

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD., and
SAMSUNG ELECTRONICS AMERICA, INC.,
Petitioner

v.

ZOPHONOS INC.,
Patent Owner

Case IPR2026-00084
U.S. Patent No. 11,204,736

**DECLARATION OF JUSTIN D. MATHEW, PH.D.,
IN SUPPORT OF PATENT OWNER'S PRELIMINARY RESPONSE**

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Zophonos EX2003
Samsung v. Zophonos
IPR2026-00084

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I, Justin Dan Mathew, hereby declare as follows.

I. INTRODUCTION

1. I have been retained as an expert witness on behalf of Patent Owner Zophonos Inc. (“Patent Owner”) for the above-captioned *inter partes* review (“IPR”). I am being compensated for my time in connection with this IPR at my normal hourly rate. My compensation is not contingent on either my expert opinion or the outcome of this litigation. I have no other interest in this proceeding.

2. I understand that this Declaration accompanies Patent Owner’s Preliminary Response filed in this IPR involving U.S. Patent No. 11,204,736 (“the ’736 patent”) (EX1001), which resulted from U.S. Application No. 16/656,259 (“the ’259 application”), filed October 17, 2019. The ’736 application claims priority as a continuation application to U.S. Application No. 16/421,141, filed May 23, 2019, which is a continuation-in-part of U.S. Application No. 16/155,919, filed October 10, 2018, which is a continuation of U.S. Application No. 14/862,304, filed September 23, 2015, which claims priority to U.S. Provisional Application No. 62/054286 filed September 23, 2014. My opinions regarding the knowledge in the art at the time of the ’736 patent are based on the September 23, 2014 priority date.

3. In preparing this Declaration, I have reviewed the ’736 patent and each of the documents cited herein, in light of general knowledge in the art before

the '736 patent's priority date. In formulating my opinions, I have relied upon my experience, education, and knowledge in the relevant art. In formulating my opinions, I have also considered the viewpoint of a person of ordinary skill in the art ("POSITA") (as discussed further below in Section V) at the time of the '736 patent's priority date.

II. MY BACKGROUND AND QUALIFICATIONS

4. I received a Bachelor's degree in Electrical and Computer Engineering from the University of Rochester in 2010, a Master's Degree in Music Technology from New York University in 2012, and a Ph.D. in Computer Science from the University of Paris-Saclay in 2017.

5. From 2024 to the present, I have been a member of the faculty of North Carolina State University as an Associate Teaching Professor and the Director of Undergraduate Programs for Music Technology in the Department of Performing Arts and Technology. In this role, I direct the academic offerings of the Music Technology major and the department as a whole. As part of my responsibilities, I teach courses in Acoustics & Psychoacoustics, Audio Digital Signal Processing, Audio Plugin Development, Audio Embedded Software, and Senior Capstone courses. In addition, my research focuses on three areas - measuring performance technique of musicians, personalizing binaural rendering systems, and enhancing spatial dimensions of musical excitation methods. I've

been awarded an North Carolina State University - Data Science Academy Seed Grant in 2024 on measuring performance techniques.

6. Prior to my tenure at North Carolina State University, I was a lecturer in Music Engineering from August 2022 to May 2024 for the University of Miami. I was also a staff engineering scientist for Nielsen from July 2022 to October 2024. At the University of Miami, I taught courses on digital audio signal processing and audio plugin development. At Nielsen, I worked in the research and development team working new methods to measure the audience viewership of live TV shows and streaming media. In particular, I worked on researching and developing Artificial Intelligence and Machine Learning models for embedded systems. Lastly, I was listed as an inventor on multiple patents.

7. Additionally, I was the Lead Audio Research and Development Engineering for Magic Leap from January 2018 to June 2022. In this role, I served as an R&D engineer with my main role to research and define requirements for Magic Leap customers and partners, and develop prototypes and plans for productization of those features. Some of the projects included designing tools to develop audio AI systems that can detect machinery defects through sound, a real-time spatial sound synthesis system for augmented reality applications, and automated speaker calibrations system in manufacturing. I was also listed as an inventor on a number of patents during this time.

8. I have authored numerous publications centered around audio signal processing. For instance, in 2025, I co-authored a publication for constructing a mixed-use studio designed to accommodate a versatile audio system. The publication provides a detailed account of how the space was transformed and the necessary audio and acoustical considerations needed to enhance the flexibility of the studio. I have also co-authored numerous other publications directed towards acoustical and audio processing research for immersive audio environments. I am a listed author on a number of patents directed towards audio processing technologies.

9. I understand that a copy of my complete curriculum vitae has been submitted as Exhibit 2004, which includes a list of my publications, and other details regarding my expertise and qualifications.

III. LIST OF DOCUMENTS CONSIDERED

10. I have considered the following documents listed below in addition to any other documents cited in this Declaration. To the best of my knowledge, these documents are true and accurate copies of what they purport to be. An expert in the field would reasonably rely on them to formulate opinions such as those set forth in this Declaration.

Paper No.	Description
3	Petition for <i>Inter Partes</i> Review of U.S. Patent No. 11,204,736

Exhibit No.	Description
1001	U.S. Patent No. 11,204,736 (“the ’736 Patent”)
1002	Declaration of Chris Kyriakakis, Ph.D. (“Kyriakakis”)
1003	Curriculum Vitae of Chris Kyriakakis, Ph.D.
1004	File History of U.S. Patent No. 11,204,736 (“File History”)
1005	U.S. Patent Application Publication 2015/0195641 (“DiCenso641”)
1006	U.S. Patent Application Publication 2014/0254842 (“Smith”)
1007	U.S. Patent Application Publication 2014/0337902 (“Holland”)
1008	U.S. Patent Application Publication 2008/0031481 (“Warren”)
1009	U.S. Patent Application Publication 2015/0170645 (“DiCenso645”)
1010	U.S. Patent Application Publication 2008/0137873 (“Goldstein873”)
1012	U.S. Patent Application Publication 2005/0058181 (“Lyle”)
1013	Ultrasound Bio Effects and Indus Hygiene Concerns (“Wiernicki”)
1014	U.S. Patent Application Publication 2011/0058056 (“Lindahl”)
1015	U.S. Patent Application Publication 11/734,947 (“Snow”)
1016	Excerpts from Microsoft Computer Dictionary (5th ed. 2002) (“Computer Dictionary”)
1017	Excerpts from Robert Oshana, “DSP Software Development Techniques Embedded and Real-Time Systems” (2006) (“Oshana”)
1018	Excerpts from Thomas D. Rossing, Richard F. Moore, and Paul A. Wheeler, “The Science of Sound” (3rd ed. 2002) (“Rossing”)

Exhibit No.	Description
1019	U.S. Patent Application Publication 2013/0003998 (“Kirkeby”)
1020	U.S. Patent Application Publication 2015/0371643 (“Ramo”)
1021	U.S. Patent 8,767,970 (“Eppolito”)
1022	U.S. Patent 7,970,144 (“Avendano”)
2005	Am. Speech-Language-Hearing Ass’n, Audiogram, https://www.asha.org/public/hearing/Audiogram/

IV. LEGAL UNDERSTANDING

A. My Understanding of Claim Construction

11. I understand that during an *inter partes* review proceeding, claims are to be construed in light of the specification as would be read by a person of ordinary skill in the relevant art at the time of the invention. I understand that claim terms are given their plain and ordinary meaning as would be understood by a POSITA in the context of the patent’s specification and prosecution history. A claim term, however, will not receive its ordinary meaning if the patentee acted as his or her own lexicographer and clearly set forth a definition of the claim term in the specification. In this case, the claim term will receive the definition set forth in the patent.

