

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

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

Petitioners

v.

ZOPHONOS INC.,

Patent Owner

Case IPR2026-00084

U.S. Patent No. 11,204,736

**DECLARATION OF CHRIS KYRIAKAKIS, PH.D.
IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 11,204,736**

Samsung v. Zophonos IPR2026-00084 Exhibit 1002
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TABLE OF CONTENTS

I.	INTRODUCTION	1
II.	BACKGROUND AND QUALIFICATIONS	1
	A. Relevant Academic Experience	2
	B. Relevant Professional Experience	4
III.	MATERIALS REVIEWED	7
IV.	LEVEL OF ORDINARY SKILL IN THE ART	10
V.	RELEVANT LEGAL STANDARDS	11
VI.	SUMMARY OF OPINIONS	17
VII.	OVERVIEW OF THE '736 PATENT	17
	A. The Specification	17
	B. Prosecution History	20
	1. The '736 Patent	20
	C. The Claims	22
VIII.	OVERVIEW OF THE PRIOR ART	31
	A. <i>DiCenso641</i> (Ex. 1005)	36
	B. <i>Smith</i> (Ex. 1006)	39
IX.	CLAIM CONSTRUCTION	41
X.	SPECIFIC GROUNDS FOR CHALLENGE	41
	A. Ground 1A: <i>DiCenso641</i> and <i>Smith</i> Render Obvious Claims 1, 4-11, 13-20, and 25-28	43
	1. Claim 1	43

a.	“A system comprising:”	43
b.	“a data source;”	43
c.	“at least one cluster of at least one computing device,”	45
d.	“the at least one computing device including: a sound sensing mechanism, configured to sense a noise; and an electronic bus which is configured to transmit and receive data from the data source, wherein the data source is in electronic communication with the at least one cluster and at least one output device;”	49
	(i) “sound sensing mechanism, configured to sense a noise”	49
	(ii) “an electronic bus which is configured to transmit and receive data from the data source,”	50
	(iii) “wherein the data source is in electronic communication with the at least one cluster and at least one output device;”	56
e.	“a memory, containing computer-executable instructions; and”	57
f.	“a processor configured to execute the computer-executable instructions to cause the processor to perform functions including:”	58
	(i) “identifying one or more sounds within the noise;”	59
	(ii) “isolating the one or more sounds;”	60
	(iii) “determining if one or more of the isolated one or more sounds includes a frequency outside of a predetermined threshold.”	62
2.	Claim 4	69

a.	“The system as recited in claim 1, wherein the sound-sensing mechanism is selected from the group consisting of: an ultrasonic transducer; an infrasonic transducer; and a microwave transducer.”	69
3.	Claim 5	71
a.	“The system as recited in claim 4, wherein the sensed noise includes infrasonic or ultrasonic soundwaves.”	71
4.	Claim 6	72
a.	“The system as recited in claim 1, wherein the predetermined threshold equates to a frequency determined to pose a risk of harm to a user’s hearing capabilities.”	72
5.	Claim 7	74
a.	“The system as recited in claim 1, wherein the computer-executable instructions further include: if one or more of the isolated one or more sounds includes the frequency outside of the predetermined threshold, notifying a user, via a notification, that one or more of the one or more sounds includes the frequency outside of the predetermined threshold.”	74
6.	Claim 8	77
a.	“The system as recited in claim 1, wherein the computer-executable instructions further include steps selected from the group consisting of: panning the sensed noise; and equalizing the sensed noise.”	77
7.	Claim 9	82

a.	“The system as recited in claim 1, further comprising: an in-ear device, wherein an audio output of the in-ear device auto-adjusts based on signal energy sensed within a cluster or surrounding clusters.”	82
8.	Claim 10	85
a.	“The system as recited in claim 1, wherein the altering the one or more of the isolated one or more sounds so that the frequency does not fall outside of the predetermined threshold is performed automatically.”	85
9.	Claim 25	87
a.	“The system of claim 1, further comprising: a transmission medium comprising a wireless transceiver configured to wirelessly transmit and receive data from the data source.”	87
10.	Claim 27	88
a.	“The system of claim 1, wherein if one or more of the isolated one or more sounds includes the frequency outside of the predetermined threshold, altering the one or more of the isolated one or more sounds so that the frequency does not fall outside of the predetermined threshold; and”	88
b.	“outputting the isolated one or more sounds on the at least one output device.”	89
11.	Claim 11	90
a.	“A method of managing sensed noise, comprising:”	90
b.	“providing at least one data source;”	92
c.	“providing at least one cluster of at least one computing device,”	92

d.	“the at least one computing device including: a sound sensing mechanism, configured to sense a noise; and an electronic bus configured to transmit and receive data from the data source, wherein the data source is in electronic communication with the at least one cluster and at least one output device:”	92
(i)	“a sound sensing mechanism, configured to sense a noise;”	92
(ii)	“an electronic bus configured to transmit and receive data from the data source”	93
(iii)	“wherein the data source is in electronic communication with the at least one cluster and at least one output device:”	93
e.	“providing a memory, containing computer-executable instructions; and”	93
f.	“providing a processor to execute the computer-executable instructions to cause the processor to perform steps comprising:”	93
(i)	“identifying one or more sounds within the noise;”	93
(ii)	“isolating the one or more sounds;”	94
(iii)	“determining if one or more of the isolated one or more sounds includes a frequency outside of a predetermined threshold.”	94
12.	Claim 13	94
a.	“The method as recited in claim 11, wherein the sound-sensing mechanism is selected from the group consisting of: an omnidirectional transducer; an ultrasonic transducer; an infrasonic transducer; an electro-optical transducer; and a microwave transducer.”	94
13.	Claim 14	94

a.	“The method as recited in claim 13, wherein the sensed noise includes infrasonic, ultrasonic, visible, or radio waves.”	94
14.	Claim 15	95
a.	“The method as recited in claim 11, wherein the predetermined threshold equates to a frequency determined to pose a risk of harm to a user’s hearing capabilities.”	95
15.	Claim 16	95
a.	“The method as recited in claim 11, further comprising: if one or more of the isolated one or more sounds includes the frequency outside of the predetermined threshold, notifying a user, via a notification, that one or more of the isolated one or more sounds includes the frequency outside of the predetermined threshold.”	95
16.	Claim 17	95
a.	“The method as recited in claim 11, further comprising: panning the sensed noise.”	95
17.	Claim 18	96
a.	“The method as recited in claim 11, further comprising: adding one or more audio effects to the sensed noise.”	96
18.	Claim 19	97
a.	“The method as recited in claim 11, further comprising: equalizing the sensed noise.”	97
19.	Claim 20	97

a.	“The method as recited in claim 11, wherein the altering the one or more of the isolated one or more sounds so that the frequency does not fall outside of the predetermined threshold is performed automatically.”	97
20.	Claim 26	98
a.	“The method of claim 11, further comprising: providing a transmission medium comprising a wireless transceiver configured to wirelessly transmit and receive data from the data source.”	98
21.	Claim 28	98
a.	“The method of claim 11, wherein if one or more of the isolated one or more sounds includes the frequency outside of the predetermined threshold, altering the one or more of the isolated one or more sounds so that the frequency does not fall outside of the predetermined threshold; and”	98
b.	“outputting the isolated one or more sounds on the at least one output device.”	98
B.	Ground 1B: <i>DiCenso641</i> , <i>Smith</i> , and <i>Holland</i> Render Obvious Claims 2 and 12	99
1.	Claim 2	99
a.	“The system as recited in claim 1, further comprising: an interfacing mechanism, the interfacing mechanism including:”	99
b.	“a network adapter, configured to transmit and receive the data through both wired and wireless communication; and”	100
c.	“at least one input mechanism, configured to:”	104
d.	“manipulate the interfacing mechanism; and”	105

e.	“vary the output of the at least one output device.”	105
2.	Claim 12.....	106
a.	“The method as recited in claim 11, further comprising: providing an interfacing mechanism, the interfacing mechanism including: a network adapter, configured to transmit and receive the data through both wired and wireless communication; and at least one input mechanism, configured to: manipulate the interfacing mechanism; and vary the output of the at least one output device.”	106
C.	Ground 1C: <i>DiCenso641</i> , <i>Smith</i> , and <i>Warren</i> Render Obvious Claim 3	106
1.	Claim 3.....	106
a.	“The system as recited in claim 1, wherein the sound-sensing mechanism is an omnidirectional transducer.”	106
D.	Ground 1D: <i>DiCenso641</i> , <i>Smith</i> , and <i>DiCenso645</i> Render Obvious Claims 21-24.....	109
1.	Claim 21	109
a.	“The system of claim 1, further comprising: the at least one output device, including:”	109
(i)	“a power source for operating the output device;”	109
(ii)	“a speaker for outputting sound; and”	113
(iii)	“a communication mechanism, for receiving electronic information from the data source; and”	114
(iv)	“a display.”	115
2.	Claim 22.....	118
a.	“The system of claim 21, wherein the power source and the display are varied outputs.”	118

3.	Claim 23	119
a.	“The method of claim 11, further comprising: providing the at least one output device, including:”	119
	(i) “a power source for operating the output device;”	119
	(ii) “a speaker for outputting sound; and”	119
	(iii) “a communication mechanism, for receiving electronic information from the data source; and”	119
	(iv) “a display.”	120
4.	Claim 24	120
a.	“The method of claim 23, wherein the power source and the display are varied outputs.”	120
E.	Ground 1E: <i>DiCenso641, Smith, and Goldstein873</i> Render Obvious Claim 32	120
1.	Claim 32	120
a.	“A system comprising:”	120
b.	“a data source;”	120
c.	“at least one cluster of at least one computing device,”	121
d.	“the at least one computing device including: a noise sensing mechanism configured to sense a noise; wherein the sensed noise includes infrasonic, ultrasonic, visible, audio or radio waves; an electronic bus which is configured to transmit and receive data from the data source, wherein the data source is in electronic communication with at least one cluster and at least one output device;”	121

	(i) “a noise sensing mechanism configured to sense a noise; wherein the sensed noise includes infrasonic, ultrasonic, visible, audio or radio waves;”	121
	(ii) “an electronic bus which is configured to transmit and receive data from the data source,”	122
	(iii) “wherein the data source is in electronic communication with at least one cluster and at least one output device;”	122
e.	“a memory, containing computer-executable instructions; and”	122
f.	“a processor configured to execute the computer-executable instructions to cause the processor to perform functions including:”	123
	(i) “identifying one or more frequencies within the noise;”	123
	(ii) “isolating the one or more frequencies; and”	124
	(iii) “determining if one or more of the isolated one or more frequencies includes a frequency outside of a predetermined threshold,”	125
	(iv) “wherein if one or more of the isolated one or more frequencies includes the frequency outside of the predetermined threshold, transmitting an alert to another computing device regarding the frequency of the one or more of the isolated one or more frequencies being outside of the predetermined threshold.”	125
F.	Ground 2A: <i>DiCenso641</i> , <i>Goldstein873</i> , and <i>Smith</i> Render Obvious Claims 1, 4-11, 13-20 and 25-28	130
G.	Ground 2B: <i>DiCenso641</i> , <i>Goldstein873</i> , <i>Smith</i> , and <i>Holland</i> Render Obvious Claims 2 and 12.....	136
H.	Ground 2C: <i>DiCenso641</i> , <i>Goldstein873</i> , <i>Smith</i> , and <i>Warren</i> Render Obvious Claim 3	136

I.	Ground 2D: <i>DiCenso641</i> , <i>Goldstein873</i> , <i>Smith</i> , and <i>DiCenso645</i> Render Obvious Claims 21-24	136
J.	Ground 2E: <i>DiCenso641</i> , <i>Smith</i> , and <i>Goldstein873</i> Render Obvious Claim 32.....	137
XI.	SECONDARY CONSIDERATIONS	137
XII.	CONCLUSION.....	137

I, Chris Kyriakakis, declare that:

I. INTRODUCTION

1. I have been retained by Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. (together “Samsung”) (collectively “Petitioners”) as an independent expert consultant in this proceeding before the United States Patent and Trademark Office (“USPTO”).

2. I am being compensated at a rate of \$525/hour for my services in this proceeding, which is my regular and customary rate.

3. My compensation is in no way contingent on the nature of my findings, the presentation of my findings in testimony, or the outcome of this or any other proceeding. I have no other interest in this proceeding.

4. I have been asked to consider whether certain references disclose or suggest the features recited in the claims of U.S. Patent No. 11,204,736 (“the ’736 patent”) (Ex. 1001).¹ My opinions are set forth below.

II. BACKGROUND AND QUALIFICATIONS

5. I am an independent consultant. All of my opinions stated in this declaration are based on my own personal knowledge and professional judgment. In

¹ Where appropriate, I refer to exhibits I understand will be attached to the petition for *inter partes* review of the ’736 patent (the “Petition”).

forming my opinions, I have relied on my education, experience, and knowledge regarding electrical engineering, computer science, and audio and acoustic sciences.

6. I am over 18 years of age and, if I am called upon to do so, I would be competent to testify as to the matters set forth herein. A copy of my current curriculum vitae, which details my education and professional and academic experience, as well as a list of publications I have authored in the past ten years, is included as Ex. 1003 in this proceeding. The following provides an overview of some of my experience that is relevant to the matters set forth in this declaration.

A. Relevant Academic Experience

7. I earned my Bachelor of Science degree in Engineering and Applied Science from the California Institute of Technology (Caltech) in 1985. I received my Master of Science degree in Electrical Engineering in 1987 and my Ph.D. in Electrical Engineering in 1993, both from the University of Southern California (USC).

8. Since 2002, I have been a tenured Associate Professor in the Electrical Engineering Department at USC. My research interests lie at the intersection of acoustics, psychoacoustics (the science that studies human perception of sound), and audio signal processing. My recent research has focused on the study of audio systems in challenging environments including automobiles and mobile devices, as well as algorithms for enhancing the performance of voice recognition engines.

Another focus of my research has been on the perception of loudness by human listeners. Specifically, I developed algorithms to automatically adjust the frequency response (EQ) and dynamic range of audio content to match the needs of human hearing. I have published nearly 100 technical papers, including several peer reviewed papers. I have published a book entitled *Immersive Audio Signal Processing*, and hold several patents in acoustic measurement of loudspeakers in rooms and cars, loudspeaker crossover optimization, and loudspeaker response correction using signal processing. My publications examine various aspects of sound measurement, how sound interacts with the acoustical elements of the environment, novel methods for surround sound recording and reproduction, and the perception of sound by human listeners.

9. A focus of my research has been the study of microphone arrays for applications in enhanced far field voice recognition. This includes methods for Direction of Arrival finding and beam forming from linear and circular microphone arrays. I have also investigated methods for noise removal and reverberation reduction from microphone signals. In addition, I have worked on methods for echo cancellation for applications in wearable devices. Previous work includes loudspeakers and how they interact with their acoustical environment. In particular, I have researched the role of sound reflections, absorption, and diffusion in the performance of loudspeakers. I have also published several technical papers on

acoustical measurement methods in rooms and device enclosures and developed novel signal processing algorithms for optimizing sound system performance. Other topics I have researched include multichannel audio acquisition and rendering, virtual microphones and virtual speakers, hybrid headphone-loudspeaker rendering methods, and advanced signal processing techniques for optimizing sound quality from small portable devices.

B. Relevant Professional Experience

10. I am the founding Director of the USC Immersive Audio Laboratory with facilities for experimental work in room acoustics, multichannel audio, and psychoacoustics. This laboratory also serves as a unique teaching facility for my undergraduate course in Acoustics of Real and Virtual Spaces and my graduate course in Spatial Audio Acoustics and Psychoacoustics. Both courses have a major acoustics component that examines the interaction of sound with the acoustical environment (e.g., home, movie theater, headphones, car). The graduate course was developed through a two-year grant I received from the National Science Foundation entitled “Collaborative Learning in Engineering Using Immersive Environments,” and was the first of its kind to assess the impact of audio immersion in student learning. In addition to the courses I teach, I have also supervised and served on Ph.D. dissertation committees for more than 30 students.

11. In 2019, I joined Syng as the Chief Audio Scientist. Syng creates innovative products for next generation spatial audio and my role there includes research and development of audio algorithms for sound capture using microphone arrays to measure the acoustics of the room and loudspeaker beamforming for rendering sound in various directions.

12. From 2003 to 2018, I was the co-founder and Chief Technology Officer of Audyssey Laboratories, a USC spin-off company that develops and licenses audio technology to leading automotive, professional and consumer electronic companies around the world. A major project that I led and worked on was focused on the measurement and characterization of in-ear and over ear earbuds and headphones. This work included the development of methods for measuring earbuds and headphones using a mannequin with artificial ears and, in particular, methods for testing for proper seal prior to taking acoustical measurements. It also included the use of ear canal microphones and comparisons of the in-ear microphone response with a reference microphone in the room. A database of over 500 in-ear earbuds and headphones was created using these methods. The acoustical correction filters that were generated for each headphone were implemented as an embedded solution that could run on DSP processors in mobile devices and laptop computers.

13. I also developed audio algorithms and designed speakers. These speakers were novel acoustical designs that used a combination of unique

enclosures, and audio signal processing to optimize their performance and overcome limitations that arise from small drivers and enclosures. For example, we used signal processing technologies combined with novel acoustical design to extend the bass response of small woofers and passive radiators beyond what was previously possible in small speaker enclosures. The innovations in these designs have received awards, including Popular Science's "Best of What's New."

14. In April 2018 I was elected as Senior Member of the Institute of Electrical and Electronic Engineers (IEEE) in recognition of my contributions to the field of engineering. I am also a member of the Audio Engineering Society (AES), an association for professionals in the audio industry.

15. In 2006, I received a World Technology Network Award. This organization presents awards to innovators in several areas in which technology can foster a paradigm change. My award was for innovations in immersive audio that enable new capabilities in media and journalism. Other award recipients at that event included Vice President Al Gore, Google, and Space-X. In addition, my work has been featured in multiple news articles, including pieces by The Atlantic, the BBC World Service, the New York Times, and National Public Radio.

