IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

JAWBONE INNOVATIONS, LLC,	§	Case No. 2:21-cv-00186-JRG
Plaintiff,	§	**JURY TRIAL DEMANDED**
v.	§	
SAMSUNG ELECTRONICS CO., LTD. and SAMSUNG ELECTRONICS AMERICA, INC.,	§	
Defendants.	§	

FIRST AMENDED COMPLAINT FOR PATENT INFRINGEMENT

Plaintiff Jawbone Innovations, LLC ("Jawbone" or "Plaintiff") for its First Amended Complaint against Defendants Samsung Electronics Co., Ltd. ("Samsung Electronics") and Samsung Electronics America, Inc. ("Samsung Electronics America") (collectively "Samsung" or "Defendants") alleges as follows:

THE PARTIES

1. Jawbone is a limited liability company organized and existing under the laws of the State of Texas, with places of business located at 100 West Houston Street, Marshall, Texas 75670 and 104 East Houston Street, Suite 165, Marshall, Texas 75670.

2. Defendant Samsung Electronics is a corporation organized and existing under the laws of the Republic of Korea, with its principal place of business at 129 Samsung-Ro, Yeongtong-Gu, Suwon-Si, Gyeonggi-Do, 443-742, Republic of Korea. Upon information and belief, Samsung Electronics 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 the Judicial District of the Eastern District of Texas.

3. Defendant Samsung Electronics America is a corporation organized under the laws of New York, with its principal place of business at 85 Challenger Road, Ridgefield Park, New Jersey 07660. Upon information and belief, Samsung Electronics America has corporate offices in the Eastern District of Texas at 1303 East Lookout Drive, Richardson, Texas 75082 and 2800 Technology Drive, Suite 200, Plano, Texas 75074. Samsung Electronics America has publicly indicated that, in early 2019, it would be centralizing multiple offices in a new location in the Eastern District of Texas at the Legacy Central office campus,[1] located at 6225 Declaration Drive, Plano, Texas 75023. Samsung Electronics America may be served with process through its registered agent CT Corporation System, 1999 Bryan Street, Suite 900, Dallas, Texas 75201-3136.

4. Defendants have authorized sellers and sales representatives that offer and sell products pertinent to this Amended Complaint through the State of Texas, including in this Judicial District, and to consumers throughout this Judicial District, such as: Best Buy, 422 West TX-281 Loop, Suite 100, Longview, Texas 75605; AT&T Store, 1712 East Grand Avenue, Marshall, Texas 75670; Sprint Store, 1806 East End Boulevard North, Suite 100, Marshall, Texas 75670; T-Mobile, 900 East End Boulevard North, Suite 100, Marshall, Texas 75670; Verizon authorized retailers, including Russell Cellular, 1111 East Grand Avenue, Marshall, Texas 75670; Victra, 1006 East End Boulevard, Marshall, Texas 75670; and Cricket Wireless authorized retailer, 120 East End Boulevard South, Marshall, Texas 75670.

[1] https://news.samsung.com/us/samsung-electronics-america-open-flagship-north-texas-campus/, last accessed Apr. 29, 2019.

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 subject matter jurisdiction over this action pursuant to 28 U.S.C. §§ 1331, 1332, 1338, and 1367.

6. This Court has specific and personal jurisdiction over each of the Defendants consistent with the requirements of the Due Process Clause of the United States Constitution and the Texas Long Arm Statute. Upon information and belief, each Defendant has sufficient minimum contacts with the forum because each Defendant transacts substantial business in the State of Texas and in this Judicial District. Further, each Defendant has, directly or through subsidiaries or intermediaries, committed and continues to commit acts of patent infringement in the State of Texas and in this Judicial District as alleged in this Amended Complaint, as alleged more particularly below.

7. Venue is proper in this Judicial District pursuant to 28 U.S.C. §§ 1400(b) and 1391(b) and (c) because each Defendant is subject to personal jurisdiction in this Judicial District, has committed acts of patent infringement in this Judicial District, and has a regular and established place of business in this Judicial District. Each Defendant, through its own acts and/or through the acts of each other Defendant, makes, uses, sells, and/or offers to sell infringing products within this Judicial District, regularly does and solicits business in this Judicial District, and has the requisite minimum contacts with the Judicial District such that this venue is a fair and reasonable one. Further, venue is proper in this Judicial District because Samsung Electronics is a foreign corporation formed under the laws of Korea with a principal place of business in Korea. Further, upon information and belief, the Defendants have admitted or not contested proper venue in this Judicial District in other patent infringement actions.

FACTUAL BACKGROUND

8. 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.

9. 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 B.

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 C.

11. 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." A true and correct copy of the '080 Patent is attached hereto as Exhibit D.

12. 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 E.

13. On Jun 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 F.

14. 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 G.

15. Jawbone is the sole and exclusive owner of all right, title, and interest to and in the '091 Patent,'072 Patent, '058 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.

16. 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.

17. AliphCom launched a mobile headset called the "Jawbone" in 2004. The "Jawbone" included the innovative noise-suppression technology that AliphCom developed for the military.[2] 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.

18. 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

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

wearables, such as health tracking devices. Unfortunately, due to the intensely competitive marketplace, Jawbone, Inc. was forced into liquidation in 2017.

19. 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 Patents."[3] Upon information and belief, Envision IP (and other parties) contacted Samsung regarding the value of the Patents-in-Suit, including regarding Samsung's infringement of the Patents-in-Suit. Upon information and belief, Samsung was notified that Samsung ear buds, smart phones, tablets, wearables, smart home devices, and smart televisions (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.

INFRINGEMENT ALLEGATIONS

20. The '091 and '058 Patents generally describes acoustic noise suppression with a voice activity detector that senses vibration in human tissue associated with voicing activity. The technology of the '091 Patent 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 inventions 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.

