from the plurality of microphone signals from physical MEMS microphones at each earbud.[21] For example, the number of physical microphones in the array (at least four) is greater than the number of virtual microphones in the array (two).

88. Each Accused Product further practices a method comprising generating output signals by combining signals output from the virtual microphone array, the output signals including less acoustic noise than the received acoustic signals. For example, upon information and belief, the Apple AirPods Pro suppresses acoustic noise by combining the signals output by the beamformed microphone of each earbud.

89. Defendant has and continues to indirectly infringe one or more claims of the ’072 Patent by knowingly and intentionally inducing others, including Apple’s customers and end-users of the Accused Products, to directly infringe, either literally or under the doctrine of equivalents, by making, using, offering to sell, selling, and/or importing into the United States products that include infringing technology, such as the Apple AirPods Pro. On information and belief, Defendant has been aware of how it and its customers and end-users infringe the ’072 Patent since around the time it first became aware of the ’072 Patent. Defendant has further been aware of how it and its customers and end-users infringe the ’072 Patent at least since the filing of the original

[21] https://www.ifixit.com/Teardown/AirPods+Pro+Teardown/127551

Complaint in this case. As a sophisticated technology company, to the extent Defendant failed to investigate its infringement upon learning of the '072 Patent, it has been willfully blind.

90. Defendant, with knowledge that these products, or the use thereof, infringe the '072 Patent at least as of the date of the original Complaint, knowingly and intentionally induced, and continues to knowingly and intentionally induce, direct infringement of the '072 Patent by providing these products to customers and ultimately to end-users for use in an infringing manner in the United States including, but not limited to, products that include infringing technology, such as the Apple AirPods Pro. For example, Apple's instruction manuals, websites, promotional materials, advertisements, and other information demonstrate to others, including customers, prospective customers, and distributors, how to use the Accused Products in an infringing manner. Upon information and belief, Apple is aware that the normal and customary use of the Accused Products by customers, distributors, and others would infringe the Patents-in-Suit.

91. Defendant has induced infringement by others, including end-users, with the intent to cause infringing acts by others or, in the alternative, with the belief that there was a high probability that others, including end-users, infringe the '072 Patent, but while remaining willfully blind to the infringement.

92. Defendant has willfully infringed, and continues to willfully infringe, the '072 Patent by intentionally and deliberately carrying out acts of direct and indirect infringement, while knowing, or taking deliberate steps to avoid learning, that those acts infringe. For example, upon information and belief, Defendant has known of Jawbone's patents, including the '072 Patent, at least since May 2015 but has not ceased infringement.

93. Jawbone has suffered damages as a result of Defendant's direct and indirect infringement of the '072 Patent in an amount to be proved at trial.

94. Jawbone has suffered, and will continue to suffer, irreparable harm as a result of Defendant's infringement of the '072 Patent, for which there is no adequate remedy at law, unless Defendant's infringement is enjoined by this Court. Accordingly, Jawbone seeks a preliminary and permanent injunction enjoining Apple from making, using, importing, offering to sell, and/or selling the Accused Products, including at least all versions and variants of Apple AirPods, iPhone, iPad, and HomePod products.

COUNT IV
(Infringement of the '213 Patent)

95. Paragraphs 1 through 46 are incorporated by reference as if fully set forth herein.

96. Jawbone has not licensed or otherwise authorized Apple to make, use, offer for sale, sell, or import any products that embody the inventions of the '213 Patent.

97. Defendant has and continues to directly infringe the '213 Patent, either literally or under the doctrine of equivalents, without authority and in violation of 35 U.S.C. § 271, by making, using, offering to sell, selling, and/or importing into the United States products that satisfy each and every limitation of one or more claims of the '213 Patent. Upon information and belief, these products include at least the Accused Products, such as those which comprise an acoustic voice activity detector that includes and utilizes physical and virtual microphone arrays. The Accused Products include at least all versions and variants of Apple iPhone, AirPods, iPad, and HomePod.

98. For example, Defendant has and continues to directly infringe at least claim 1 of the '213 Patent by making, using, offering to sell, selling, and/or importing into the United States products that include an acoustic voice activity detection system comprising: a first virtual microphone comprising a first combination of a first signal and a second signal, wherein the first signal is received from a first physical microphone and the second signal is received from a second physical microphone; a filter, wherein the filter is formed by generating a first quantity by applying

a calibration to at least one of the first signal and the second signal, generating a second quantity by applying a delay to the first signal, and forming the filter as a ratio of the first quantity to the second quantity; and a second virtual microphone formed by applying the filter to the first signal to generate a first intermediate signal and summing the first intermediate signal and the second signal, wherein acoustic voice activity of a speaker is determined to be present when an energy ratio of energies of the first virtual microphone and the second virtual microphone is greater than a threshold value.

99. Each Accused Product comprises a system comprising a first virtual microphone comprising a first combination of a first signal and a second signal, wherein the first signal is received from a first physical microphone and the second signal is received from a second physical microphone. For example, on information and belief, the Apple HomePod and iPhone 12 Pro Max each form a first virtual microphone from the outputs of a first and a second physical microphone.[22] For example, upon information and belief, the Apple HomePod comprises at least six physical microphones which supply inputs for beamformed microphones.[23] For example, upon information and belief, the iPhone 12 Pro Max comprises at least four physical microphones which supply inputs for beamformed microphones.

100. Each Accused Product comprises a system comprising a filter, wherein the filter is formed by generating a first quantity by applying a calibration to at least one of the first signal and the second signal, generating a second quantity by applying a delay to the first signal, and forming the filter as a ratio of the first quantity to the second quantity. For example, upon information and belief, the Accused Apple HomePod products and iPhone 12 Pro Max each form a calibration

[22] https://machinelearning.apple.com/research/optimizing-siri-on-homepod-in-far-field-settings
[23] https://www.ifixit.com/Teardown/HomePod+Teardown/103133

filter, such as a time and/or frequency domain filter, that describes a relationship for speech between at least a first and second physical microphones by applying a delay to the first signal.[24] For example, upon information and belief, the Apple HomePod and iPhone 12 Pro Max each use least squares adaptive filtering.[25]

101. Each Accused Product comprises a system comprising a second virtual microphone formed by applying the filter to the first signal to generate a first intermediate signal and summing the first intermediate signal and the second signal. For example, upon information and belief, the Apple HomePod and iPhone 12 Pro Max each form a second beamformed microphone by applying an adaptive filter to the output of at least a first microphone and summing the filtered output of the first microphone with the output of a second microphone.[26] For example, upon information and belief, the Apple HomePod and iPhone 12 Pro Max each use a form of filter-and-sum beamforming with at least an adaptive filter and a calibration filter.