B. My Understanding of Obviousness

12. I understand that a patent claim is invalid if the claimed invention would have been obvious to a person of ordinary skill in the art at the time of the

application's priority date. I understand that this means that even if all of the limitations of the claim cannot be found in a single prior-art reference that would anticipate the claim, the claim can still be invalid.

13. To obtain a patent, a claimed invention must have been, as of its priority date, nonobvious in view of the prior art in the field. I understand that a patent claim is obvious when the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art.

14. I understand that to prove that prior art or a combination of prior art renders a patent claim obvious, it is necessary to: (1) identify the particular references that, singly or in combination, render the patent claim obvious; (2) specifically identify which elements of the patent claim appear in each of the asserted references; and (3) explain how the prior art references could have been combined in order to create the inventions claimed in the patent claim.

15. I also understand that when considering the obviousness of a patent claim, one should consider whether a teaching, suggestion, or motivation to combine the references exists so as to avoid impermissibly applying hindsight when considering the prior art. I understand this test should not be rigidly applied, but that the test can be important to avoiding such hindsight.

16. I understand that certain objective indicia can be important evidence as to whether a patent is obvious or nonobvious. Such indicia include:

(1) commercial success of products covered by the patent claims; (2) a long-felt need for the invention; (3) failed attempts by others to make the invention; (4) copying of the invention by others in the field; (5) unexpected results achieved by the invention as compared to the closest prior art; (6) praise of the invention by the infringer or others in the field; (7) the taking of licenses under the patent by others; (8) expressions of surprise by experts and those skilled in the art at the making of the invention; and (9) the patentee proceeded contrary to the accepted wisdom of the prior art.

17. I also understand that “obviousness” is a legal conclusion based on the underlying factual issues of the scope and content of the prior art, the differences between the claimed invention and the prior art, the level of ordinary skill in the pertinent art, and any objective indicia of non-obviousness. For that reason, I am not rendering a legal opinion on the ultimate legal question of obviousness. Rather, my testimony addresses the underlying facts and factual analysis that would support a legal conclusion of obviousness or non-obviousness, and when I use the term obvious, I am referring to the perspective of one of ordinary skill at the time of invention of the '736 patent.

C. My Understanding of a Person Having Ordinary Skill in the Art

18. I understand that a POSITA is presumed to be aware of all pertinent art, thinks along conventional wisdom in the art, and is a person of ordinary creativity.

19. I understand that the following should be considered when deciding the level of ordinary skill in the art that someone would have had at the time the claimed invention was made:

- the levels of education and experience of persons working in the field;
- the types of problems encountered in the field; and
- the sophistication of the technology.

20. My opinion below explains how a POSITA would have understood the technology described in the documents I have identified herein around the time of the '736 patent.

21. Regardless of whether I use “I” or “POSITA” during my technical analysis below, all of my statements and opinions are always to be understood to be based on how a POSITA would have understood or read a document at the time of the '736 patent.

V. PERSON OF ORDINARY SKILL IN THE ART

22. For purposes of this Declaration, I have applied Dr. Kyriakakis's articulation of a POSITA. EX1002, ¶52. It is my opinion that the definition of a

POSITA would not materially affect the limited analysis required for deciding institution and presented in this Declaration. If called to give further opinions in this proceeding should trial be instituted, I reserve the right to reconsider the definition of a POSITA and arrive at my own conclusion.

VI. OVERVIEW OF THE STATE OF THE ART

23. I understand that the '736 patent arises from the deficiencies among audio monitoring and manipulation systems implemented among a variety of audiological environments. The '736 patent describes how “sound systems [are] designed to be used in a specific environment.” EX1001, 2:6-7. Audio quality and acoustic treatment, regardless of the environment, were typically “controlled, managed and manipulated by humans, and/or audio software and hardware.” EX1001, 2:17-19.

24. However, audio outputs within these systems could not be effectively managed due to “improper calibrations of signal propagation and signal degradation, as well as unwanted harmonics and soundwave reflections.” EX1001, 1:51-54. Accordingly, systems prior to the priority date of the '736 patent could not appropriately manage and manipulate sound in a manner that produced clear, high-fidelity output while prioritizing the hearing health of listeners. For example, to overcome crowd noise, performance sound was often “broadcast above 110 dB, the range where the volume of sound begins to pose danger to human listeners.”

EX1001, 2:8-11. Consequently, audio system operators found it “difficult to granularly control the loud perception of a given individual listener while managing loudness perception for the remainder of the audience.” EX1001, 2:11-14.

25. These issues are compounded in sound systems implemented in any venue or distributed settings. See EX1001, 1:64-2:2. Developments in the audio engineering field required that devices “be capable of incorporating new hardware and software to create new functions and applications such as sensing infrasonic, ultrasonic... and in some cases, autonomous manipulation of audio outputs.” EX1001, 2:26-32. As such, conventional systems lacked the modularity needed to implement audio manipulation functionality across an ecosystem of devices to address issues such as “unintelligible sounds and echoes” or environmental factors where “temperature gradients and wind can still steer sound in undesirable ways.” EX1001, 1:61-63.

VII. OVERVIEW OF THE '736 PATENT

26. **Overview of the System.** The '736 Patent, titled “Multi-Frequency Sensing Method and Apparatus Using Mobile-Based Clusters,” describes a system for sensing environmental phenomena (such as sound) and controlling audio outputs in real-time. EX1001, Title, Abstract. The system generally comprises an “a data source,” “at least one cluster” of computing devices with sensing

mechanisms, and “at least one output device.” *Id.* cl. 1.

27. **“Cluster” Architecture.** One feature of the '736 Patent is its reliance on “clusters.” The claims recites system including a cluster that includes “at least one computing device” equipped with a sound sensing mechanism and a wireless transceiver. *Id.* cl. 1.

28. The '736 specification distinguishes the “cluster” from the “output device” and the “data control source.” Figure 3 depicts devices that “sense audio signal energy within the confines of a single cluster and then sends data directly to a control unit and other clusters.” *Id.* at 13:6–10. In my opinion, this topology includes distinct architectural entities: a sensing node (the cluster) that gathers data and a separate control node that analyzes data across multiple points to vary the output of potentially separate output devices. *Id.* at 8:35–40.

29. **Frequency-Based, Not Amplitude-Based, Thresholds.** The '736 Patent claims a specific logic for sound threshold detection. It recites “determining if one or more of the one or more sounds includes a frequency outside of a predetermined threshold” and altering the sound so that the frequency does not fall outside that threshold. *Id.* cl. 1. Furthermore, Claim 6 specifies that this predetermined threshold “equates to a frequency determined to pose a risk of harm to a user’s hearing capabilities.” *Id.* cl. 6.