[3] *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/

21. 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.

22. Samsung 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 Samsung products with voice activity detection devices including, but not limited to, Samsung ear buds and smartphones. For example, this functionality is included and utilized in the Samsung Galaxy Buds Pro. The Galaxy Buds Pro includes an accelerometer, voice pickup unit, and an infrared sensor which, upon information and belief, comprise a voice activity detector.[4] The Galaxy Buds Pro includes a "voice detect" unit which generates a signal when the wearer speaks to "instantly switch [] from [active

[4] https://www.androidauthority.com/samsung-galaxy-buds-live-1137500/

noise cancelling] to ambient sound."[5] The Galaxy Buds Pro further comprises a "mic array for superior beamforming performance" which, upon information and belief, generates transfer functions representative of a ratio of energy of the acoustic signals received at each microphone.[6]

Galaxy Buds Pro offer the best call quality from our buds yet, so you can feel confident you're connected and heard, no matter where you are. With three built-in microphones and a voice pickup unit, every word is crystal clear.

[7]

23. 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

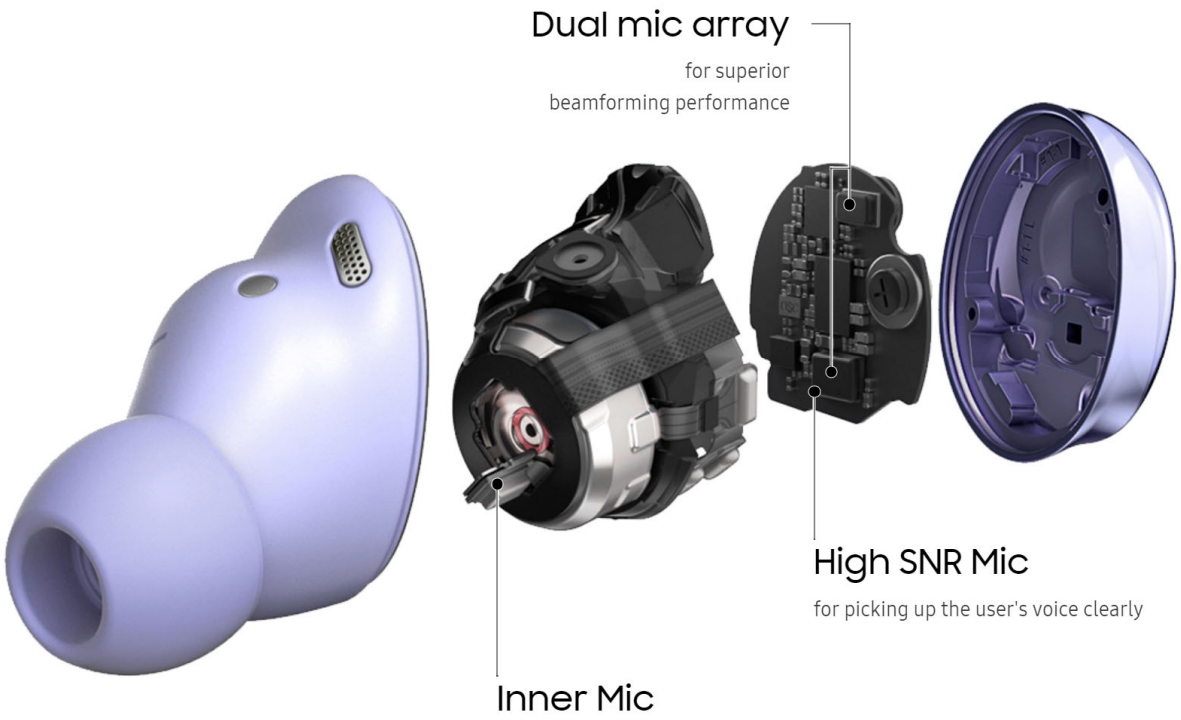
[5] https://www.samsung.com/us/mobile/audio/galaxy-buds-pro/
[6] https://www.samsung.com/us/mobile/audio/galaxy-buds-pro/
[7] https://www.samsung.com/us/mobile/audio/galaxy-buds-pro/#popNoiseFreeCall

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.

24. Samsung 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 Samsung products with omnidirectional physical MEMs microphones which form virtual beamformed microphones including, but not limited to, Samsung ear buds, smart phones, tablets, wearables, smart home devices, and smart televisions. For example, upon information and belief, the Samsung Galaxy Buds 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.[8] Samsung states that "[t]he microphones use beamforming technology to pick up your voice—so you can confidently contribute in meetings without worrying about background noise."[9] Similarly, upon information and belief, the Samsung Galaxy S20 smartphone comprises arrays of at least three physical

[8] https://www.samsung.com/us/mobile/audio/galaxy-buds-pro/
[9] *Id.*

microphones and two beamformed microphones, the outputs of which are combined to reduce the noise of a signal.[10]



[11]

25. 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

[10] *See* https://www.samsung.com/au/support/mobile-devices/s20-device-layout-and-functions/*; see also* https://news.samsung.com/global/galaxy-s5-explained-audio; https://www.theverge.com/2019/8/7/20754566/samsung-galaxy-note-10-plus-2-size-price-release-date-s-pen-dex-laptop-unpacked-event

