

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

VOCALIFE LLC,

Plaintiff,

v.

AMAZON.COM, INC. and  
AMAZON.COM SERVICES, INC.,

Defendants.

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Case No. 2:20-cv-00401-JRG

**JURY TRIAL DEMANDED**

**FIRST AMENDED COMPLAINT FOR PATENT INFRINGEMENT**

Plaintiff Vocalife LLC (“Vocalife” or “Plaintiff”) files this First Amended Complaint against Defendants Amazon.com, Inc. and Amazon.com Services, Inc. (collectively, “Amazon” or “Defendants”), for patent infringement under 35 U.S.C. § 271 and alleges as follows:

**THE PARTIES**

1. Vocalife is a limited liability company organized and existing under the laws of the State of Texas, with its principal place of business located at 7300 Lone Star Drive, C200 Plano, Texas 75024.

2. Upon information and belief, Defendant Amazon.com, Inc. is a corporation organized and existing under the laws of the State of Delaware, with its principal place of business located at 410 Terry Avenue North, Seattle, Washington 98109-5210.

3. Upon information and belief, Defendant Amazon.com Services, Inc. is a corporation organized and existing under the laws of the State of Delaware, which is headquartered at 410 Terry Avenue North, Seattle, Washington 98109-5210.

4. Upon information and belief, Amazon.com, Inc. is the ultimate parent of

Amazon.com Services, Inc.<sup>1</sup> Amazon is a leading manufacturer and seller of virtual assistant smart speakers in the world and in the United States.<sup>2</sup>

### **JURISDICTION**

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 Amazon. Amazon regularly conducts business and has committed acts of patent infringement and/or has induced acts of patent infringement by others in this District and/or has contributed to patent infringement by others in this 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) because, among other things, upon information and belief Amazon maintains regular and established physical places of business in Texas and in the Eastern District of Texas, directly or through intermediaries.

8. Amazon has admitted that it operates an Amazon Fulfillment Center within this District.<sup>3</sup>

9. Amazon has admitted that it employs information technology personnel at its Fulfillment Center in Denton County, which is in this District.<sup>4</sup>

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<sup>1</sup> See *Vocalife LLC v. Amazon.com, Inc. and Amazon.com, LLC*, Case No. 2:19-cv-00123-JRG, Dkt. 226 ¶ 4 (E.D. Tex. July 31, 2020) (“Amazon.com, Inc. is the parent company of Amazon.com Services, Inc.”).

<sup>2</sup> See *id.* (“Amazon admits that subsidiaries of Amazon.com, Inc. sell virtual assistant smart speakers in the United States and outside the United States.”).

<sup>3</sup> See Exhibit A ¶¶ 7 and 16; see also *Vocalife LLC v. Amazon.com, Inc. and Amazon.com, LLC*, Case No. 2:19-cv-00123-JRG, Dkt. 226 ¶ 8 (“Amazon admits that subsidiaries of Amazon.com, Inc. operate a fulfillment center in this district.”).

<sup>4</sup> Ex. A ¶ 20.

10. Upon information and belief, Amazon, by itself and/or through its subsidiaries, operates one or more “Fulfillment Centers” within this Judicial District including, at least, a Fulfillment Center located in Denton County at 15201 Heritage Parkway, Fort Worth, Texas 76177.

11. Upon information and belief, Amazon has a regular and established place of business in this Judicial District, including, at least, a distribution facility located at 1649 West Frankford Road, Carrollton, Texas 75007, Amazon “lockers,”<sup>5</sup> employees, and other business.

12. Upon information and belief, Amazon has a regular and established place of business in this Judicial District, including, at least, a Fulfillment Center located in Denton County at 4121 International Parkway, Carrollton, Texas, 75007.

13. Upon information and belief, Amazon has property in Denton County appraised on the property tax rolls by Denton County at \$104,448,891.00<sup>6</sup> and \$26,168,603.00.<sup>7</sup> Amazon and/or its subsidiaries employ individuals within this Judicial District responsible for the distribution of its products including those accused of infringement below.

14. Amazon offers its products and/or services, including those accused of infringement below, to customers and potential customers located in Texas and in this District.

15. Amazon offers its products and/or services, including those accused of infringement below, to customers and potential customers located in Texas and in this District.

16. Amazon is subject to personal jurisdiction in this District, has a regular and established place of business in this District, including Amazon Fulfillment Centers in this District and throughout Texas, has purposely transacted business involving the Accused Products in this

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<sup>5</sup> Amazon operates “Amazon Hub Lockers” in at least the following locations: Plano, Carrollton, The Colony, and Lewisville. See <https://www.amazon.com/gp/css/account/address/view.html>.

<sup>6</sup> <https://www.dentoncad.com/home/details?search=699143&year=2020>.

<sup>7</sup> <https://www.dentoncad.com/home/details?search=776100&year=2020>.

District, has purposely transacted business involving the Accused Products in this District, including sales to one or more customers in Texas, has employees in this District, and certain of the acts complained of herein occurred in this District.

17. Amazon is subject to this Court's jurisdiction pursuant to due process and/or the Texas Long Arm Statute due at least to its substantial business in this State and 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.

**PATENTS-IN-SUIT**

18. On October 14, 2014, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 8,861,756 (the "'756 Patent") entitled "Microphone Array System." A true and correct copy of the '756 Patent attached hereto as Exhibit B.

19. On October 14, 2016, a reissue application was filed for the '756 Patent. As a result, on September 18, 2018, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. RE47,049 (the "'049 Patent") entitled "Microphone Array System." A true and correct copy of the '049 Patent is attached hereto as Exhibit C.

20. On August 2, 2018, a reissue application was filed for the '756 Patent. As a result, on December 29, 2020, the United States Patent and Trademark office duly and legally issued U.S. Patent No. RE48,371 (the "'371 Patent") entitled "Microphone Array System." A true and correct copy of the '371 Patent is attached hereto as Exhibit D.

21. Vocalife is the sole and exclusive owner of all right, title, and interest in the '049 Patent and '371 Patent (collectively, 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. Vocalife 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.

22. Vocalife 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.

### **FACTUAL ALLEGATIONS**

23. The claimed inventions of the Patents-in-Suit were developed at Li Creative Technologies Inc. (“Li Creative”) by Dr. Manli Zhu and Dr. Qi (“Peter”) Li, who have been at the forefront of audio processing technology for over two decades. In the late 2000’s, Dr. Li and Dr. Zhu worked to develop novel audio, speech, and image processing technology, including circular microphone arrays. Their work resulted in the issuance of the Patents-in-Suit.

24. In 2011, Li Creative participated in the Consumer Electronics Show (“CES”) where it was awarded the CES Innovations Design and Engineering Award in the Audio Accessories Category.

25. On or about September 20, 2011, Jerry Wu from A2Z Development Center, Inc., d/b/a Lab126 (“Lab126”), the hardware design arm of Defendant Amazon, reached out to Dr. Li expressing interest in the 3D audio, noise and echo cancellation technology and, in particular, adaptive beamforming technology.

26. On or about October 17, 2011, Dr. Li accepted an invitation by Lab126 and met with at least Aleksandar Pance, Wei Li,<sup>8</sup> and Matthew Holland from Lab126 (the “Meeting”). At the Meeting, Dr. Qi Li performed a confidential demonstration and presented the claimed invention

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<sup>8</sup> Wei Li was a former employee at Li Creative and, while employed by Lab126, had knowledge that Li Creative had filed patents on circular microphone array, noise reduction, noise cancellation, and sound source localization technologies.

including a circular microphone array, 3D sound, acoustic echo cancellations, and sound source localization, including both hardware and software. Dr. Li's presentation materials, which were provided to Amazon, referenced Li Creative's pending and issued patents. Dr. Li also confidentially introduced the concept of using voice and cloud computation to search music as one of the applications of the microphone array technology.

27. Dr. Qi Li contacted Lab126 to follow-up on the Meeting on or about June 22, 2012 and December 11, 2014; however, Dr. Li did not receive a response to his emails during this timeframe.

28. Following the commercialization of the first Amazon Echo product, Dr. Li attended a launch event hosted by Amazon in New York City. After the event, Dr. Li received a message from an Amazon employee regarding recruitment. Dr. Li responded with a message directed to Amazon and Rohit Prasad, currently Vice President and Head Scientist – Alexa Artificial Intelligence, regarding the meeting between Li Creative and Lab126 and Li Creative's issued and pending patents. On information and belief, Amazon and Mr. Prasad received Dr. Li's message.

29. Amazon has a policy or practice of not reviewing the patents of others (including instructing its employees to not review the patents of others). On information and belief, at least the following employees of Amazon and/or its subsidiaries were aware of Vocalife's patents but adhered to Amazon's established policy or practice of not reviewing the patents of others: Aleksander Pance, Matthew Holland, Wei Li, Jerry Wu, and Rohit Prasad. Further, Amazon and/or one or more of its subsidiaries have cited the Asserted Patents during prosecution of its own patent applications.