102. Each of the Accused Products comprises a system wherein acoustic voice activity of a speaker is determined to be present when an energy ratio of energies of the first virtual microphone and the second virtual microphone is greater than a threshold value. For example, on information and belief, the Apple HomePod determines that voicing activity of a speaker is present when a ratio of energies between beamformed microphones is greater than a threshold value associated with the "Hey Siri" wake word.

[24] https://machinelearning.apple.com/research/optimizing-siri-on-homepod-in-far-field-settings
[25] https://machinelearning.apple.com/research/double-talk-robust-multichannel-accoustic-echo
[26] https://storage.Appleapis.com/pub-tools-public-publication-data/pdf/45399.pdf

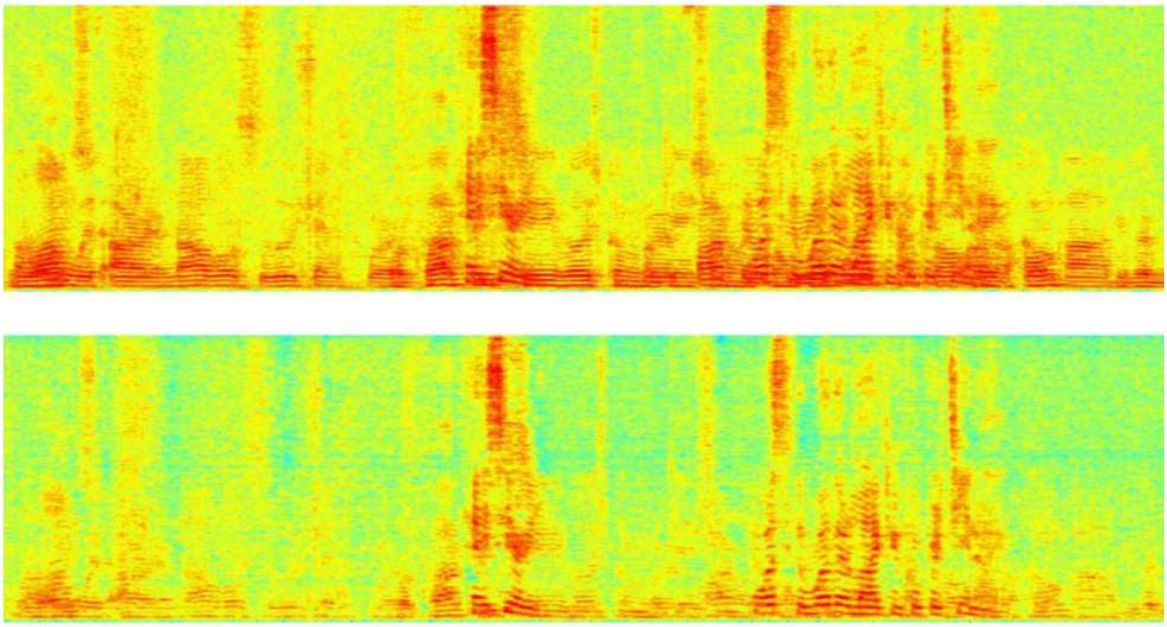

Figure 8. Siri voice command recorded in presence of interference from other talkers: [27]

103. Defendant has and continues to indirectly infringe one or more claims of the '213 Patent by knowingly and intentionally inducing others, including Apple's customers and end-users of the Accused Products, to directly infringe, either literally or under the doctrine of equivalents, by making, using, offering to sell, selling, and/or importing into the United States products that include infringing technology, such as the Apple HomePod and iPhone 12 Pro Max.

104. Defendant, with knowledge that these products, or the use thereof, infringe the '213 Patent at least as of the date of the original Complaint, knowingly and intentionally induced, and continues to knowingly and intentionally induce, direct infringement of the '213 Patent by providing these products to customers and ultimately to end-users for use in an infringing manner in the United States including, but not limited to, products that include infringing technology, such

[27] https://machinelearning.apple.com/research/optimizing-siri-on-homepod-in-far-field-settings

as the Apple HomePod and iPhone 12 Pro Max. For example, Apple's instruction manuals, websites, promotional materials, advertisements, and other information demonstrate to others, including customers, prospective customers, and distributors, how to use the Accused Products in an infringing manner. Upon information and belief, Apple is aware that the normal and customary use of the Accused Products by customers, distributors, and others would infringe the Patents-in-Suit. On information and belief, Defendant has been aware of how it and its customers and end-users infringe the '213 Patent since around the time it first became aware of the '213 Patent. Defendant has further been aware of how it and its customers and end-users infringe the '213 Patent at least since the filing of the original Complaint in this case. As a sophisticated technology company, to the extent Defendant failed to investigate its infringement upon learning of the '213 Patent, it has been willfully blind.

105. Defendant induced infringement by others, including end-users, with the intent to cause infringing acts by others or, in the alternative, with the belief that there was a high probability that others, including end-users, infringe the '213 Patent, but while remaining willfully blind to the infringement.

106. Defendant has willfully infringed, and continues to willfully infringe, the '213 Patent by intentionally and deliberately carrying out acts of direct and indirect infringement, while knowing, or taking deliberate steps to avoid learning, that those acts infringe. For example, upon information and belief, Defendant has known of Jawbone's patents, including the '213 Patent, at least since May 2015, but has not ceased or avoided infringement.

107. Jawbone has suffered damages as a result of Defendant's direct and indirect infringement of the '213 Patent in an amount to be proved at trial.

108. Jawbone has suffered, and will continue to suffer, irreparable harm as a result of Defendant's infringement of the '213 Patent, for which there is no adequate remedy at law, unless Defendant's infringement is enjoined by this Court. Accordingly, Jawbone seeks a preliminary and permanent injunction enjoining Apple from making, using, importing, offering to sell, and/or selling the Accused Products, including at least all versions and variants of Apple AirPods, iPhone, iPad, and HomePod products.

COUNT V
(Infringement of the '611 Patent)

109. Paragraphs 1 through 46 are incorporated by reference as if fully set forth herein.

110. Jawbone has not licensed or otherwise authorized Apple to make, use, offer for sale, sell, or import any products that embody the inventions of the '611 Patent.

111. Defendant has and continues to directly infringe the '611 Patent, either literally or under the doctrine of equivalents, without authority and in violation of 35 U.S.C. § 271, by using products that satisfy each and every limitation of one or more claims of the '611 Patent. Upon information and belief, these products include at least the Accused Products, such as those which comprise an acoustic voice activity detector that includes and utilizes physical and virtual microphone arrays. The Accused Products include at least all versions and variants of Apple iPhone, AirPods, iPad, and HomePod.