[11] https://www.samsung.com/us/mobile/audio/galaxy-buds-pro/

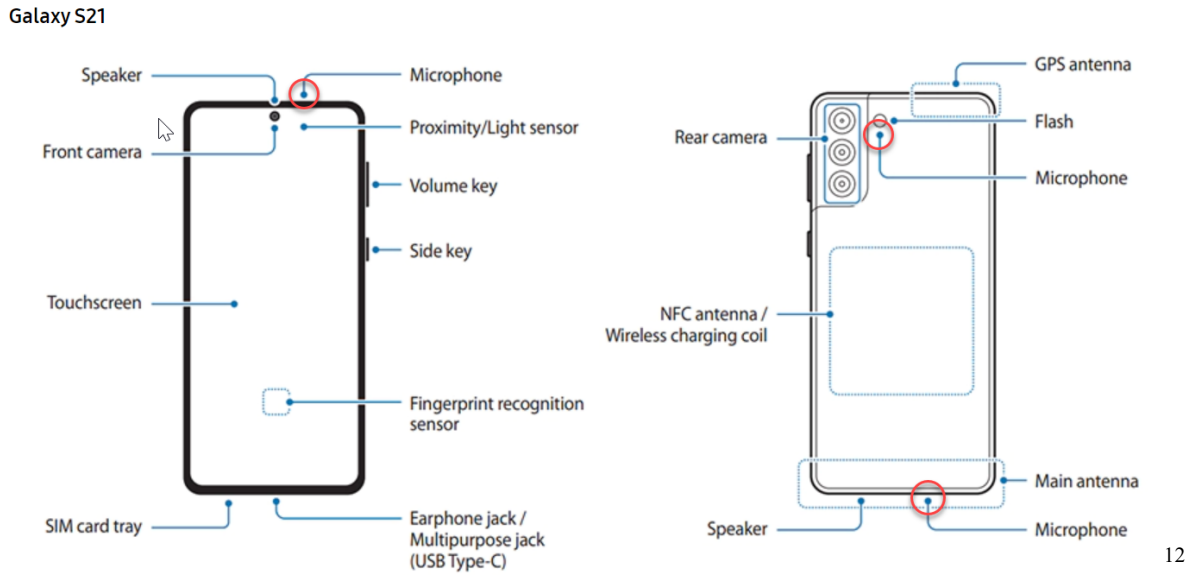
the desired speech. In some embodiments, output of each physical microphone can be delayed, multiplied by a gain, and summed with the other in order to form at least one virtual microphone, which may be paired with an adaptive filter and/or VAD algorithm to suppress noise. The invention of the '080 Patent provides substantial advantages for noise suppression systems, particularly in detecting, transmitting, or recording speech.

26. Samsung 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 Samsung products with omnidirectional physical MEMS microphones which form virtual beamformed microphones, including, but not limited to, Samsung ear buds, smart phones, tablets, wearables, and smart home devices. For example, upon information and belief, each Samsung Galaxy Buds Pro earbud 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.

27. 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.

28. Samsung 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 Samsung products with physical MEMS microphones which form virtual beamformed microphones including, but not limited to, Samsung ear buds, smart phones, tablets, wearables, and smart home devices. For example, upon information and belief, the Samsung Galaxy Buds 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 Samsung Galaxy Buds Pro earbuds combine the outputs the signals generated by the beamforming microphone array of each earbud to further reduce noise. Similarly, the Samsung Galaxy S21 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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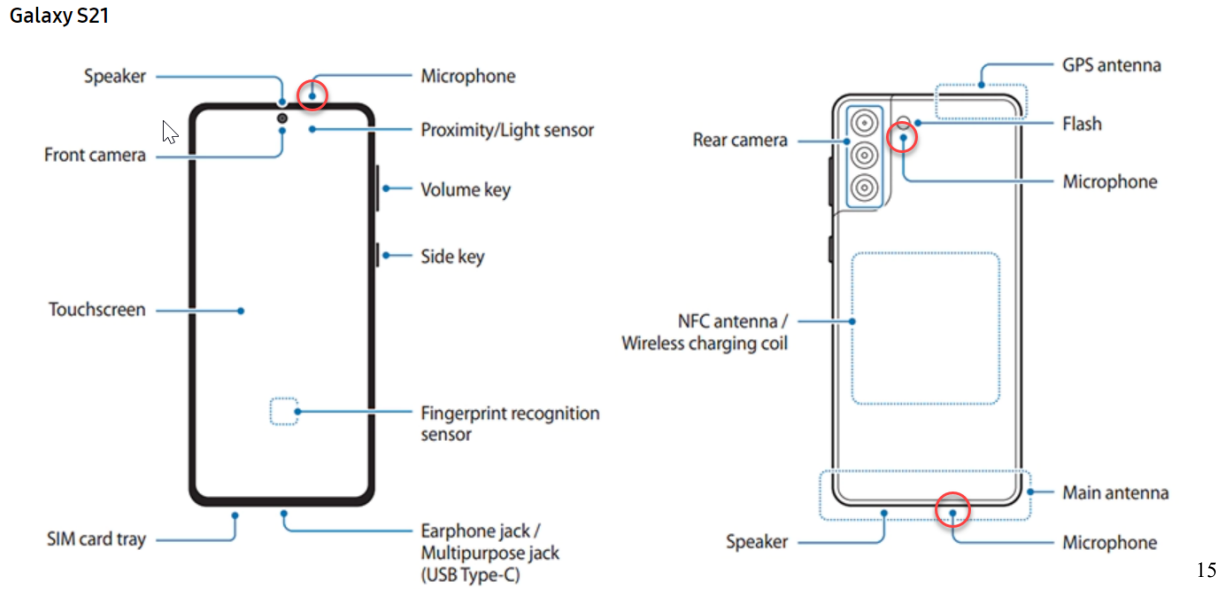
[12] https://www.samsung.com/au/support/mobile-devices/s21-device-layout-and-functions/

29. 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.