30. In my opinion, for this limitation, the system identifies a risk based

specifically on the *frequency* (pitch) of the sound, rather than its *amplitude* (loudness). The specification supports this by distinguishing between identifying “instruments and/or frequencies” (step 310) and manipulating “signal amplitude” (step 315) or controlling “dynamic range” (step 330). *Id.* at 13:62–14:1, 16:10–13, Fig. 5. As I will explain in my analysis of the prior art, this distinguishes the invention from references like Smith, which protect hearing by monitoring decibel levels (amplitude) rather than frequency-based risk thresholds.

31. **Specific Definition of “Panning.”** The '736 Patent also recites “panning the sensed noise” as a specific processing step. *Id.* cl. 8, 17. Specifically, the patent states: “At step 335, the audio is panned. That is, like frequencies in the sensed audio are separated.” *Id.* at 16:11–12; *see also id.* at 9:2-4 (describing the function of “separating like frequencies (panning)”). In my opinion, this idiosyncratic definition includes the separation of frequency components, not merely the spatial placement of sound types. This distinction is critical because prior art references that disclose spatial positioning (e.g., placing a voice in a stereo panorama as in DiCenso641) do not necessarily perform the “separating of like frequencies” recited by the '736 Patent’s specific definition of panning.

VIII. OVERVIEW OF THE APPLIED REFERENCES

32. I understand that Petitioner’s expert, Dr. Kyriakakis, relies on numerous references in his proposed obviousness grounds for the challenged

claims of the '736 patent. Two of those references are particularly relevant to my opinions provided in this Declaration: DiCenso641 (EX1005) and Smith (EX1006). I provide brief overviews of these references below.

A. DiCenso641 (U.S. Pub. No. 2015/0195641)

33. **Overview of the System.** DiCenso641 describes a “system and method for generating a user controllable auditory environment.” EX1005, Title. In my opinion, the reference is directed toward a consumer-grade “augmented reality audio experience” that allows a user to personalize their listening experience by selectively filtering specific types of sounds based on subjective preference. *Id.* ¶ 0087. The system comprises a “wearable device 130” (typically a pair of earpieces 134) and a mobile device 320 (e.g., a smartphone) that provides a user interface. *Id.* ¶¶ 0022, 0039.

34. **Separation-Based Signal Processing Architecture.** An important feature of DiCenso641 is its specific signal-processing workflow. DiCenso641 explicitly teaches a “separation-based” architecture. The reference criticizes traditional systems that “cancel or enhance the overall sound field,” and instead proposes a system that first separates the audio into discrete sound types before any modification occurs. *Id.* ¶ 0003.

35. Specifically, DiCenso641 teaches that the received ambient audio signal is processed by “**dividing the signal into a plurality of component signals**

each representing one of the plurality of types of sounds.” *Id.* ¶ 0007. It is my opinion that this division is an architectural prerequisite; the DSP 310 “separate[s] sounds or divide[s] signals,” and only *after* this separation does the system provide that “[e]ach sound type or group may be modified or manipulated.” *Id.* ¶ 0044; *see also id.* ¶ 0009 (claiming code to “separate the ambient audio signal into component signals ... [and] modify the component signals”). As I will explain in my analysis of Ground 1, this architecture destroys the aggregate environmental baseline required by other references (such as Smith) to perform full-spectrum analysis.

36. DiCenso641 relies on manual user inputs to determine how sounds are altered. The reference discloses a user interface (implemented on the mobile device) featuring “slider bars” and “checkboxes” that allow the user to specify preferences “on the fly.” *Id.* ¶¶ 0048-0049. For example, a user may manually slide a control to “cancel noise” or “lower voices.” *Id.* ¶ 0054.

37. In my opinion, DiCenso641 does not disclose a system that automatically determines if a frequency exceeds a threshold and alters it. Instead, modification in DiCenso641 is driven by subjective “user preferences” regarding what the user *chooses* to hear. *Id.* ¶ 0029 (“wearable device 130 cancels only the sound events that the user chooses not to hear”). The system modifies the signal “based on the corresponding user preference,” not based on an autonomous

determination of hearing risk. *Id.* ¶ 0042.

38. Architecturally, DiCenso641 describes the wearable device 130 as a system, typically comprising two earpieces 134 (a left and a right) that function as a unified stereo pair for a single user. *Id.* ¶ 0024. The system generates a “left signal” and a “right signal” to recreate a “stereo panorama” so that sounds appear in the correct spatial position relative to the user. *Id.* ¶¶ 0007, 0026.

39. It is my opinion that DiCenso641 describes these earpieces as a single logical component—the “wearable device”—communicating with the mobile device via a single wireless link 360. *Id.* ¶ 0039, Fig. 3. The reference does not describe the earpieces as architecturally distinct entities where one functions as a sensing mechanism and the other functions as a separate “output device” managed independently by a controller.

40. **Processing Distribution.** Finally, regarding the location of processing, DiCenso641 describes a bi-directional loop. An “unprocessed audio stream” may be sent from the wearable device to the mobile device for “additional processing power,” which is then returned to the wearable’s DSP 310. *Id.* ¶ 0039. However, the wearable’s DSP 310 retains the primary role of managing the identification and separation of sounds. *Id.* ¶ 0042 (“DSP 310 processes the signal... to identify...”).

B. Smith (U.S. Pub. No. 2014/0254842)

41. **Overview of the System.** Smith describes a system and method for “situational hearing enhancement and protection.” EX1006, Title. In my opinion, the reference is directed toward a tactical or industrial hearing device, such as those used by soldiers, police officers, or hunters, to manage high-noise environments involving “gunfire, explosions, [and] car motors” while preserving the intelligibility of speech and environmental cues. *Id.* ¶ 0019. The system generally comprises an earpiece 101 containing a microphone, a digital signal processor (DSP), and a speaker. *Id.* ¶ 0020.

42. **Aggregate, Full-Spectrum Analysis.** Smith relies on analyzing the acoustic environment as a whole aggregate signal. Smith explicitly teaches determining a “frequency spectrum of an environment” and using that holistic characterization (plus the use of sound signatures) to “modify an electronic signal to attenuate noise and to amplify information.” *Id.* ¶¶ 0006, 0019.

43. In my opinion, Smith’s hazard-detection logic is fundamentally dependent on this environmental baseline. Smith evaluates whether sounds are desirable or harmful by analyzing the “environmental noise frequency content” using Fourier analysis (e.g., FFT) on the digital audio signal. *Id.* ¶ 0108. By determining a “transient frequency spectrum of the environment,” Smith identifies the frequency content of short-lived impulse sounds (like gunshots) and attenuates

them relative to the broader environment. *Id.* ¶ 0114. Unlike DiCenso641, which separates sounds into sound types before modification, Smith operates on the combined signal to determine noise floors and transient behavior. As I will explain in my analysis of Ground 1, this aggregate analysis is technically distinct from, and often incompatible with, separation-based architectures that destroy the environmental baseline required for Smith’s detection logic.

44. Amplitude-Based, Not Frequency-Based, Protection Thresholds.

While Smith discusses frequency in the context of identifying noise signatures, its actual *safety* mechanisms are triggered by amplitude (loudness), not by the mere presence of a specific frequency. Smith teaches that hearing protection devices attempt to “attenuate excessive levels of ambient sound.” *Id.* ¶ 0003. Smith discusses using audiograms to attenuate frequencies associate with noise and amplify frequencies associate with information. Smith does mention creating synthetic audiograms as a means to generate to provide the target frequency spectrum for desired hearing enhancement and hearing protection. Audiograms are traditionally based on the following frequencies 125 Hz, 250 Hz, 500 Hz, 1000 Hz, 2000 Hz, 3000 Hz, 4000 Hz, 8000 Hz. EX2005, (<https://www.asha.org/public/hearing/audiogram/> and <https://www.ncbi.nlm.nih.gov/books/NBK578179/>). While the patent describes an embodiment with three frequency bands and another embodiment with a swatch of

frequency bands.