30. The Patents-in-Suit generally cover systems and methods for use in a microphone array system. The claimed inventions described in the Patents-in-Suit were developed by Manli

Zhu and Qi Li. For example, the invention is implemented by infringing virtual assistant smart speakers utilizing Amazon “Alexa” Technology. Upon information and belief, Amazon makes, uses, sells, exports, and/or imports infringing virtual assistant smart speakers, such as the Amazon Echo products.

31. Amazon has also infringed and is continuing to infringe the Patents-in-Suit by making, using, selling, offering to sell, exporting, and/or importing, and by actively inducing others to make, use, sell, offer to sell, exporting, and/or importing, products including microphone array systems technology and associated software that infringes the Patents-in-Suit. Such products include at least the Amazon Alexa-enabled products including, but not limited to, the Amazon Echo products. Vocalife manufactures and sells the CrispMic II, a smart microphone as a module for voice interactive products. The CrispMic II is a multiple-microphone array module for smart speakers, robotic devices, smart appliances, and other IoT platforms that require far-field voice capture, speech recognition, and voice control. The CrispMic II is powered by Vocalife’s advanced digital signal processors (“DSP”) algorithms developed over the past decade to suppress background noise, enhance speech intelligibility, and improve automatic speech recognition accuracy.<sup>9</sup>

32. Vocalife marks the CrispMic II product with the Patents-in-Suit and has complied with 35 U.S.C. § 287.<sup>10</sup>

33. Amazon’s infringement of the Patents-in-Suit is willful. Amazon continues to commit acts of infringement despite a high likelihood that its actions constitute infringement, and Amazon knew or should have known that its actions constituted an unjustifiably high risk of

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<sup>9</sup> [https://vocalife.com/wp-content/uploads/2019/02/Farfield\\_Mic\\_Developer\\_Module\\_Vocalife\\_Datasheet\\_4Feb2019.pdf](https://vocalife.com/wp-content/uploads/2019/02/Farfield_Mic_Developer_Module_Vocalife_Datasheet_4Feb2019.pdf).

<sup>10</sup> *Id.*

infringement.

**COUNT I**  
**(Infringement of the '371 Patent)**

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

35. Vocalife has not licensed or otherwise authorized Amazon to make, use, offer for sale, sell, export, or import any products that embody the inventions of the '371 Patent.

36. Amazon has directly infringed and continues to directly infringe the '371 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, exporting, and/or importing into the United States products that satisfy each and every limitation of one or more claims of the '371 Patent. Such products include virtual assistant smart speakers and other hardware and software implementing a microphone array system. On information and belief, infringing products include at least the Alexa enabled products made, used, offered for sale, sold, exported, and/or imported on or after December 29, 2020, such as the Amazon Echo products, including but not limited to the following products: Amazon Echo (1st Generation); Amazon Echo (2nd Generation); Amazon Echo (3rd Generation); Amazon Echo Dot (1st Generation); Amazon Echo Dot (2nd Generation); Amazon Echo Dot (3rd Generation); Amazon Echo Dot Kids Edition (1st Generation); Amazon Echo Dot Kids (2nd Generation); Amazon Echo Look; Amazon Echo Show (1st Generation); Amazon Echo Show (2nd Generation); Amazon Echo Spot; Amazon Echo Plus (1st Generation); Amazon Echo Plus (2nd Generation); and Amazon Echo Studio.<sup>11</sup>

37. For example, Amazon has and continues to directly infringe at least claim 26 of the '371 Patent by making, using, offering to sell, selling, exporting, and/or importing into the United

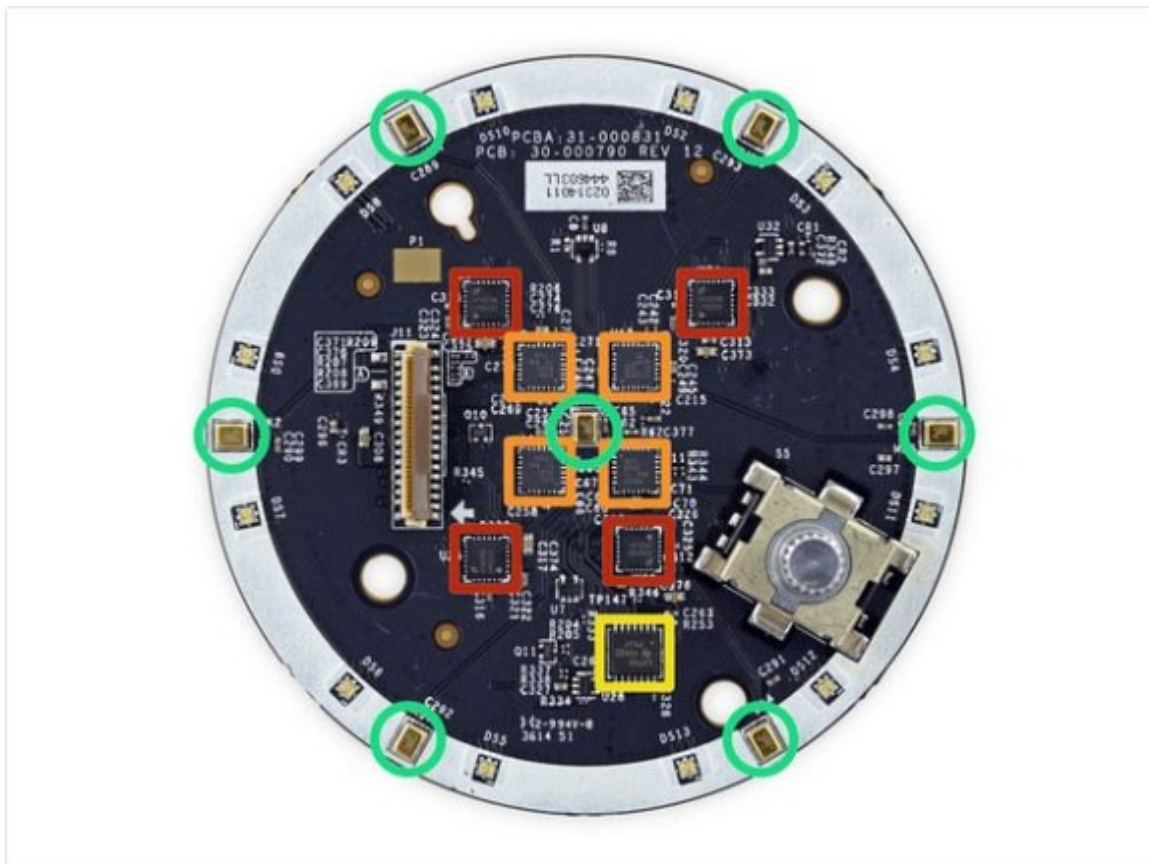
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<sup>11</sup> Vocalife expressly reserves the right to modify this list of infringing products.



States virtual assistant smart speakers that utilize a microphone array system.

38. Upon information and belief, the Amazon Echo products include a microphone array which is an array of sound sensors positioned in a linear, circular, or other configuration, wherein said sound sensors receive said sound signals from a plurality of disparate sound sources, wherein received sound signals comprise said target sound signal from a target sound source among said disparate sound sources, and ambient noise signals. An image of Amazon's Echo product is shown below.<sup>12</sup>



39. Upon information and belief, the Amazon Echo products include a digital signal processor, such as digital signal processors (“DSP”) manufactured by third parties including Texas

<sup>12</sup> <https://www.ifixit.com/Teardown/Amazon+Echo+Teardown/33953>; Annotations in the image originate from <https://www.ifixit.com/Teardown/Amazon+Echo+Teardown/33953>. Green circles indicate the microphones located in Amazon's Echo product.

Instruments, MediaTek, and AMLogic.

40. Upon information and belief, the DSPs included in the Amazon Echo products implement a sound source localization unit that estimates a spatial location of said target sound signal from said received sound signals, by determining a delay between each of said sound sensors and an origin of said array of said sound sensors as a function of distance between each of said sound sensors and said origin, a predefined angle between each of said sound sensors and a reference axis, and an azimuth angle between said reference axis and said target sound signal, when said target sound source that emits said target sound signal is in a two-dimensional plane, wherein said delay is represented in terms of number of samples, and wherein said determination of said delay enables beamforming for arbitrary numbers of said array of sound sensors and in a plurality of arbitrary configurations of said array of said sound sensors.<sup>13</sup>

41. Upon information and belief, the DSPs included in the Amazon Echo products implement an adaptive beamforming unit that steers directivity pattern of said array of said sound sensors in a direction of said spatial location of said target sound signal, wherein said adaptive beamforming unit enhances said target sound signal and partially suppresses said ambient noise signals.<sup>14</sup> An image of Amazon Echo's sound source localization unit is shown below:<sup>15</sup>

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<sup>13</sup> <https://developer.amazon.com/docs/alexa-voice-service/audio-hardware-configurations.html#hardware>.