30. Samsung 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 Samsung products with voice activity detection devices including, but not limited to, Samsung ear buds and smartphones. For example, this functionality is included and utilized in the Samsung Galaxy Buds Pro and the Samsung Galaxy S21. For example, upon information and belief, the Samsung Galaxy Buds 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.[13] Samsung states that “[t]he microphones use beamforming technology to pick up your voice—so you can confidently

[13] https://www.samsung.com/us/mobile/audio/galaxy-buds-pro/

contribute in meetings without worrying about background noise."[14] At least one microphone of the Samsung Galaxy Buds 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 Samsung Galaxy S21 comprises multiple beamforming microphones and an accelerometer which, upon information and belief, is utilized for speech detection. At least one microphone of the Samsung Galaxy S21 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 with beamforming microphones to suppress noise.



[15]

31. Samsung has infringed and is continuing to infringe the '091 and '072 Patents 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 noise cancellation features. On information and belief, the Accused Products include, but are not

[14] *Id.*
[15] https://www.samsung.com/au/support/mobile-devices/s21-device-layout-and-functions/

limited to, at least all versions and variants of Samsung smartphones (*e.g.*, Galaxy S, Galaxy Note, Galaxy Z, Galaxy A, Galaxy M series, and Galaxy Core series smartphones) and earbuds (*e.g.*, Gear and Galaxy series earbuds).

32. 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.

COUNT I
(Infringement of the '091 Patent)

33. Paragraphs 1 through 32 are incorporated by reference as if fully set forth herein.

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

35. Defendants have and continue 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 Samsung smartphones (*e.g.*, Galaxy S, Galaxy Note, Galaxy Z, Galaxy A, Galaxy M series, and Galaxy Core series smartphones) and earbuds (*e.g.*, Gear and Galaxy series earbuds).

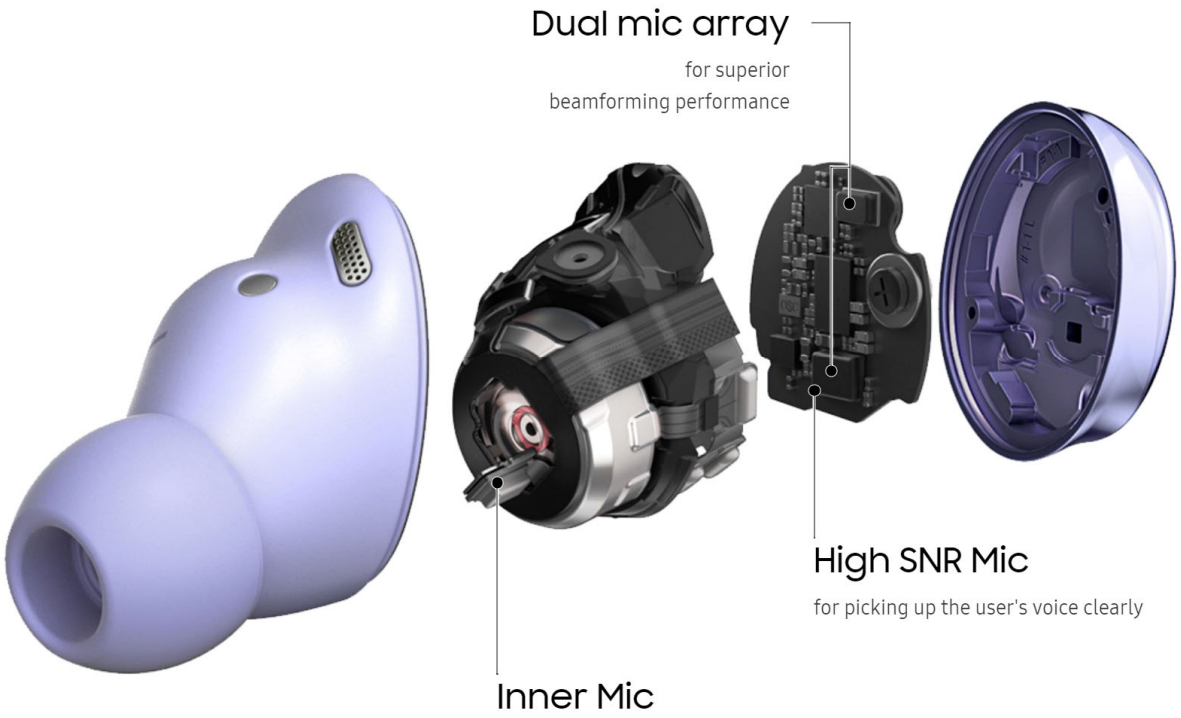
36. For example, Defendants have and continue to directly infringe at least claim 11 of the '091 Patent by making, using, offering to sell, selling, and/or importing into the United States products that comprise a system for removing acoustic noise from the acoustic signals, comprising: a receiver that 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.

37. The Accused Products comprise a system for removing acoustic noise from acoustic signals. For example, the Samsung Galaxy Buds Pro receives acoustic signals from a microphone array and "use[s] beamforming technology to pick up your voice – so that you can contribute in meetings without worrying about background noise."[16]

38. 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 Galaxy Buds Pro comprises a receiver that receives signals via a microphone array, with at least two microphones positioned in a plurality of locations.

[16] https://www.samsung.com/us/mobile/audio/galaxy-buds-pro/#popNoiseFreeCall



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39. 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 Samsung Galaxy Buds Pro comprises an at least one accelerometer and IR sensor which, upon information and belief, receives human tissue vibration associated with voicing activity.[18] Upon information and belief, the voice pickup unit of the Galaxy Buds Pro comprises the voice detecting accelerometer and/or IR sensor.