112. For example, Defendant has and continues to directly infringe at least claim 1 of the '611 Patent by using products that perform a method comprising: forming a first virtual microphone by combining a first signal of a first physical microphone and a second signal of a second physical microphone; forming a filter that describes a relationship for speech between the first physical microphone and the second physical microphone; forming a second virtual microphone by applying the filter to the first signal to generate a first intermediate signal, and

summing the first intermediate signal and the second signal; generating an energy ratio of energies of the first virtual microphone and the second virtual microphone; and detecting acoustic voice activity of a speaker when the energy ratio is greater than a threshold value.

113. Each Accused Product performs a method comprising forming a first virtual microphone by combining a first signal of a first physical microphone and a second signal of a second physical microphone. For example, on information and belief, the Apple HomePod and iPhone 12 Pro Max each form a first virtual microphone from the outputs of a first and a second physical microphones.[28] For example, upon information and belief, the Apple HomePod comprises at least six physical microphones which supply inputs for beamformed microphones.[29]

114. Each Accused Product performs a method comprising forming a filter that describes a relationship for speech between the first physical microphone and the second physical microphone. For example, upon information and belief, the Accused Apple HomePod products and iPhone 12 Pro Max each use a calibration filter, such as a time and/or frequency domain filter, which describes a relationship for speech between at least a first and a second physical microphone. For example, upon information and belief, the Apple HomePod and iPhone 12 Pro Max each use least squares adaptive filtering.[30]

115. Each Accused Product performs a method comprising forming a second virtual microphone by applying the filter to the first signal to generate a first intermediate signal and summing the first intermediate signal and the second signal. For example, upon information and belief, the Apple HomePod and iPhone 12 Pro Max each forms a second beamformed microphone by applying an adaptive filter to the output of at least a first microphone and summing the filtered

[28] https://machinelearning.apple.com/research/optimizing-siri-on-homepod-in-far-field-settings
[29] https://www.ifixit.com/Teardown/HomePod+Teardown/103133
[30] https://machinelearning.apple.com/research/double-talk-robust-multichannel-accoustic-echo

output of the first microphone with the output of a second microphone.[31] For example, upon information and belief, the Apple HomePod and iPhone 12 Pro Max each use a form of filter-and-sum beamforming with at least an adaptive filter and a calibration filter.

116. Each of the Accused Products performs a method comprising generating an energy ratio of energies of the first virtual microphone and the second virtual microphone; and detecting acoustic voice activity of a speaker when the energy ratio is greater than a threshold value. For example, on information and belief, the Apple HomePod and iPhone 12 Pro Max each determine that voicing activity of a speaker is present when a ratio of energies between beamformed microphones is greater than a threshold value associated with the "Hey Siri" wake word.

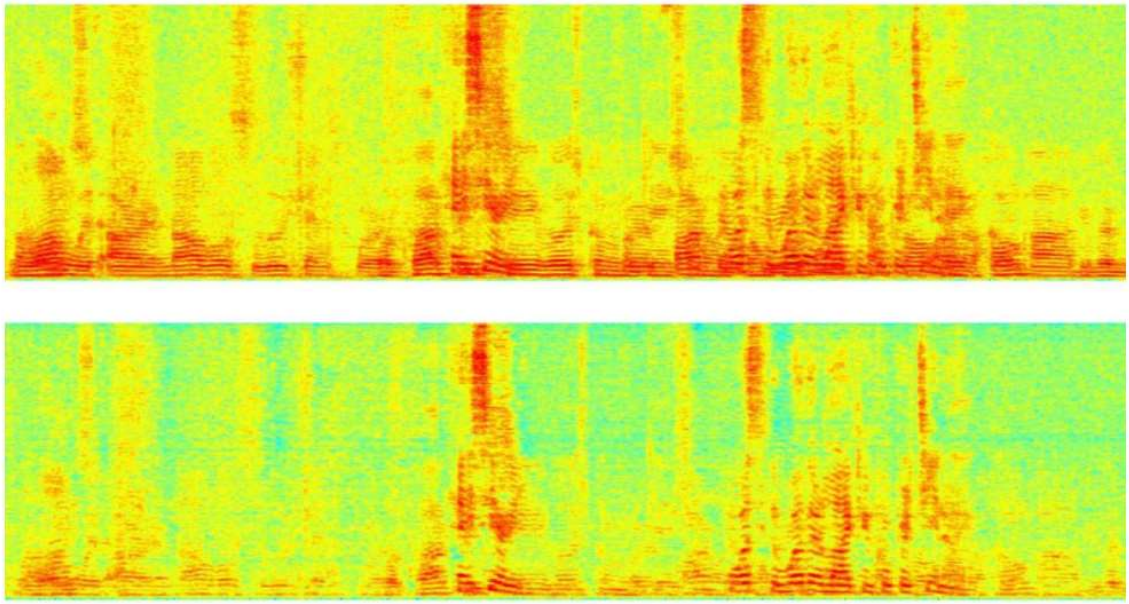

Figure 8. Siri voice command recorded in presence of interference from other talkers:[32]

[31] https://storage.Appleapis.com/pub-tools-public-publication-data/pdf/45399.pdf
[32] https://machinelearning.apple.com/research/optimizing-siri-on-homepod-in-far-field-settings

117. Defendant has and continues to indirectly infringe one or more claims of the '611 Patent by knowingly and intentionally inducing others, including Apple's customers and end-users of the Accused Products, to directly infringe, either literally or under the doctrine of equivalents, by using products that include infringing technology, such as the Apple HomePod and iPhone 12 Pro Max.

118. Defendant, with knowledge that these products, or the use thereof, infringe the '611 Patent at least as of the date of the original Complaint, knowingly and intentionally induced, and continues to knowingly and intentionally induce, direct infringement of the '611 Patent by providing these products to customers and ultimately to end-users for use in an infringing manner in the United States including, but not limited to, products that include infringing technology, such as the Apple HomePod and iPhone 12 Pro Max. For example, Apple's instruction manuals, websites, promotional materials, advertisements, and other information demonstrate to others, including customers, prospective customers, and distributors, how to use the Accused Products in an infringing manner. Upon information and belief, Apple is aware that the normal and customary use of the Accused Products by customers, distributors, and others would infringe the Patents-in-Suit.

119. Defendant has induced infringement by others, including end-users, with the intent to cause infringing acts by others or, in the alternative, with the belief that there was a high probability that others, including end-users, infringe the '611 Patent, but while remaining willfully blind to the infringement. On information and belief, Defendant has been aware of how it and its customers and end-users infringe the '611 Patent since around the time it first became aware of the '611 Patent. Defendant has further been aware of how it and its customers and end-users infringe the '611 Patent at least since the filing of the original Complaint in this case. As a

sophisticated technology company, to the extent Defendant failed to investigate its infringement upon learning of the '611 Patent, it has been willfully blind.