<sup>14</sup> *Id.*

<sup>15</sup> <https://thewirecutter.com/reviews/amazon-echo-vs-google-home/>; The beamforming technology is indicated by the light ring in Amazon Echo products which will turn solid blue upon hearing the "wake word" or when it is manually awakened, and a small section of the light ring will turn cyan and point in the direction of the sound. *See* <https://www.amazon.com/gp/help/customer/display.html?nodeId=201601790>; *see also* <https://www.cnet.com/how-to/light-ring-colors-amazon-echo-alexa/>.



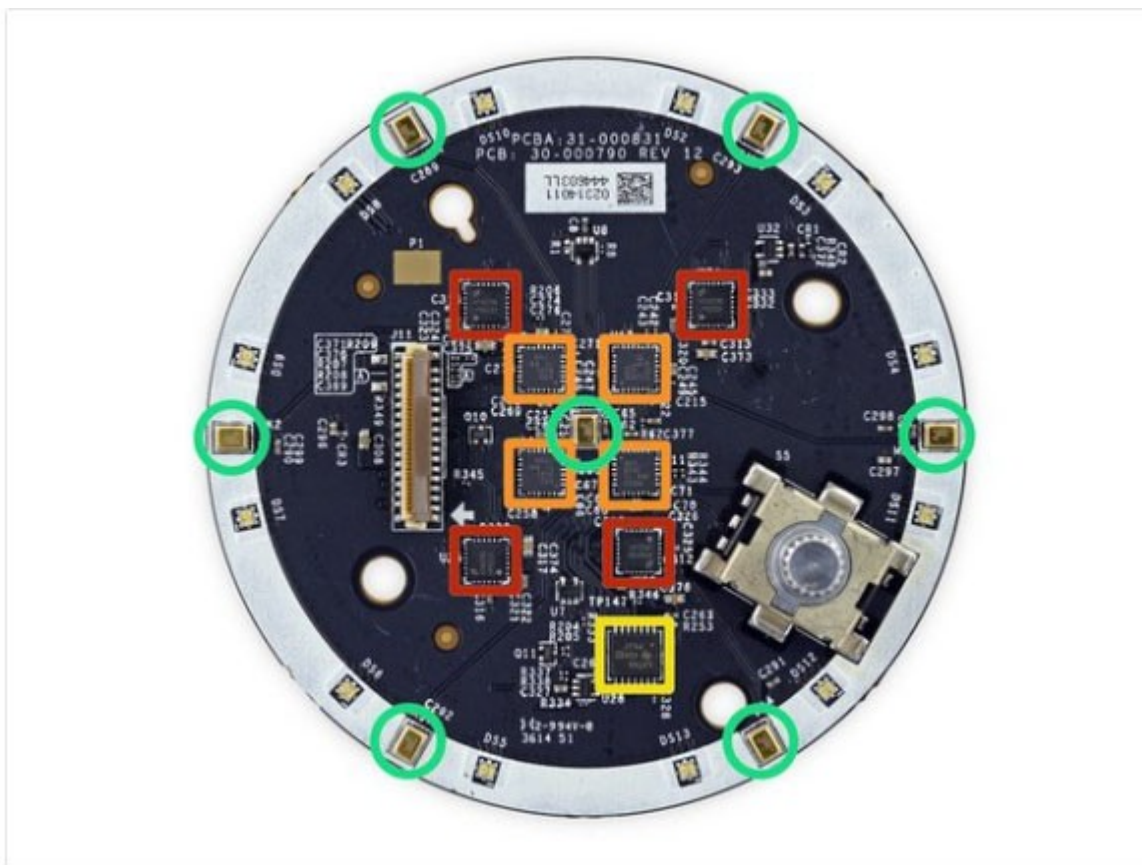
42. Upon information and belief, the DSPs included in the Amazon Echo products implement a noise reduction unit that suppresses said ambient noise signals for further enhancing said target sound signal.

43. Upon information and belief, the DSPs included in the Amazon Echo products implement an echo cancellation unit for performing echo cancellation for further enhancing said target sound signal.

44. For example, Amazon has and continues to directly infringe at least claim 34 of the '371 Patent by making, using, offering to sell, selling, exporting, and/or importing into the United States virtual assistant smart speakers that utilize a microphone array system.

45. Upon information and belief, the Amazon Echo products include a microphone array, which is an array of sound sensors positioned in a linear, circular, or other configuration, wherein said sound sensors receive said sound signals from a plurality of disparate sound sources, wherein said received sound signals comprise said target sound signal from a target sound source

among said disparate sound sources, and ambient noise signals. An image of Amazon's Echo product is shown below:<sup>16</sup>



46. Upon information and belief, the Amazon Echo products include a digital signal processor, such as digital signal processors (“DSP”) manufactured by third parties including Texas Instruments, MediaTek, and AMLogic.

47. Upon information and belief, the DSPs included in the Amazon Echo products comprise a sound source localization unit that estimates a spatial location of said target sound signal from said received sound signals, by determining a delay between each of said sound sensors and an origin of said array of said sound sensors as a function of distance between each of said sound

<sup>16</sup> <https://www.ifixit.com/Teardown/Amazon+Echo+Teardown/33953>; Annotations in the image originate from <https://www.ifixit.com/Teardown/Amazon+Echo+Teardown/33953>. Green circles indicate the microphones located in Amazon's Echo product.

sensors and said origin, a predefined angle between each of said sound sensors and a reference axis, and an azimuth angle between said reference axis and said target sound signal, when said target sound source that emits said target sound signal is in a two-dimensional plane, wherein said delay is represented in terms of number of samples, and wherein said determination of said delay enables beamforming for arbitrary numbers of said array of sound sensors and in a plurality of arbitrary configurations of said array of said sound sensors.<sup>17</sup>

48. Upon information and belief, the DSPs included in the Amazon Echo products comprise an adaptive beamforming unit that steers directivity pattern of said array of said sound sensors in a direction of said spatial location of said target sound signal, wherein said adaptive beamforming unit enhances said target sound signal and partially suppresses said ambient noise signals.<sup>18</sup> An image of Amazon Echo's sound source localization unit is shown below:<sup>19</sup>

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<sup>17</sup> <https://developer.amazon.com/docs/alexa-voice-service/audio-hardware-configurations.html#hardware>.

<sup>18</sup> *Id.*

<sup>19</sup> <https://thewirecutter.com/reviews/amazon-echo-vs-google-home/>; The beamforming technology is indicated by the light ring in Amazon Echo products which will turn solid blue upon hearing the "wake word" or when it is manually awakened, and a small section of the light ring will turn cyan and point in the direction of the sound. *See* <https://www.amazon.com/gp/help/customer/display.html?nodeId=201601790>; *see also* <https://www.cnet.com/how-to/light-ring-colors-amazon-echo-alexa/>.





49. Upon information and belief, the DSPs included in the Amazon Echo products comprise a noise reduction unit that suppresses said ambient noise signals for further enhancing said target sound signal.

50. Upon information and belief, the DSPs included in the Amazon Echo products comprise an echo cancellation unit that performs echo cancellation for further enhancing said target sound signal.

51. Additionally, on information and belief, infringing products include at least the Alexa enabled products made, used, offered for sale, sold, exported, and/or imported on or after December 29, 2020, including but not limited to the following products released on or after September 2020: Amazon Echo (4th Generation), Amazon Echo Dot (4th Generation), Amazon Echo Dot With Clock (3rd Generation), Amazon Echo Dot With Clock (4th Generation), Amazon Echo Dot Kids (3rd Generation), Amazon Echo Dot Kids (4th Generation), Amazon Echo Show

10 (3rd Generation), and Amazon Fire TV Cube (2nd Generation).<sup>20</sup> These infringing products for this Count released on or after September 2020 were not previously accused nor the subject of the October 8, 2021 jury verdict of infringement and no invalidity rendered in *Vocalife LLC v. Amazon.com*, Case No. 2:19-cv-00123 (E.D. Tex.), Dkt. 277 at p. 3.