40. 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 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

[17] https://www.samsung.com/us/mobile/audio/galaxy-buds-pro/
[18] https://www.samsung.com/global/galaxy/galaxy-buds-pro/specs/

microphones. For example, the Galaxy Buds Pro comprises a BCM 43015 SoC which "is designed for audio applications."[19] Upon information and belief, the 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.[20]

41. 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 Galaxy Buds Pro generates the first transfer function when a voice pickup unit, accelerometer, and/or IR sensor indicate that voicing activity is absent.

42. 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 Galaxy Buds Pro generates a second transfer function in response to a determination that voicing activity is present, such as based on detection of human tissue vibrations by the voice pickup unit, accelerometer, and/or IR sensor. For example, "[v]oice detect instantly switches from [active noise cancellation] to ambient sound when it hears your voice."[21]

43. 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

[19] https://www.broadcom.com/products/wireless/bluetooth-socs/bcm43015
[20] https://www.samsung.com/us/mobile/audio/galaxy-buds-pro/
[21] *Id.*

transfer function and the second transfer function to produce the denoised acoustic data stream. For example, upon information and belief, the Galaxy Buds Pro removes 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 Samsung Galaxy Buds Pro utilizes a least mean squares method to suppress acoustic noise.

44. Defendants have and continue to indirectly infringe one or more claims of the '091 Patent by knowingly and intentionally inducing others, including Samsung customers and end-users of the Accused Products and products that include 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 Samsung Galaxy Buds Pro.

45. Defendants, with knowledge that these products, or the use thereof, infringe the '091 Patent at least as of the date of this Amended Complaint, knowingly and intentionally induced, and continue to knowingly and intentionally induce, direct infringement of the '091 Patent by providing these products to customers and/or distributors for use in an infringing manner in the United States including, but not limited to, products that include infringing technology, such as the Samsung Galaxy Buds Pro. For example, Samsung'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, Samsung is aware that the normal and customary use of the Accused Products by customers, distributors, and others would infringe the '091 Patent.

46. Defendants induced infringement by others, including customers and distributors, 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.

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

48. Jawbone has suffered, and will continue to suffer, irreparable harm as a result of Defendants' infringement of the '091 Patent, for which there is no adequate remedy at law, unless Defendants' infringement is enjoined by this Court. Accordingly, Jawbone seeks a preliminary and permanent injunction enjoining Samsung from making, using, importing, offering to sell, and/or selling the Accused Products, including at least all versions and variants of Samsung smartphones (*e.g.*, Galaxy S, Galaxy Note, Galaxy Z, Galaxy A, Galaxy M series, and Galaxy Core series smartphones) and earbuds (*e.g.*, Gear and Galaxy series earbuds).

COUNT II
(Infringement of the '072 Patent)

49. Paragraphs 1 through 32 are incorporated by reference as if fully set forth herein.

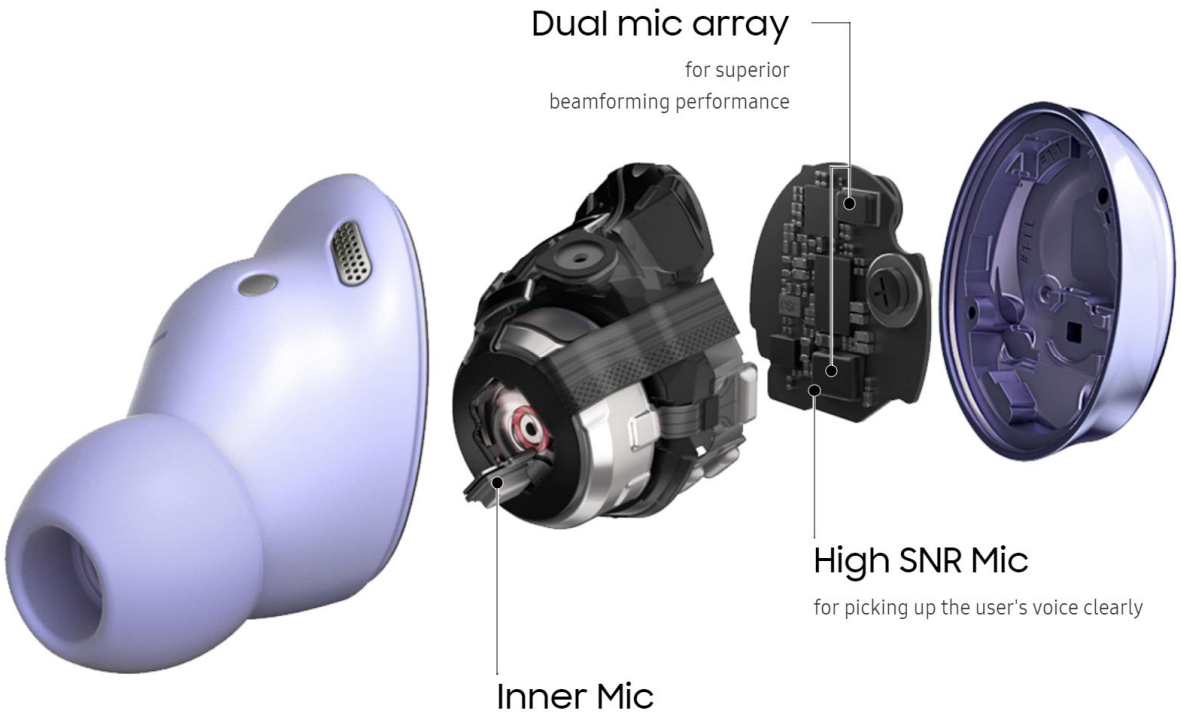
50. Jawbone has not licensed or otherwise authorized Samsung to make, use, offer for sale, sell, or import any products that embody the inventions of the '072 Patent.