120. Defendant has willfully infringed, and continues to willfully infringe, the '611 Patent by intentionally and deliberately carrying out acts of direct and indirect infringement, while knowing, or taking deliberate steps to avoid learning, that those acts infringe. For example, upon information and belief, Defendant has known of Jawbone's patents, as described above, but has not ceased infringement.

121. Jawbone has suffered damages as a result of Defendant's direct and indirect infringement of the '611 Patent in an amount to be proved at trial.

122. Jawbone has suffered, and will continue to suffer, irreparable harm as a result of Defendant's infringement of the '611 Patent, for which there is no adequate remedy at law, unless Defendant's infringement is enjoined by this Court. Accordingly, Jawbone seeks a preliminary and permanent injunction enjoining Apple from making, using, importing, offering to sell, and/or selling the Accused Products, including at least all versions and variants of Apple AirPods, iPhone, iPad, and HomePod products.

COUNT VI
(Infringement of the '080 Patent)

123. Paragraphs 1 through 46 are incorporated by reference as if fully set forth herein.

124. Jawbone has not licensed or otherwise authorized Apple to make, use, offer for sale, sell, or import any products that embody the inventions of the '080 Patent.

125. Defendant has and continues to directly infringe the '080 Patent, either literally or under the doctrine of equivalents, without authority and in violation of 35 U.S.C. § 271, by making, using, offering to sell, selling, and/or importing into the United States products that satisfy each and every limitation of one or more claims of the '080 Patent. Upon information and belief, these

products include at least the Accused Products, such as those which comprise an array of physical and virtual microphones and suppress noise from received signals. The Accused Products include at least all versions and variants of Apple iPhone, AirPods, iPad, and HomePod.

126. For example, Defendant has and continues to directly infringe at least claim 1 of the '080 Patent by making, using, offering to sell, selling, and/or importing into the United States, a system comprising: a microphone array including a first physical microphone outputting a first microphone signal and a second physical microphone outputting a second microphone signal; a processing component coupled to the microphone array and generating a virtual microphone array including a first virtual microphone and a second virtual microphone, the first virtual microphone including a first combination of the first microphone signal and the second microphone signal, the second virtual microphone including 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 and the second virtual microphone have substantially similar responses to noise and substantially dissimilar responses to speech; and an adaptive noise removal application coupled to the processing component 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 microphone array.

127. Each Accused Product comprises a microphone array including a first physical microphone outputting a first microphone signal and a second physical microphone outputting a second microphone signal. For example, upon information and belief, each earbud of the Apple

AirPods Pro comprises at least two outward facing microphones, each of which outputs a microphone signal. For example, upon information and belief, the Apple iPhone 12 Pro Max comprises at least two downward facing microphones, each of which outputs a microphone signal.

128. Each Accused Product comprises a processing component coupled to the microphone array and generating a virtual microphone array including a first virtual microphone and a second virtual microphone. For example, each earbud of the Apple AirPods Pro comprises an H1 system-in-package and/or other DSP that is coupled to the microphone array and, upon information and belief, generates at least two beamformed microphones. For example, the iPhone 12 Pro Max comprises an A14 Bionic SoC and/or other DSP that is coupled to the microphone array and, upon information and belief, generates at least two beamformed microphones.

129. Each Accused Product comprises a system wherein the first virtual microphone including a first combination of the first microphone signal and the second microphone signal, the second virtual microphone including a second combination of the first microphone signal and the second microphone signal, wherein the second combination is different from the first combination. For example, upon information and belief, each beamformed microphone of the Apple AirPods Pro and iPhone 12 Pro Max includes a different combination of signals from their respective physical microphones.

130. Each Accused Product comprises a system wherein the first virtual microphone and the second virtual microphone have substantially similar responses to noise and substantially dissimilar responses to speech. For example, upon information and belief, the beamformed microphones of the Apple AirPods Pro and iPhone 12 Pro Max each have a substantially similar response to noise and a substantially dissimilar response to speech.[33]

[33] https://machinelearning.apple.com/research/optimizing-siri-on-homepod-in-far-field-settings

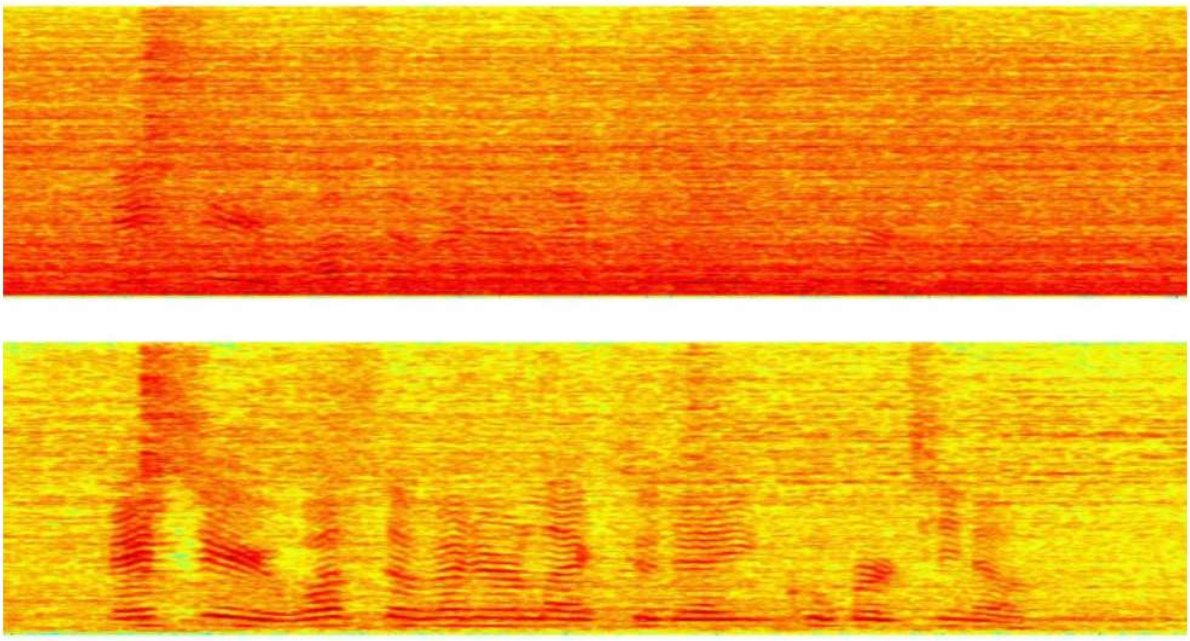

Figure 6. Siri voice command in presence of background noise generated by a nearby dishwasher:

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131. Each Accused Product comprises an adaptive noise removal application coupled to the processing component 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. For example, upon information and belief, each Apple AirPods Pro earbud comprises an adaptive noise removal application coupled to an H1 system-in-package and/or other DSP, which generates denoised output signals by forming at least two combinations of signals from the beamformed microphones, by filtering and summing those combinations in the time domain, and by varying a

[34] https://machinelearning.apple.com/research/optimizing-siri-on-homepod-in-far-field-settings

linear transfer function between those combinations of signals.[35] For example, upon information and belief, the Apple iPhone 12 Pro Max comprises an adaptive noise removal application coupled to an A14 Bionic SoC and/or other DSP, which generates denoised output signals by forming at least two combinations of signals from the beamformed microphones, by filtering and summing those combinations in the time domain, and by varying a linear transfer function between those combinations of signals

132. Each Accused Product comprises a system wherein the denoised output signals include less acoustic noise than acoustic signals received at the microphone array. For example, upon information and belief, the signals denoised by the adaptive noise removal application of the Apple AirPods Pro and iPhone 12 Pro Max each include less noise than the acoustic signals received at their respective microphones.

133. Defendant has and continues to indirectly infringe one or more claims of the '080 Patent by knowingly and intentionally inducing others, including Apple customers and end-users of the Accused Products, to directly infringe, either literally or under the doctrine of equivalents, by making, using, offering to sell, selling, and/or importing into the United States products that include infringing technology, such as the Apple HomePod and iPhone 12 Pro Max.

134. Defendant, with knowledge that these products, or the use thereof, infringe the '080 Patent at least as of the date of the original Complaint, knowingly and intentionally induced, and continues to knowingly and intentionally induce, direct infringement of the '080 Patent by providing these products to customers and ultimately to end-users for use in an infringing manner in the United States including, but not limited to, products that include infringing technology, such

[35] *See e.g.*
https://developer.apple.com/documentation/avfaudio/avaudiosessiondatasourcedescription;
https://developer.apple.com/documentation/avfaudio/avaudiosession/polarpattern

as the Apple HomePod and iPhone 12 Pro Max. For example, Apple's instruction manuals, websites, promotional materials, advertisements, and other information demonstrate to others, including customers, prospective customers, and distributors, how to use the Accused Products in an infringing manner. Upon information and belief, Apple is aware that the normal and customary use of the Accused Products by customers, distributors, and others would infringe the Patents-in-Suit.

135. Defendant has induced infringement by others, including end-users, with the intent to cause infringing acts by others or, in the alternative, with the belief that there was a high probability that others, including end-users, infringe the '080 Patent, but while remaining willfully blind to the infringement. On information and belief, Defendant has been aware of how it and its customers and end-users infringe the '080 Patent since around the time it first became aware of the '080 Patent. Defendant has further been aware of how it and its customers and end-users infringe the '080 Patent at least since the filing of the original Complaint in this case. As a sophisticated technology company, to the extent Defendant failed to investigate its infringement upon learning of the '080 Patent, it has been willfully blind.

136. Defendant has willfully infringed, and continues to willfully infringe, the '080 Patent by intentionally and deliberately carrying out acts of direct and indirect infringement, while knowing, or taking deliberate steps to avoid learning, that those acts infringe. For example, upon information and belief, Defendant has known of Jawbone's patents, as described above, but has not ceased infringement.

137. Jawbone has suffered damages as a result of Defendant's direct and indirect infringement of the '080 Patent in an amount to be proved at trial.

138. Jawbone has suffered, and will continue to suffer, irreparable harm as a result of Defendant's infringement of the '080 Patent, for which there is no adequate remedy at law, unless Defendant's infringement is enjoined by this Court. Accordingly, Jawbone seeks a preliminary and permanent injunction enjoining Apple from making, using, importing, offering to sell, and/or selling the Accused Products, including at least all versions and variants of Apple iPhone, iPad, AirPods, and HomePod products.

COUNT VII
(Infringement of the '357 Patent)

139. Paragraphs 1 through 46 are incorporated by reference as if fully set forth herein.

140. Jawbone has not licensed or otherwise authorized Apple to make, use, offer for sale, sell, or import any products that embody the inventions of the '357 Patent.

141. Defendant has and continues to directly infringe the '357 Patent, either literally or under the doctrine of equivalents, without authority and in violation of 35 U.S.C. § 271, by making, using, offering to sell, selling, and/or importing into the United States products that satisfy each and every limitation of one or more claims of the '357 Patent. Upon information and belief, these products include at least the Accused Products, such as those which comprise physical and virtual microphone arrays. The Accused Products include at least all versions and variants of Apple iPhone, AirPods, iPad, and HomePod.

142. For example, Defendant has and continues to directly infringe at least claim 1 of the '357 Patent by making, using, offering to sell, selling, and/or importing into the United States products comprising a first virtual microphone comprising 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 comprising 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 and the second virtual microphone are distinct virtual directional microphones with substantially similar responses to noise and substantially dissimilar responses to speech; and a signal processor coupled with the first and second microphone signals and operative to combine the first and second microphone signals by filtering and summing in the time domain, to apply a varying linear transfer function between the first and second microphone signals, and to generate an output signal having noise content that is attenuated with respect to speech content.

143. Each Accused Product comprises a first virtual microphone comprising 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. For example, upon information and belief, each Apple AirPods Pro earbud and/or set of Apple AirPods Pro earbuds comprises at least two physical microphones, and a first beamformed microphone comprising signals generated by both microphones.

144. Each Accused Product comprises a second virtual microphone comprising a second combination of the first microphone signal and the second microphone signal, wherein the second combination is different from the first combination. For example, upon information and belief, each Apple AirPods Pro earbud and/or set of Apple AirPods Pro earbuds comprises a second beamformed microphone comprising signals generated by the first and second physical microphones.

145. Each Accused Product comprises a system wherein the first virtual microphone and the second virtual microphone are distinct virtual directional microphones with substantially

similar responses to noise and substantially dissimilar responses to speech. For example, upon information and belief, the beamformed microphones of the Apple AirPods Pro have similar noise responses and dissimilar speech responses.