45. Specifically, Smith describes controlling the dynamic range of the sensed audio using compression or limiting. *Id.* ¶ 0093. The reference teaches that when the “signal amplitude reaches” a defined threshold or “knee” in the gain curve, the system reduces gain “to prevent damaging amplitudes from reaching the user’s ear drum.” *Id.* ¶ 0094. Similarly, Smith discusses attenuating “undesirable sounds above 100 dB” and limiting total output power so that the maximum “sound level” remains safe. *Id.* ¶¶ 0078, 0125. In my opinion, Smith does not disclose a “predetermined threshold” that equates to a *frequency* determined to pose a risk of harm (as recited by Claim 6). Instead, Smith discloses protecting the user from excessive *decibel levels*, regardless of the frequency.

46. **Handling of Inaudible Frequencies.** Smith also discloses detecting sounds outside the audible range, such as infrasound (below 20 Hz) or ultrasound (above 20 kHz). *Id.* ¶ 0026. However, Smith does not treat these frequencies as “hearing hazards” or “risks of harm” that trigger a safety cutoff. To the contrary, Smith teaches that these sounds “can be converted to the audible range for enhanced hearing.” *Id.* For example, ultrasound is “down converted in frequency to facilitate processing and/or human hearing.” *Id.*

47. It is my opinion that this teaches away from the claimed determining if a frequency poses a risk of harm and altering it to prevent that risk. Smith

actively *introduces* these frequencies to the user's perception for “enhancement,” rather than blocking them as hazardous. This further confirms that Smith’s protection logic is tied to amplitude (preventing damaging pressure levels), while its frequency processing is tied to intelligibility and enhancement.

IX. DETAILED DISCUSSION OF OPINIONS

48. For purposes of this Declaration, I have been asked to opine on certain positions taken by Petitioner and Dr. Kyriakakis. That I omit certain claims, claim elements, or presented grounds from my analysis should not be viewed as agreement that any claims or claim elements are obvious.

49. Upon considering the materials listed above and discussed herein, based on my extensive experience and education in the relevant art, in view of my understanding of the governing legal principles and the arguments presented in the Petition, I have formed the following opinions.

A. Dr. Kyriakakis and the Petition fail to show that DiCenso641 discloses the claimed system topology of a distinct “cluster” and “output device” managed separately.

50. Claim 1 recites “at least one cluster” comprising a computing device with a sound sensing mechanism, and a separate “at least one output device” that includes a speaker. EX1001, cl. 1. The claim further recites that the data control source be in electronic communication with *both* the cluster and the output device to vary the output of the output device. *Id.* In my opinion, this recites a system in

which sensing nodes (clusters) and output nodes are architecturally distinct entities.

51. It is my opinion that the Petition fails to demonstrate this topology because it relies on an arbitrary and technically unsupported subdivision of DiCenso641's single wearable device. The Petition identifies DiCenso641's "a pair of earpiece" as the claimed "cluster" and the "second earpiece" as the claimed "output device." Pet., 13-14, 20. However, DiCenso641 describes these earpieces as a pair forming a single "wearable device 130" that functions as a unified stereo system for a single user. EX1005, ¶ 0026 ("[T]he system can optimize the stereo panorama...").

52. DiCenso641 describes a system where two speakers work as a pair to recreate a stereo panorama. It does not describe a "cluster" of sensing devices sends data to an control unit that subsequently performs analysis across distinct devices. By the pair of earbuds to the "cluster" and the right earbud to the "output device," the Petition creates a false distinction. In my opinion, a POSITA would understand DiCenso641's earbuds to function as a single logical peripheral (the wearable), not as the cluster and output components recited by the claim.

B. Dr. Kyriakakis and the Petition fail to show that DiCenso641 discloses the claimed "Electronic Bus" under the proper construction of the term.

53. Independent Claim 1 recites that each computing device within the cluster include "an electronic bus which is configured to transmit and receive data

from the data source.” EX1001, cl. 1. Although the specification does not expressly define the term “electronic bus,” it is my opinion that a POSITA at the time of the invention would have understood an “electronic bus” to be a well-known hardware construct referring to an internal data pathway used to transfer data between components *within* a computing device, such as a processor, memory, sensing mechanisms, and peripheral interfaces. In computer architecture, a “bus” is a recognized term of art denoting a shared communication structure within a device, rather than a general reference to any mechanism capable of transmitting data.

54. At the time of the invention, an electronic bus was commonly implemented as a wired communication medium, using conductors, traces, and associated signaling protocols to enable bidirectional data transfer among internal components of a computing device. Such buses serve as internal conduits over which data is routed to and from functional elements, including interfaces that may themselves support external communications. This understanding reflects the conventional and ordinary meaning of “bus” in the relevant technical field.

55. **The Specification Distinguishes Electronic Buses from Wireless Transceivers.** While the ’736 patent does not use the phrase “electronic bus” elsewhere in the specification, it separately and expressly describes wireless communication components. For example, the specification explains that

computing devices may “include one or more wireless transceivers” used to “wirelessly share sensed data with each other” and with an “audio control source.” EX1001, 11:63-65, 13:9-13.

56. In my opinion, these disclosures concern external communication interfaces operating over wireless channels, not internal data pathways. Nothing in the specification equates a wireless transceiver with an electronic bus, suggests that the bus itself operates wirelessly, or indicates that the term “electronic bus” was intended to encompass over-the-air communication links. To the contrary, the specification’s separate treatment of wireless transceivers confirms that they are distinct architectural components from any internal bus structure.

57. **Claim Structure Confirms the Distinction.** The claim structure further supports this distinction. Claim 1 recites the electronic bus as a structural component of the computing device itself, configured to transmit and receive data from the data source. Dependent claims then separately add wireless communication capabilities using “further comprising” language. *See, e.g.*, EX1001, cls. 2, 25-26.

58. This claim hierarchy reflects a system architecture in which internal data movement is handled by an electronic bus, while wireless communication is an optional, additional feature layered onto the base system. For example, dependent Claim 25 recites “further comprising: a transmission medium

comprising a wireless transceiver.” EX1001, cl. 25. If the “electronic bus” of Claim 1 already encompassed a wireless transceiver as the Petition suggests, the dependent claims expressly reciting wireless transmission mechanisms would be rendered redundant or superfluous, contrary to established principles of claim differentiation.

59. **Application to the Petition.** The Petition fails to address this distinction. Dr. Kyriakakis asserts, without technical support or analysis of the intrinsic record, that a POSITA would understand “an electronic bus” to encompass a wireless transceiver. Pet., 20-21; EX1002, ¶ 85. Based on this unsupported assertion, the Petition maps the claimed “electronic bus” to *DiCenso641*’s wireless communication link (e.g., Bluetooth or Wi-Fi) between the earpiece and the mobile device. Pet., 20–21.