16. In the late 1990s and early 2000s, I was a faculty researcher and later Deputy Director of the National Science Foundation's engineering research center established at USC. I was studying the fundamental and technological limitations of

immersive audio and the role of acoustics on the performance of loudspeakers and audio systems in homes and cars. In 2003, together with one of my graduate students, I received the award for Best Paper at the IEEE Conference on Signals, Systems and Computers.

III. MATERIALS REVIEWED

17. The opinions contained in this declaration are based on the documents I reviewed, my professional judgment, as well as my education, experience, and knowledge regarding electrical engineering, computer science, and audio and acoustic sciences.

18. In forming my opinions expressed in this declaration, I reviewed the following materials:

- the '736 patent (Ex. 1001);
- the file history of the '736 patent (Ex. 1004);
- U.S. Patent Application Publication 2015/0195641 ("*DiCenso64I*") (Ex. 1005);
- U.S. Patent Application Publication 2014/0254842 ("*Smith*") (Ex. 1006);
- U.S. Patent Application Publication 2014/0337902 ("*Holland*") (Ex. 1007);

- U.S. Patent Application Publication 2008/0031481 (“*Warren*”) (Ex. 1008);
- U.S. Patent Application Publication 2015/0170645 (“*DiCenso645*”) (Ex. 1009);
- U.S. Patent Application Publication 2008/0137873 (“*Goldstein873*”) (Ex. 1010);
- U.S. Patent Application Publication 2005/0058181 (“*Lyle*”) (Ex. 1012);
- C. Wiernicki and W. Karoly, “Ultrasound: Biological Effects and Industrial Hygiene Concerns,” *Am. Ind. Hyg. Assoc. J.*, 46:488–496 (1985) (“*Wiernicki*”) (Ex. 1013);
- U.S. Patent Application Publication 2011/0058056 (“*Lindahl*”) (Ex. 1014);
- U.S. Patent 7,991,171 (“*Snow*”) (Ex. 1015);
- Excerpts from Microsoft Computer Dictionary (5th ed. 2002) (“*Computer Dictionary*”) (Ex. 1016);
- Excerpts from Robert Oshana, “DSP Software Development Techniques Embedded and Real-Time Systems” (2006) (“*Oshana*”) (Ex. 1017);

- Excerpts from Thomas D. Rossing, Richard F. Moore, and Paul A. Wheeler, “The Science of Sound” (3rd ed. 2002) (“*Rossing*”) (Ex. 1018);
- U.S. Patent Application Publication 2013/0003998 (“*Kirkeby*”) (Ex. 1019);
- U.S. Patent Application Publication 2015/0371643 (“*Ramo*”) (Ex. 1020);
- U.S. Patent 8,767,970 (“*Eppolito*”) (Ex. 1021)
- U.S. Patent 7,970,144 (“*Avendano*”) (Ex. 1022); and

any other materials I refer to in this declaration in support of my opinions.

19. All of the opinions contained in this declaration are based on the documents I reviewed and my knowledge and professional judgment. My opinions have also been guided by my appreciation of how a person of ordinary skill in the art would have understood the claims and the specification of the '736 patent at the time of the alleged invention, which I have been asked to consider as no earlier than September 23, 2014 (the filing date of U.S. Provisional Patent Application 62/054,286). My opinions reflect how one of ordinary skill in the art would have understood the '736 patent, the prior art to the patent, and the state of the art at the time of the alleged invention.

20. Based on my experience and expertise, it is my opinion that certain references disclose and/or suggest all the features recited in claims 1-28 and 32 (“challenged claims”) of the ’736 patent, as I discuss in detail below.

IV. LEVEL OF ORDINARY SKILL IN THE ART

21. I have been informed and understand that, in the context of an invalidity analysis, a person having ordinary skill in the art is a hypothetical person who looks to prior art at the time of the invention. I further understand that the factors that may be considered in determining the level of ordinary skill include: (1) the problems encountered in the art; (2) the prior art solutions to the problems encountered in the art; (3) the rapidity of innovation; (4) the sophistication of the technology; and (5) the education level of active workers in the field. I understand that these factors need not all be considered for the analysis and that one or more of these factors may control.

22. I was asked to provide my opinion on the level of one of ordinary skill in the art with respect to the alleged invention of the ’736 patent as of September 23, 2014. Based on my consideration of the factors above, I believe a person having ordinary skill in the art would have had a Bachelor of Science (or equivalent) in electrical engineering, computer science, audio engineering, or a similar field and at least two years of experience in the design of digital audio systems and associated signal processing in hearing instruments such as earphones, hearing aids, and/or

hearing protectors. Persons of ordinary skill in the art could have also obtained similar knowledge and experience through other means. *Id.*, ¶ .

23. As of September 23, 2014, I met, and in fact exceeded, the qualifications of a person of ordinary skill in the art. To be clear, all of my opinions in this declaration are from the perspective of one of ordinary skill in the art as I have defined it here during the relevant timeframe.

V. RELEVANT LEGAL STANDARDS

24. I am not an attorney and offer no legal opinions, but in the course of my work, I have had experience studying and analyzing patents and patent claims from the perspective of a person skilled in the art.

25. For the purposes of this declaration, I have been informed about certain aspects of the law that are relevant to forming my opinions. My understanding of the law is as follows.

26. Petitioners' counsel has informed me that a published nonprovisional application is entitled to claim priority to the filing date of its provisional application (as opposed to the filing date of the published non-provisional application) if (1) the provisional application discloses the portions of the published non-provisional application relied upon as prior art, and (2) at least one claim of the published non-provisional claim is supported by the provisional application, i.e., the provisional

application must disclose the subject matter of the claim and enable a person of ordinary skill in the art to make and use the claim.

27. Petitioners' counsel has informed me that for the prior art to inherently disclose a claimed limitation, the prior art need not expressly disclose the limitation, so long as the claimed limitation necessarily flows from a disclosure in the prior art. I also understand that it is acceptable to examine evidence outside the prior art reference (extrinsic evidence) in determining whether a feature, while not expressly discussed in the reference, is necessarily present in that reference.

28. Petitioners' counsel has informed me that a patent claim can be considered to have been obvious to a person having ordinary skill in the art at the time the application was filed. I am informed that this means that, even if all of the requirements of a claim are not found in a single prior art reference, the claim is not patentable if the differences between the subject matter in the prior art and the subject matter in the claim would have been obvious to a person having ordinary skill in the art at the time of the invention.

29. I have been informed by Petitioners' counsel that a determination of whether a claim would have been obvious should be based upon several factors, including, among others:

- the level of ordinary skill in the art at the time the application was filed;
- the scope and content of the prior art; and

- what differences, if any, existed between the claimed invention and the prior art.

30. I have been informed by Petitioners' counsel that a single reference can render a patent claim obvious if any differences between that reference and the claims would have been obvious to a person having ordinary skill in the art. Alternatively, I understand that the teachings of two or more references may be combined in the same way as disclosed in the claims, if such a combination would have been obvious to one having ordinary skill in the art. In determining whether a combination based on either a single reference or multiple references would have been obvious, it is appropriate to consider, among other factors:

- whether the teachings of the prior art references disclose known concepts combined in familiar ways, and when combined, would yield predictable results;
- whether a person having ordinary skill in the art could implement a predictable variation, and would see the benefit of doing so;
- whether the claimed elements represent one of a limited number of known design choices, and would have a reasonable expectation of success by those skilled in the art;
- whether a person having ordinary skill would have recognized a reason to combine known elements in the manner described in the claim;

- whether there is some teaching or suggestion in the prior art to make the modification or combination of elements claimed in the patent; and
- whether the innovation applies a known technique that had been used to improve a similar device or method in a similar way.

31. I have been informed by Petitioners' counsel that one of ordinary skill in the art has ordinary creativity and is not an automaton. Petitioners' counsel has also informed me that in considering obviousness, obviousness may not be determined using the benefit of hindsight, including hindsight derived from the patent being considered.

32. I further understand that a hypothetical person of ordinary skill in the art is assumed to know and to have all relevant prior art in the field of endeavor covered by the patent at issue. I have been informed that there are two criteria for determining whether prior art is analogous and thus can be considered prior art: (1) whether the art is from the same field of endeavor, regardless of the problem addressed, and (2) if the reference is not within the field of the patentee's endeavor, whether the reference still is reasonably pertinent to the particular problem with which the patentee is involved. I have also been informed that the field of endeavor of a patent is not limited to the specific point of novelty, the narrowest possible conception of the field, or the particular focus within a given field. I have also been informed that a reference is reasonably pertinent if, even though it may be in a

different field from that of the patentee's endeavor, it is one which, because of the matter with which it deals, logically would have commended itself to a patentee's attention in considering their problem.

33. I further understand that, in making a determination as to whether the claimed invention would have been obvious to a person of ordinary skill, the Board may consider certain objective factors if they are present, such as: commercial success of products practicing the claimed invention; long-felt but unsolved need; teaching away; unexpected results; copying; and praise by others in the field. These factors are generally referred to as "secondary considerations" or "objective indicia" of nonobviousness. I understand, however, that for such objective evidence to be relevant to the obviousness of a claim, there must be a causal relationship (called a "nexus") between the claim and the evidence and that this nexus must be based on a novel element of the claim rather than something in the prior art. I also understand that even when they are present, secondary considerations may be unable to overcome primary evidence of obviousness (such as motivation to combine with predictable results) that is sufficiently strong.

34. I have been informed by Petitioners' counsel that for a patent claim in a later-filed application to be entitled to the priority date of an earlier-filed application, the specification of the earlier-filed application must adequately support the patent claim of the later-filed application. This means that the

specification of the earlier-filed application must provide an adequate written description of the invention claimed in the later-filed application.

35. I have been informed by Petitioners' counsel that the written description requirement is met if the applicant conveys in the specification with reasonable clarity to those skilled in the art that he or she possessed the claimed invention as of the filing date of the application. An applicant shows that one is "in possession" of the invention by describing the invention, with all its claimed limitations, not merely that which makes it obvious. A description that merely renders the later-filed claim obvious is not sufficient. One may satisfy the written description requirement with words, structures, figures, diagrams, and/or formulas that fully set forth the claimed invention. Although the exact terms of the claim need not be recited verbatim in the specification, the specification must contain an equivalent description of the claimed subject matter.

36. I am also informed that the failure to include in the written description aspects of the claimed invention that would be routinely known and understood by one of ordinary skill in the art when the application was filed will not be fatal to the validity of the claim if such aspects are inherent to what was disclosed. To be inherent, the missing descriptive matter must necessarily be present in the specification such that one skilled in the art would recognize such a disclosure

VI. SUMMARY OF OPINIONS

37. For the reasons I discuss below, it is my opinion that claims 1-28 and 32 of the '736 patent are rendered obvious by the prior art.

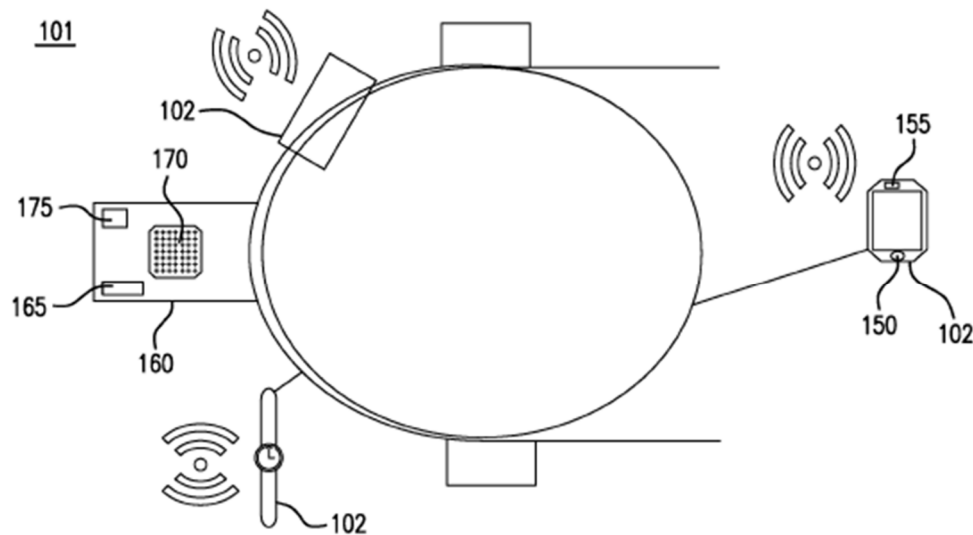
VII. OVERVIEW OF THE '736 PATENT

A. The Specification

38. The '736 patent is titled “Multi-frequency Sensing Method and Apparatus Using Mobile-clusters” and is directed to a system with devices “having the ability to sense the frequency and magnitude of audio signals,” and using this information to control audio output. Ex. 1001 ('736 patent), 8:22-32. Previously, professionals (e.g., at concert venues) and/or software controlled the audio to produce the desired output. *See id.*, 1:37-47. Prior systems, however, lacked granular control of a given individual listener’s audio output. *See id.*, 2:3-19.

39. The '736 patent describes a system with “clusters of various computing devices and wearable computers with sound management techniques and methods” that can sense the sound and control audio output. *Id.*, 8:9-32. An audio control source collects audio data via integrated devices and adjusts outputs so that desired sounds are intelligible, such as “important intercom announcements.” *Id.*, 8:35-40.

40. Figure 1 (reproduced below) illustrates a cluster 101 including computing device 102 with sound sensing mechanism 150 and wireless transceiver 155. *See id.*, 11:36-44.

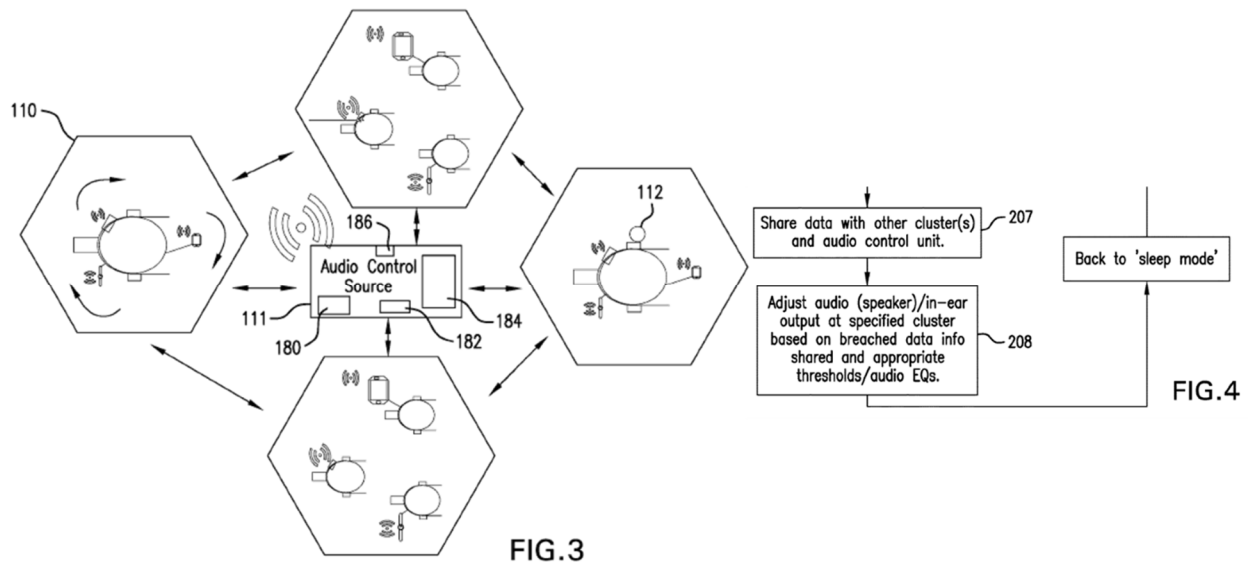


Ex. 1001 ('736 patent), FIG. 1

41. An output device 160 includes a speaker 170 and communications mechanism 175. *See id.*, 12:48-13:5. The output device 160 “is located within said at least one cluster 101, such that audio control source 111 may alter the power supplied to said speaker 170 in real-time.” *Id.*, 13:2-13:5. In some embodiments, the system includes in-ear systems. *Id.*, 8:51-63, 12:57-58, FIG. 3 (element 112).

42. Figure 3 (reproduced below) illustrates audio control source 111 communicating with clusters. “The embodiment depicted [in figure 3] shows devices that sense audio signal energy within the confines of a single cluster and then sends data directly to an audio control unit and other clusters.” *Id.*, 13:6-9. The audio control source 111 adjusts “any connected output devices ... to ensure high quality/fidelity output.” *Id.*, 13:13-16; *see also id.*, 13:40-43, FIG. 4 (step 208), 8:51-63 (adjusting “in-ear monitors”), 13:2-5 (adjusting speakers). The '736 patent further

discloses that some output devices include displays. *See id.*, 9:44-47 (displays on “pet products/wearables, pet owner smartphones, smartwatches”), 9:10-59 (disclosing the pet embodiment).



Ex. 1001 ('736 patent), FIG. 3, FIG. 4 (excerpted)

43. The '736 patent states the system performs “the functions of sensing and isolating frequency bands associated with music instruments/human voices.” *Id.*, 8:66-9:2. The sensing devices sense the audio. *Id.*, 13:59-61, FIG. 5 (step 305). The “instruments and/or frequencies are identified and isolated from the sensed audio” (step 310), and the signal amplitude is manipulated (step 315). *Id.*, 13:62-14:3, FIG. 5.

44. In addition, the '736 patent discloses notifying the user (step 325) when the sensed audio is hazardous to hearing (step 320). *Id.*, 15:62-16:3, FIG. 5. In some

embodiments, the system “reports findings [to a] cloud-based system for audio signal processing (if necessary).” *Id.*, 13:48-55. Further, the system controls the dynamic range of the sensed audio to remove the hazardous audio (step 330). *Id.*, 16:4-13, FIG. 5. The system may also perform additional functions, including panning the audio (step 335), “add[] depth and texture to audio output” (step 340), and equalizing the audio (step 345). *See id.*, 16:12-16, FIGs. 5-6.