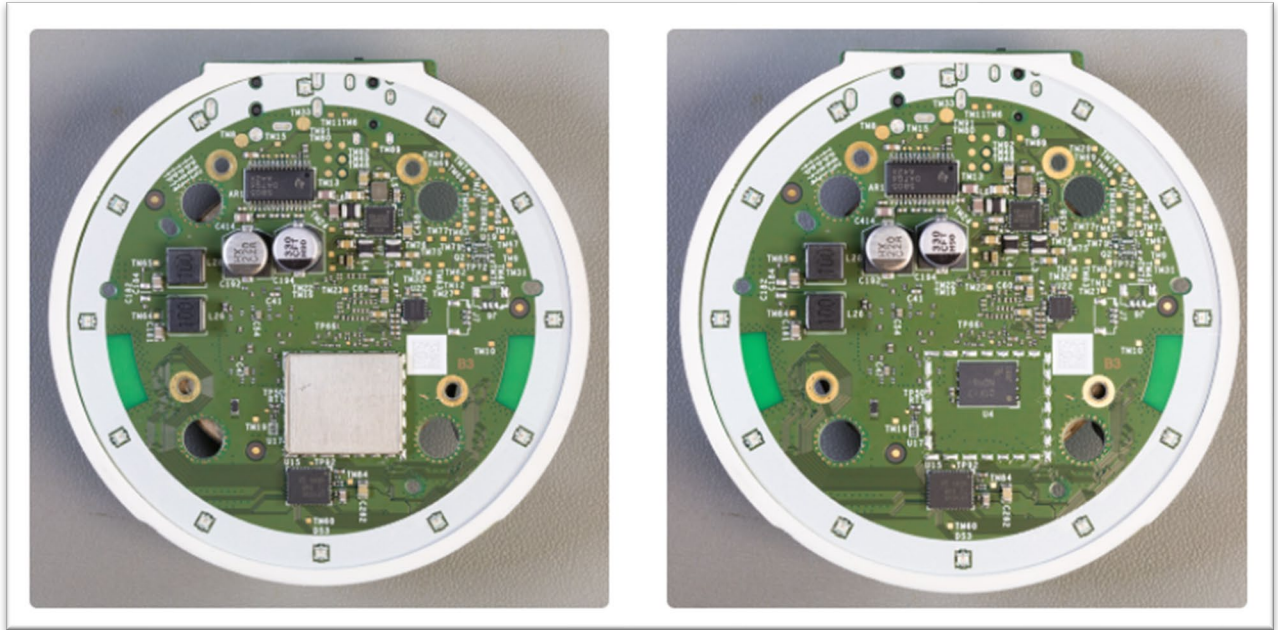
52. For example, Amazon has and continues to directly infringe at least claim 26 of the '371 Patent by making, using, offering to sell, selling, exporting, and/or importing into the United States virtual assistant smart speakers that utilize a microphone array system.

53. Upon information and belief, the Amazon Echo products include a microphone array which is an array of sound sensors positioned in a linear, circular, or other configuration, wherein said sound sensors receive said sound signals from a plurality of disparate sound sources, wherein received sound signals comprise said target sound signal from a target sound source among said disparate sound sources, and ambient noise signals. An image of Amazon's Echo Dot (4th Generation) product is shown below.<sup>21</sup>

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<sup>20</sup> Vocalife expressly reserves the right to modify this list of infringing products.

<sup>21</sup> <https://www.briandorey.com/post/echo-dot-4th-gen-smart-speaker-teardown>.

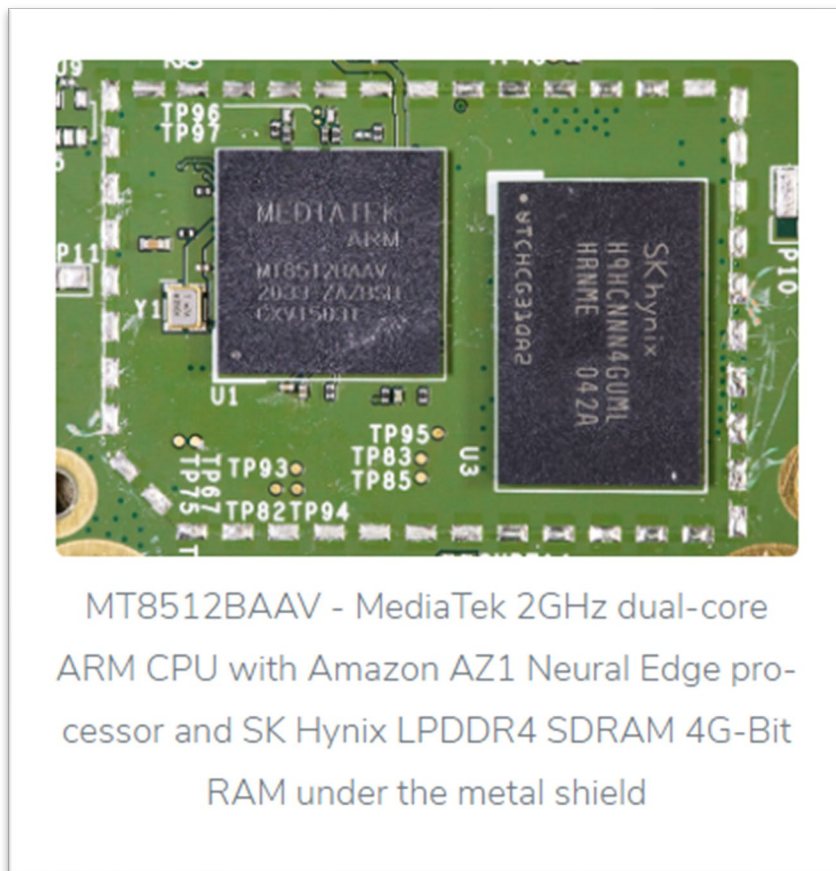


54. Upon information and belief, the Amazon Echo products include a digital signal processor, such as digital signal processors (“DSP”) manufactured by third parties including Texas Instruments, MediaTek, and AMLogic.<sup>22</sup>

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<sup>22</sup> <https://www.briandorey.com/post/echo-dot-4th-gen-smart-speaker-teardown>.





55. Upon information and belief, the DSPs included in the Amazon Echo products implement a sound source localization unit that estimates a spatial location of said target sound signal from said received sound signals, by determining a delay between each of said sound sensors and an origin of said array of said sound sensors as a function of distance between each of said sound sensors and said origin, a predefined angle between each of said sound sensors and a reference axis, and an azimuth angle between said reference axis and said target sound signal, when said target sound source that emits said target sound signal is in a two-dimensional plane, wherein said delay is represented in terms of number of samples, and wherein said determination of said delay enables beamforming for arbitrary numbers of said array of sound sensors and in a plurality

of arbitrary configurations of said array of said sound sensors.<sup>23</sup>

56. Upon information and belief, the DSPs included in the Amazon Echo products implement an adaptive beamforming unit that steers directivity pattern of said array of said sound sensors in a direction of said spatial location of said target sound signal, wherein said adaptive beamforming unit enhances said target sound signal and partially suppresses said ambient noise signals.<sup>24</sup> An image of Amazon Echo's sound source localization unit is shown below:<sup>25</sup>

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<sup>23</sup> <https://developer.amazon.com/docs/alexa-voice-service/audio-hardware-configurations.html#hardware>.

<sup>24</sup> *Id.*

<sup>25</sup> [https://www.amazon.com/all-new-Echo-Dot/dp/B084J4KNDS/ref=asc\\_df\\_B07XJ8C8F5/?tag=hyprod-20&linkCode=df0&hvadid=459646709164&hvpos=&hvnetw=g&hvrnd=7187628846021380035&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=1026597&hvtargid=pla-980550844000&th=1](https://www.amazon.com/all-new-Echo-Dot/dp/B084J4KNDS/ref=asc_df_B07XJ8C8F5/?tag=hyprod-20&linkCode=df0&hvadid=459646709164&hvpos=&hvnetw=g&hvrnd=7187628846021380035&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=1026597&hvtargid=pla-980550844000&th=1); The beamforming technology is indicated by the light ring in Amazon Echo products which will turn solid blue upon hearing the “wake word” or when it is manually awakened, and a small section of the light ring will turn cyan and point in the direction of the sound. *See* <https://www.amazon.com/gp/help/customer/display.html?nodeId=201601790>; *see also* <https://www.cnet.com/how-to/light-ring-colors-amazon-echo-alexa/>.



57. Upon information and belief, the DSPs included in the Amazon Echo products implement a noise reduction unit that suppresses said ambient noise signals for further enhancing said target sound signal.<sup>26</sup>

58. Upon information and belief, the DSPs included in the Amazon Echo products implement an echo cancellation unit for performing echo cancellation for further enhancing said target sound signal.

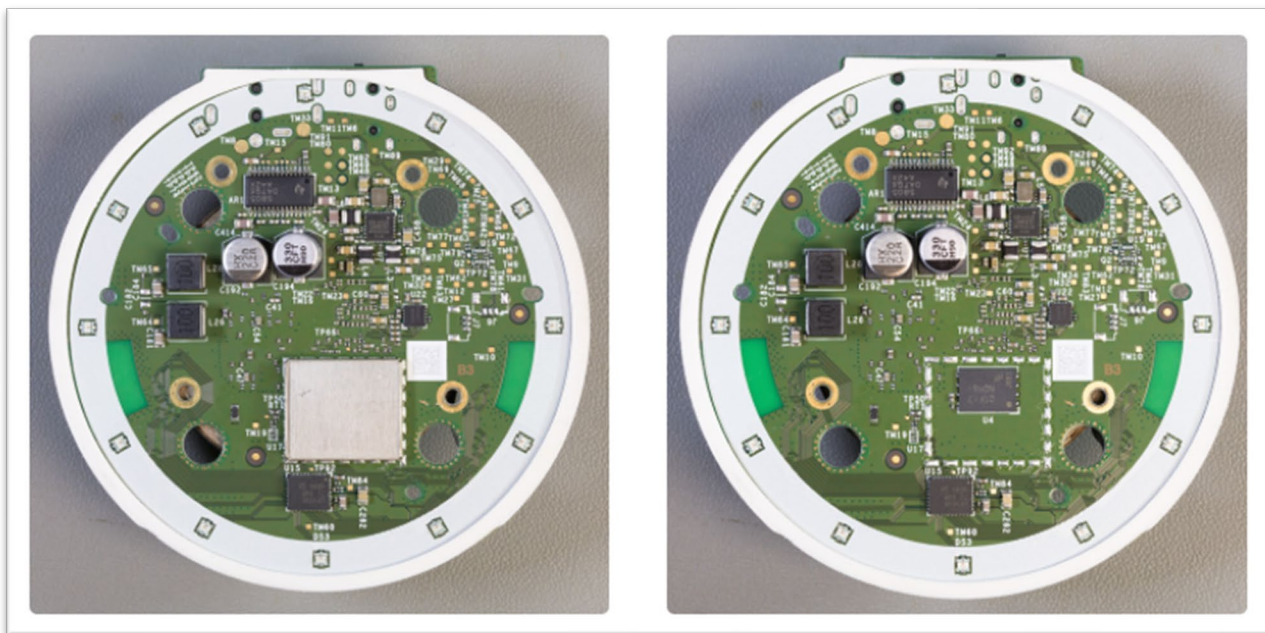
59. For example, Amazon has and continues to directly infringe at least claim 34 of the '371 Patent by making, using, offering to sell, selling, exporting, and/or importing into the United States virtual assistant smart speakers that utilize a microphone array system.