60. I disagree with this mapping. *DiCenso641* discloses that the wearable device is “equipped with wireless communication (integrated Bluetooth or Wi-Fi)” to connect to external sources. EX1005, ¶ 0025. This is an external radio link, not an internal electronic bus. By mapping an external wireless transmission standard to a term of art describing internal computer architecture, and by ignoring the intrinsic evidence distinguishing the bus from the transceiver, the Petition fails to show that the prior art discloses the specific structural limitation recited in Claim 1.

C. Dr. Kyriakakis and the Petition fail to present a coherent system mapping for Claim 1, relying on mutually exclusive processing states for the same audio stream.

61. **Incoherent System Mapping.** It is my opinion that the Petition's mapping of DiCenso641 to Independent Claim 1 is technically incoherent because it relies on two mutually exclusive factual descriptions of how DiCenso641's audio is processed to satisfy different limitations of the same claim. In my opinion, the Petition toggles between distinct, incompatible embodiments found in different sections of the DiCenso641 specification.

62. **The "Data Source" and "Bus" Theory Requires an Unprocessed Stream.** On one hand, to satisfy the "data source" (1[a]) and "electronic bus" (1[c][ii]) limitations, the Petition relies expressly on DiCenso641's offloading embodiment. Specifically, Dr. Kyriakakis and the Petition cite DiCenso641's disclosure that "an **unprocessed audio stream** may be sent to mobile device 320, which processes the audio stream and sends this modified audio stream back to DSP 310." Pet., 18-19, 20-21 (citing EX1005, ¶ 0039); EX1002, ¶ 84. The Petition's theory for the "electronic bus" depends on the specific factual premise that the audio leaving the wearable device via the wireless transceiver is raw and "unprocessed" so that the mobile device can provide the necessary "additional processing power." Pet., 20; EX1005, ¶ 0039.

63. **The "Processor" Theory Requires Local Isolation (Processing).**

On the other hand, to satisfy the “processor” limitations (1[e]), the Petition abandons the mobile device offloading theory and points back to the wearable device’s internal DSP 310. The Petition argues that “DSP 310 processes the signal... to identify” sounds (1[e][i]) and “DSP 310 may separate sounds or divide signals” to isolate them (1[e][ii]). Pet., 24-25 (citing EX1005, ¶¶ 0042, 0044); EX1002, ¶¶ 105, 110. Under this mapping, the wearable DSP 310 is the component actively performing the separation and isolation of sound objects locally, before modification occurs.

64. **Technical Contradiction.** In my opinion, these positions are technically irreconcilable within a single system configuration.

65. **Scenario A:** If the wearable DSP 310 performs the identifying and isolating functions locally as mapped for Claim 1[e], then the audio stream leaving the wearable is no longer “unprocessed.” DiCenso641 teaches that the DSP “separates sounds” or “divides signals into a plurality of component signals.” EX1005, ¶¶ 0009, 0044. If this substantial signal processing and separation occurs locally at the DSP (as Dr. Kyriakakis asserts for element 1[e]), the stream transmitted to the mobile device cannot be the “unprocessed audio stream” relied upon for the “bus” and “data source” limitations in elements 1[a] and 1[c][ii].

66. **Scenario B:** Conversely, if the stream sent to the mobile device is truly “unprocessed” (as required for the Petition’s “data source” and “bus”

mapping), then the local DSP 310 has not yet performed the identifying and isolating steps required by Claim 1[e]. The wearable cannot simultaneously transmit raw, unprocessed audio (implying no local analysis) and claim to have already isolated and identified specific sound objects within that same stream.

67. The Petition never explains how these distinct embodiments—one sending raw audio out for external processing, and one processing audio locally—combine into a single operable system. It is my opinion that the Petition impermissibly picks and chooses between incompatible processing states to stitch together a claim mapping. There is no disclosure in DiCenso641 suggesting that the same audio stream can be both “unprocessed” for transmission to a data source and simultaneously “isolated” and “identified” by the local processor.

D. Dr. Kyriakakis and the Petition fail to establish a motivation to combine DiCenso641 and Smith or a reasonable expectation of success from such combination because DiCenso641 and Smith rely on fundamentally incompatible signal-processing architectures.

68. Independent Claims 1 and 11 recite the following functions: identifying sounds within noise, isolating those sounds, determining if they exceed a frequency threshold, and altering them. EX1001, cls. 1, 11. It is my opinion that the Petition fails to demonstrate that a POSITA would have been motivated to combine DiCenso641 and Smith to perform these functions, or would have had a reasonable expectation of success in making such a combination. The Petition assumes, without technical analysis, that the processing taught by DiCenso641 can

simply be overlaid with the processing taught by Smith. In my opinion, this ignores the fact that the references rely on materially different and mutually destructive signal-processing models.

69. Smith **relies on full-spectrum environmental analysis**. It is my opinion that Smith's system is designed to enhance hearing and provide protection by first characterizing the acoustic environment as a whole aggregate signal. Smith teaches determining a "frequency spectrum of an environment" and using that holistic characterization to "modify an electronic signal to attenuate noise and to amplify information." EX1006, Abstract, ¶ 0006.

70. Critically, Smith's hazard-detection logic depends on this environmental baseline. Smith evaluates whether sounds pose a risk or are undesirable by comparing frequency-based gain levels against noise floors derived from the surrounding acoustic environment. EX1006, ¶¶ 0080-0081. For example, Smith uses "frequency-specific compression" to manage "acoustic transients and nominal acoustic signature[s] to within predetermined limits." *Id.* By determining a "transient frequency spectrum of the environment," Smith identifies the frequency content of short-lived impulse sounds (e.g., gunshots) and attenuates them relative to the broader environment. *Id.* ¶¶ 0114-0116. A POSITA would understand that Smith's determination of noise floors, transient behavior, and risk of harm arises from comparisons across the unseparated, full-spectrum signal, not from analysis

of pre-separated sound types.

71. DiCenso641 **uses a separation-based architecture**. In direct contrast, DiCenso641 is built around a separation-based signal-processing pipeline. DiCenso641 expressly teaches that the ambient audio is first separated into component signals *before* any manipulation occurs. The reference states that the received ambient audio signal is processed by “dividing the signal into a plurality of component signals each representing one of the plurality of types of sounds.” EX1005, ¶ 0007.

72. In my opinion, DiCenso641 establishes separation as a rigid architectural prerequisite. The DSP “may separate sounds or divide signals associated with particular sounds,” and only after this division does the system provide that “[e]ach sound type or group may be modified or manipulated.” EX1005, ¶ 0044. This allows the system to selectively adjust individual component signals by “attenuating . . . amplifying . . . equalizing . . . [or] cancelling the component signal.” *Id.* ¶ 0007. As I noted previously, DiCenso641 explicitly contrasts this approach with conventional systems that operate on the “overall sound field.” *Id.* ¶ 0003.

73. DiCenso641 makes clear that separation precedes manipulation as a matter of architectural design. DiCenso641 describes the signal-processing flow as one in which the DSP “may separate sounds or divide signals associated with

particular sounds,” after which “[e]ach sound type or group may be modified or manipulated.” EX1005, ¶ 0044. In my opinion, this disclosure identifies the separation or division of signals as a prerequisite step that must occur before any attenuation, amplification, cancellation, or other sound modification is applied.