B. Prosecution History

1. The '736 Patent

45. The original application that issued as the '736 patent was filed on October 17, 2019. Ex. 1001 ('736 patent), Cover (code 22). The '736 patent states it is a continuation of Application No. 16/421,141 which issued as U.S. Patent No. 10,656,906, a continuation-in-part of Application No. 16/155,919, and a continuation-in-part of Application No. 14/862,304 which issued as U.S. Patent No. 10,127,005. *Id.* (code 63) The application claims priority to Provisional Application No. 62/054,286 filed September 23, 2014. *Id.* (code 60).

(21) Appl. No.: **16/656,259**

(22) Filed: **Oct. 17, 2019**

(65) **Prior Publication Data**

US 2020/0278827 A1 Sep. 3, 2020

Related U.S. Application Data

(63) Continuation of application No. 16/421,141, filed on May 23, 2019, now Pat. No. 10,656,906, which is a continuation-in-part of application No. 16/155,919, filed on Oct. 10, 2018, now abandoned, which is a continuation of application No. 14/862,304, filed on Sep. 23, 2015, now Pat. No. 10,127,005.

(60) Provisional application No. 62/054,286, filed on Sep. 23, 2014.

Ex. 1001 ('736 patent), Cover (excerpted)

46. I understand that for purposes of this proceeding, I am to assume the priority date is September 23, 2014.

47. The original application was filed with twenty claims. Ex. 1004, 5-10. The Examiner issued a Non-final Office Action on June 16, 2020 identifying issues with the specification and drawings, and rejecting all claims for statutory double patenting over U.S. Patent 10,656,906. *Id.*, 295-300. The applicant amended the claims and added dependent claims 21-24 in a September 16, 2020 filing. *Id.*, 331-339. In the Final Office Action issued October 29, 2020, the Examiner identified antecedent basis issues with the claims, rejected all claims for nonstatutory double patenting over U.S. Patent 10,656,906, but also indicated that the claims contained allowable subject matter. *Id.*, 355-362.

48. In a December 16, 2020 filing, the applicant amended the claims to address antecedent basis, added dependent claims 25-26, and filed a Terminal Disclaimer. *Id.*, 376-387, 391 (terminal disclaimer). After the applicant filed a Request for Continued Examination on January 9, 2021 (*id.*, 427), the Examiner issued a Non-final Office Action on January 19, 2021 that identified multiple indefiniteness issues, but also indicated that all claims contained allowable subject matter. *Id.*, 435-446. The applicant amended the claims and added claims 27-32 on April 16, 2021. *Id.*, 460-473. A Notice of Allowance issued July 13, 2021 with an Examiner's Amendment. *Id.*, 479-491. The '736 patent issued December 21, 2021. Ex. 1001 ('736 patent), Cover (code 45).

C. The Claims

49. The table below includes identifiers for the '736 patent claims and limitations, which are referenced throughout.

Claim 1	
1[pre]	A system comprising:
1[a]	a data source;
1[b]	at least one cluster of at least one computing device,
1[c]	the at least one computing device including:
1[c][i]	a sound sensing mechanism, configured to sense a noise; and

1[c][ii]	an electronic bus which is configured to transmit and receive data from the data source,
1[c][iii]	wherein the data source is in electronic communication with the at least one cluster and at least one output device;
1[d]	a memory, containing computer-executable instructions; and
1[e]	a processor configured to execute the computer-executable instructions to cause the processor to perform functions including:
1[e][i]	identifying one or more sounds within the noise;
1[e][ii]	isolating the one or more sounds; and
1[e][iii]	determining if one or more of the isolated one or more sounds includes a frequency outside of a predetermined threshold.
Claim 2	
2[a]	The system as recited in claim 1, further comprising: an interfacing mechanism, the interfacing mechanism including:
2[b]	a network adapter, configured to transmit and receive the data through both wired and wireless communication; and
2[c]	at least one input mechanism, configured to:
2[d]	manipulate the interfacing mechanism; and
2[e]	vary the output of the at least one output device.

Claim 3	
3	The system as recited in claim 1, wherein the sound-sensing mechanism is an omnidirectional transducer.
Claim 4	
4	The system as recited in claim 1, wherein the sound-sensing mechanism is selected from the group consisting of: an ultrasonic transducer; an infrasonic transducer; and a microwave transducer.
Claim 5	
5	The system as recited in claim 4, wherein the sensed noise includes infrasonic or ultrasonic soundwaves.
Claim 6	
6	The system as recited in claim 1, wherein the predetermined threshold equates to a frequency determined to pose a risk of harm to a user's hearing capabilities.
Claim 7	
7	The system as recited in claim 1, wherein the computer-executable instructions further include: if one or more of the isolated one or more sounds includes the frequency outside of the predetermined threshold, notifying a user, via a notification, that one or more of the isolated one or more sounds includes the frequency outside of the predetermined threshold.
Claim 8	
8	The system as recited in claim 1, wherein the computer-executable instructions further include steps selected from the group consisting of: panning the sensed noise; and equalizing the sensed noise.

Claim 9	
9	The system as recited in claim 1, further comprising: an in-ear device, wherein an audio output of the in-ear device auto-adjusts based on signal energy sensed within a cluster or surrounding clusters.
Claim 10	
10	The system as recited in claim 1, wherein the altering the one or more of the isolated one or more sounds so that the frequency does not fall outside of the predetermined threshold is performed automatically.
Claim 11	
11[pre]	A method of managing sensed noise, comprising:
11[a]	providing at least one data source;
11[b]	providing at least one cluster of at least one computing device,
11[c]	the at least one computing device including:
11[c][i]	a sound sensing mechanism, configured to sense a noise; and
11[c][ii]	an electronic bus configured to transmit and receive data from the data source,
11[c][iii]	wherein the data source is in electronic communication with the at least one cluster and at least one output device:
11[d]	providing a memory, containing computer-executable instructions; and

11[e]	providing a processor to execute the computer-executable instructions to cause the processor to perform steps comprising:
11[e][i]	identifying one or more sounds within the noise;
11[e][ii]	isolating the one or more sounds; and
11[e][iii]	determining if one or more of the isolated one or more sounds includes a frequency outside of a predetermined threshold.
Claim 12	
12[a]	The method as recited in claim 11, further comprising: providing an interfacing mechanism, the interfacing mechanism including:
12[b]	a network adapter, configured to transmit and receive the data through both wired and wireless communication; and
12[c]	at least one input mechanism, configured to:
12[d]	manipulate the interfacing mechanism; and
12[e]	vary the output of the at least one output device.
Claim 13	
13	The method as recited in claim 11, wherein the sound-sensing mechanism is selected from the group consisting of: an omnidirectional transducer; an ultrasonic transducer; an infrasonic transducer; an electro-optical transducer; and a microwave transducer.

Claim 14	
14	The method as recited in claim 13, wherein the sensed noise includes infrasonic, ultrasonic, visible, or radio waves.
Claim 15	
15	The method as recited in claim 11, wherein the predetermined threshold equates to a frequency determined to pose a risk of harm to a user's hearing capabilities.
Claim 16	
16	The method as recited in claim 11, further comprising: if one or more of the isolated one or more sounds includes the frequency outside of the predetermined threshold, notifying a user, via a notification, that one or more of the isolated one or more sounds includes the frequency outside of the predetermined threshold.
Claim 17	
17	The method as recited in claim 11, further comprising: panning the sensed noise.
Claim 18	
18	The method as recited in claim 11, further comprising: adding one or more audio effects to the sensed noise.
Claim 19	
19	The method as recited in claim 11, further comprising: equalizing the sensed noise.

Claim 20	
20	The method as recited in claim 11, wherein the altering the one or more of the isolated one or more sounds so that the frequency does not fall outside of the predetermined threshold is performed automatically.
Claim 21	
21[a]	The system of claim 1, further comprising: the at least one output device, including:
21[a][i]	a power source for operating the output device;
21[a][ii]	a speaker for outputting sound; and
21[a][iii]	a communication mechanism, for receiving electronic information from the data source; and
21[a][iv]	a display.
Claim 22	
22	The system of claim 21, wherein the power source and the display are varied outputs.
Claim 23	
23[a]	The method of claim 11, further comprising: providing the at least one output device, including:
23[a][i]	a power source for operating the output device;
23[a][ii]	a speaker for outputting sound; and

23[a][iii]	a communication mechanism, for receiving electronic information from the data source; and
23[a][iv]	a display.
Claim 24	
24	The method of claim 23, wherein the power source and the display are varied outputs.
Claim 25	
25	The system of claim 1, further comprising: a transmission medium comprising a wireless transceiver configured to wirelessly transmit and receive data from the data source.
Claim 26	
26	The method of claim 11, further comprising: providing a transmission medium comprising a wireless transceiver configured to wirelessly transmit and receive data from the data source.
Claim 27	
27[a]	The system of claim 1, wherein if one or more of the isolated one or more sounds includes the frequency outside of the predetermined threshold, altering the one or more of the isolated one or more sounds so that the frequency does not fall outside of the predetermined threshold; and
27[b]	outputting the isolated one or more sounds on the at least one output device.

Claim 28	
28[a]	The method of claim 11, wherein if one or more of the isolated one or more sounds includes the frequency outside of the predetermined threshold, altering the one or more of the isolated one or more sounds so that the frequency does not fall outside of the predetermined threshold; and
28[b]	outputting the isolated one or more sounds on the at least one output device.
Claim 32	
32[pre]	A system comprising:
32[a]	a data source;
32[b]	at least one cluster of at least one computing device,
32[c]	the at least one computing device including:
32[c][i]	a noise sensing mechanism configured to sense a noise; wherein the sensed noise includes infrasonic, ultrasonic, visible, audio or radio waves;
32[c][ii]	an electronic bus which is configured to transmit and receive data from the data source,
32[c][iii]	wherein the data source is in electronic communication with at least one cluster and at least one output device;
32[d]	a memory, containing computer-executable instructions; and
32[e]	a processor configured to execute the computer-executable instructions to cause the processor to perform functions including:

32[e][i]	identifying one or more frequencies within the noise;
32[e][ii]	isolating the one or more frequencies; and
32[e][iii]	determining if one or more of the isolated one or more frequencies includes a frequency outside of a predetermined threshold,
32[e][iv]	wherein if one or more of the isolated one or more frequencies includes the frequency outside of the predetermined threshold, transmitting an alert to another computing device regarding the frequency of the one or more of the isolated one or more frequencies being outside of the predetermined threshold.

VIII. OVERVIEW OF THE PRIOR ART

50. I first note that the prior art references analyzed in the grounds below are analogous to the '736 patent because they are within the same field of endeavor and are reasonably pertinent to one or more problems addressed by the '736 patent. For example, the '736 patent discloses “a series of methods to sense and control audio output in various venues.” Ex. 1001 ('736 patent), 8:30-32. The '736 patent discloses an in-ear embodiment of a system providing this capability:

In yet another preferred embodiment, various in-ear systems may be integrated into the present invention, software-defined and/or cognitive-defined based in-ear transceivers can be used to wirelessly communicate with an audio control source and thus, the output of such an in-ear monitor can be autonomously adjusted after sensing

audio output. A given output can be adjusted according to what is sensed within specified location or what is sensed at external clusters. Similarly, to a software-defined and/or cognitive-defined based in-ear transceivers, an in-ear monitor system for use with the present invention will preferably comprise hardware such as, earphones, at least one body pack receiver, at least one mixer and at least one transmitter. These functions can also be adjusted and controlled via the audio control source of the present invention.²

Id., 8:51-65.

51. In my opinion, a person of ordinary skill in the art would have recognized that both *DiCenso641* and *Smith* are analogous art. One reason is that both are directed to earpieces providing an auditory environment for a user.

52. For example, like the '736 patent, *DiCenso641* is directed to a system comprising earpieces and a mobile phone for generating a user controllable auditory environment for the user.

FIG. 1 illustrates operation of a representative embodiment of **a system or method for generating a user controllable auditory environment for a user** that may be personalized or customized in response to user preferences for particular types or groups of sounds.

² I added all **bold/italics/color** emphases and annotations unless I note otherwise.

System 100 includes a user 120 surrounded by an ambient auditory environment including a plurality of types or groups of sounds.

See, e.g., Ex. 1005 (*DiCenso641*), [0019].

As also shown in FIG. 1, system 100 includes **a wearable device 130 that includes at least one microphone, at least one speaker, and a microprocessor-based digital signal processor (DSP)** as illustrated and described in greater detail with reference to FIGS. 2-6. **Wearable device 130 may be implemented by headphones or ear buds 134** that each contain an associated speaker and one or more microphones or transducers, which may include an ambient microphone to detect ambient sounds within the ambient auditory environment, and an internal microphone used in a closed loop feedback control system for cancellation of user selected sounds.

Id., [0022].

Although wearable device 130 is depicted with earpieces 134, other embodiments may include various components of system 100 contained within, or implemented by, different kinds of wearable devices. For example, the speakers and/or microphones may be disposed within a hat, scarf, shirt collar, jacket, hood, etc. Similarly, **the user interface may be implemented within a separate mobile or wearable device**, such as a **smartphone**, tablet, wrist watch, arm band, etc. The separate mobile or

wearable device may include an associated microprocessor and/or digital signal processor that may also be used to provide additional processing power to augment the capabilities of the main system microprocessor and/or DSP.

Id., [0027].

53. Similarly, *Smith* is directed to an earpiece providing hearing enhancement and protection that may be adjusted or fine-tuned substantially in real time based, for example, on user selection of the types of noise to be attenuated and the corresponding level of attenuation.

According to an embodiment, **a user can select which types of noise are to be attenuated and the level of attenuation**. For example, the user can select to **attenuate** gunshot noise by 12 dB, dog barking by 6 dB, and car noise by 3 dB. Such selection can be preset, such as in a shop environment, or can be performed **substantially real time**, such as in the field. Thus, **noise which needs to be mitigated for hearing protection can be maintained at a desired level** when the noise may also be information.

See, e.g., Ex. 1006 (*Smith*), [0082].

According to an embodiment, **a user can select which types of information are to be amplified and the level of amplification**. For example, the user can select to **amplify** low level human voice (such as below 50 dB) by 18 dB, high level human voice (such as above 50 dB) by

9 dB, noise associated with furtive movements by 6 dB, and non-shooting gun noises (such as loading and cocking noises) by 3 dB. Such selection can be preset, such as in a shop environment, or can be performed **substantially real time**, such as in the field. **Information can be captured real time** and further occurrences of the same **information can be amplified by a desired amount**. Thus, the **user can at least partially define the environment noise signature** substantially in real time.

Id., [0085]; *see also id.*, [0088]-[0089].

54. *Holland*, *Warren*, *DiCenso*⁶⁴⁵, and *Goldstein*⁸⁷³ are also analogous to the '736 patent. For example, *Holland* is directed to a media player device, which may comprise a cell phone, configured to deliver and control presentation of media on companion content devices. *See, e.g.*, Ex. 1007 (*Holland*), [0039] (“Some embodiments provide a system for delivering content associated with a media presentation to devices that are auxiliary to the devices that play and display the media presentation. The auxiliary content devices are referred to herein as ‘companion content devices’, ‘companion devices’, or ‘clients.’”). *Warren* is directed to a personal listening device for use as a hearing aid, earphone, headphone, wireless headset, or other type of listening device. *See, e.g.*, Ex. 1008 (*Warren*), [0026] (“FIGS. 1-2 illustrate the flexibility and usefulness of a personal listening device 2 to be fitted in the ear, on the ear, near the ear, or behind the ear, in

accordance with one or more of the herein described embodiments. The personal listening device 2, which may be virtually any personal listening device or system such as a hearing aid 8, an earphone 10, a headphone (not shown), a wireless headset 12, an insert earphone (not shown), and the like.”). *DiCenso645* is directed to “a method for providing audio enhancement to a user of a listening device.” *See, e.g.*, Ex. 1009 (*DiCenso645*), [0007]. Finally, *Goldstein873* is directed to an earpiece for “continually monitor[ing] the environment for warning sounds.” Ex. 1010 (*Goldstein873*), [0066].

A. *DiCenso641* (Ex. 1005)

55. *DiCenso641* is titled “System And Method For User Controllable Auditor Environment Customization.” *DiCenso641* is directed generally to “a system or method for generating a user controllable auditory environment for a user.” Ex. 1005 (*DiCenso641*), [0019]. *DiCenso641* explains that a “user 120 may personalize or customize his/her auditory environment using system 100 by setting different user preferences applied to different types or groups of sounds selected by an associated user interface.” *Id.*, [0023].

As also generally depicted by the block diagram of system 100 in FIG. 1, **a user interface (FIGS. 5-6) allows user 120 to create a personalized or customized auditory experience by setting his/her preferences indicated by symbols 140, 142, 144, 146, for associated sound types**

to indicate which sounds to amplify, cancel, add or insert, or attenuate, respectively. Other functions may be used to enhance a sound by providing equalization or filtering, selective attenuation or amplification of one or more frequencies of an associated sound, or replacing an undesired sound with a more pleasant sound (using a combination of cancellation and addition/insertion, for example). The changes made by user 120 using the user interface are communicated to the wearable device 130 to control corresponding processing of input signals to create auditory output signals that implement the user preferences.

Id., [0028].

56. *DiCenso641* discloses that “system 100 includes a wearable device 130 that includes at least one microphone, at least one speaker, and a microprocessor-based digital signal processor (DSP).” *Id.*, [0022]. *DiCenso641* also discloses that wearable device 130 may be implemented by multiple earpieces 134³ “that each contain an associated speaker and one or more microphones or transducers.” *Id.* *DiCenso641* discloses that “[w]earable device 130, which may be implemented

³ I note that *DiCenso641* interchangeably refers to component 134 as “headphones or ear buds” (*id.*, [0022]), “earpieces” or “ear pieces” (*id.*, [0022], [0023], [0025], [0027]), and “devices” (*id.*, [0024]).

within earpieces 134, may also be equipped with wireless communication (integrated Bluetooth or Wi-Fi) to connect with various external sound sources, an external user interface, or other similar wearable devices.” *Id.*, [0025].