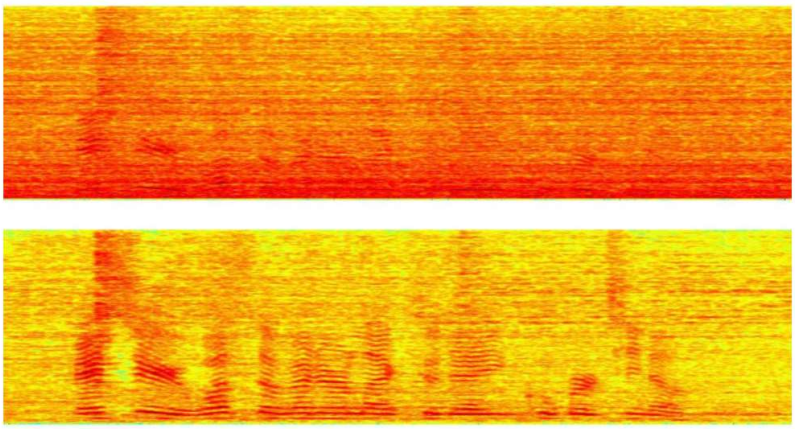

Figure 6. Siri voice command in presence of background noise generated by a nearby dishwasher: [36]

146. Each Accused Product comprises a signal processor coupled with the first and second microphone signals and operative to combine the first and second microphone signals by filtering and summing in the time domain, to apply a varying linear transfer function between the first and second microphone signals, and to generate an output signal having noise content that is attenuated with respect to speech content. For example, upon information and belief, each Apple AirPods Pro earbud comprises an H1 system-in-package and/or other DSP, which generates denoised output signals by forming at least two combinations of signals from the beamformed microphones, by filtering and summing those combinations, and by varying a linear transfer function between those combinations of signals.[37]

[36] https://machinelearning.apple.com/research/optimizing-siri-on-homepod-in-far-field-settings
[37] *See e.g.* https://developer.apple.com/documentation/avfaudio/avaudiosessiondatasourcedescription; https://developer.apple.com/documentation/avfaudio/avaudiosession/polarpattern

147. Defendant has and continues to indirectly infringe one or more claims of the '357 Patent by knowingly and intentionally inducing others, including Apple's customers and end-users of the Accused Products, to directly infringe, either literally or under the doctrine of equivalents, by making, using, offering to sell, selling and/or importing into the United States products that include infringing technology, such as the Apple AirPods Pro.

148. Defendant, with knowledge that these products, or the use thereof, infringe the '357 Patent at least as of the date of the original Complaint, knowingly and intentionally induced, and continues to knowingly and intentionally induce, direct infringement of the '357 Patent by providing these products to customers and ultimately to end-users for use in an infringing manner in the United States including, but not limited to, products that include infringing technology, such as the Apple AirPods Pro. For example, Apple's instruction manuals, websites, promotional materials, advertisements, and other information demonstrate to others, including customers, prospective customers, and distributors, how to use the Accused Products in an infringing manner. Upon information and belief, Apple is aware that the normal and customary use of the Accused Products by customers, distributors, and others would infringe the Asserted Patents.

149. Defendant has induced infringement by others, including end-users, with the intent to cause infringing acts by others or, in the alternative, with the belief that there was a high probability that others, including end-users, infringe the '357 Patent, but while remaining willfully blind to the infringement. On information and belief, Defendant has been aware of how it and its customers and end-users infringe the '357 Patent since around the time it first became aware of the '357 Patent. Defendant has further been aware of how it and its customers and end-users infringe the '357 Patent at least since the filing of the original Complaint in this case. As a

sophisticated technology company, to the extent Defendant failed to investigate its infringement upon learning of the '357 Patent, it has been willfully blind.

150. Defendant has willfully infringed, and continues to willfully infringe, the '357 Patent by intentionally and deliberately carrying out acts of direct and indirect infringement, while knowing, or taking deliberate steps to avoid learning, that those acts infringe. For example, upon information and belief, Defendant has known of Jawbone's patents, as described above, but has not ceased infringement.

151. Jawbone has suffered damages as a result of Defendant's direct and indirect infringement of the '357 Patent in an amount to be proved at trial.

152. Jawbone has suffered, and will continue to suffer, irreparable harm as a result of Defendant's infringement of the '357 Patent, for which there is no adequate remedy at law, unless Defendant's infringement is enjoined by this Court. Accordingly, Jawbone seeks a preliminary and permanent injunction enjoining Apple from making, using, importing, offering to sell, and/or selling the Accused Products, including at least all versions and variants of Apple AirPods, iPhone, iPad, and HomePod products.

COUNT VIII
(Infringement of the '543 Patent)

153. Paragraphs 1 through 46 are incorporated by reference as if fully set forth herein.

154. Jawbone has not licensed or otherwise authorized Apple to make, use, offer for sale, sell, or import any products that embody the inventions of the '543 Patent.

155. Defendant has and continues to directly infringe the '543 Patent, either literally or under the doctrine of equivalents, without authority and in violation of 35 U.S.C. § 271, by making, using, offering to sell, selling, and/or importing into the United States products that satisfy each and every limitation of one or more claims of the '543 Patent. Upon information and belief, these

products include at least the Accused Products, such as those which comprise a microphone array and a voice activity detector. The Accused Products include at least all versions and variants of Apple iPhone, AirPods, iPad, and HomePod.

156. For example, Defendant has and continues to directly infringe at least claim 1 of the '543 Patent by making, using, offering to sell, selling, and/or importing into the United States products that comprise a communications system, comprising: a voice detection subsystem configured to receive voice activity signals that includes information associated with human voicing activity, the voice detection subsystem configured to automatically generate control signals using the voice activity signals; and a denoising subsystem coupled to the voice detection subsystem, the denoising subsystem comprising a microphone array including a plurality of microphones, wherein a first microphone of the array is fixed at a first position relative to a mouth, wherein the first position orients a front of the first microphone towards the mouth, wherein a second microphone of the array is fixed at a second position relative to the mouth, wherein the second position orients a front of the second microphone away from the mouth, such that the second position forms an angle relative to the first position, wherein the angle is greater than zero degrees, the microphone array providing acoustic signals of an environment to components of the denoising subsystem, components of the denoising subsystem automatically selecting at least one denoising method appropriate to data of at least one frequency subband of the acoustic signals using the control signals and processing the acoustic signals using the selected denoising method to generate denoised acoustic signals, wherein the denoising method includes generating a noise waveform estimate associated with noise of the acoustic signals and subtracting the noise waveform estimate from the acoustic signal when the acoustic signal includes speech and noise, wherein the voice detection subsystem is configured to receive the voice activity signals using a

sensor independent from the microphone array and to output the control signals generated from the voice activity signals to the denoising system, the denoising system configured to use the control signals to denoise the acoustic signals from the microphone array.