74. Consistent with this separation-based, sound-type-oriented signal-processing approach, DiCenso641 teaches that modification is performed on a per-sound basis. The system selectively adjusts individual component signals by “attenuating the component signal, amplifying the component signal, equalizing the component signal, [and/or] cancelling the component signal,” depending on the type of sound and the user’s selected preferences. EX1005, ¶ 0007; see also *id.*, cl. 10. It is my opinion that under this architecture, each sound type is treated independently, allowing different processing techniques to be applied to different sound types within the same ambient environment, distinct from aggregate environmental processing.

75. DiCenso641 further confirms that its architecture is built around a three-stage workflow: separation, modification, and recombination. The system executes code to “separate the ambient audio signal into component signals,” “modify the component signals,” and then “combine the component signals after modification to generate an output signal.” EX1005, ¶ 0009; *see also id.*, cl. 23. In my opinion, under this approach, the original ambient signal does not persist as a

unified entity during processing; it is replaced by a collection of discrete sound types that are independently manipulated and then recomposed into an output.

76. Accordingly, it is my opinion that DiCenso641’s signal-processing logic operates exclusively at the sound type level. Sound modification is expressly performed on isolated component signals, not on a combined, environmental frequency spectrum, and only after the ambient signal has been segmented into discrete sound types. This separation-based architecture is central to DiCenso641’s design and stands in sharp contrast to approaches, such as *Smith*, that rely on evaluating frequencies relative to an aggregate environmental baseline.

77. DiCenso641 explicitly contrasts its approach with “aggregate” processing. DiCenso641 distinguishes its invention from prior art systems by noting that traditional methods operate on the entire environmental signal indiscriminately, whereas its system operates selectively on separated sounds. DiCenso641 states: “Noise cancelling systems usually cancel or enhance the overall sound field, but do not distinguish between various types of sounds or sound events. . . . In contrast . . . wearable device 130 cancels only the sound events that the user chooses not to hear . . .” EX1005, ¶ 0003; *see also* id. ¶ 0029 (reiterating the contrast with systems that “attempt to reduce any/all noise”).

78. **The architectures are technically incompatible: Frequency-Based vs. Time-Based.** It is my opinion that the Petition fails to account for the

fundamental technical incompatibility between the signal processing architectures of Smith and DiCenso641. Smith relies on a frequency-domain analysis of the aggregate environment. Smith discloses utilizing Fast Fourier Transforms (FFT) to identify energy across the spectrum that may be associated with multiple different sounds simultaneously. EX1006, ¶¶ 0043, 0050. This approach evaluates the “frequency spectrum of the environment” to apply global modifications, such as compression or attenuation, based on the total energy present in specific frequency bands.

79. In contrast, *DiCenso641* relies on a **time-based separation logic**. As I noted in my review of the technical disclosures, *DiCenso641* identifies specific sound types and utilizes techniques similar to active noise cancellation, generating signals with inverted phase to cancel them individually. EX1005, ¶ 0037. This process depends on precise time-domain alignment to create destructive interference for specific isolated sound objects. In my opinion, these methods are not merely different; they are destructive to one another when combined in a single signal path.

80. Combining these creates a fundamental technical contradiction:

81. **Scenario A (Smith First):** Smith’s broad-spectrum processing occurs first, it utilizes non-linear compression algorithms to manage acoustic transients. EX1006, ¶ 0094. From a signal processing perspective, this compression

fundamentally alters the amplitude characteristics (dynamic range) of the waveform. If this amplitude-modified signal is then passed to DiCenso641, the phase-cancellation logic will fail. DiCenso641 relies on destructive interference, which requires generating an inverse signal having not only opposite phase but also "[s]ubstantially equal amplitude" to the target sound. EX1005, Claim 12; see also ¶ 0029. Because Smith's compression dynamically alters the amplitude profile of the sound, the signal no longer matches the amplitude of the inverted waveform generated by DiCenso641, preventing the precise cancellation of specific sound types..

82. **Scenario B (DiCenso First):** If DiCenso641's separation step occurs first (as the Petition suggests), the aggregate frequency spectrum required for Smith's thresholding and compression logic is destroyed. Smith requires the full environmental context to determine noise floors and distinguish transients. EX1006, ¶ 0114. If the signal is pre-separated into isolated components, Smith's algorithms are rendered inoperable because the aggregate baseline against which they calculate attenuation no longer exists.

83. **Conclusion:** Incorporating DiCenso641 into Smith's processing system or vice versa would create distorted, unpredictable outputs rather than the claimed result.

84. Therefore, it is my opinion that there is no sequencing in which both

references can operate as disclosed. One reference's required processing step necessarily disables the other's core functionality. Because the Petition offers only conclusory assertions and fails to explain how a POSITA would reconcile these fundamental architectural conflicts, it fails to establish a motivation to combine or a reasonable expectation of success.

E. Dr. Kyriakakis and the Petition fail to show that the cited references disclose a “predetermined threshold” that equates to a frequency determined to pose a risk of harm to a user’s hearing capabilities (Claims 6 and 15).

85. Dependent Claims 6 and 15 recite that the “predetermined threshold equates to a frequency determined to pose a risk of harm to a user’s hearing capabilities.” EX1001, cls. 6, 15. In my opinion, this limitation expressly ties the control threshold to a determination of *risk* associated with a specific *frequency*, rather than merely audibility, user preference, or general sound pressure level (amplitude).

86. It is my opinion that the Petition’s Ground 1 (combining DiCenso641 and Smith) fails to satisfy this limitation because neither reference discloses a system that determines a harmful frequency and uses that specific determination as a control threshold. Instead, the Petition conflates background knowledge about frequencies (citing Wiernicki (EX1013)) with what the prior art systems actually use operationally.

87. Regarding DiCenso641, it is my opinion that this reference does not

disclose determining or applying a frequency-based threshold for safety purposes.

DiCenso641 is primarily concerned with the personalization of an auditory environment based on received “user preferences,” allowing a user to select subjective levels such as “low,” “real,” or “loud” for different sound categories.

EX1005, ¶¶ 0019, 0049. Nothing in DiCenso641 identifies a specific frequency as posing a risk of harm that the system itself evaluates and uses as a threshold for control logic.

88. Furthermore, I disagree with the Petition’s suggestion that DiCenso641’s handling of ultrasonic frequencies satisfies this limitation. DiCenso641 describes detecting sounds outside the human audible range and down-converting those sounds so they may be perceived by the user. If frequencies above 20 kHz were treated by the DiCenso641 system as “hearing hazards” or “risks of harm” (as Claim 6 recites), a system designed for protection would be expected to attenuate, suppress, or block those frequencies. Instead, DiCenso641 preserves this content and converts it into the audible range for delivery to the user. In my opinion, this behavior confirms that DiCenso641’s sound check is directed to perceptibility and enhancement, not a threshold-driven safety control based on frequency risk.

89. Regarding Smith, it is my opinion that the Petition fails to satisfy this limitation because Smith’s detection logic relies on monitoring signal amplitude

(sound pressure levels), even when that monitoring is performed across frequency bands. While Smith utilizes frequency analysis—specifically “synthetic audiograms” and Fast Fourier Transforms (FFT)—to characterize the environment and improve intelligibility (EX1006, ¶¶0043, 0066), its mechanism for preventing harm is triggered by excessive amplitude. Stated differently, although Smith discusses frequency bands in the context of audiograms (to enhance clarity), those discussions relate to improving audibility or selectively attenuating noise sources for intelligibility, not to the system determining that a specific frequency itself poses a risk of harm and using that frequency as a trigger for control.