51. Defendants have and continue 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 Samsung

smartphones (*e.g.*, Galaxy S, Galaxy Note, Galaxy Z, Galaxy A, Galaxy M series, and Galaxy Core series smartphones) and earbuds (*e.g.*, Gear and Galaxy series earbuds).

52. For example, Defendants have and continue 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.

53. 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 Samsung Galaxy Buds Pro receives signals at a microphone array of each earbud and, in response, output a plurality of microphone signals.



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54. 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 Galaxy Buds Pro forms a virtual beamformed microphone from the plurality of microphone signals from physical MEMS microphones at each earbud.[23] 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).

55. Each Accused Product further practices a method comprising generating output signals by combining signals output from the virtual microphone array, the output signals

[22] https://www.samsung.com/us/mobile/audio/galaxy-buds-pro/
[23] https://www.samsung.com/us/mobile/audio/galaxy-buds-pro/

including less acoustic noise than the received acoustic signals. For example, upon information and belief, the Samsung Galaxy Buds Pro suppresses acoustic noise by combining the signals output by the beamformed microphone of each earbud.

56. Defendants have and continue to indirectly infringe one or more claims of the '072 Patent by knowingly and intentionally inducing others, including Samsung customers and end-users of the Accused Products and products that include 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 Samsung Galaxy Buds pro.

57. Defendants, with knowledge that these products, or the use thereof, infringe the '072 Patent at least as of the date of this Amended Complaint, knowingly and intentionally induced, and continue to knowingly and intentionally induce, direct infringement of the '072 Patent by providing these products to customers and/or distributors for use in an infringing manner in the United States including, but not limited to, products that include infringing technology, such as the Samsung Galaxy Buds Pro. For example, Samsung'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, Samsung is aware that the normal and customary use of the Accused Products by customers, distributors, and others would infringe the '072 Patent.

58. Defendants induced infringement by others, including customers and distributors, 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.

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

60. Jawbone has suffered, and will continue to suffer, irreparable harm as a result of Defendants' infringement of the '072 Patent, for which there is no adequate remedy at law, unless Defendants' infringement is enjoined by this Court. Accordingly, Jawbone seeks a preliminary and permanent injunction enjoining Samsung from making, using, importing, offering to sell and/or selling the Accused Products, including at least all versions and variants of Samsung smartphones (*e.g.*, Galaxy S, Galaxy Note, Galaxy Z, Galaxy A, Galaxy M series, and Galaxy Core series smartphones) and earbuds (*e.g.*, Gear and Galaxy series earbuds).

COUNT III
(Infringement of the '058 Patent)

61. Paragraphs 1 through 32 are incorporated by reference as if fully set forth herein.

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

63. Samsung 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 Samsung smartphones (*e.g.*, Galaxy S, Galaxy Note, Galaxy Z, Galaxy A, Galaxy M series, and Galaxy Core series smartphones) and earbuds (*e.g.*, Gear and Galaxy series earbuds).

64. For example, Samsung 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.

65. The Accused Products comprise at least two microphones that receive the acoustic signals. For example, each earbud of the Galaxy Buds Pro comprises at least two MEMS microphones that receive acoustic signals.[24] For example, the Galaxy S21 comprises at least two microphones that receive acoustic signals.

66. The Accused Products further comprise at least one voicing sensor that receives physiological information associated with human voicing activity. For example, the Samsung Galaxy Buds Pro comprise an accelerometer which, upon information and belief, receives human tissue vibration associated with voicing activity. For example, the Galaxy S21 similarly includes

[24] *See* https://www.samsung.com/us/mobile/audio/galaxy-buds-pro/

an accelerometer which, upon information and belief, is used for speech detection and/or receives a speech detection signal from any paired Galaxy Buds.

67. The Accused Products further comprise at least one processor coupled among the microphones and the voicing sensor. For example, the Galaxy Buds Pro comprises a BCM 43015 coupled between the microphones and accelerometers.[25] For example, the Galaxy S21 comprises a Qualcomm Snapdragon 888 SoC coupled between the microphones and accelerometer and/or accelerometer signal received from any paired Galaxy Buds Pro earbuds.[26]

68. 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 BCM 43015 of the Galaxy Buds 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 Qualcomm Snapdragon 888 SoC of the Galaxy S21 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).

69. 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 BCM 43015 of the Galaxy Buds Pro identifies the acoustic signals as speech when the cross-correlation data corresponding to a portion of the acoustic signal received

[25] https://www.samsung.com/global/galaxy/galaxy-buds-pro/specs/
[26] https://www.ifixit.com/Teardown/Samsung+Galaxy+S21+Ultra+Teardown/141188

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 Qualcomm Snapdragon 888 SoC of the Galaxy S21 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).

70. 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 BCM 43015 of the Galaxy Buds 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 Qualcomm Snapdragon 888 SoC of the Galaxy S21 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.

71. 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 BCM 43015 of the Galaxy Buds 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 Qualcomm Snapdragon 888 SoC of the Galaxy S21 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.

72. 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 BCM 43015 of the Galaxy Buds 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 Qualcomm Snapdragon 888 SoC of the Galaxy S21 similarly identifies acoustic signals as noise (e.g., unwanted background noise) when the difference parameters are less than the gain threshold.

73. Samsung has and continues to indirectly infringe one or more claims of the '058 Patent by knowingly and intentionally inducing others, including Samsung'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 Samsung Galaxy Buds Pro and Galaxy S21.

74. Samsung, with knowledge that these products, or the use thereof, infringe the '058 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 '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 Galaxy Buds Pro and Galaxy S21. For example, Samsung'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, Samsung is aware that the normal and customary

use of the Accused Products by customers, distributors, and others would infringe the Asserted Patents.

75. Samsung 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.

76. Samsung 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, Samsung has known of Jawbone's patents, including the '058 Patent, at least since they were marketed to Samsung following Jawbone Inc.'s liquidation.