157. The Accused Products comprise a voice detection subsystem configured to receive voice activity signals that includes information associated with human voicing activity, the voice detection subsystem configured to automatically generate control signals using the voice activity signals. For example, the Apple AirPods Pro earbuds comprise a speech detecting accelerometer which, upon information and belief, is configured to receive voice activity signals that include information associated with human voicing activity, and to automatically generate control signals using the voice activity signals. For example, upon information and belief, the accelerometer of the Apple iPhone 12 Pro Max is similarly configured to receive voice activity signals that includes information associated with human voicing activity, and to automatically generate control signals using the voice activity signals

158. The Accused Products further comprise a denoising subsystem coupled to the voice detection subsystem, the denoising subsystem comprising a microphone array including a plurality of microphones. For example, the Apple AirPods Pro earbuds include a denoising system comprising an array of microphones, coupled to the accelerometer (*e.g.*, via a DSP and/or processor). For example, the Apple iPhone 12 Pro Max similarly comprises an array of microphones coupled to the accelerometer (*e.g.*, via a DSP and/or processor). For example, upon information and belief, the Apple iPhone 12 Pro Max further receives accelerometer data from the AirPods Pro earbuds.

159. The Accused Products further comprise a system wherein a first microphone of the array is fixed at a first position relative to a mouth, wherein the first position orients a front of the

first microphone towards the mouth, wherein a second microphone of the array is fixed at a second position relative to the mouth, wherein the second position orients a front of the second microphone away from the mouth such that the second position forms an angle relative to the first position, wherein the angle is greater than zero degrees. For example, a lower microphone of each earbud of the Apple AirPods Pro is oriented towards a user's mouth, an upper microphone is oriented away from a user's mouth, and the angle between the orientation of the microphones is greater than zero degrees. For example, at least one lower microphone of the iPhone 12 Pro Max is oriented towards a user's mouth, at least a rear and/or upper microphone is oriented away from a user's mouth, and the angle between the orientation of the lower and upper/rear microphones of the iPhone 12 Pro Max is greater than zero degrees.

160. The Accused Products further comprise a system wherein the microphone array provides acoustic signals of an environment to components of the denoising subsystem. For example, the microphone arrays of the Apple iPhone 12 Pro Max and the AirPods Pro provide acoustic signals of an environment (*e.g.*, environmental noise) to components of the denoising subsystem (*e.g.*, a DSP and/or processor).

161. The Accused Products further comprise a system wherein components of the denoising subsystem automatically select at least one denoising method appropriate to data of at least one frequency subband of the acoustic signals, using the control signals and processing the acoustic signals using the selected denoising method to generate denoised acoustic signals. For example, upon information and belief, the Apple AirPods Pro and iPhone 12 Pro Max each further automatically select at least one denoising method appropriate to data of at least one frequency subband using the control signals, such as least mean squares adaptive filtering, and/or other forms

of noise suppression, and process the acoustic signals using the selected denoising method to generate denoised acoustic signals.

162. The Accused Products further comprise a system wherein the denoising method includes generating a noise waveform estimate associated with noise of the acoustic signals and subtracting the noise waveform estimate from the acoustic signal when the acoustic signal includes speech and noise. For example, upon information and belief, the Apple AirPods Pro and iPhone 12 Pro Max each suppress noise in received signals by generating a waveform associated with noise (*e.g.*, noise detected by a microphone facing away from a user's mouth) and subtract the noise waveform from the acoustic signal when the signal includes both speech and noise.

163. For example, the Accused Products further comprise a system wherein the voice detection subsystem is configured to receive the voice activity signals using a sensor independent from the microphone array and to output the control signals generated from the voice activity signals to the denoising system, the denoising system configured to use the control signals to denoise the acoustic signals from the microphone array. For example, the Apple AirPods Pro earbuds comprise a speech detecting accelerometer independent of a microphone array, configured to supply control signals triggering the denoising subsystem when speech is occurring. For example, on information and belief, the iPhone 12 Pro Max similarly comprises an accelerometer independent of a microphone array (and/or uses signals supplied by a pair of AirPods), configured to trigger the denoising subsystem when speech is occurring.

164. Defendant has and continues to indirectly infringe one or more claims of the '543 Patent by knowingly and intentionally inducing others, including Apple's customers and end-users of the Accused Products, to directly infringe, either literally or under the doctrine of equivalents,

by making, using, offering to sell, selling and/or importing into the United States products that include infringing technology, such as the Apple AirPods Pro.

165. Defendant, with knowledge that these products, or the use thereof, infringe the '543 Patent at least as of the date of the original Complaint, knowingly and intentionally induced, and continues to knowingly and intentionally induce, direct infringement of the '543 Patent by providing these products to customers and ultimately to end-users for use in an infringing manner in the United States including, but not limited to, products that include infringing technology, such as the AirPods Pro. For example, Apple's instruction manuals, websites, promotional materials, advertisements, and other information demonstrate to others, including customers, prospective customers, and distributors, how to use the Accused Products in an infringing manner. Upon information and belief, Apple is aware that the normal and customary use of the Accused Products by customers, distributors, and others would infringe the Asserted Patents.

166. Defendant has induced infringement by others, including end-users, with the intent to cause infringing acts by others or, in the alternative, with the belief that there was a high probability that others, including end-users, infringe the '543 Patent, but while remaining willfully blind to the infringement. On information and belief, Defendant has been aware of how it and its customers and end-users infringe the '543 Patent since around the time it first became aware of the '543 Patent. Defendant has further been aware of how it and its customers and end-users infringe the '543 Patent at least since the filing of the original Complaint in this case. As a sophisticated technology company, to the extent Defendant failed to investigate its infringement upon learning of the '543 Patent, it has been willfully blind.

167. Defendant has willfully infringed, and continues to willfully infringe, the '543 Patent by intentionally and deliberately carrying out acts of direct and indirect infringement, while

knowing, or taking deliberate steps to avoid learning, that those acts infringe. For example, upon information and belief, Defendant has known of Jawbone's patents, as described above, but has not ceased infringement.

168. Jawbone has suffered damages as a result of Defendant's direct and indirect infringement of the '543 Patent in an amount to be proved at trial.

169. Jawbone has suffered, and will continue to suffer, irreparable harm as a result of Defendant's infringement of the '543 Patent, for which there is no adequate remedy at law, unless Defendant's infringement is enjoined by this Court. Accordingly, Jawbone seeks a preliminary and permanent injunction enjoining Apple from making, using, importing, offering to sell, and/or selling the Accused Products, including at least all versions and variants of the Accused Products.

COUNT IX
(Infringement of the '691 Patent)

170. Paragraphs 1 through 46 are incorporated by reference as if fully set forth herein.

171. Jawbone has not licensed or otherwise authorized Apple to make, use, offer for sale, sell, or import any products that embody the inventions of the '691 Patent.