90. For example, Smith teaches that hearing protection devices attempt to “attenuate excessive levels of ambient sound.” EX1006, ¶ 0003. Smith employs compression curves where, “[w]hen the signal amplitude reaches a defined threshold or ‘knee’ . . . the gain can be slowly reduced to prevent damaging amplitudes from reaching the user’s ear drum.” EX1006, ¶ 0094. Although Smith applies this compression in a “frequency-specific” manner (*Id.*, ¶ 0081), the threshold being evaluated to trigger protection is the decibel level (amplitude) of that frequency band, not the frequency itself. A system that limits volume at 3kHz to avoid damage is technically distinct from a system that identifies 3kHz itself as a “frequency outside of a predetermined threshold” posing a risk of harm.

91. Furthermore, regarding frequencies that are actually “outside”

standard thresholds (e.g., ultrasound above 20 kHz), Smith does not treat them as “risks of harm” to be blocked. Instead, Smith teaches that such sounds “can be converted to the audible range for enhanced hearing.” EX1006, ¶ 0026. If the frequency itself were the threshold for harm (as Claim 6 implies for hazard detection), a protective system would likely attenuate or eliminate it. Smith does the opposite: it processes these frequencies to make them perceptible to the user. This confirms that Smith’s protection logic is driven by amplitude limits (preventing loud noises like gunshots), while its frequency processing is driven by enhancement and intelligibility, failing to teach the specific limitation of determining a frequency-based safety threshold.

92. Finally, I note that the Petition attempts to bridge this gap by relying on *Wiernicki* (EX1013), a reference not asserted in any Ground, to assert that a POSITA would know that frequencies above 20 kHz pose a risk of hearing harm. Pet., 42-43. In my opinion, this reliance on extraneous evidence confirms that the applied references (DiCenso641 and Smith) do not themselves disclose the limitation. Even if a POSITA knew that ultrasonic frequencies could be harmful, that general knowledge does not alter the fact that the specific systems disclosed in DiCenso641 and Smith do not contain the logic to determine a frequency-based risk threshold and apply it. DiCenso641 down-converts such frequencies for listening, and Smith attenuates based on amplitude. Therefore, the claimed

functionality is not inherent or obvious from the prior art systems themselves.

F. Dr. Kyriakakis and the Petition fail to show that the prior art teaches the specific notification, auto-adjustment, and signal processing limitations recited in the dependent claims.

93. Claims 7 and 16 (Notification of Frequency Outside Threshold).

Dependent Claims 7 and 16 recite “notifying a user... that one or more of the one or more sounds includes the frequency outside of the predetermined threshold.”

EX1001, cls. 7, 16. In my opinion, the Petition fails to satisfy this limitation because neither Smith nor DiCenso641 discloses a system that generates a notification responsive to the specific determination that a frequency threshold has been violated.

94. It is my opinion that Dr. Kyriakakis conflates audibility substitution with the claimed threshold violation notification. The Petition relies on Smith’s disclosure that inaudible sounds may be “replaced with other sounds, such as a warning.” EX1002, ¶¶ 60, 271 (citing EX1006, ¶ 0027). However, Smith describes substituting inaudible sounds (e.g., ultrasound) so they can be perceived by the user, or providing a voice identification of a specific sound signature (e.g., “handgun being cocked”). EX1006, ¶ 0027. This is technically distinct from the claimed invention, which evaluates a frequency against a predetermined threshold and notifies the user of that specific threshold violation. Similarly, DiCenso641 discloses user-configured sound modification, such as amplification, cancellation,

or replacement, based on sound type and user preference, not alerting a user to the presence of an out-of-range frequency. EX1005, ¶¶ 0028, 0033.

95. Furthermore, I note that the Petition relies on the '736 patent itself to explain what the alleged alert would be and how it would operate, rather than identifying the teaching in the prior art. Pet., 157, which in my opinion highlights the fact that the '906 patent is being used to supply missing teachings in the prior art and the prior art does not actually disclose the limitation.

96. **Claim 9 (Auto-Adjustment Based on Signal Energy).** Claim 9 recites an in-ear device where output “auto-adjusts based on signal energy sensed within a cluster or surrounding clusters.” EX1001, cl. 9.

97. The Petition attempts to map this to DiCenso641's user preference settings. Pet., 50. I disagree with this technical mapping because the Petition conflates manual user selection with autonomous signal energy-based adjustment. DiCenso641 repeatedly characterizes its system as being “personalized or customized in response to user preferences,” utilizing manual interface tools like “slider bars” to select levels such as “low,” “real,” or “loud.” EX1005, ¶¶ 0019, 0049. In my opinion, an adjustment driven by a user manually sliding a bar on a smartphone screen is fundamentally different from a system that “auto-adjusts” based on “signal energy sensed.” DiCenso641's adjustments are driven by subjective user choice, not by the objective measurement of signal energy. Using

sensors to automatically alter sound parameters (as in the '736 patent) is not taught by DiCenso641, which relies on the user to define what is "too loud" or "undesirable" via the UI.

98. Additionally, the Petition fails to identify the “cluster” aspect of this claim. As I opined previously regarding Claim 1, DiCenso641 describes earpieces capturing sound from the user’s immediate vicinity. It is my opinion that the Petition fails to identify any disclosure in DiCenso641 of this cluster-based sensing architecture. The Petition relies on DiCenso641’s “pair of earpieces 134” to satisfy the “cluster” limitation. Pet., 13. However, DiCenso641 describes these earpieces as a unified wearable device that captures sound solely from the user’s immediate vicinity to generate a “stereo panorama” for that specific user. EX1005, ¶ 0026. I found no disclosure in DiCenso641 of a system that senses signal energy within a “cluster,” nor any teaching of sensing energy from “surrounding clusters” and using that energy data to coordinate output adjustments.

99. Although the Petition treats DiCenso641’s pair of earpieces as a “cluster,” it identifies no mechanism by which the device adjusts its output based on energy data aggregated from other, distinct sensing nodes as taught in the ’736 patent. DiCenso641 describes a personal system where the “stereo panorama” is reconstructed based on the user’s head position and local microphone input. EX1005, ¶ 0026. DiCenso641 does not disclose sensing signal energy across

clusters or coordinating output adjustments based on measurements from “surrounding clusters.” Instead, DiCenso641’s adjustments are driven by local sensors and manual user preferences (e.g., sliders), failing to teach the inter-cluster signal energy logic required by the claim.

100. Furthermore, Smith does not cure this deficiency. The Petition relies on Smith for its teaching regarding environmental noise signatures. Pet., 68. However, Smith focuses on processing signals to compensate for hearing loss or to attenuate noise according to an “environmental noise signature” to protect the individual wearer. EX1006, ¶ 0005. Smith does not disclose auto-adjusting an in-ear device based on signal energy sensed within a “cluster or surrounding clusters,” nor does it disclose the cluster-based sensing architecture.