60. Upon information and belief, the Amazon Echo products include a microphone array, which is an array of sound sensors positioned in a linear, circular, or other configuration,

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<sup>26</sup> <https://mashable.com/shopping/echo-vs-echo-dot/>.

wherein said sound sensors receive said sound signals from a plurality of disparate sound sources, wherein said received sound signals comprise said target sound signal from a target sound source among said disparate sound sources, and ambient noise signals. An image of Amazon's Echo product is shown below:<sup>27</sup>



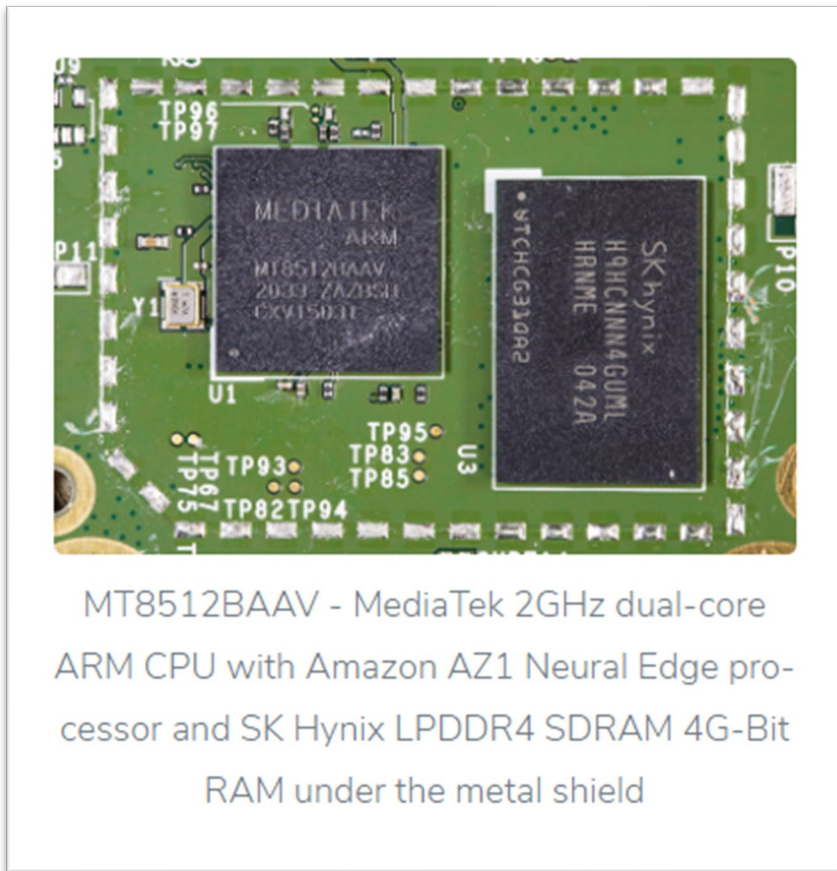
61. Upon information and belief, the Amazon Echo products include a digital signal processor, such as digital signal processors (“DSP”) manufactured by third parties including Texas Instruments, MediaTek, and AMLogic.<sup>28</sup>

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<sup>27</sup> <https://www.briandorey.com/post/echo-dot-4th-gen-smart-speaker-teardown>.

<sup>28</sup> <https://www.briandorey.com/post/echo-dot-4th-gen-smart-speaker-teardown>.





62. Upon information and belief, the DSPs included in the Amazon Echo products comprise a sound source localization unit that estimates a spatial location of said target sound signal from said received sound signals, by determining a delay between each of said sound sensors and an origin of said array of said sound sensors as a function of distance between each of said sound sensors and said origin, a predefined angle between each of said sound sensors and a reference axis, and an azimuth angle between said reference axis and said target sound signal, when said target sound source that emits said target sound signal is in a two-dimensional plane, wherein said delay is represented in terms of number of samples, and wherein said determination of said delay enables beamforming for arbitrary numbers of said array of sound sensors and in a plurality of arbitrary

configurations of said array of said sound sensors.<sup>29</sup>

63. Upon information and belief, the DSPs included in the Amazon Echo products comprise an adaptive beamforming unit that steers directivity pattern of said array of said sound sensors in a direction of said spatial location of said target sound signal, wherein said adaptive beamforming unit enhances said target sound signal and partially suppresses said ambient noise signals.<sup>30</sup> An image of Amazon Echo's sound source localization unit is shown below:<sup>31</sup>

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<sup>29</sup> <https://developer.amazon.com/docs/alexa-voice-service/audio-hardware-configurations.html#hardware>.

<sup>30</sup> *Id.*

<sup>31</sup> [https://www.amazon.com/all-new-Echo-Dot/dp/B084J4KNDS/ref=asc\\_df\\_B07XJ8C8F5/?tag=hyprod-20&linkCode=df0&hvadid=459646709164&hvpos=&hvnetw=g&hvrnd=7187628846021380035&hvpon=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=1026597&hvtargid=pla-980550844000&th=1](https://www.amazon.com/all-new-Echo-Dot/dp/B084J4KNDS/ref=asc_df_B07XJ8C8F5/?tag=hyprod-20&linkCode=df0&hvadid=459646709164&hvpos=&hvnetw=g&hvrnd=7187628846021380035&hvpon=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=1026597&hvtargid=pla-980550844000&th=1); The beamforming technology is indicated by the light ring in Amazon Echo products which will turn solid blue upon hearing the “wake word” or when it is manually awakened, and a small section of the light ring will turn cyan and point in the direction of the sound. *See* <https://www.amazon.com/gp/help/customer/display.html?nodeId=201601790>; *see also* <https://www.cnet.com/how-to/light-ring-colors-amazon-echo-alexa/>.



64. Upon information and belief, the DSPs included in the Amazon Echo products comprise a noise reduction unit that suppresses said ambient noise signals for further enhancing said target sound signal.<sup>32</sup>

65. Upon information and belief, the DSPs included in the Amazon Echo products implement an echo cancellation unit for performing echo cancellation for further enhancing said target sound signal.

66. Amazon has had knowledge and notice of the '371 Patent at least as of the filing of the Complaint in *Vocalife LLC v. Amazon.com, Inc.*, Case No. 2:19-cv-00123-JRG (E.D. Tex.). On information and belief, Amazon and/or one or more of Amazon's subsidiaries have cited the '756 Patent and/or its application during prosecution of their own patent applications. Amazon has also had specific knowledge of the '371 Patent as of the date when it was notified of the filing of

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<sup>32</sup> <https://mashable.com/shopping/echo-vs-echo-dot/>.

the action, *Vocalife LLC v. Amazon.com, Inc.*, Case No. 2:19-cv-00123-JRG (E.D. Tex.).

67. Amazon has a policy or practice of not reviewing the patents of others (including instructing its employees to not review the patents of others), and thus has been willfully blind to Vocalife's patent rights.

68. On information and belief, Amazon and/or one or more of its subsidiaries<sup>33</sup> had knowledge of the risk of infringement of the Asserted Patents or that said risk was so obvious that it should have been known.

69. Amazon has indirectly infringed and continues to indirectly infringe one or more claims of the '371 Patent, as provided by 35 U.S.C. § 271(b), by inducing infringement by others, such as Amazon's customers and end-users, in this District and elsewhere in the United States. For example, Amazon's customers and end-users directly infringe, either literally or under the doctrine of equivalents, through their use of the inventions claimed in the '371 Patent. Amazon induces this direct infringement through its affirmative acts of manufacturing, selling, distributing, and/or otherwise making available the Accused Products, and providing instructions, documentation, and other information to customers and end-users suggesting that they use the Accused Products in an infringing manner, including technical support, marketing, product manuals, advertisements, and online documentation. Because of Amazon's inducement, Amazon's customers and end-users use Accused Products in a way Amazon intends and directly infringe the '371 Patent. Amazon performs these affirmative acts with knowledge of the '371 Patent and with the intent, or willful blindness, that the induced acts directly infringe the '371 Patent.