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

78. Jawbone has suffered, and will continue to suffer, irreparable harm as a result of Samsung's infringement of the '058 Patent, for which there is no adequate remedy at law, unless Samsung's infringement is enjoined by this Court. Accordingly, Jawbone seeks a preliminary and permanent injunction enjoining Samsung from making, using, importing, offering to sell, and/or selling the Accused Products, including at least all versions and variants of Samsung smartphones (*e.g.*, Galaxy S, Galaxy Note, Galaxy Z, Galaxy A, Galaxy M series, and Galaxy Core series smartphones) and earbuds (*e.g.*, Gear and Galaxy series earbuds).

COUNT IV
(Infringement of the '080 Patent)

79. Paragraphs 1 through 32 are incorporated by reference as if fully set forth herein.

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

81. Samsung 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 Samsung smartphones (*e.g.*, Galaxy S, Galaxy Note, Galaxy Z, Galaxy A, Galaxy M series, and Galaxy Core series smartphones) and earbuds (*e.g.*, Gear and Galaxy series earbuds).

82. For example, Samsung 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.

83. 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 Samsung Galaxy Buds Pro comprises at least two outward facing microphones, each of which outputs a microphone signal. For example, upon information and belief, the Galaxy S21 comprises at least two downward and/or inward facing microphones, each of which outputs a microphone signal.

84. 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 Samsung Galaxy Buds Pro comprises a BCM 43015 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 Galaxy S21 comprises a Qualcomm Snapdragon 888 SoC and/or other DSP that is coupled to the microphone array and, upon information and belief, generates at least two beamformed microphones.

85. 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 Samsung Galaxy Buds Pro and Galaxy S21 includes a different combination of signals from their respective physical microphones.

86. 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 Samsung Galaxy Buds Pro and Galaxy S21 each have a substantially similar response to noise and a substantially dissimilar response to speech.

87. 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 Samsung Galaxy Buds Pro earbud comprises an adaptive noise removal application coupled to an BCM 43015 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. For example, upon information and belief, the Galaxy S21 comprises an adaptive noise removal application coupled to an Qualcomm Snapdragon 888 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

88. 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 Galaxy Buds Pro and Galaxy S21 each include less noise than the acoustic signals received at their respective microphones.

89. Samsung has and continues to indirectly infringe one or more claims of the '080 Patent by knowingly and intentionally inducing others, including Samsung 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 Samsung Galaxy Buds Pro and Galaxy S21.

90. Samsung, with knowledge that these products, or the use thereof, infringe the '080 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 '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 as the Galaxy Buds Pro and Galaxy S21. For example, Samsung'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, Samsung is aware that the normal and customary use of the Accused Products by customers, distributors, and others would infringe the '080 Patent.

91. Samsung 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.

92. Samsung 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, Samsung has known of Jawbone's patents, including the '080 Patent, at least since they were marketed to Samsung following Jawbone Inc.'s liquidation.

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

94. Jawbone has suffered, and will continue to suffer, irreparable harm as a result of Samsung's infringement of the '080 Patent, for which there is no adequate remedy at law, unless Samsung's infringement is enjoined by this Court. Accordingly, Jawbone seeks a preliminary and permanent injunction enjoining Samsung from making, using, importing, offering to sell, and/or selling the Accused Products, including at least all versions and variants of Samsung smartphones (*e.g.*, Galaxy S, Galaxy Note, Galaxy Z, Galaxy A, Galaxy M series, and Galaxy Core series smartphones) and earbuds (*e.g.*, Gear and Galaxy series earbuds).

COUNT V
(Infringement of the '357 Patent)

95. Paragraphs 1 through 32 are incorporated by reference as if fully set forth herein.

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

97. Samsung 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 Samsung smartphones (*e.g.*, Galaxy S, Galaxy Note, Galaxy Z, Galaxy A, Galaxy M series, and Galaxy Core series smartphones) and earbuds (*e.g.*, Gear and Galaxy series earbuds).

98. For example, Samsung 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.

99. 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

earbud comprises at least two physical microphones, and a first beamformed microphone comprising signals generated by both microphones.

100. 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 Samsung Galaxy Buds Pro earbud and/or set of Samsung Galaxy Buds Pro earbuds comprises a second beamformed microphone comprising signals generated by the first and second physical microphones.

101. 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 Samsung Galaxy Buds Pro have similar noise responses and dissimilar speech responses.

102. 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 Samsung Galaxy Buds Pro earbud comprises a BCM 43015 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.

103. Samsung has and continues to indirectly infringe one or more claims of the ’357 Patent by knowingly and intentionally inducing others, including Samsung’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 Samsung Galaxy Buds Pro.

104. Samsung, with knowledge that these products, or the use thereof, infringe the ’357 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 ’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 Galaxy Buds Pro. For example, Samsung’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, Samsung is aware that the normal and customary use of the Accused Products by customers, distributors, and others would infringe the ’357 Patent.

105. Samsung 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.

106. Samsung 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, Samsung has known of Jawbone's patents, including the '357 Patent, at least since they were marketed to Samsung following Jawbone Inc.'s liquidation.

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

108. Jawbone has suffered, and will continue to suffer, irreparable harm as a result of Samsung's infringement of the '357 Patent, for which there is no adequate remedy at law, unless Samsung's infringement is enjoined by this Court. Accordingly, Jawbone seeks a preliminary and permanent injunction enjoining Samsung from making, using, importing, offering to sell, and/or selling the Accused Products, including at least all versions and variants of Samsung smartphones (*e.g.*, Galaxy S, Galaxy Note, Galaxy Z, Galaxy A, Galaxy M series, and Galaxy Core series smartphones) and earbuds (*e.g.*, Gear and Galaxy series earbuds).