57. *DiCenso641* discloses that “the user interface may be implemented within a separate mobile or wearable device, such as a smartphone” *Id.*, [0027]. *DiCenso641* also discloses that “[t]he separate mobile or wearable device may include an associated microprocessor and/or digital signal processor that may also be used to provide additional processing power to augment the capabilities of the main system microprocessor and/or DSP.” *Id.* *DiCenso641* also discloses that “mobile device 320 may provide additional processing power for system 300.” *Id.*, [0039]. For example, *DiCenso641* explains 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.” *Id.*

58. *DiCenso641* discloses that “changes made by user 120 using the user interface are communicated to the wearable device 130 to control corresponding processing of input signals to create auditory output signals that implement the user preferences.” *Id.*, [0028]. *DiCenso641* discloses that signals captured by one or more microphones 312 are processed and modified based on user preferences, and “[t]he modified signal is output to amp(s) 314 and speaker(s) 316 to generate the auditory environment for the user.” *Id.*, [0042].

B. *Smith* (Ex. 1006)

59. *Smith* is titled “Situational Hearing Enhancement and Protection.” *Smith* discloses a system and method for providing both hearing enhancement and hearing protection. *See* Ex. 1006 (*Smith*), Abstract. *Smith* discloses that its earpiece 101 may include one or multiple microphones 102. *See id.*, [0020] (“[E]arpiece 101 can substantially contain a microphone 102, electronics 103, a connector 104, and a speaker 105. The microphone 102 can pick up ambient sound and can transduce the sound into a signal, such as an analog electronic signal.”). When more than one microphone is used, *Smith* discloses that “[e]ach microphone 102 can be comparatively more sensitive to a different portion of the audio spectrum. Thus, a plurality of different microphones 102 can provide desired sensitivity to substantially all or to some desired portion(s) of the audio spectrum.” *Id.*, [0025]. These microphones provide the sounds that “can be converted to the audible range for enhanced hearing.”

One or more microphones 102 can be sensitive to one or more portions of the audio spectrum that are considered to be outside of the audible range. For example, one microphone 102 can be sensitive to infrasound (such as sound having a frequency less than 20 Hz) and another microphone 102 can be sensitive to ultrasound (such as sound having a frequency greater than 20 kHz). Such sounds outside of the audible range

can be converted to the audible range for enhanced hearing. Thus, infrasound can be up converted in frequency and ultrasound can be down converted in frequency to facilitate processing and/or human hearing.

Id., [0026].

60. *Smith* also discloses that its system “can alert the user to otherwise inaudible sounds. Such sounds can be inaudible due to their frequency content and/or amplitude. Such inaudible sounds can be reproduced at an increased amplitude and/or different frequency so that they can be heard by the user.” *Id.*, [0027]. *Smith* also explains that “inaudible sounds can be replaced with other sounds, such as a warning, voice identification or other identification. For example, an inaudible sound that is characterized as a handgun being cocked can result in a voice notification that such a sound has been identified or can result in a distinctive siren or other indication.” *Id.*

61. To identify individual sounds, *Smith* discloses storing sound signatures for various sounds, including inaudible sounds. *See id.*, [0028] (“Such inaudible sounds or sound signatures representative thereof can be stored in a database (such as in the manner of environmental signatures).”). *Smith* also discloses comparing inaudible sounds to their sound signature stored in the database and providing an indication to the user if a match is found. *See id.*, [0029] (“Then, subsequently received inaudible sounds or their sound signatures can be compared to the sounds

or sound signatures stored in the database. When a match is determined, the appropriate indication can be provided to the user.”).

IX. CLAIM CONSTRUCTION

62. Here, I have given all the claim terms of the challenged claims their plain and ordinary meaning, as would have been understood by a person having ordinary skill in the art at the time of the alleged invention, having taken into consideration the language of the claims, the specification, and the prosecution history of record.

X. SPECIFIC GROUNDS FOR CHALLENGE

63. In the sections below, I explain in detail how claims 1-28 and 32 of the '736 patent are obvious in view of the prior art. More particularly:

- **Ground 1A** challenges claims 1, 4-11, 13-20, 25-28 as obvious over *DiCenso641* and *Smith*.
- **Ground 1B** challenges claims 2 and 12 as obvious over *DiCenso641*, *Smith*, and *Holland*.
- **Ground 1C** challenges claim 3 as obvious over *DiCenso641*, *Smith*, and *Warren*.
- **Ground 1D** challenges claims 21-24 as obvious over *DiCenso641*, *Smith*, and *DiCenso645*.

- **Ground 1E** challenges claim 32 as obvious over *DiCenso641*, *Smith*, and *Goldstein873*.
- **Ground 2A** challenges claims 1, 4-11, 13-20, 25-28 as obvious over *DiCenso641*, *Goldstein873*, and *Smith* .
- **Ground 2B** challenges claims 2 and 12 as obvious over *DiCenso641*, *Goldstein873*, *Smith*, and *Holland*.
- **Ground 2C** challenges claim 3 as obvious over *DiCenso641*, *Goldstein873*, *Smith*, and *Warren*.
- **Ground 2D** challenges claims 21-24 as obvious over *DiCenso641*, *Goldstein873*, *Smith*, and *DiCenso645*.
- **Ground 2E** challenges claim 32 as obvious over *DiCenso641*, *Smith*, and *Goldstein873*.

A. Ground 1A: *DiCenso641* and *Smith* Render Obvious Claims 1, 4-11, 13-20, and 25-28

1. Claim 1

a. “A system comprising:”

64. I understand “[a] system comprising” is the preamble to claim 1. I have been asked to assume that the preamble is a claim limitation. Under that assumption, in my opinion, *DiCenso641* teaches this feature.⁴

65. For example, *DiCenso641* discloses “a **system** or method for generating a user controllable auditory environment for a user that may be personalized or customized in response to user preferences for particular types or groups of sounds.” Ex. 1005 (*DiCenso641*), [0019].

b. “a data source;”

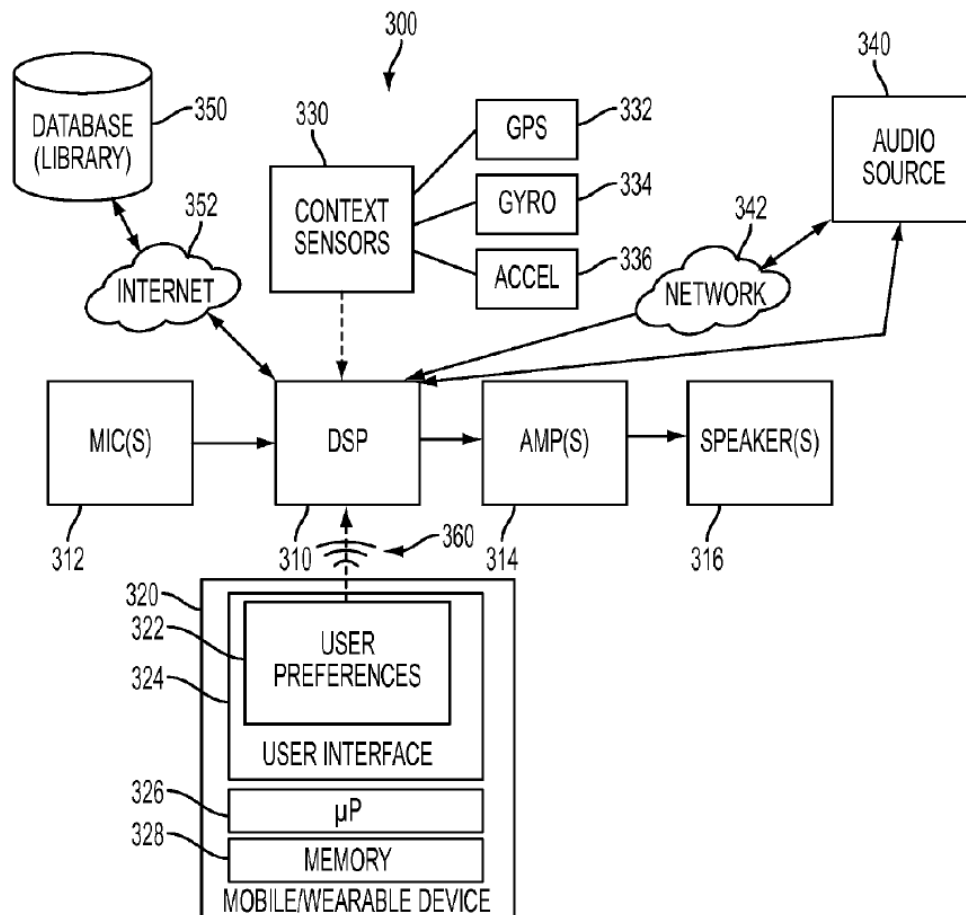
66. In my opinion, *DiCenso641* teaches this feature.

67. *DiCenso641* discloses that “system 100 includes a wearable device 130 that includes at least one microphone, at least one speaker, and a microprocessor-based digital signal processor (DSP) as illustrated and described in greater detail with reference to FIGS. 2-6.” Ex. 1005 (*DiCenso641*), [0022]. *DiCenso641*

⁴ Throughout my declaration, I use the term “teaches” to refer to both express teachings or those that, in my opinion, are fairly suggested to a person of ordinary skill in the art.

discloses that “[w]earable device 130, which may be implemented within earpieces 134, may also be equipped with wireless communication (integrated Bluetooth or Wi-Fi) to connect with various external sound sources, an external user interface, or other similar wearable devices.” *Id.*, [0025].

68. *DiCenso641*’s figure 3 depicts components of its system in communication with mobile device 320:



Ex. 1005 (*DiCenso641*), FIG. 3

69. *DiCenso641* discloses that “mobile device 320 may provide additional processing power for system 300.” *Id.*, [0039]. For example, *DiCenso641* explains 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” of wearable device 130. *Id.* *DiCenso641* also discloses that “[t]he modified signal is output to amp(s) 314 and speaker(s) 316 to generate the auditory environment for the user.” *Id.*, [0042]; *see also id.*, [0076] (“The user listens to music on his in-ear devices, **streamed directly from his mobile device**. The system plays back the music in a very spatial way that allows him to hear the sounds of his surroundings.”).

70. Accordingly, *DiCenso641* teaches a mobile device 320 sending a modified audio stream to wearable device 130 for providing to the user via speaker(s) 316 (“a data source”).

c. “at least one cluster of at least one computing device,”

71. In my opinion, *DiCenso641* teaches this feature.

72. *DiCenso641* discloses the system includes a wearable device with at least one microphone, at least one speaker, and “a microprocessor-based digital signal processor (DSP).”

As also shown in FIG. 1, **system 100 includes a wearable device 130 that includes at least one microphone, at least one speaker, and a microprocessor-based digital signal processor (DSP)** as illustrated and described in

greater detail with reference to FIGS. 2-6.

Ex. 1005 (*DiCenso641*), [0022].

73. *DiCenso641* also discloses that when wearable device 130 is implemented by multiple earpieces 134,⁵ they each contain a speaker and one or more microphones.

Wearable device 130 may be implemented by headphones or ear buds 134 that each contain an associated speaker and one or more microphones or transducers, which may include an ambient microphone to detect ambient sounds within the ambient auditory environment, and an internal microphone used in a closed loop feedback control system for cancellation of user selected sounds.

Id.; *see also id.*, [0024] (“In one embodiment as generally depicted in FIG. 1, user 120 wears two in-ear or intra-aural devices 134 (one in each ear) that may be custom fitted or molded using technology similar to that used for hearing aids.”).

74. *DiCenso641* discloses that “[w]earable device 130, which may be implemented within earpieces 134, may also be equipped with wireless communication (integrated Bluetooth or Wi-Fi) to connect with various external

⁵ As I stated previously, *DiCenso641* interchangeably refers to component 134 as “headphones or ear buds,” “earpieces,” “ear pieces,” and “devices.” *See* footnote 3.

sound sources, an external user interface, **or other similar wearable devices.**” *Id.*, [0025]. Thus, in my opinion, a person of ordinary skill in the art would have understood *DiCenso641*’s disclosure to encompass earpieces 134 communicating with each other via wireless communication (such as Bluetooth or Wi-Fi). A person of ordinary skill in the art would also have understood that, when implemented by earpieces 134, wearable device 130 comprises a pair of earpieces 134 each containing a speaker and one or more microphones or transducers, and at least one of which includes a DSP.

75. Finally, a person of ordinary skill in the art would have understood that a device that includes a DSP, such as *DiCenso641*’s wearable device 130, comprises a “computing device.” By September 2014, a person of ordinary skill in the art would have understood that a computer was “[a]ny device capable of processing information to produce a desired result.” Ex. 1016 (*Computer Dictionary*), 3 (definition of “computer”).⁶ A person of ordinary skill in the art would have also recognized that computers may use integrated circuits. *Id.* (disclosing computers “in which **integrated circuits** replaced transistors.”). A person of ordinary skill in the art would have further understood that “computers typically perform their work in

⁶ I rely on *Computer Dictionary* to demonstrate the knowledge of a person of ordinary skill in the art. It is not part of the unpatentability ground.

three well-defined steps: (1) accepting input, (2) processing the input according to predefined rules (programs), and (3) producing output.” *Id.*

76. By September 2014, a person of ordinary skill in the art would have understood that DSPs were “[a]n **integrated circuit** designed for high-speed data manipulation and used in audio, communications, image manipulation, and other data acquisition and data control applications.” *Id.*, 4. In my opinion, a person of ordinary skill in the art would have therefore considered *DiCenso641*’s wearable device 130 with a DSP to comprise a computing device. *See also* Ex. 1017 (*Oshana*), 7 (“[A]n embedded system is a specialized computer system that is integrated as part of a larger system. Many embedded systems are implemented using digital signal processors.”)⁷

77. *DiCenso641* also discloses the wearable device 130 performs the tasks of a computer. For example, the wearable device 130 includes earpieces 134 receiving input from microphones to “detect ambient sounds within the ambient auditory environment” and “for cancellation of user selected sounds.” Ex. 1005 (*DiCenso641*), [0022]. The device’s DSP 310 processes the input to identify the sounds. *Id.*, [0042], [0044] (disclosing DSP 310 analyzing signals, identifying

⁷ I rely on *Oshana* to demonstrate the knowledge of a person of ordinary skill in the art. It is not part of the unpatentability ground.

sounds, and separating sounds or dividing signals). In accordance with user preferences, the DSP modifies and outputs the signal. *Id.*, [0042]; *see also id.*, [0025] (“earpieces 134 may isolate the user from the ambient auditory environment through passive and/or active attenuation or cancellation, while, at the same time, **reproducing only the desired sound sources either with or without enhancement or augmentation.**”). In my opinion, a person of ordinary skill in the art would have therefore considered *DiCenso641*’s wearable device with a DSP comprises a computing device.

78. Accordingly, *DiCenso641* teaches a pair of earpieces 134 (“at least one cluster”) including a first earpiece having a DSP (“of at least one computing device”).

d. **“the at least one computing device including: a sound sensing mechanism, configured to sense a noise; and an electronic bus which is configured to transmit and receive data from the data source, wherein the data source is in electronic communication with the at least one cluster and at least one output device;”**

(i) **“sound sensing mechanism, configured to sense a noise”**

79. In my opinion, *DiCenso641* teaches this feature.

80. *DiCenso641* discloses that the earpieces 134 “each contain an associated speaker and one or more microphones or transducers, which may include an ambient microphone to detect ambient sounds within the ambient auditory

environment.” Ex. 1005 (*DiCenso641*), [0022]. *DiCenso641* also explains that ambient sounds within the ambient auditory environment include, for example, “traffic noise 102, a voice from a person 104 talking to user 120, various types of alerts 106, voices from a crowd or conversations 108 either not directed to user 120 or in a different spatial location than voice from person 104, nature sounds 110, and music 112.” *Id.*, [0019].

81. Accordingly, *DiCenso641* teaches a first earpiece 134 including an ambient microphone (“a sound sensing mechanism”) to detect ambient sounds within the ambient auditory environment (“configured to sense a noise”).

(ii) “an electronic bus which is configured to transmit and receive data from the data source,”

82. In my opinion, *DiCenso641* teaches this feature.

83. *DiCenso641* discloses that “[w]earable device 130, which may be implemented within earpieces 134, may also be equipped with wireless communication (integrated Bluetooth or Wi-Fi) to connect with various external sound sources, an external user interface, or other similar wearable devices.” Ex. 1005 (*DiCenso641*), [0025]. *DiCenso641* discloses that “the user interface may be implemented within a separate mobile or wearable device, such as a smartphone” *Id.*, [0027]. Thus, *DiCenso641* discloses earpieces 134 wirelessly communicating with mobile device 320. *See also id.*, [0023] (describing mobile

device communicating with earpieces 134 “through wired or wireless technology, such as Wi-Fi, Bluetooth, or similar technology, for example”), [0039] (describing mobile device in communication with wearable device using various types of wired or wireless communications technology or protocols, including “via a wired or wireless communications link 360”), FIG. 3 (depicting wireless communications link 360).

84. *DiCenso641* also discloses that “mobile device 320 may provide additional processing power for system 300.” *Id.*, [0039]. For example, *DiCenso641* explains 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.” *Id.* Thus, *DiCenso641* discloses earpieces 134 sending an unprocessed audio stream and receiving back a modified audio stream from mobile device 320.

Alternatively, microprocessor 326 may be integrated within the same wearable device as DSP 310 rather than within a separate mobile device 320. In addition to user interface functions, **mobile device 320 may provide additional processing power for system 300.** For example, DSP 310 may rely on microprocessor 326 of mobile device 320 to detect the user context, to receive broadcast messages, alerts, or information, etc. **In some embodiments, the system may communicate with external devices for additional processing power; e.g. a**

smartphone 320, a smart watch, or connect directly to remote servers **using a wireless network**. In these embodiments, **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**. Similarly, context sensors associated with mobile device 320 may be used to provide context information to DSP 310 as previously described.