70. Amazon has indirectly infringed and continues to indirectly infringe one or more

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<sup>33</sup> See *Vocalife LLC v. Amazon.com, Inc. and Amazon.com, LLC*, Case No. 2:19-cv-00123-JRG, Dkt. 95-24 (E.D. Tex. Apr. 8, 2020) ("Amazon's Stipulation Regarding Amazon and Lab126").



claims of the '371 Patent, as provided by 35 U.S.C. § 271(c), by contributing to direct infringement by others, such as customers and end-users, in this District and elsewhere in the United States. Amazon's affirmative acts of selling and offering to sell the Accused Products in this District and elsewhere in the United States and causing the Accused Products to be manufactured, used, sold, and offered for sale contributes to others' use and manufacture of the Accused Products such that the '371 Patent is directly infringed by others. The accused components within the Accused Products are material to the invention of the '371 Patent, are not staple articles or commodities of commerce, have no substantial non-infringing uses, and are known by Amazon to be especially made or adapted for use in the infringement of the '371 Patent. Amazon performs these affirmative acts with knowledge of the '371 Patent and with intent, or willful blindness, that they cause the direct infringement of the '371 Patent.

71. Because of Amazon's direct and indirect infringement of the '371 Patent, Vocalife has suffered damages, and will continue to suffer, damages in an amount to be proved at trial.

72. Because of Amazon's direct and indirect infringement of the '371 Patent, Vocalife has suffered, and will continue to suffer, irreparable harm for which there is no adequate remedy at law, unless Amazon's infringement is enjoined by this Court.

73. Amazon has committed and continues to commit acts of infringement that Amazon actually knew or should have known constituted an unjustifiably high risk of infringement of at least one valid and enforceable claim of the '371 Patent. Amazon's direct and indirect infringement of the '371 Patent has been and continues to be willful, intentional, deliberate, and/or in conscious disregard of Vocalife's rights under the patent. Vocalife is entitled to an award of treble damages, reasonable attorney fees, and costs in bringing this action.

**COUNT II**  
**(Infringement of the '049 Patent)**

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

75. Vocalife has not licensed or otherwise authorized Amazon to make, use, offer for sale, sell, export, or import any products that embody the inventions of the '049 Patent.

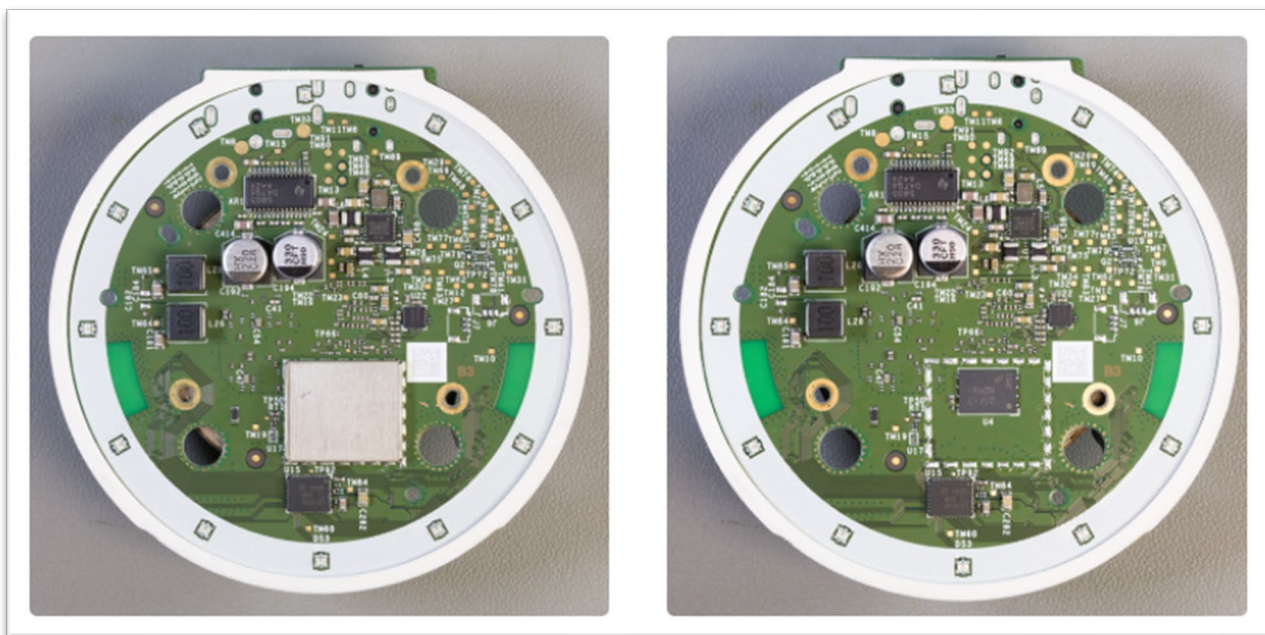
76. Amazon has directly infringed and continues to directly infringe the '049 Patent, either literally or under the doctrine of equivalents, without authority and in violation of 35 U.S.C. § 271, by making, using, offering to sell, selling, exporting, and/or importing into the United States products that satisfy each and every limitation of one or more claims of the '049 Patent. Such products include virtual assistant smart speakers and other hardware and software implementing a microphone array system. On information and belief, infringing products include at least the Alexa enabled products with an official release date on or after September 2020, including but not limited to, the Amazon Echo (4th Generation), Amazon Echo Dot (4th Generation), Amazon Echo Dot With Clock (3rd Generation), Amazon Echo Dot With Clock (4th Generation), Amazon Echo Dot Kids (3rd Generation), Amazon Echo Dot Kids (4th Generation), Amazon Echo Show 10 (3rd Generation), and Amazon Fire TV Cube (2nd Generation).<sup>34</sup> These infringing products for this Count released on or after September 2020 were not previously accused nor the subject of the October 8, 2021 jury verdict of infringement and no invalidity rendered in *Vocalife LLC v. Amazon.com*, Case No. 2:19-cv-00123 (E.D. Tex.), Dkt. 277 at p. 3.

77. For example, Amazon has and continues to directly infringe at least claim 1 of the '049 Patent by making, using, offering to sell, selling, exporting, and/or importing into the United States virtual assistant smart speakers that utilize a microphone array system.

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<sup>34</sup> Vocalife expressly reserves the right to modify this list of products as the case progresses.

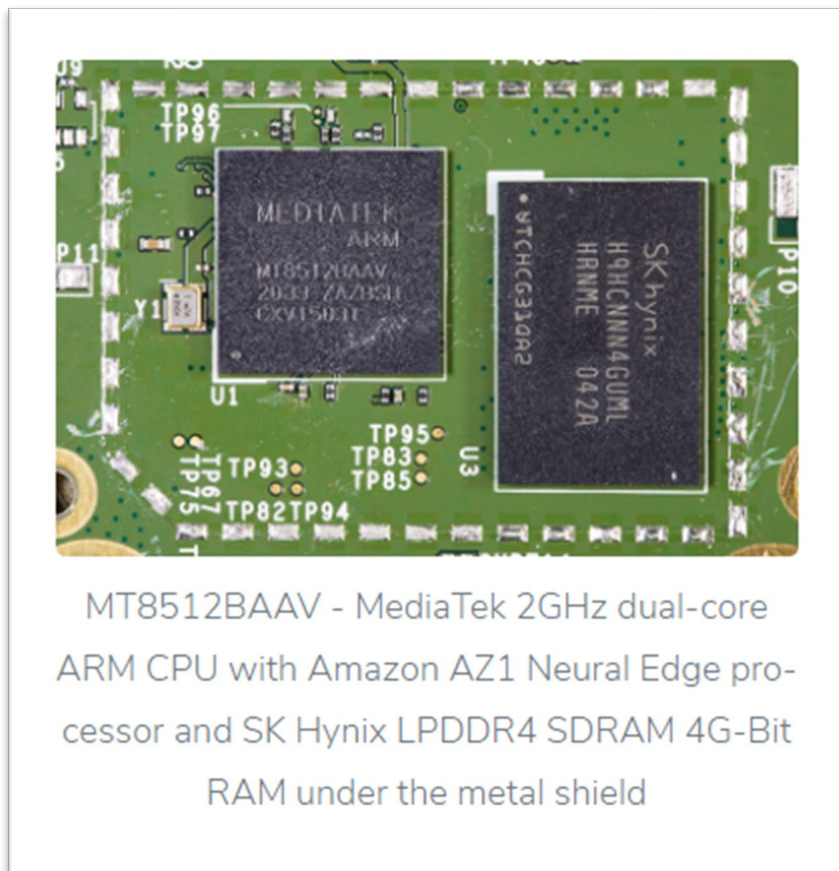
78. Upon information and belief, the Amazon Echo products include a microphone array which is an array of sound sensors positioned in a linear, circular, or other configuration, wherein said sound sensors receive said sound signals from a plurality of disparate sound sources, wherein received sound signals comprise said target sound signal from a target sound source among said disparate sound sources, and ambient noise signals. An image of Amazon's Echo Dot (4th Generation) product is shown below.<sup>35</sup>



79. Upon information and belief, the Amazon Echo products include a digital signal processor, such as digital signal processors (“DSP”) manufactured by third parties including Texas Instruments, MediaTek, and AMLogic.<sup>36</sup>

<sup>35</sup> <https://www.briandorey.com/post/echo-dot-4th-gen-smart-speaker-teardown>.