COUNT VI
(Infringement of the '543 Patent)

109. Paragraphs 1 through 32 are incorporated by reference as if fully set forth herein.

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

111. Samsung 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 Samsung smartphones (*e.g.*, Galaxy S, Galaxy Note, Galaxy Z, Galaxy A, Galaxy M series, and Galaxy Core series smartphones) and earbuds (*e.g.*, Gear and Galaxy series earbuds).

112. For example, Samsung 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.

113. 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 Samsung Galaxy Buds Pro earbuds comprise a speech detecting accelerometer which, upon information and belief, is 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. For example, upon information and belief, the accelerometer of the Galaxy S21 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.

114. 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 Galaxy Buds 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 Galaxy S21 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 Galaxy S21 further receives accelerometer data from the Galaxy Buds Pro.

115. 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 Samsung Galaxy Buds 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 Galaxy S21 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 Galaxy S21 is greater than zero degrees.

116. 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 Galaxy S21 and the Galaxy Buds Pro provide acoustic signals of an environment (e.g., environmental noise) to components of the denoising subsystem (e.g., a DSP and/or processor).

117. 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 Galaxy Buds Pro and Galaxy S21 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.

118. 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 Galaxy Buds Pro and Galaxy S21 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.

119. 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 Galaxy Buds 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 Galaxy S21 similarly comprises an accelerometer independent of a microphone array (and/or uses signals supplied by a pair of Galaxy Buds), configured to trigger the denoising subsystem when speech is occurring.

120. Samsung has and continues to indirectly infringe one or more claims of the '543 Patent by knowingly and intentionally inducing others, including Samsung'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 Samsung Galaxy Buds Pro.

121. Samsung, with knowledge that these products, or the use thereof, infringe the '543 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 '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 Galaxy Buds Pro. For example, Samsung'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, Samsung is aware that the normal and customary use of the Accused Products by customers, distributors, and others would infringe the '543 Patent.

122. Samsung 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.

123. Samsung 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, Samsung has known of Jawbone's patents, including the '543 Patent, at least since they were marketed to Samsung following Jawbone Inc.'s liquidation.

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

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

(*e.g.*, Galaxy S, Galaxy Note, Galaxy Z, Galaxy A, Galaxy M series, and Galaxy Core series smartphones) and earbuds (*e.g.*, Gear and Galaxy series earbuds).

COUNT VII
(Infringement of the '691 Patent)

126. Paragraphs 1 through 32 are incorporated by reference as if fully set forth herein.

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

128. Samsung 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 Samsung smartphones (e.g., Galaxy S, Galaxy Note, Galaxy Z, Galaxy A, Galaxy M series, and Galaxy Core series smartphones) and earbuds (e.g., Gear and Galaxy series earbuds).

129. For example, Samsung 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.

130. 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 Samsung Galaxy Buds Pro earbud and/or set of Samsung Galaxy Buds Pro earbuds comprises at least two physical omnidirectional microphones, and a first beamformed microphone comprising signals generated by both microphones.

131. 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 Samsung Galaxy Buds Pro earbud and/or set of Samsung Galaxy Buds Pro earbuds comprises a second beamformed microphone comprising signals generated by the first and second physical microphones.

132. 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 Samsung Galaxy Buds 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.

133. 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 Samsung Galaxy Buds 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.

134. 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.

135. Each Accused Product comprises a system wherein the speech is human speech. For example, the speech activity detected by the Samsung Galaxy Buds Pro is the voice of a user.

136. Samsung has and continues to indirectly infringe one or more claims of the '691 Patent by knowingly and intentionally inducing others, including Samsung'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 Samsung Galaxy Buds Pro.

137. Samsung, 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 Galaxy Buds Pro. For example, Samsung'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, Samsung is aware that the normal and customary use of the Accused Products by customers, distributors, and others would infringe the '691 Patent.

138. Samsung 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.

139. Samsung 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, Samsung has known of Jawbone's patents, including the '691 Patent, at least since they were marketed to Samsung following Jawbone Inc.'s liquidation.

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

141. Jawbone has suffered, and will continue to suffer, irreparable harm as a result of Samsung's infringement of the '691 Patent, for which there is no adequate remedy at law, unless Samsung's infringement is enjoined by this Court. Accordingly, Jawbone seeks a preliminary and permanent injunction enjoining Samsung from making, using, importing, offering to sell, and/or selling the Accused Products, including at least all versions and variants of Samsung smartphones (e.g., Galaxy S, Galaxy Note, Galaxy Z, Galaxy A, Galaxy M series, and Galaxy Core series smartphones) and earbuds (*e.g.*, Gear and Galaxy series earbuds).

DEMAND FOR JURY TRIAL

Plaintiff hereby demands a jury for all issues so triable.

PRAYER FOR RELIEF

WHEREFORE, Jawbone prays for relief against Defendants as follows:

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

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

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

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

e. An order awarding damages sufficient to compensate Jawbone for Defendants' 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. Entry of judgment declaring that this case is exceptional and awarding Jawbone its costs and reasonable attorneys' fees under 35 U.S.C. § 285;

g. An accounting for acts of infringement;

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

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

Dated: October 26, 2021

Respectfully submitted,

/s/ Alfred R. Fabricant

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ATTORNEYS FOR PLAINTIFF JAWBONE INNOVATIONS, LLC

CERTIFICATE OF SERVICE

The undersigned hereby certifies that, on October 26, 2021, all counsel of record who are deemed to have consented to electronic service are being served with a copy of this document via the Court's CM/ECF system per Local Rule CV-5(a)(3)

/s/ Alfred R. Fabricant
Alfred R. Fabricant