Id., [0039].

85. The specification of the '736 patent does not refer to a “bus” or an “electronic bus.” It does, however, state that the computing device can comprise a wireless transceiver for communicating with the audio control source/data source. *See, e.g.*, Ex. 1001 ('736 patent), 4:67-5:5. Additionally, claims 25 and 26 of the '736 patent recite that a transmission medium for wirelessly transmitting and receiving data from the data source comprises a wireless transceiver. *Id.*, claims 25 & 26. Accordingly, in my opinion, a person of ordinary skill in the art would also have understood “an electronic bus which is configured to transmit and receive data from the data source” as recited in claim 1 to encompass a wireless transceiver.

86. A person of ordinary skill in the art would have understood *DiCenso641* disclosing earpieces 134 being “equipped with wireless communication (integrated Bluetooth or Wi-Fi)” to encompass *DiCenso641*'s earpieces 134 including a wireless transceiver. A person of ordinary skill in the art would also have understood that

because earpieces 134 include integrated Bluetooth technology, earpieces 134 necessarily include a transceiver because Bluetooth is a two way communication protocol and must both receive and transmit information. This is further confirmed by U.S. Patent Application Publication 2005/0058181 (“*Lyle*”), which discloses that Bluetooth communication requires a transceiver. Ex. 1012 (*Lyle*), [0002] (“Bluetooth® technology defines a specific wireless frequency hopping spread spectrum communication link operating in the unlicensed ISM band at 2.4 GHz using **a frequency hopping transceiver** [*sic*]. It allows real-time voice and data communications **between** Bluetooth® devices.”).⁸

87. A person of ordinary skill in the art would also have understood *DiCenso641* to teach each of earpieces 134 sending an unprocessed audio stream captured by the microphones on the respective earpiece 134 to mobile device 320 and receiving back a modified audio stream from mobile device 320 for outputting on the speaker(s) of the respective earpiece 134. For example, *DiCenso641* discloses receiving a signal from multiple microphones. Ex. 1005 (*DiCenso641*), [0042] (“In operation, a representative embodiment of a system or method as illustrated in FIG. 3, for example, generates a customized or personalized user controllable auditory

⁸ I rely on *Lyle* to demonstrate the knowledge of a person of ordinary skill in the art. It is not part of the unpatentability ground.

environment based on sounds from the ambient auditory environment **by receiving a signal** representing the sounds in the ambient auditory environment of the user **from one or more microphones 312.”**). *DiCenso641* also discloses generating separate signals for outputting on the speakers of the respective earpieces.

The received ambient audio signal may be processed by dividing the signal into a plurality of component signals each representing one of the plurality of types of sounds, modifying each of the component signals for each type of sound in the ambient auditory environment based on the corresponding user preference, **generating a left signal and a right signal for each of the plurality of component signals** based on a corresponding desired spatial position for the type of sound within the auditory environment of the user, **combining the left signals into a combined left signal, and combining the right signals into a combined right signal**. The combined left signal is provided to a first speaker and the combined right signal is provided to a second speaker.

Id., [0007]; *see also id.*, [0045] (“[T]he combined modified signal may be separated into a left signal provided to a first speaker and a right signal provided to a second speaker.”)

88. As such, in my opinion, a person of ordinary skill in the art would have understood each of *DiCenso641*'s earpieces 134 to include a wireless transceiver to wirelessly communicate with mobile device 320.

89. At a minimum, a person of ordinary skill in the art would have found it obvious to include a wireless transceiver in each earpiece 134 because *DiCenso641* already discloses using a wireless transceiver for the wearable device 130 to communicate with the mobile device 320, and it also discloses the mobile device generating a left signal and a right signal for output. Thus, in my opinion, incorporating a wireless transceiver in each earpiece would have amounted to mere application of a known technique (using a wireless transceiver to communicate between a mobile device and a wearable device) to a similar device (*DiCenso641*'s two earpieces) ready for improvement to yield predictable results (the mobile device transmitting left and right signals to left and right earpieces, respectively).

90. Accordingly, *DiCenso641* teaches a pair of earpieces 134 including a first earpiece having integrated Bluetooth or Wi-Fi technology that includes a wireless transceiver ("an electronic bus") for sending, for example, an unprocessed audio stream and receiving back a modified audio stream ("which is configured to transmit and receive data") from mobile device 320 ("from the data source").

(iii) “wherein the data source is in electronic communication with the at least one cluster and at least one output device;”

91. In my opinion, *DiCenso641* teaches this feature.

92. For the reasons I discussed in §X.A.1.d(ii), *DiCenso641* teaches each of earpieces 134 in wireless communication with mobile device 320 to send an unprocessed audio stream captured by the microphones on the respective earpiece 134 and to receive back a modified audio stream from mobile device 320 for outputting on the speaker(s) of the respective earpieces 134.

93. As I also discussed in §X.A.1.c, a person of ordinary skill in the art would have understood that, when implemented by earpieces 134, wearable device 130 comprises a pair of earpieces 134 each containing a speaker and one or more microphones or transducers, and at least one of which includes a DSP. Thus, a person of ordinary skill in the art would have understood *DiCenso641* to disclose a pair of earpieces 134 including at least a first earpiece having a speaker, one or more microphones or transducers, and a DSP, and a second earpiece having at least a speaker and one or more microphones or transducers.

94. Accordingly, *DiCenso641* teaches the mobile device 320 in wireless communication (“wherein the data source is in electronic communication”) with a first earpiece of earpieces 134 (“with the at least one cluster”) and the second earpiece (“and at least one output device”).

e. **“a memory, containing computer-executable instructions; and”**

95. In my opinion, *DiCenso641* teaches this feature.

96. *DiCenso641* discloses device 130 “includes at least one microphone, at least one speaker, and **a microprocessor-based digital signal processor (DSP).**” Ex. 1005 (*DiCenso641*), [0022]; *see also id.*, [0032] (“System 300 includes a microprocessor or digital signal processor (DSP) 310 in communication with one or more microphones 312, one or more amplifiers 314 and one or more speakers 316.”). *Dicenso641* also states “[a]lternatively, microprocessor 326 may be integrated within the same wearable device as DSP 310 rather than within a separate mobile device 320”. *Id.*, [0039]. In my opinion, a person of ordinary skill in the art would have understood from this statement that DSP 310 is contained within the wearable device 130.

97. *DiCenso641* also discloses its “functions or logic may be performed by hardware and/or software executed by a programmed microprocessor. Functions implemented at least partially by software may be stored in a computer program product comprising a non-transitory computer readable storage medium having stored data representing code or instructions executable by a computer or processor to perform the indicated function(s).” *Id.*, [0031]. Thus, a person of ordinary skill in the art would have understood that the functionality described with respect to

microprocessor-based DSP 310 is performed by DSP 310 executing code stored in a computer readable storage medium accessible to the DSP 310.

98. Accordingly, *DiCenso641* teaches a computer readable storage medium (“a memory”) containing code or instructions executable by DSP 310 (“containing computer-executable instructions”).

f. “a processor configured to execute the computer-executable instructions to cause the processor to perform functions including:”

99. In my opinion, *DiCenso641* teaches this feature.

100. As I discussed in §X.A.1.e, *DiCenso641* teaches the wearable device 130—which can be implemented as earpieces 134—having a microprocessor-based DSP 310. As I discussed in §X.A.1.e, a person of ordinary skill in the art would have understood that, when implementing the functionality described with respect to DSP 310, code or instructions executable by DSP 310 would be stored in a computer readable storage medium.

101. Accordingly, *DiCenso641* teaches a microprocessor-based DSP 310 (“a processor”) implementing functionality by executing code or instructions stored in a computer readable storage medium (“configured to execute the computer-executable instructions”).

102. Moreover, because as I discuss below and in §X.A.1.e, *DiCenso641*’s DSP 310 operates by executing code stored in a computer readable storage medium,

the *DiCenso641-Smith* combination teaches that when the code stored in the computer readable storage medium is executed by DSP 310, the microprocessor performs operations that meet the claim elements discussed in §§X.A.1.f(i)-X.A.1.f(iii) and the dependent claims discussed below.

(i) **“identifying one or more sounds within the noise;”**

103. In my opinion, *DiCenso641* teaches this feature.

104. *DiCenso641* discloses that the system may communicate with a local or remote database or library 350 that “include[s] sound libraries having stored sounds and/or associated signal characteristics for use by DSP 310 in **identifying a particular type or group of sounds from the ambient audio environment.**” Ex. 1005 (*DiCenso641*), [0040]. *DiCenso641* also explains that its system “generates a customized or personalized user controllable auditory environment based on sounds from the ambient auditory environment by receiving a signal representing the sounds in the ambient auditory environment of the user from one or more microphones 312.” *Id.*, [0042]. To do so, “DSP 310 processes the signal ... to identify at least one of a plurality of types of sounds in the ambient auditory environment.” *Id.*; *see also id.*, claims 1, 15, & 22.

105. Accordingly, *DiCenso641* teaches microprocessor 326 of mobile device 320 identifying at least one of a plurality of types of sounds in the ambient auditory environment (“identifying one or more sounds within the noise”).

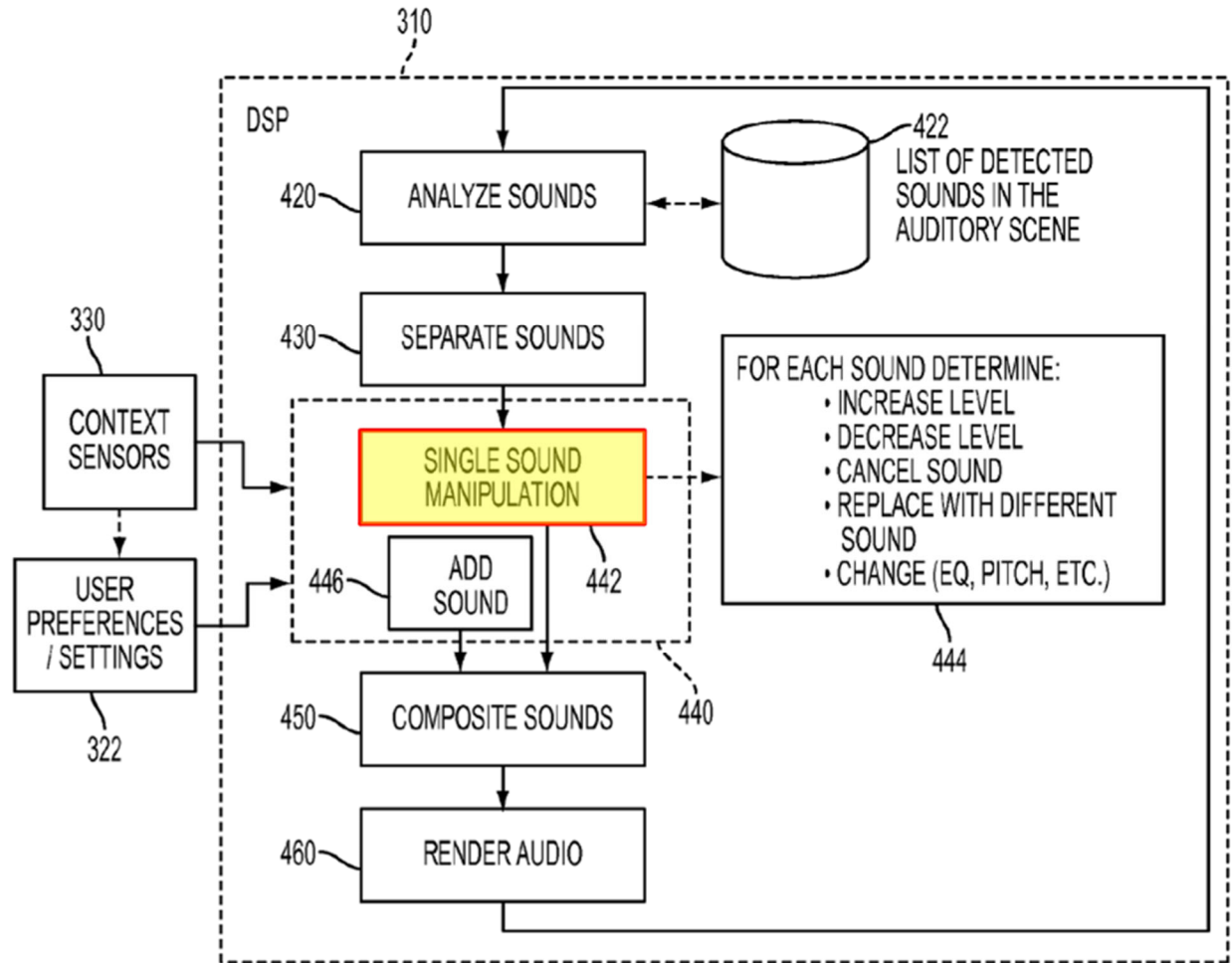
(ii) “isolating the one or more sounds;”

106. In my opinion, *DiCenso641* teaches this feature.

107. *DiCenso641* discloses that, to generate an auditory environment for a user, “DSP 310 processes the signal ... to identify at least one of a plurality of types of sounds in the ambient auditory environment.” Ex. 1005 (*DiCenso641*), [0042]. *DiCenso641* explains that “DSP 310 receives user preferences 322 corresponding to each of the plurality of types of sounds and modifies the signal for each type of sound in the ambient auditory environment based on the corresponding user preference.” *Id.* For example, *DiCenso641* explains that modifying the signal “may include increasing level or volume, decreasing level or volume, canceling a particular sound, replacing a sound with a different sound (a combination of cancelling and inserting/adding a sound), or changing various qualities of a sound, such as equalization, pitch, etc.” *Id.*, [0044].

108. Before modifying the signal, *DiCenso641* discloses that “DSP 310 may **separate sounds or divide signals associated with particular sounds** as represented at 430. Each sound type or group may be modified or manipulated as

represented at 442.” *Id.* In figure 4 (reproduced below), *DiCenso641* describes step 442 as “single sound manipulation.”



Ex. 1005 (*DiCenso641*), FIG. 4 (annotated)

109. Thus, a person of ordinary skill in the art would have understood *DiCenso641* to disclose separating sounds to enable individual sounds to be modified (or manipulated) without impacting other sounds. For example, *DiCenso641* explains that user interface 324 “allows user 120 to create a personalized or customized auditory experience by setting his/her preferences

indicated by symbols 140, 142, 144, 146, for associated sound types to indicate which sounds to amplify, cancel, add or insert, or attenuate, respectively.” Ex. 1005 (*DiCenso641*), [0028]. Thus, *DiCenso641* explains, for example, that certain sounds may be amplified, while other sounds are attenuated, and a person of ordinary skill in the art would have understood *DiCenso641* to disclose separating the sounds from one another (or isolating the sounds) in order to individually modify or manipulate such sounds.

110. Accordingly, *DiCenso641* teaches DSP 310 separating sounds or dividing signals associated with particular sounds (“isolating the one or more sounds”) before modifying the signals based on corresponding user preferences.

(iii) “determining if one or more of the isolated one or more sounds includes a frequency outside of a predetermined threshold.”

111. In my opinion, *DiCenso641* in combination with *Smith* teaches this feature.

112. *Smith* discloses that its earpiece 101 includes one or multiple microphones 102.

FIG. 1 shows a block diagram illustrating a device for hearing enhancement and protection, in accordance with an embodiment of the invention. A fully occluding **earpiece 101 can substantially contain a microphone 102**, electronics 103, a connector 104, and a speaker 105.

The **microphone 102 can pick up ambient sound and can transduce the sound into a signal**, such as an analog electronic signal.

See Ex. 1006 (*Smith*), [0020], [0025] (“More than one microphone 102 can be used. Each microphone 102 can be comparatively more sensitive to a different portion of the audio spectrum.”).

113. *Smith* discloses that the more than one microphone may be used where the microphones are sensitive to different portions of the audio spectrum, and that these sounds may be converted.

One or more microphones 102 can be sensitive to one or more portions of the audio spectrum that are considered to be outside of the audible range. For example, one microphone 102 can be sensitive to infrasound (such as sound having a frequency less than 20 Hz) and another microphone 102 can be sensitive to ultrasound (such as sound having a frequency greater than 20 kHz). Such **sounds outside of the audible range can be converted to the audible range for enhanced hearing.** Thus, **infrasound can be up converted in frequency** and **ultrasound can be down converted in frequency** to facilitate processing and/or human hearing.

Id., [0026].

114. *Smith* also discloses that its system “can alert the user to otherwise inaudible sounds. **Such sounds can be inaudible due to their frequency content**

and/or amplitude. **Such inaudible sounds can be reproduced at** an increased amplitude and/or **different frequency so that they can be heard by the user.”** *Id.*, [0027]. To do so, *Smith* discloses storing sound signatures for various sounds, including inaudible sounds. *See id.*, [0028] (“Such inaudible sounds or sound signatures representative thereof can be stored in a database (such as in the manner of environmental signatures).”). *Smith* also discloses comparing inaudible sounds to their sound signature stored in the database and providing an indication to the user if a match is found. *See id.*, [0029] (“Then, subsequently received inaudible sounds or their sound signatures can be compared to the sounds or sound signatures stored in the database. When a match is determined, the appropriate indication can be provided to the user.”). Thus, a person of ordinary skill in the art would have understood *Smith* to disclose identifying sounds outside of the audible range and that doing so would include determining that the sound includes a frequency outside of the audible range—*e.g.*, less than 20 Hz or greater than 20 kHz.