<sup>36</sup> <https://www.briandorey.com/post/echo-dot-4th-gen-smart-speaker-teardown>.



80. Upon information and belief, the DSPs included in the Amazon Echo products implement a sound source localization unit that estimates a spatial location of said target sound signal from said received sound signals, by determining a delay between each of said sound sensors and an origin of said array of said sound sensors as a function of distance between each of said sound sensors and said origin, a predefined angle between each of said sound sensors and a reference axis, and an azimuth angle between said reference axis and said target sound signal, when said target sound source that emits said target sound signal is in a two-dimensional plane, wherein said delay is represented in terms of number of samples, and wherein said determination of said delay enables beamforming for arbitrary numbers of said array of sound sensors and in a plurality

of arbitrary configurations of said array of said sound sensors.<sup>37</sup>

81. Upon information and belief, the DSPs included in the Amazon Echo products implement an adaptive beamforming unit that steers directivity pattern of said array of said sound sensors in a direction of said spatial location of said target sound signal, wherein said adaptive beamforming unit enhances said target sound signal and partially suppresses said ambient noise signals.<sup>38</sup> An image of Amazon Echo's sound source localization unit is shown below:<sup>39</sup>

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<sup>37</sup> <https://developer.amazon.com/docs/alexa-voice-service/audio-hardware-configurations.html#hardware>.

<sup>38</sup> *Id.*

<sup>39</sup> [https://www.amazon.com/all-new-Echo-Dot/dp/B084J4KNDS/ref=asc\\_df\\_B07XJ8C8F5/?tag=hyprod-20&linkCode=df0&hvadid=459646709164&hvpos=&hvnetw=g&hvrnd=7187628846021380035&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=1026597&hvtargid=pla-980550844000&th=1](https://www.amazon.com/all-new-Echo-Dot/dp/B084J4KNDS/ref=asc_df_B07XJ8C8F5/?tag=hyprod-20&linkCode=df0&hvadid=459646709164&hvpos=&hvnetw=g&hvrnd=7187628846021380035&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=1026597&hvtargid=pla-980550844000&th=1); The beamforming technology is indicated by the light ring in Amazon Echo products which will turn solid blue upon hearing the “wake word” or when it is manually awakened, and a small section of the light ring will turn cyan and point in the direction of the sound. *See* <https://www.amazon.com/gp/help/customer/display.html?nodeId=201601790>; *see also* <https://www.cnet.com/how-to/light-ring-colors-amazon-echo-alexa/>.





82. Upon information and belief, the DSPs included in the Amazon Echo products implement a noise reduction unit that suppresses said ambient noise signals for further enhancing said target sound signal.<sup>40</sup>

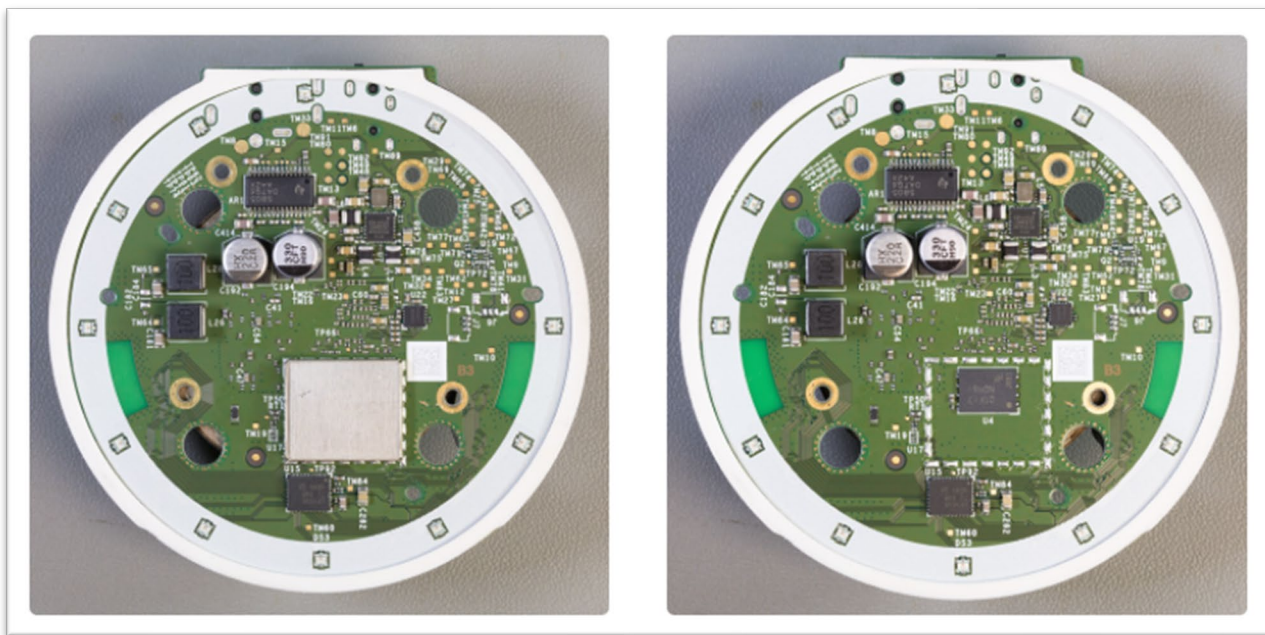
83. For example, Amazon has and continues to directly infringe at least claim 9 of the '049 Patent by making, using, offering to sell, selling, exporting, and/or importing into the United States virtual assistant smart speakers that utilize a microphone array system.

84. Upon information and belief, the Amazon Echo products include a microphone array, which is an array of sound sensors positioned in a linear, circular, or other configuration, wherein said sound sensors receive said sound signals from a plurality of disparate sound sources, wherein said received sound signals comprise said target sound signal from a target sound source among said disparate sound sources, and ambient noise signals. An image of Amazon's Echo

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<sup>40</sup> <https://mashable.com/shopping/echo-vs-echo-dot/>.

product is shown below:<sup>41</sup>

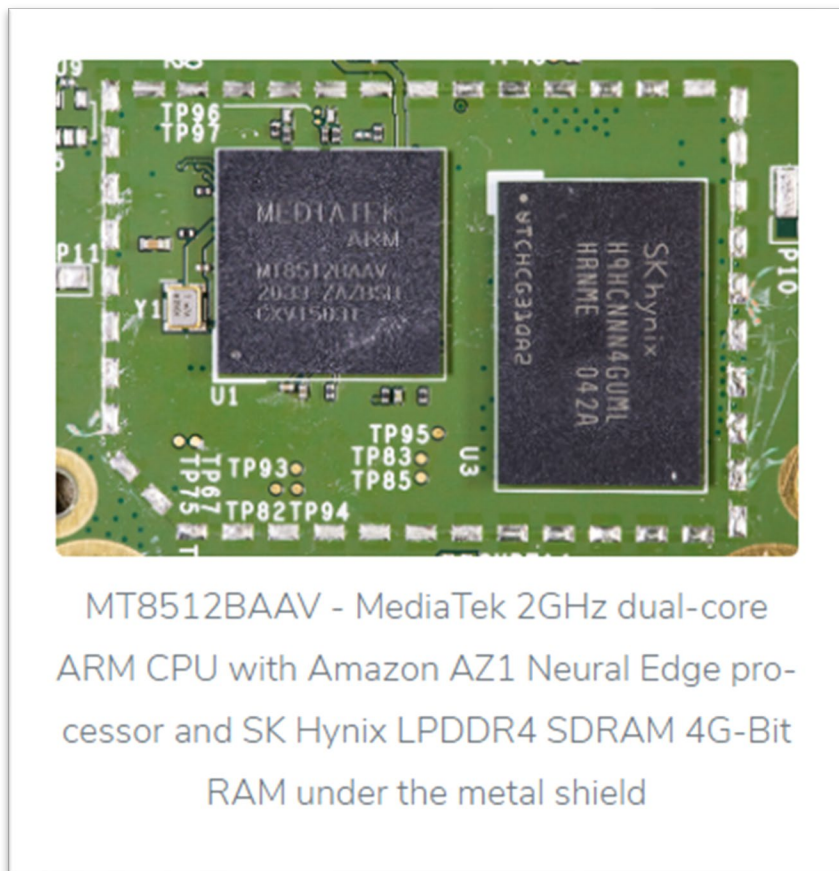


85. Upon information and belief, the Amazon Echo products include a digital signal processor, such as digital signal processors (“DSP”) manufactured by third parties including Texas Instruments, MediaTek, and AMLogic.<sup>42</sup>

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<sup>41</sup> <https://www.briandorey.com/post/echo-dot-4th-gen-smart-speaker-teardown>.