101. **Claims 10 and 20 (Automatic vs. User-Driven Alteration).** Claims 10 and 20 recite that the altering of sounds be “performed automatically.” EX1001, cls. 10, 20. It is my opinion that the Petition advances internally inconsistent theories to satisfy this limitation. To meet the claimed “automatic,” the Petition argues that the microprocessor executes code without human intervention. Pet., 51–52. However, to satisfy the “altering” limitation itself, the Petition relies on DiCenso641’s manual user controls (slider bars, checkboxes, gestures).

102. From a technical perspective, these positions are irreconcilable. DiCenso641 explicitly teaches that sound modification is effectuated through

manual inputs—users must actively manipulate slider bars or draw gestures (e.g., a “V” for voices) to dictate how sounds are altered. EX1005, ¶¶ 0049, 0056. A system where the alteration logic waits for and depends upon specific user input “on the fly” is not performing the alteration “automatically” based on a predetermined frequency threshold as recited by the claim. The alteration in DiCenso641 is the result of user choice, not autonomous system logic.

103. Furthermore, the Petition fails to identify any system-determined decision-making in the prior art that replaces this user input. The alleged “automation” identified by Dr. Kyriakakis is merely the processor executing the settings previously chosen by the user. In my opinion, this conflates electronic execution with automatic determination. In DiCenso641, the processor is not autonomously determining when or how sounds should be altered based on a frequency threshold; it is serving as dependent to the user's manual preferences. EX1005, ¶ 0019 (system is “customized in response to user preferences”). Because the Petition relies on user control to establish the act of altering, but asserts a lack of user involvement to establish the “automatic” nature of that act, it fails to teach the specific limitation of Claim 10 where the system itself automatically alters sound to ensure a frequency does not fall outside a predetermined threshold.

104. **Claim 17 (Panning the Sensed Noise).** Claim 17 recites “panning the sensed noise.” EX1001, cl. 17. I understand the patent to describe it “as the

specific process of panning of a frequency band. In my opinion, the '736 patent defines “panning” as the specific process of “separating like frequencies.” EX1001, 9:2-4 (“separating like frequencies (panning)”); 16:12–13 (“At step 335, the audio is panned. That is, like frequencies in the sensed audio are separated.”). I disagree with the Petition’s assertion that DiCenso641 teaches this limitation, as the Petition relies on conflating distinct signal processing concepts, specifically “filtering” and “spatial placement,” with the specific definition of panning recited by the claim.

105. The Petition argues that DiCenso641 discloses panning because it describes generating left and right signals to place sounds in a "stereo panorama." Pet., 49; EX1005, ¶¶ 0007, 0026. However, DiCenso641 describes an sound-type-oriented architecture where the received signal is first "divid[ed] . . . into a plurality of component signals," and it is these separated component signals (e.g., a specific voice type) that are spatially placed based on user preference. EX1005, ¶ 0007. In my opinion, this is technically distinct from "panning the sensed noise" as recited in the claim. DiCenso641 deconstructs the auditory scene into separate sound types and reconstructs it based on user selection; it does not perform the automated separation of like frequencies within the raw "sensed noise" signal itself to pan that noise across outputs as contemplated by the '736 patent.

106. DiCenso641 describes reconstructing the "stereo panorama" to place

sounds in a spatial location. EX1005, ¶0026. In audio engineering, spatial panning is an algorithm based on the Summing Localization Phenomenon, where sounds are placed between speakers by manipulating the ratio of power (amplitude) between channels. This is a spatial manipulation of an audio object. It is distinctly different from the '736 patent's definition of "separating like frequencies," which implies a spectral decomposition or filtering operation. DiCenso641 manipulates the location of the sound, whereas the claimed invention requires the separation of frequencies within the sensed noise itself.

107. Furthermore, the Petition acknowledges the patent's definition of panning as "separating like frequencies" but attempts to satisfy it by arguing that DiCenso641's use of filters constitutes panning because "filtering involves frequency separation." Pet., 46-47. I technically disagree with this characterization. In audio signal processing, "filtering" (used in DiCenso641 to attenuate or cancel specific sounds like traffic noise) is a distinct operation from "panning." Filtering modifies the energy of a set of frequencies and their respective phase to attenuate or enhance content. The fundamental algorithms of filtering are based on a single mono array of audio data. Panning is the algorithms across multiple output channels (stereo, surround sound, 3D speaker arrangement). EX1005, ¶ 0028 (listing filtering and selective attenuation as functions to "enhance a sound," distinct from spatial positioning). By conflating the attenuation of noise

(filtering) with the spatial separation of frequencies (panning), the Petition fails to identify a precise teaching of the claimed limitation in the prior art.

G. Dr. Kyriakakis and the Petition fail to identify the claimed “Interfacing Mechanism” in Claims 2 and 12.

108. **Claims 2 and 12 (Interfacing Mechanism).** Claims 2 and 12 recite an “interfacing mechanism” that includes a “network adapter” (capable of wired and wireless communication) and an “input mechanism” configured to manipulate the interfacing mechanism to vary the output. EX1001, cls. 2, 12.

109. It is my opinion that the Petition fails to identify a prior art disclosure corresponding to the claimed interfacing mechanism. Instead, the Petition improperly collapses the claim elements into a generic “User Interface.” The Petition maps DiCenso641’s mobile software UI (UI 324) to the “interfacing mechanism” generally, and then relies on a different prior art reference, *Holland*, to supply the physical “network adapter.” Pet., 58. By reading the term “interfacing mechanism” to mean “any UI,” the Petition untethers the claim language from the specific recitation that the input mechanism manipulates the interfacing mechanism (which includes the adapter) to vary output.

110. Regarding DiCenso641, it is my opinion that its disclosure is limited to software-level preference selection. DiCenso641 teaches that “the user interface gives the user the ability to set auditory preferences on the fly,” utilizing “slider bars 510, 520, 530, and 540” or checkboxes to update variables in memory.

EX1005, ¶¶ 0048-0049. DiCenso641 does not disclose a network adapter as a specific component of the mechanism being manipulated by these sliders. The user interaction in DiCenso641 manipulates software controls, not the interfacing mechanism itself.

111. Regarding Holland, the Petition relies on this reference to supply the “network adapter” limitation (Pet., 58), but Holland fails to bridge the functional gap. *Holland* describes a network adapter only as a means to couple an electronic system to a network for downloading content. EX1007, ¶ 0162. *Holland* teaches content delivery, not control. It does not disclose an input mechanism that manipulates that specific interfacing mechanism (with the adapter) to vary the output of a separate output device.

112. By piecing together a software UI from DiCenso641 and a physical network component from *Holland*, the Petition relies on a role-splitting approach that fails to show the claimed functional relationship: an input mechanism that manipulates the interfacing mechanism (including the adapter) to vary output. The Petition never explains how DiCenso641’s software sliders or *Smith*’s user selections manipulate *Holland*’s network adapter to vary the output of the output device. Therefore, the combination fails to teach the specific structural and functional limitations of Claims 2 and 12.

X. CONCLUSION

113. In signing this Declaration, I recognize that the Declaration will be filed as evidence in an *inter partes* review before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject to cross-examination in the case and that cross-examination will take place within the United States. If cross-examination is required, I will appear for cross-examination within the United States during the time allotted.

114. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

115. Executed on this 17th day of February, 2026, in Raleigh, North Carolina, USA.



Justin D. Mathew, PhD