115. Furthermore, a person of ordinary skill in the art would have been motivated to modify *DiCenso641* in view of *Smith* to determine, for example, when a sound includes a frequency greater than 20 kHz (“determining if one or more of the one or more sounds includes a frequency outside of a predetermined threshold”). Indeed, both *DiCenso641* and *Smith* are directed to systems and methods for providing an altered auditory environment for a user. For example, *DiCenso641*

discloses that the user interface “allows user 120 to create a personalized or customized auditory experience by setting his/her preferences ... for associated sound types to indicate which sounds to amplify, cancel, add or insert, or attenuate, respectively.” Ex. 1005 (*DiCenso641*), [0028]. *DiCenso641* also discloses that “[o]ther functions may be used to enhance a sound by providing equalization or filtering, selective attenuation or amplification of one or more frequencies of an associated sound, or replacing an undesired sound with a more pleasant sound (using a combination of cancellation and addition/insertion, for example).” *Id.* Like *DiCenso641*, *Smith* similarly discloses a system and method for modifying select sounds within an ambient environment. *See* Ex. 1006 (*Smith*), [0082] (“[A] user can select which types of noise are to be attenuated and the level of attenuation. For example, the user can select to attenuate gunshot noise by 12 dB, dog barking by 6 dB, and car noise by 3 dB.”), [0085] (“[A] user can select which types of information are to be amplified and the level of amplification. For example, the user can select to amplify low level human voice (such as below 50 dB) by 18 dB, high level human voice (such as above 50 dB) by 9 dB, noise associated with furtive movements by 6 dB, and non-shooting gun noises (such as loading and cocking noises) by 3 dB.”).

116. A person of ordinary skill in the art would have recognized the benefit of implementing *Smith*’s teachings for processing inaudible sounds in *DiCenso641*’s system. For example, a person of ordinary skill in the art would have understood

converting sounds outside the audible range to the audible range and/or that alerting the user to otherwise inaudible sounds would provide enhanced hearing and awareness, and an enhanced auditory environment. *See* Ex. 1006 (*Smith*), [0027] (disclosing reproducing the inaudible sounds “at an increased amplitude and/or different frequency so that they can be heard by the user” and alerting the user “to otherwise inaudible sounds”). A person of ordinary skill in the art would also have understood that identifying inaudible sounds would enable such sounds to be altered (e.g., reproduced at a different frequency) and potentially replaced with other sounds, such as a warning or other identification. *See id.* (disclosing reproducing the inaudible sounds “at an increased amplitude and/or different frequency so that they can be heard by the user” and replacing the sounds with “a warning, voice identification or other identification”). A person of ordinary skill in the art would thus have been motivated to modify DSP 310’s programming to also perform the additional processing steps described by *Smith* on audio streams.

117. A person of ordinary skill in the art would also have been motivated to modify *DiCenso641*’s earpieces 134 to incorporate additional microphones—for example, at least one microphone sensitive to infrasound and one microphone sensitive to ultrasound—as taught by *Smith* to enable this additional capability taught by *Smith* in *DiCenso641*’s system for generating a personalized or customized auditory environment. A person of ordinary skill in the art would have recognized

that including, for example, at least ultrasound microphone in order to incorporate *Smith*'s teaching for identifying and processing otherwise inaudible sounds would promote, or at a minimum be consistent with, *DiCenso641*'s stated objective to generate a user controllable auditory environment. A person of ordinary skill in the art would also have had a reasonable expectation of success in incorporating such additional microphones into *DiCenso641*'s earpieces 134 at least because *DiCenso641* expressly contemplates having more than one microphone in each earpiece 134. *See* Ex. 1005 (*DiCenso641*), [0022] ("Wearable device 130 may be implemented by headphones or ear buds 134 that each contain an associated speaker and **one or more microphones or transducers**, which may include an ambient microphone to detect ambient sounds within the ambient auditory environment, and an internal microphone used in a closed loop feedback control system for cancellation of user selected sounds.").

118. In my opinion, the combination would have been obvious to a person of ordinary skill in the art because it would have amounted to mere use of a known technique (*Smith*'s teaching of identifying and processing inaudible sounds) to improve a similar system (*DiCenso641*'s system for providing a personalized or customized auditory experience via earpieces 134) in the same way (by allowing the user to be aware of, for example, otherwise inaudible infrasonic and ultrasonic sounds).

119. As I discussed in §X.A.1.f(ii), a person of ordinary skill in the art would have understood *DiCenso641* to disclose separating the sounds from one another (or isolating the sounds) in order to individually modify or manipulate such sounds. A person of ordinary skill in the art would have found it obvious that in the *DiCenso641-Smith* combination, the DSP 310 would continue to first separate (or isolate) sounds identified within signals captured by the microphones 312 before performing the further processing taught by *Smith*. Thus, for example, the *DiCenso641-Smith* combination would first separate (or isolate) the portion of the signal comprising ultrasonic frequencies, and then down convert those frequencies as taught by *Smith* to allow the user to hear them. A person of ordinary skill in the art would have recognized that doing so would have promoted, or at least remain consistent with, *DiCenso641*'s stated goal of allowing a user to "create a personalized or customized auditory experience by setting his/her preferences ... for **associated sound types** to indicate **which sounds** to amplify, cancel, add or insert, or attenuate, respectively." Ex. 1005 (*DiCenso641*), [0028].

120. Accordingly, the *DiCenso641-Smith* combination teaches DSP 310 determining when a sound includes, for example, a frequency greater than 20 kHz ("determining if one or more of the isolated one or more sounds includes a frequency outside of a predetermined threshold").

2. Claim 4

- a. **“The system as recited in claim 1, wherein the sound-sensing mechanism is selected from the group consisting of: an ultrasonic transducer; an infrasonic transducer; and a microwave transducer.”**

121. In my opinion, *DiCenso641* in combination with *Smith* teaches this claim.

122. As I discussed in §X.A.1.f(iii), a person of ordinary skill in the art would have found it obvious to modify *DiCenso641*'s earpieces 134 to incorporate additional microphones—for example, at least one microphone sensitive to ultrasound—as taught by *Smith*. In my opinion, a person of ordinary skill in the art would also have understood that a microphone sensitive to infrasound comprises an infrasonic transducer and that a microphone sensitive to ultrasound comprises an ultrasonic transducer. In other words, it is my opinion that a microphone is a type of a transducer.

123. *Smith* discloses the availability of infrasonic and ultrasonic microphones. Ex. 1006 (*Smith*), [0026] (“one microphone 102 can be sensitive to infrasound ... and another microphone 102 can be sensitive to ultrasound”). *Smith* also discloses that the microphones “transduce the sound into a signal.” *Id.*, [0020] (“The microphone 102 can pick up ambient sound and can **transduce the sound into a signal, such as an analog electronic signal.**”). A person of ordinary skill in the art would have therefore understood *Smith*'s microphones are, at a minimum, a

particular type of transducer. Confirming this, *DiCenso641* discloses that the headphones or earbuds “each contain an associated speaker and **one or more microphones or transducers.**” Ex. 1005 (*DiCenso641*), [0022].

124. *Smith* and *DiCenso641*’s disclosures are also consistent with common definitions of microphones and transducers. For example, in a textbook titled “The Science of Sound,” a chapter includes a section titled “Microphones as Transducers” and states that “[a] microphone is a transducer that produces an electrical signal when actuated by sound waves.” Ex. 1018 (*Rossing*), 16.⁹ By September 2014, a person of ordinary skill in the art would have understood that microphones were devices that convert “sound waves into analog electrical signals.” Ex. 1016 (*Computer Dictionary*), 5.¹⁰ A person of ordinary skill in the art would have also understood that transducers were devices that convert “one form of energy into another.” *Id.*, 6 (“Electronic transducers either convert electric energy to another form of energy or convert nonelectric to electric energy.”). A person of ordinary skill in the art would therefore have understood microphones, which convert sound waves

⁹ I rely on *Rossing* to demonstrate the knowledge of a person of ordinary skill in the art. It is not part of the unpatentability ground.

¹⁰ I rely on *Computer Dictionary* to demonstrate the knowledge of a person of ordinary skill in the art. It is not part of the unpatentability ground.

into analog electrical signals, are a particular type of transducer that turns a certain type of “nonelectric” energy into electrical energy.

125. Indeed, the '736 patent itself acknowledges that the sound-sensing mechanism is a microphone, and that a microphone is a type of transducer. Ex. 1001 ('736 patent), 13:59-61 (“At step 305, audio/noise is sensed by one or more audio sensing devices. According to an embodiment, the one or more sensing devices are microphones.”), 14:4-10 (“According to an embodiment, the present system may sense different types of phenomena (e.g., it may sense audio **using an audio transducer such as a microphone**, it may include a smartwatch and/or other similar device that may be able to sense ultrasonic waves using an ultrasonic transducer, and/or the system may incorporate one or more various suitable types of transducers).”).

126. Accordingly, the *DiCenso641-Smith* combination teaches *DiCenso641*'s earpieces 134 including at least one ultrasonic microphone (“an ultrasonic transducer”) or infrasonic microphone (“infrasonic transducer”).

3. Claim 5

a. **“The system as recited in claim 4, wherein the sensed noise includes infrasonic or ultrasonic soundwaves.”**

127. In my opinion, *DiCenso641* in combination with *Smith* teaches this claim.

128. For the reasons I discussed in §X.A.1.f(iii), the *DiCenso641-Smith* combination teaches *DiCenso641*'s DSP 310 receiving sound detected by earpieces 134 that includes a frequency outside of the audible range (*e.g.*, greater than 20 kHz) and down converting such sound outside of the audible range to the audible range for enhanced hearing.

129. Accordingly, the *DiCenso641-Smith* combination teaches the sound captured by microphones 312 of earpieces 134 including sound with a frequency outside of the audible range (*e.g.*, greater than 20 kHz) (“ultrasonic soundwaves”).

4. Claim 6

- a. **“The system as recited in claim 1, wherein the predetermined threshold equates to a frequency determined to pose a risk of harm to a user’s hearing capabilities.”**

130. In my opinion, *DiCenso641* in combination with *Smith* teaches this claim.

131. As I discussed in §X.A.1.f(iii), the *DiCenso641-Smith* combination teaches DSP 310 determining whether sound(s) detected by earpiece(s) 134 includes a frequency outside of the audible range (*e.g.*, greater than 20 kHz) and, if so, down converting such sounds outside of the audible range to the audible range. A person of ordinary skill in the art would have understood that 20 kHz, when used to determine when to down convert the frequency of a sound to within the audible range of human hearing (as taught by *Smith*), constitutes a threshold. A person of ordinary

skill in the art would also have understood that frequencies greater than 20 kHz comprise frequencies determined to pose a risk of harm to a user's hearing capabilities. For example, a person of ordinary skill in the art would have appreciated that it was known in the art that ultrasonic sounds (*i.e.*, sounds having a frequency greater than 20 kHz) were at some point determined to pose a risk of harm to a user's hearing capabilities. *See, e.g.*, Ex. 1013 (*Wiernicki*), 15-16 (“These standards are consistent in that they present exposure limits to prevent subjective effects at one-third octave bands centered at or below 20 kHz **and exposure limits for one-third octave bands at 20 kHz and above to prevent thermal effects and hearing loss from possible subharmonics.**”).¹¹

132. Accordingly, the *DiCenso641-Smith* combination teaches determining when a sound includes a frequency greater than 20 kHz (“determining if one or more of the one or more sounds includes a frequency outside of a predetermined threshold”), which comprises frequencies known in the art to pose a risk of harm to a user's hearing capabilities (“wherein the predetermined threshold equates to a frequency determined to pose a risk of harm to a user's hearing capabilities”).

¹¹ I rely on *Wiernicki* to demonstrate the knowledge of a person of ordinary skill in the art. It is not part of the unpatentability ground.

5. Claim 7

- a. **“The system as recited in claim 1, wherein the computer-executable instructions further include: if one or more of the isolated one or more sounds includes the frequency outside of the predetermined threshold, notifying a user, via a notification, that one or more of the one or more sounds includes the frequency outside of the predetermined threshold.”**

133. In my opinion, *DiCenso641* in combination with *Smith* teaches this claim.

134. As I discussed in §X.A.1.f(iii), a person of ordinary skill in the art would have found it obvious to incorporate *Smith*’s teachings for processing inaudible sounds into *DiCenso641*’s system.

135. In addition to disclosing up converting and/or down converting inaudible sounds (*see* §§X.A.1.f(iii) and X.A.10.a), *Smith* also explains that “inaudible sounds can be replaced with other sounds, such as a warning, voice identification or other identification.” Ex. 1006 (*Smith*), [0027]. *DiCenso641* also discloses that the user interface “allows user 120 to create a personalized or customized auditory experience by setting his/her preferences indicated by symbols 140, 142, 144, 146, for associated sound types to indicate which sounds to amplify, cancel, **add or insert**, or attenuate, respectively. Other functions may be used to enhance a sound by providing equalization or filtering, selective attenuation or amplification of one or more frequencies of an associated sound, or replacing an

undesired sound with a more pleasant sound (using a combination of cancellation and addition/insertion, for example).” Ex. 1005 (*DiCenso641*), [0028]. *DiCenso641* also notes that user preferences may include “one **or more** modifications to the associated sound.” *Id.*, [0033].

136. When incorporating *Smith*’s teachings for processing inaudible sounds in *DiCenso641*’s system, a person of ordinary skill in the art would also have found it obvious to further modify *DiCenso641*’s system to present a user 120 the option to provide an alert, such as a warning, voice identification or other identification—as taught by *Smith*—when sounds are detected outside the audible range. In other words, a person of ordinary skill in the art would have found it obvious to further modify the *DiCenso641-Smith* combination such that, when a sound is detected with, for example, a frequency greater than 20 kHz, in addition to down converting the sound to within the audible range, DSP 310 is configured to provide an alert responsive to the inaudible sound being detected (as taught by *Smith*). A person of ordinary skill in the art would also have understood that such an alert would amount to an audible notification of the presence of such an inaudible sound within the signals captured by the one or more microphones or transducers of earpieces 134. *see also* Ex. 1001 (’736 patent), 15:64-16:2 (“According to an embodiment, if audio in the hazardous range has been detected, then one or more users are notified, at step

325. The notification may take the form of a visual notification, an audible notification, and/or any other suitable form of notification.”).

137. A person of ordinary skill in the art would have also found the modification obvious because it would have amounted to applying a known technique (*Smith*’s teaching regarding processing inaudible sounds, including providing a warning or other identification for inaudible sounds) to a known device (the *DiCenso641-Smith* combination that processes inaudible sounds) ready for improvement to yield predictable results (further modifying the *DiCenso641-Smith* combination to provide a warning or other identification regarding inaudible sounds in addition to up converting and/or down converting such sounds).

138. A person of ordinary skill in the art would have also had a reasonable expectation of success in doing so as it would have merely involved programming additional digital signal processing operations already taught and performed by *Smith* to be performed by *DiCenso641*’s DSP 310.

139. Accordingly, the *DiCenso641-Smith* combination teaches if an inaudible sound is detected that corresponds to a frequency for which user preferences indicate that an alert should be provided (“if one or more of the one or more sounds includes the frequency outside of the predetermined threshold”), DSP 310 provides an alert to user 102 via speaker(s) of earpieces 134 (“notifying a user,

via a notification, that one or more of the one or more sounds includes the frequency outside of the predetermined threshold”).

6. Claim 8

- a. “The system as recited in claim 1, wherein the computer-executable instructions further include steps selected from the group consisting of: panning the sensed noise; and equalizing the sensed noise.”**

140. In my opinion, *DiCenso641* in combination with *Smith* teaches this claim.

141. *DiCenso641* discloses that the user interface “allows user 120 to create a personalized or customized auditory experience by setting his/her preferences ... for associated sound types to indicate which sounds to amplify, cancel, add or insert, or attenuate, respectively.” Ex. 1005 (*DiCenso641*), [0028]. *DiCenso641* also explains that other functions may be used to enhance a sound, including “providing equalization” of the sound. *Id.*; *see also id.*, Abstract (“A microprocessor processes ambient sounds and generates modified audio signals using attenuation, amplification, cancellation, and/or **equalization** based on user preferences associated with particular types of sounds.”), [0007] (“Modifying the signal may include ... **equalizing the component signal** ...”), [0044] (“Each sound type or group may be modified or manipulated as represented at 442. As previously described, this may include ... changing various qualities of a sound, **such as equalization**, pitch, etc., as represented by block 444.”). *DiCenso641* also explicitly

discloses “receiving a signal representing an ambient auditory environment of the user” (*id.*, claim 1) and “modifying the signal for each type of sound in the ambient auditory environment based on the corresponding user preference” (*id.*), “wherein modifying the signal for each type of sound comprises at least one of attenuating the signal, amplifying the signal, and **equalizing the signal**” (*id.*, claim 10).

142. Accordingly, the *DiCenso641-Smith* combination teaches providing equalization of the signal captured by one or more microphones 312 (“equalizing the sensed noise”).

143. *DiCenso641* also discloses wearable device 130 including context sensors “to determine accurately the user’s location and/or head position and orientation. This allows the system to reproduce voices and sounds in the correct spatial position as they occur within the ambient auditory environment to not confuse the user.” Ex. 1005 (*DiCenso641*), [0026] (“As an example, if a voice comes from the left of the user and he turns his head 45 degrees toward his left, the voice is placed in the correct location of the stereo panorama to not confuse the user’s perception. Alternatively, the system can optimize the stereo panorama of a conversation (for example, by spreading out the audio sources), which may lower the user’s cognitive load in certain situations.”). For example, *DiCenso641* explains that additional processing can be performed on signals “to virtually locate the sound(s) within the auditory environment of the user using stereo or multiple speaker

arrangements as generally understood by those of skill in the art.” *Id.*, [0034]; *see also id.*, [0045] (“In various embodiments, the combined modified signal is processed to virtually locate one or more sound sources within an auditory environment of the user based on positions of the sources within the ambient auditory environment or based on user selected spatial orientation.”).