172. Apple has and continues to directly infringe the '691 Patent, either literally or under the doctrine of equivalents, without authority and in violation of 35 U.S.C. § 271, by making, using, offering to sell, selling, and/or importing into the United States products that satisfy each and every limitation of one or more claims of the '691 Patent. Upon information and belief, these products include at least the Accused Products, such as those which comprise physical and virtual microphone arrays. The Accused Products include at least all versions and variants of Apple iPhone, AirPods, HomePod, and iPad.

173. For example, Apple has and continues to directly infringe at least claim 23 of the '691 Patent by making, using, offering to sell, selling, and/or importing into the United States

products comprising a microphone array 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 omnidirectional microphone and the second microphone signal is generated by a second omnidirectional microphone; and 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 that is substantially similar across a plurality of frequencies for a speech source within a predetermined angle relative to an axis of the microphone array and devoid of a null, and a first linear response to noise that is 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 that is devoid of a null, wherein the second linear response to noise is substantially similar to the first linear response to noise and the second linear response to speech is substantially dissimilar to the first linear response to speech, wherein the speech is human speech.

174. Each Accused Product comprises 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 omnidirectional microphone and the second microphone signal is generated by a second omnidirectional microphone. For example, upon information and belief, each Apple AirPods Pro earbud and/or set of Apple AirPods Pro earbuds comprises at least two physical omnidirectional microphones, and a first beamformed microphone comprising signals generated by both microphones.

175. Each Accused Product comprises 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. For example, upon information and belief, each Apple AirPods Pro earbud and/or set of Apple AirPods Pro earbuds comprises a second beamformed microphone comprising signals generated by the first and second physical microphones.

176. Each Accused Product comprises a system wherein the first virtual microphone has a first linear response to speech that is substantially similar across a plurality of frequencies for a speech source within a predetermined angle relative to an axis of the microphone array and devoid of a null, and a first linear response to noise that is devoid of a null. For example, upon information and belief, the first beamformed microphone of the Apple AirPods Pro has a linear response to speech across a predetermined angle relative to an axis of the array pointed towards a user's mouth, and a first linear response to noise in another direction without a null.

177. Each Accused Product comprises a system 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 that is devoid of a null. For example, upon information and belief, the second beamformed microphone of the Apple AirPods Pro has a linear response to speech that has a single null oriented in a direction towards a source of the speech (*e.g.*, the user's mouth), and a second linear response to noise that is devoid of a null.

178. Each Accused Product comprises a system wherein the second linear response to noise is substantially similar to the first linear response to noise and the second linear response to speech is substantially dissimilar to the first linear response to speech. For example, upon information and belief, the second linear response to speech of the first beamformed microphone is similar to the first linear response to noise of the first beamformed microphone, and the second

linear response to speech of the second beamformed microphone is substantially dissimilar to the first linear response to speech of the first beamformed microphone.

179. Each Accused Product comprises a system wherein the speech is human speech. For example, the speech activity detected by the Apple AirPods Pro earbuds is the voice of a user.

180. Apple has and continues to indirectly infringe one or more claims of the ’691 Patent by knowingly and intentionally inducing others, including Apple’s customers and end-users of the Accused Products, to directly infringe, either literally or under the doctrine of equivalents, by making, using, offering to sell, selling, and/or importing into the United States products that include infringing technology, such as the Apple AirPods Pro.

181. Apple, with knowledge that these products, or the use thereof, infringe the ’691 Patent at least as of the date of this Amended Complaint, knowingly and intentionally induced, and continues to knowingly and intentionally induce, direct infringement of the ’691 Patent by providing these products to customers and ultimately to end-users for use in an infringing manner in the United States including, but not limited to, products that include infringing technology, such as the Apple AirPods Pro. For example, Apple’s instruction manuals, websites, promotional materials, advertisements, and other information demonstrate to others, including customers, prospective customers, and distributors, how to use the Accused Products in an infringing manner. Upon information and belief, Apple is aware that the normal and customary use of the Accused Products by customers, distributors, and others would infringe the ’691 Patent.

182. Apple has induced infringement by others, including end-users, with the intent to cause infringing acts by others or, in the alternative, with the belief that there was a high probability that others, including end-users, infringe the ’691 Patent, but while remaining willfully blind to the infringement. On information and belief, Defendant has been aware of how it and its customers

and end-users infringe the '691 Patent since around the time it first became aware of the '691 Patent. As a sophisticated technology company, to the extent Defendant failed to investigate its infringement upon learning of the '691 Patent, it has been willfully blind.

183. Apple has willfully infringed, and continues to willfully infringe, the '691 Patent by intentionally and deliberately carrying out acts of direct and indirect infringement, while knowing, or taking deliberate steps to avoid learning, that those acts infringe. For example, upon information and belief, Apple has known of Jawbone's patents, including the '691 Patent, as described above, but has not ceased infringement.

184. Jawbone has suffered damages as a result of Apple's direct and indirect infringement of the '691 Patent in an amount to be proved at trial.

185. Jawbone has suffered, and will continue to suffer, irreparable harm as a result of Apple's infringement of the '691 Patent, for which there is no adequate remedy at law, unless Apple's infringement is enjoined by this Court. Accordingly, Jawbone seeks a preliminary and permanent injunction enjoining Apple from making, using, importing, offering to sell, and/or selling the Accused Products, including at least all versions and variants of Apple smartphones and tablets (*e.g.*, all variants of the Apple iPhone and iPad), HomePod, and earbuds (*e.g.*, AirPods).

DEMAND FOR JURY TRIAL

Plaintiff hereby demands a jury for all issues so triable.

PRAYER FOR RELIEF

WHEREFORE, Jawbone prays for relief against Defendant as follows:

a. Entry of judgment declaring that Defendant has directly and/or indirectly infringed one or more claims of each of the Patents-in-Suit;

b. Entry of judgment declaring that Defendant's infringement of the Patents-in-Suit is willful;

c. Entry of a preliminary injunction enjoining Apple from making, using, importing, offering to sell, and/or selling the Accused Products;

d. Entry of a permanent injunction enjoining Apple from making, using, importing, offering to sell, and/or selling the Accused Products;

e. An order awarding damages sufficient to compensate Plaintiff for Defendant's infringement of the Patents-in-Suit, but in no event less than a reasonable royalty, including supplemental damages post-verdict, together with pre-judgment and post-judgment interest and costs;

f. Enhanced damages pursuant to 35 U.S.C. § 284;

g. Entry of judgment declaring that this case is exceptional and awarding Plaintiff its costs and reasonable attorney fees under 35 U.S.C. § 285;

h. An accounting for acts of infringement;

i. Such other equitable relief which may be requested and to which the Plaintiff is entitled; and

j. Such other and further relief as the Court deems just and proper.

Dated: December 23, 2021

Respectfully submitted,

/s/ Raymond W. Mort, III

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