<sup>42</sup> <https://www.briandorey.com/post/echo-dot-4th-gen-smart-speaker-teardown>.



86. Upon information and belief, the DSPs included in the Amazon Echo products comprise a sound source localization unit that estimates a spatial location of said target sound signal from said received sound signals, by determining a delay between each of said sound sensors and an origin of said array of said sound sensors as a function of distance between each of said sound sensors and said origin, a predefined angle between each of said sound sensors and a reference axis, and an azimuth angle between said reference axis and said target sound signal, when said target sound source that emits said target sound signal is in a two-dimensional plane, wherein said delay is represented in terms of number of samples, and wherein said determination of said delay enables beamforming for arbitrary numbers of said array of sound sensors and in a plurality of arbitrary



configurations of said array of said sound sensors.<sup>43</sup>

87. Upon information and belief, the DSPs included in the Amazon Echo products comprise an adaptive beamforming unit that steers directivity pattern of said array of said sound sensors in a direction of said spatial location of said target sound signal, wherein said adaptive beamforming unit enhances said target sound signal and partially suppresses said ambient noise signals.<sup>44</sup> An image of Amazon Echo's sound source localization unit is shown below:<sup>45</sup>

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<sup>43</sup> <https://developer.amazon.com/docs/alexa-voice-service/audio-hardware-configurations.html#hardware>.

<sup>44</sup> *Id.*

<sup>45</sup> [https://www.amazon.com/all-new-Echo-Dot/dp/B084J4KNDS/ref=asc\\_df\\_B07XJ8C8F5/?tag=hyprod-20&linkCode=df0&hvadid=459646709164&hvpos=&hvnetw=g&hvrnd=7187628846021380035&hvpon=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=1026597&hvtargid=pla-980550844000&th=1;;](https://www.amazon.com/all-new-Echo-Dot/dp/B084J4KNDS/ref=asc_df_B07XJ8C8F5/?tag=hyprod-20&linkCode=df0&hvadid=459646709164&hvpos=&hvnetw=g&hvrnd=7187628846021380035&hvpon=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=1026597&hvtargid=pla-980550844000&th=1;;) The beamforming technology is indicated by the light ring in Amazon Echo products which will turn solid blue upon hearing the “wake word” or when it is manually awakened, and a small section of the light ring will turn cyan and point in the direction of the sound. *See* <https://www.amazon.com/gp/help/customer/display.html?nodeId=201601790>; *see also* <https://www.cnet.com/how-to/light-ring-colors-amazon-echo-alexa/>.



88. Upon information and belief, the DSPs included in the Amazon Echo products comprise a noise reduction unit that suppresses said ambient noise signals for further enhancing said target sound signal.<sup>46</sup>

89. Amazon has had knowledge and notice of the '049 Patent at least as of the filing of the Complaint in *Vocalife LLC v. Amazon.com, Inc.*, Case No. 2:19-cv-00123-JRG (E.D. Tex.). On information and belief, Amazon and/or one or more of Amazon's subsidiaries have cited the '756 Patent and/or its application during prosecution of their own patent applications. Amazon has also had specific knowledge of the '049 Patent as of the date when it was notified of the filing of the action, *Vocalife LLC v. Amazon.com, Inc.*, Case No. 2:19-cv-00123-JRG (E.D. Tex.).

90. Amazon has a policy or practice of not reviewing the patents of others (including instructing its employees to not review the patents of others), and thus has been willfully blind to

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<sup>46</sup> <https://mashable.com/shopping/echo-vs-echo-dot/>.

Vocalife's patent rights.

91. On information and belief, Amazon and/or one or more of its subsidiaries<sup>47</sup> had knowledge of the risk of infringement of the Asserted Patents or that said risk was so obvious that it should have been known.

92. Amazon has indirectly infringed and continues to indirectly infringe one or more claims of the '049 Patent, as provided by 35 U.S.C. § 271(b), by inducing infringement by others, such as Amazon's customers and end-users, in this District and elsewhere in the United States. For example, Amazon's customers and end-users directly infringe, either literally or under the doctrine of equivalents, through their use of the inventions claimed in the '049 Patent. Amazon induces this direct infringement through its affirmative acts of manufacturing, selling, distributing, and/or otherwise making available the Accused Products, and providing instructions, documentation, and other information to customers and end-users suggesting that they use the Accused Products in an infringing manner, including technical support, marketing, product manuals, advertisements, and online documentation. Because of Amazon's inducement, Amazon's customers and end-users use Accused Products in a way Amazon intends and directly infringe the '049 Patent. Amazon performs these affirmative acts with knowledge of the '049 Patent and with the intent, or willful blindness, that the induced acts directly infringe the '049 Patent.

93. Amazon has indirectly infringed and continues to indirectly infringe one or more claims of the '049 Patent, as provided by 35 U.S.C. § 271(c), by contributing to direct infringement by others, such as customers and end-users, in this District and elsewhere in the United States. Amazon's affirmative acts of selling and offering to sell the Accused Products in this District and

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<sup>47</sup> See *Vocalife LLC v. Amazon.com, Inc. and Amazon.com, LLC*, Case No. 2:19-cv-00123-JRG, Dkt. 95-24 (E.D. Tex. Apr. 8, 2020) ("Amazon's Stipulation Regarding Amazon and Lab126").

elsewhere in the United States and causing the Accused Products to be manufactured, used, sold, and offered for sale contributes to others' use and manufacture of the Accused Products such that the '049 Patent is directly infringed by others. The accused components within the Accused Products are material to the invention of the '049 Patent, are not staple articles or commodities of commerce, have no substantial non-infringing uses, and are known by Amazon to be especially made or adapted for use in the infringement of the '049 Patent. Amazon performs these affirmative acts with knowledge of the '049 Patent and with intent, or willful blindness, that they cause the direct infringement of the '049 Patent.

94. Because of Amazon's direct and indirect infringement of the '049 Patent, Vocalife has suffered damages, and will continue to suffer, damages in an amount to be proved at trial.

95. Because of Amazon's direct and indirect infringement of the '049 Patent, Vocalife has suffered, and will continue to suffer, irreparable harm for which there is no adequate remedy at law, unless Amazon's infringement is enjoined by this Court.

96. Amazon has committed and continues to commit acts of infringement that Amazon actually knew or should have known constituted an unjustifiably high risk of infringement of at least one valid and enforceable claim of the '049 Patent. Amazon's direct and indirect infringement of the '049 Patent has been and continues to be willful, intentional, deliberate, and/or in conscious disregard of Vocalife's rights under the patent. Vocalife is entitled to an award of treble damages, reasonable attorney fees, and costs in bringing this action.

#### **DEMAND FOR JURY TRIAL**

Plaintiff hereby demands a jury for all issues so triable.

#### **PRAYER FOR RELIEF**

WHEREFORE, Vocalife prays for relief against Amazon as follows:

- a. Entry of judgment declaring that Amazon infringes one or more claims of the Patents-in-Suit;
- b. Entry of judgment declaring that Amazon's infringement of the Patents-in-Suit is willful;
- c. An order awarding damages sufficient to compensate Vocalife for Amazon'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;
- d. Enhanced damages pursuant to 35 U.S.C. § 284;
- e. Entry of judgment declaring that this case is exceptional and awarding Vocalife its costs and reasonable attorney fees under 35 U.S.C. § 285;
- f. An accounting for acts of infringement;
- g. Such other equitable relief which may be requested and to which the Plaintiff is entitled; and
- h. Such other and further relief as the Court deems just and proper.

Dated: June 15, 2021

Respectfully submitted,

/s/ Vincent J. Rubino, III

Alfred R. Fabricant

NY Bar No. 2219392

Email: [ffabricant@fabricantllp.com](mailto:ffabricant@fabricantllp.com)

Peter Lambrianakos

NY Bar No. 2894392

Email: [plambrianakos@fabricantllp.com](mailto:plambrianakos@fabricantllp.com)

Vincent J. Rubino, III

NY Bar No. 4557435

Email: [vrubino@fabricantllp.com](mailto:vrubino@fabricantllp.com)

**FABRICANT LLP**

411 Theodore Fremd Road, Suite 206 South  
Rye, New York 10580

Telephone: (212) 257-5797

Facsimile: (212) 257-5796

Samuel F. Baxter  
Texas State Bar No. 01938000  
sbaxter@mckoolsmith.com  
Jennifer L. Truelove  
Texas State Bar No. 24012906  
jtruelove@mckoolsmith.com  
**MCKOOL SMITH, P.C.**  
104 East Houston Street, Suite 300  
Marshall, Texas 75670  
Telephone: (903) 923-9000  
Facsimile: (903) 923-9099

***ATTORNEYS FOR PLAINTIFF  
VOCALIFE LLC***

**CERTIFICATE OF SERVICE**

The undersigned hereby certifies that on June 15, 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/ Vincent J. Rubino, III*

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Vincent J. Rubino, III