144. A person of ordinary skill in the art would have understood reproducing sounds captured by one or more microphones 312 in the correct spatial position within a stereo panorama, as described in *DiCenso641*, comprises panning the sounds. *See, e.g.*, Ex. 1018 (*Rossing*), 58 (“**panning** Applying a set of output signals to a series of loudspeakers sequentially so that the sound seems to move in space); Ex. 1019 (*Kirkeby*), [0040] (disclosing “a standard operation usually referred to as amplitude panning” for narrowing the sound stage and reproducing sound signals closer together), [0061] (“Repanning is an audio processing method, basically applied to stereo music tracks, which maps energy in a specific spatial position to a new spatial position.”); Ex. 1021 (*Eppolito*), 4:25-28 (“**Audio panning is the spreading of audio signal in a sound space.** Panning can be done by moving a sound signal to certain audio speakers. Panning can also be done by changing the width, attenuating, and/or collapsing the audio signal.”); Ex. 1022 (*Avendano*), 1:30-44 (“Stereo recordings and other multichannel audio signals may comprise one or more components designed to give listeners the sense that a particular source of

sound is positioned at a particular location relative to the listener. For example, in the case of a stereo recording made in a studio, **the recording engineer might mix the left and right signal so as to give the listener a sense that a particular source recorded in isolation of other sources is located at some angle off the axis between the left and right speakers.** The term “panning” is often used to describe such techniques, and a source panned to a particular location relative to a listener located at a certain spot equidistant from both the left and right speakers (and/or other or different speakers in the case of audio signals other than stereo signals) will be referred to herein as a “panned source.”)¹²

145. I note that the '736 patent at times refers to panning as “separating like frequencies.” *See* Ex. 1001 ('736 patent), 9:2-4, 16:12-13. This is not the standard usage of the term “panning” in the art. In my opinion, *Rossing's*, *Kirkeby's*, *Eppolito's*, and *Avendano's* disclosures are consistent with a person of ordinary skill in the art's understanding of the term in the audio arts as moving sound sources around within the sound stage.

¹² I rely on *Rossing*, *Kirkeby*, *Eppolito*, and *Avendano* to demonstrate the knowledge of a person of ordinary skill in the art. They are not part of the unpatentability ground.

146. It is also my opinion that the '736 patent does not clearly redefine “panning” to have a different meaning. At most, the '736 patent states that panning is “separating like frequencies.” Ex. 1001 ('736 patent), 9:2-4; *see also id.*, 16-12-13 (“At step 335, the audio is panned. That is, like frequencies in the sensed audio are separated.”). Other usages of the “panning” term do not include any similar suggestions as to the term’s meaning. *Id.*, 6:4-6, 7:9-11, 17:11, FIG. 5 (element 335). The '736 patent does not use phrases such as “as used here” or “refer to” in connection with panning, does not state that panning is “defined” or has a particular “meaning,” and does not use other words that would suggest to a person of ordinary skill in the art that the applicant intended to ascribe a special meaning to “panning” inconsistent with how the term is understood by a person of ordinary skill in the art.

147. But to the extent that Patent Owner alleges, and the Board finds, that the usage of panning by the '736 patent means “separating like frequencies,” *DiCenso641* discloses this through its usage of filters. Ex. 1005 (*DiCenso641*), [0028] (“Other functions may be used to enhance a sound by providing equalization or **filtering**, selective attenuation or amplification of one or more frequencies of an associated sound, or replacing an undesired sound with a more pleasant sound (using a combination of cancellation and addition/insertion, for example).”). A person of ordinary skill in the art would have understood filtering includes the separation of frequencies. *See, e.g.*, Ex. 1020 (*Ramo*), [0063] (disclosing “a filter configured to

separate the frequency domain representation for the at least two audio channels of the audio signal into at least two frequency bands”), Ex. 1018 (*Rossing*), 39 (“A *filter* element in a restricted sense is a device that modifies the amplitude or phase of a signal in a frequency-dependent manner. More generally, filters can modify or process signals in any manner whatsoever”).¹³

148. Accordingly, the *DiCenso641-Smith* combination also teaches reproducing in the correct spatial position within a stereo panorama sounds captured by one or more microphones 312 (“panning the sensed noise”).

7. Claim 9

- a. **“The system as recited in claim 1, further comprising:
an in-ear device, wherein an audio output of the in-ear device auto-adjusts based on signal energy sensed within a cluster or surrounding clusters.”**

149. In my opinion, *DiCenso641* in combination with *Smith* teaches this claim.

150. In my opinion, claim 9 does not limit where the in-ear device is in the claimed system or how it relates to the components recited in claim 1. The ’736 patent also contemplates that “various in-ear systems may be integrated into the present invention,” including “an in-ear monitor.” Ex. 1001 (’736 patent), 8:51-65.

¹³ I rely on *Ramo* and *Rossing* to demonstrate the knowledge of a person of ordinary skill in the art. It is not part of the unpatentability ground.

For example, the '736 patent provides that “the output of such an in-ear monitor can be autonomously adjusted after sensing audio output.” *Id.* For example, “[a] given output can be adjusted according to what is sensed within specified location or what is sensed at external clusters.” *Id.* Accordingly, a person of ordinary skill in the art would have understood the plain and ordinary meaning of this claim to encompass as if claim 1 were written as “... at least one output device including an in-ear device, wherein an audio output of the in-ear device auto-adjusts based on signal energy sensed within a cluster or surrounding clusters, the at least one output device including:”

151. *DiCenso641* discloses earpieces 134 comprising “in-the-ear devices that partially or substantially completely seal the ear canal of user 120 to provide passive attenuation of ambient sounds.” Ex. 1005 (*DiCenso641*), [0022]; *see also id.*, [0023] (“In one embodiment, wearable device 130 includes in-the-ear or intra-aural earpieces 134 ...”). *DiCenso641* also discloses that the user interface “allows user 120 to create a personalized or customized auditory experience by setting his/her preferences ... for associated sound types to indicate which sounds to amplify, cancel, add or insert, or attenuate, respectively.” *Id.*, [0028]. For example, *DiCenso641* discloses that “DSP 310 receives user preferences 322 corresponding to each of the plurality of types of sounds and modifies the signal for each type of sound in the ambient auditory environment based on the corresponding user

preference.” *Id.*, [0042]. *DiCenso641* further discloses that “[t]he modified signal is output to amp(s) 314 and speaker(s) 316 to generate the auditory environment for the user.” *Id.*

152. A person of ordinary skill in the art would thus have understood *DiCenso641* to disclose automatically adjusting the signal output via speaker(s) 316 based on the signals captured by one or more microphones 312. For example, *DiCenso641* does not describe or suggest any human intervention outside of the setting of preferences for the auditory environment when generating the auditory environment. *Id.*, [0042]-[0043]; *see also id.*, [0030] (“However, in contrast to current hearing aid technology, sound enhancement is applied selectively in response to particular user preference settings.”), [0034] (“The received user preferences are applied to associated sounds within the ambient auditory environment as represented by block 240. ... Modification of one or more types or categories of sounds received by one or more ambient microphones of the wearable device in response to associated user preferences continues until the user preferences change as represented by block 250.”). Even though the user may adjust the preferences at any time, *DiCenso641* discloses that the DSP “modifies the signal for each type of sound in the ambient auditory environment based on the corresponding user preference.” *Id.*, [0042]. No human intervention is therefore disclosed. Similarly, *DiCenso641* discloses a use case where “the headphones are actively

listening for the user's name, and will let a conversation pass through if it is explicitly addressed to the user." *Id.*, [0064]. No human intervention is disclosed before *DiCenso641*'s "actively listening" headphones adjust the signal output.

153. Accordingly, the *DiCenso641-Smith* combination teaches each of earpieces 134 comprising an in-the-ear device ("an in-ear device") and that the signal output via the speakers 316 of earpieces 134 is automatically adjusted based on the signals captured by one or more microphones 312 ("wherein an audio output of the in-ear device auto-adjusts based on signal energy sensed within a cluster").

8. Claim 10

- a. **"The system as recited in claim 1, wherein the altering the one or more of the isolated one or more sounds so that the frequency does not fall outside of the predetermined threshold is performed automatically."**

154. In my opinion, *DiCenso641* in combination with *Smith* teaches this claim.

155. For the reasons I discussed in §X.A.1.e, *DiCenso641* teaches the wearable device 130—which can be implemented as earpieces 134—having a microprocessor-based DSP 310, and that, when implementing the functionality described with respect to DSP 310, code or instructions executable by DSP 310 would be stored in a computer readable storage medium. As I discussed in §X.A.1.f(iii), the *DiCenso641-Smith* combination teaches *DiCenso641*'s DSP 310

determining that a sound includes a frequency outside of the audible range and converting such sounds outside of the audible range to the audible range for enhanced hearing.

156. A person of ordinary skill in the art would have understood DSP 310's operations in the *DiCenso641-Smith* combination to be automatic as the DSP would execute relevant code without requiring further human intervention. For example, *DiCenso641* does not describe or suggest any human intervention outside of the setting of preferences for the auditory environment when generating the auditory environment. *Id.*, [0042]-[0043]; *see also id.*, [0030] (“However, in contrast to current hearing aid technology, sound enhancement is applied selectively in response to particular user preference settings.”), [0034] (“The received user preferences are applied to associated sounds within the ambient auditory environment as represented by block 240. ... Modification of one or more types or categories of sounds received by one or more ambient microphones of the wearable device in response to associated user preferences continues until the user preferences change as represented by block 250.”). Even though the user may adjust the preferences at any time, *DiCenso641* discloses that the DSP “modifies the signal for each type of sound in the ambient auditory environment based on the corresponding user preference.” *Id.*, [0042]. No human intervention is therefore disclosed. Similarly, *DiCenso641* discloses a use case where “the headphones are actively

listening for the user's name, and will let a conversation pass through if it is explicitly addressed to the user." *Id.*, [0064]. No human intervention is disclosed before *DiCenso641*'s "actively listening" headphones adjust the signal output.

157. Accordingly, the *DiCenso641-Smith* combination teaches determining that a sound includes a frequency outside of the audible range (*e.g.*, greater than 20 kHz) and, if so, converting such sounds outside of the audible range to the audible range for enhanced hearing ("altering the one or more of the isolated one or more sounds so that the frequency does not fall outside of the predetermined threshold") automatically based on code or instructions stored in a computer readable storage medium and executed by DSP 310 ("is performed automatically").

9. Claim 25

- a. "The system of claim 1, further comprising: a transmission medium comprising a wireless transceiver configured to wirelessly transmit and receive data from the data source."**

158. In my opinion, *DiCenso641* in combination with *Smith* teaches this claim.

159. As I discussed in §X.A.1.d(ii), *DiCenso641* discloses earpieces 134 sending an unprocessed audio stream and receiving back a modified audio stream from mobile device 320, and a person of ordinary skill in the art would have understood each of *DiCenso641*'s earpieces 134 to include a wireless transceiver to wirelessly communicate with mobile device 320.

160. Accordingly, the *DiCenso641-Smith* combination teaches a pair of earpieces 134 including a first earpiece having integrated Bluetooth or Wi-Fi technology that includes a wireless transceiver (“a transmission medium comprising a wireless transceiver”) for sending an unprocessed audio stream and receiving back a modified audio stream (“configured to wirelessly transmit and receive data”) from mobile device 320 (“from the data source”).

10. Claim 27

- a. “The system of claim 1, wherein if one or more of the isolated one or more sounds includes the frequency outside of the predetermined threshold, altering the one or more of the isolated one or more sounds so that the frequency does not fall outside of the predetermined threshold; and”**

161. In my opinion, *DiCenso641* in combination with *Smith* teaches this feature.

162. As I discussed in §X.A.1.f(iii), *Smith* discloses determining that a sound includes a frequency outside of the audible range and converting such sounds to the audible range. For example, *Smith* discloses that “infrasound can be up converted in frequency and ultrasound can be down converted in frequency to facilitate processing and/or human hearing.” Ex. 1006 (*Smith*), [0026]. Also, for the reasons I discussed in §X.A.1.f(iii), it would have been obvious to a person of ordinary skill in the art to modify *DiCenso641* based on *Smith* to incorporate *Smith*’s teachings for processing inaudible sounds via *DiCenso641*’s DSP 310. As I also discussed in

§X.A.1.f(iii), a person of ordinary skill in the art would also have understood that, when implementing *Smith*'s teaching of identifying and processing inaudible sounds, *DiCenso641*'s DSP 310 would first separate (or isolate) sounds identified within signals captured by the microphones 312 before further processing and modifying the sounds.

163. Accordingly, the *DiCenso641-Smith* combination teaches DSP 310 determining whether isolated sound(s) detected by earpiece(s) 134 include a frequency outside of the audible range (*e.g.*, greater than 20 kHz) (“if one or more of the isolated one or more sounds includes the frequency outside of the predetermined threshold”) and, if so, converting such sound(s) outside of the audible range to the audible range (“altering the one or more of the isolated one or more sounds so that the frequency does not fall outside of the predetermined threshold”).

b. “outputting the isolated one or more sounds on the at least one output device.”

164. In my opinion, *DiCenso641* in combination with *Smith* teaches this feature.

165. *DiCenso641* discloses that, after modifying sounds by applying user preferences to associated sounds within the ambient auditory environment, “[t]he modified sounds are then provided to one or more speakers associated with or integrated with the wearable device.” *DiCenso641*, [0034]; *see also id.*, [0042] (“The

modified signal is output to amp(s) 314 and speaker(s) 316 to generate the auditory environment for the user.”); §X.A.1.d(iii) (describing each earpiece 134 having a speaker 316 for outputting a modified signal to generate an auditory environment for a user).

166. Accordingly, the *DiCenso64I-Smith* combination teaches *DiCenso64I*’s DSP 310 separating the sounds from one another in order to individually modify or manipulate such sounds and then outputting the modified sounds (“outputting the isolated one or more sounds”) to the speakers 316 on earpieces 134 (“on the at least one output device”) to generate the auditory environment for the user.

11. Claim 11

a. “A method of managing sensed noise, comprising:”

167. I understand “[a] method of managing sensed noise, comprising” is the preamble to claim 11. I have been asked to assume that the preamble is a claim limitation. Under that assumption, in my opinion, *DiCenso64I* teaches this feature. For example, *DiCenso64I* discloses “a system or **method** for generating a user controllable auditory environment for a user that may be personalized or customized in response to user preferences for particular types or groups of sounds.” Ex. 1005 (*DiCenso64I*), [0019].

168. *DiCenso641* discloses that the system includes a wearable device 130 that may be implemented as earpieces 134 that “each contain an associated speaker and one or more microphones or transducers, which may include an ambient microphone to detect ambient sounds within the ambient auditory environment.” *Id.*, [0022]. *DiCenso641* discloses that a user interface “allows user 120 to create a personalized or customized auditory experience by setting his/her preferences ... for associated sound types to indicate which sounds to amplify, cancel, add or insert, or attenuate, respectively.” *Id.*, [0028]. For example, *DiCenso641* discloses that “DSP 310 receives user preferences 322 corresponding to each of the plurality of types of sounds and modifies the signal for each type of sound in the ambient auditory environment based on the corresponding user preference.” *Id.*, [0042]. *DiCenso641* further discloses that, after modifying sounds by applying user preferences to associated sounds within the ambient auditory environment, “[t]he modified sounds are then provided to one or more speakers associated with or integrated with the wearable device.” *Id.*, [0034]; *see also id.*, [0042] (“The modified signal is output to amp(s) 314 and speaker(s) 316 to generate the auditory environment for the user.”).

169. Accordingly, *DiCenso641* teaches a method for generating a user controllable auditory environment that includes modifying sounds in the ambient auditory environment (“a method of managing sensed noise”).

170. I note that independent claim 11 recites a method for providing the physical components of the system recited in claim 1. *See, e.g.*, Ex. 1001 ('736 patent), claim 11 (the method comprising “providing at least one data source,” “providing at least one cluster of at least one computing device,” etc.). As such, a person of ordinary skill in the art would have understood that the *DiCenso641-Smith* combination, which teaches each component of the system of claim 1, also teaches providing such components for the same reasons I discussed with respect to claim 1 and as outlined further below. The same also applies to the claims depending from claim 11.

b. “providing at least one data source;”

171. In my opinion, *DiCenso641* teaches this feature for the reasons I discussed in §X.A.1.b.

c. “providing at least one cluster of at least one computing device,”

172. In my opinion, *DiCenso641* teaches this feature for the reasons I discussed in §X.A.1.c.

d. “the at least one computing device including: a sound sensing mechanism, configured to sense a noise; and an electronic bus configured to transmit and receive data from the data source, wherein the data source is in electronic communication with the at least one cluster and at least one output device:”

(i) “a sound sensing mechanism, configured to sense a noise;”

173. In my opinion, *DiCenso641* teaches this feature for the reasons I discussed in §X.A.1.d(i).

- (ii) “an electronic bus configured to transmit and receive data from the data source”**

174. In my opinion, *DiCenso641* teaches this feature for the reasons I discussed in §X.A.1.d(ii).

- (iii) “wherein the data source is in electronic communication with the at least one cluster and at least one output device:”**

175. In my opinion, *DiCenso641* teaches this feature for the reasons I discussed in §X.A.1.d(iii).

- e. “providing a memory, containing computer-executable instructions; and”**

176. In my opinion, *DiCenso641* teaches this feature for the reasons I discussed in §X.A.1.e.

- f. “providing a processor to execute the computer-executable instructions to cause the processor to perform steps comprising:”**

177. In my opinion, *DiCenso641* teaches this feature for the reasons I discussed in §X.A.1.f.

- (i) “identifying one or more sounds within the noise;”**

178. In my opinion, *DiCenso641* in combination with *Smith* teaches this feature for the reasons I discussed in §X.A.1.f(i).

(ii) “isolating the one or more sounds;”

179. In my opinion, *DiCenso641* in combination with *Smith* teaches this feature for the reasons I discussed in §X.A.1.f(ii).

(iii) “determining if one or more of the isolated one or more sounds includes a frequency outside of a predetermined threshold.”

180. In my opinion, *DiCenso641* in combination with *Smith* teaches this feature for the reasons I discussed in §X.A.1.f(iii).

12. Claim 13

- a. “The method as recited in claim 11, wherein the sound-sensing mechanism is selected from the group consisting of: an omnidirectional transducer; an ultrasonic transducer; an infrasonic transducer; an electro-optical transducer; and a microwave transducer.”**

181. In my opinion, *DiCenso641* in combination with *Smith* teaches this claim for the reasons I discussed in §X.A.2.

13. Claim 14

- a. “The method as recited in claim 13, wherein the sensed noise includes infrasonic, ultrasonic, visible, or radio waves.”**

182. In my opinion, *DiCenso641* in combination with *Smith* teaches this claim for the reasons I discussed in §X.A.3.

14. Claim 15

- a. “The method as recited in claim 11, wherein the predetermined threshold equates to a frequency determined to pose a risk of harm to a user’s hearing capabilities.”**

183. In my opinion, *DiCenso641* in combination with *Smith* teaches this claim for the reasons I discussed in §X.A.4.

15. Claim 16

- a. “The method as recited in claim 11, further comprising: if one or more of the isolated one or more sounds includes the frequency outside of the predetermined threshold, notifying a user, via a notification, that one or more of the isolated one or more sounds includes the frequency outside of the predetermined threshold.”**

184. In my opinion, *DiCenso641* in combination with *Smith* teaches this claim for the reasons I discussed in §X.A.5.

16. Claim 17

- a. “The method as recited in claim 11, further comprising: panning the sensed noise.”**

185. In my opinion, *DiCenso641* in combination with *Smith* teaches this claim for the reasons I discussed in §X.A.6.

17. Claim 18

- a. **“The method as recited in claim 11, further comprising: adding one or more audio effects to the sensed noise.”**

186. In my opinion, *DiCenso641* in combination with *Smith* teaches this claim.

187. *DiCenso641* discloses that “DSP 310 receives user preferences 322 corresponding to each of the plurality of types of sounds and modifies the signal for each type of sound in the ambient auditory environment based on the corresponding user preference.” Ex. 1005 (*DiCenso641*), [0042]. For example, *DiCenso641* explains that modifying the signal “may include ... **changing various qualities of a sound, such as** equalization, **pitch**, etc.” *Id.*, [0044]. Thus, a person of ordinary skill in the art would have understood *DiCenso641* to teach changing the pitch of an ambient sound identified in the ambient auditory environment. A person of ordinary skill in the art would also have understood varying the pitch of a sound to amount to the application of an audio effect to the sound. *See, e.g.*, Ex. 1014 (*Lindahl*), [0067] (“In the presently depicted embodiment, **audio processing logic 32 may apply various audio effects 138** based on the received image characteristics. **Such audio effects may include variations in one or more characteristics of an audio signal.** For example, effects 138 applied to audio may include variation in pitch; variation in tempo; a change in frequency response (e.g., filter sweep); alteration of

equalization characteristics; application of a chorus effect, a delay effect, a reverb effect, or the like; alteration of the volume of the audio; the addition of a synthesized sound effect; or other desired audio effects.”).¹⁴

188. Accordingly, the *DiCenso641-Smith* combination teaches modifying select sounds within an ambient environment by changing the pitch of the sound signal (“adding one or more audio effects to the sensed noise”).

18. Claim 19

- a. “The method as recited in claim 11, further comprising: equalizing the sensed noise.”**

189. In my opinion, *DiCenso641* in combination with *Smith* teaches this feature for the reasons I discussed in §X.A.6.

19. Claim 20

- a. “The method as recited in claim 11, wherein the altering the one or more of the isolated one or more sounds so that the frequency does not fall outside of the predetermined threshold is performed automatically.”**

190. In my opinion, *DiCenso641* in combination with *Smith* teaches this feature for the reasons I discussed in §X.A.8.

¹⁴ I rely on *Lindahl* to demonstrate the knowledge of a person of ordinary skill in the art. It is not part of the unpatentability ground.

20. Claim 26

- a. “The method of claim 11, further comprising:
providing a transmission medium comprising a
wireless transceiver configured to wirelessly transmit
and receive data from the data source.”**

191. In my opinion, *DiCenso641* in combination with *Smith* teaches this feature for the reasons I discussed in §X.A.9.

21. Claim 28

- a. “The method of claim 11, wherein if one or more of
the isolated one or more sounds includes the
frequency outside of the predetermined threshold,
altering the one or more of the isolated one or more
sounds so that the frequency does not fall outside of
the predetermined threshold; and”**

192. In my opinion, *DiCenso641* in combination with *Smith* teaches this feature for the reasons I discussed in §X.A.10.a.

- b. “outputting the isolated one or more sounds on the at
least one output device.”**

193. In my opinion, *DiCenso641* in combination with *Smith* teaches this feature for the reasons I discussed in §X.A.10.b.

B. Ground 1B: *DiCenso641*, *Smith*, and *Holland* Render Obvious Claims 2 and 12

1. Claim 2

- a. “The system as recited in claim 1, further comprising: an interfacing mechanism, the interfacing mechanism including:”**

194. In my opinion, *DiCenso641* in combination with *Smith* teaches this feature.

195. *DiCenso641* discloses that “user interface 324 is implemented by a second microprocessor 326 having associated memory 328 embedded in a mobile device 320, such as a smartphone, tablet computer, wrist watch, or arm band, for example.” Ex. 1005 (*DiCenso641*), [0039]. *DiCenso641* explains that “changes made by user 120 using the user interface are communicated to the wearable device 130 to control corresponding processing of input signals to create auditory output signals that implement the user preferences.” *Id.*, [0028]

196. Accordingly, the *DiCenso641-Smith* combination teaches mobile device 320 implementing a user interface 324 (“an interfacing mechanism”) via which a user may control the processing of input signals to create auditory output signals.

b. “a network adapter, configured to transmit and receive the data through both wired and wireless communication; and”

197. In my opinion, *DiCenso641* in combination with *Smith* and *Holland* teaches this feature.

198. *DiCenso641* discloses mobile device 320 communicates with earpieces 134 via wired or wireless communication technology. *See* Ex. 1005 (*DiCenso641*), [0023] (“User preferences are then communicated to the DSP associated with earpieces 134 **through wired or wireless technology**, such as Wi-Fi, Bluetooth, or similar technology, for example.”), [0039] (“User preferences 322 may be communicated **via a wired or wireless communications link 360** to DSP 310. Various types of wired or wireless communications technology or protocols may be used depending on the particular application or implementation.”).

199. *DiCenso641*, however, does not focus on the implementation details relating to how the mobile device 320 implements both wired and wireless communication. Thus, a person of ordinary skill in the art would have been motivated to look for additional information regarding how to implement *DiCenso641*’s functionality of implementing both wired and wireless communication. In so looking, it is my opinion that a person of ordinary skill in the art would have readily identified *Holland*.

200. *Holland* is generally directed to a “a system for delivering content associated with a media presentation to devices that are auxiliary to the devices that play and display the media presentation.” Ex. 1007 (*Holland*), [0039]; *see also id.*, Abstract (“A system and method for providing companion content on a device that downloads content associated with a media presentation playing on a media player and displays the downloaded content at times synchronized to time-offsets (from the start of the program) of the presentation by signals from the media player.”).

201. *Holland* discloses a “media player 110, display device 120, and speakers 130 [that] are integrated on a single device such as a computer, a laptop, an enhanced television, or an enhanced cell phone.” *Id.*, [0040]. *Holland* explains that this single device may function as a “media player device” or a “companion content device.” *See id.*, (“In some such embodiments this media player device can also function as a companion content device (similar to any one of the companion content devices 140-148) simultaneously.”).

202. *Holland* discloses sending signals between such devices “wirelessly or through a wired connection.” *Id.*, [0043] (“Some embodiments allow both wired and wireless signals; while other embodiments allow only wired signals from the media player or only wireless signals from the media player.”). *Holland* also provides implementation details for facilitating wired or wireless communication between devices, including mobile phones. *See* Ex. 1007 (*Holland*), [0156] (“FIG. 20

conceptually illustrates an electronic system 2000 with which some embodiments of the invention are implemented. The electronic system 2000 may be a computer (e.g., a desktop computer, personal computer, tablet computer, etc.), phone, PDA, or any other sort of electronic device.”).

203. For example, *Holland* explains that the mobile phone includes a network adapter through which the mobile phone is coupled to a network. *See id.*, [0162] (“Finally, as shown in FIG. 20, bus 2005 also couples electronic system 2000 to a network 2065 through a network adapter (not shown). In this manner, the electronic can be a part of a network of computers (such as a local area network (“LAN”), a wide area network (“WAN”), or an Intranet, or a network of networks, such as the internet.”). *Holland* also explains that the mobile phone may be connected to the network using wireless transmitters and receivers or using wired hardware. *See id.*, [0144] (“In some embodiments, the network interface 1925 controls one or more wireless transmitters and receivers such as Bluetooth, cellular phone technology, or wireless LAN signals. In some embodiments the network interface 1925 uses wired hardware, such as Ethernet, to connect to the network. In some embodiments, the wireless interface 1905 and the transmitter interface 1987 are part of the network interface 1925, or the network interface 1925 is used instead of one or both of the wireless interface 1905 and the transmitter interface 1987.”).

204. A person of ordinary skill in the art would have appreciated that *Holland* describes essentially the same functionality of communicating data between electronic devices as *DiCenso641*. A person of ordinary skill in the art would have further recognized that *Holland* provides additional details regarding how to implement this functionality by using a network adapter to implement both wired and wireless communication.

205. A person of ordinary skill in the art would have found the combination obvious because it would have amounted to the mere application of a known technique (including a network adapter in a mobile device as *Holland* teaches) to improve a similar device (the *DiCenso641-Smith* combination's mobile device 320 that uses wired or wireless communication to connect to other devices) in the same way (providing components supporting wired or wireless communication between devices as *Holland* teaches).

206. Accordingly, the *DiCenso641-Smith-Holland* combination teaches mobile phone 320 having a network adapter ("a network adapter") to couple mobile phone 320 to a network to communicate with other devices ("configured to transmit and receive the data") via a wired or wireless communications link ("through both wired and wireless communication").

c. “at least one input mechanism, configured to:”

207. In my opinion, *DiCenso641* in combination with *Smith* and *Holland* teaches this feature.

208. *DiCenso641* discloses that “user interface 324 is implemented by a second microprocessor 326 having associated memory 328 embedded in a mobile device 320, such as a smartphone, tablet computer, wrist watch, or arm band, for example.” Ex. 1005 (*DiCenso641*), [0039]. *DiCenso641* explains that user preferences 322 are captured by user interface 324. *Id.*; see also *id.*, FIGs. 5 & 6 (depicting example user interfaces having controls for specifying user preferences associated with particular types or groups of sounds). *DiCenso641* also discloses that, through the user interface, “the user can raise or lower the volume of specific sound sources as well as completely cancel or enhance other auditory events.” *Id.*, [0048]. For example, *DiCenso641* explains that mobile device 320 “may include a touch pad or screen to capture user gestures. For example, the user draws a character “V” (for voices), then swipes down (lowering this sound category).” *Id.*, [0056].

209. Accordingly, the *DiCenso641-Smith-Holland* combination teaches mobile device 320 implementing a user interface 324 having a touchpad or screen to capture user gesture (“at least one input mechanism”) via which a user can raise or lower the volume of specific sound sources.

d. “manipulate the interfacing mechanism; and”

210. In my opinion, *DiCenso641* in combination with *Smith* and *Holland* teaches this feature.

211. As I discussed in §X.B.1.c, *DiCenso641* discloses that by manipulating the user interface (e.g., swiping on a touch pad), the user can raise or lower the volume of specific sound sources.

212. Accordingly, the *DiCenso641-Smith-Holland* combination teaches mobile device 320 implementing a user interface 324 via which a user can raise or lower the volume of specific sound sources (“manipulate the interfacing mechanism”).

e. “vary the output of the at least one output device.”

213. *DiCenso641* in combination with *Smith* and *Holland* teaches this feature. For example, as I discussed in §X.B.1.c, *DiCenso641* discloses that, through the user interface, the user can raise or lower the volume of specific sound sources as well as completely cancel or enhance other auditory events. And as I discussed in §X.A.1.d(iii), *DiCenso641* describes each earpiece 134 having a speaker 316 for outputting a modified signal to generate an auditory environment for a user.

214. Accordingly, the *DiCenso641-Smith-Holland* combination teaches modifying the signal output via speaker(s) 316 of earpieces 134 (“vary the output of

the at least one output device”) based on user input captured by user interface 324 to raise or lower the volume of specific sounds.

2. Claim 12

- a. “The method as recited in claim 11, further comprising: providing an interfacing mechanism, the interfacing mechanism including: a network adapter, configured to transmit and receive the data through both wired and wireless communication; and at least one input mechanism, configured to: manipulate the interfacing mechanism; and vary the output of the at least one output device.”**

215. In my opinion, *DiCenso641* in combination with *Smith* teaches this claim for the reasons I discussed in §§X.B.1.a through X.B.1.e.

C. Ground 1C: *DiCenso641*, *Smith*, and *Warren* Render Obvious Claim 3

1. Claim 3

- a. “The system as recited in claim 1, wherein the sound-sensing mechanism is an omnidirectional transducer.”**

216. In my opinion, *DiCenso641* in combination with *Smith* and *Warren* teaches this claim.

217. *DiCenso641* discloses that the earpieces 134 “each contain an associated speaker and one or more microphones or transducers, which may include an ambient microphone to detect ambient sounds within the ambient auditory environment.” *DiCenso641*, [0022]. *DiCenso641* does not, however, provide additional implementation details for the types of microphones or transducers

included in the wearable device (the headphones or earpieces). A person of ordinary skill in the art would have thus searched for references to supply such implementation details and would have readily found *Warren*.

218. *Warren* is directed generally to a personal listening device “to be fitted in the ear, on the ear, near the ear, or behind the ear” that “may be virtually any personal listening device or system such as a hearing aid 8, an earphone 10, a headphone (not shown), a wireless headset 12, an insert earphone (not shown), and the like.” Ex. 1008 (*Warren*), [0026]. *Warren* explains that such devices may include any of a number of types of microphones, such as “a silicon (MEMS) condenser microphone, an electret microphone, an omni-directional microphone, a directional microphone, a dynamic microphone, or a monitor microphone.” *Id.*, [0029].

219. A person of ordinary skill in the art would have been motivated to modify *DiCenso641*’s earpieces 134 based on the teachings of *Warren* to include an omni-directional microphone and would have had a reasonable expectation of success in doing so. A person of ordinary skill in the art would have appreciated that *Warren* and *DiCenso641* are similarly directed to a personal listening device. For example, *DiCenso641* generally relates to “systems and methods for a user controllable auditory environment using wearable devices, such as headphones, speakers, or in-ear devices” (Ex. 1005 (*DiCenso641*), Abstract), and *Warren* describes the components of a personal listening device that may comprise any of

a hearing aid, an earphone, a headphone, a wireless headset, an insert earphone, or the like (Ex. 1008 (*Warren*), [0026]). For that reason, *Warren* provides implementation details suitable for *DiCenso641*'s wearable device 130 or, more specifically, earpieces 134. A person of ordinary skill in the art would have considered applying *Warren*'s teaching to *DiCenso641* to amount to merely combining prior art elements (*Warren*'s omni-directional microphone and *DiCenso641*'s earpieces 134) according to known methods (*Warren* teaches including an omni-directional microphone within any of a hearing aid, an earphone, a headphone, a wireless headset, an insert earphone, or the like) to yield predictable results.

220. Moreover, for the reasons I discussed in §X.A.2.a, a person of ordinary skill in the art would also have understood that a omni-directional microphone comprises an omni-directional transducer because a microphone comprises a transducer.

221. Accordingly, a person of ordinary skill in the art would have understood the *DiCenso641-Smith-Warren* combination teaches the “one or more microphones” of *DiCenso641*'s earpieces 134 (“the sound-sensing mechanism”) including an omni-directional microphone (“an omnidirectional transducer”).

D. Ground 1D: *DiCenso641*, *Smith*, and *DiCenso645* Render Obvious Claims 21-24

1. Claim 21

a. “The system of claim 1, further comprising: the at least one output device, including:”

222. In my opinion, *DiCenso641* in combination with *Smith* teaches this feature.

223. As I discussed in §X.A.1.c, a person of ordinary skill in the art would have understood *DiCenso641* to disclose a pair of earpieces 134 including at least a first earpiece having a speaker, one or more microphones or transducers, and a DSP, and a second earpiece having at least a speaker and one or more microphones or transducers.

224. Accordingly, the *DiCenso641-Smith* combination teaches a pair of earpieces 134 including a second earpiece having at least a speaker and one or more microphones or transducers (“at least one output device”).

(i) “a power source for operating the output device;”

225. In my opinion, *DiCenso641* in combination with *Smith* teaches this feature.

226. As I discussed in §X.D.1.a, *DiCenso641* discloses a second earpiece 134 (“output device”) having at least a speaker and one or more microphones or transducers.

227. *Smith* discloses a system and method for providing both hearing enhancement and hearing protection. *See* Ex. 1006 (*Smith*), Abstract. *Smith* discloses a structure for an earpiece used in such a system that is similar to *DiCenso641*'s earpiece inasmuch as it includes "a microphone 102, electronics 103, a connector 104, and a speaker 105." *Id.*, [0020]. *Smith* also explains that these components are self contained.

According to an embodiment, **the microphone 102, the electronics 103, the connector 104, and/or the speaker 105, as well as a battery, can all be disposed within the fully occluding earpiece 101.** Thus, the situational hearing enhancement and protection device can be **autonomous or fully self-contained.**

Id., [0034]; *see also id.*, [0059] ("As a further example, a battery can be located either within the shell 111 or outside of the shell 111.").

228. *Smith* also discloses that its "earpiece does not have to be an occluding earpiece." *Id.*, [0123].

229. A person of ordinary skill in the art would have understood that *DiCenso641*'s earpieces 134 would each need a power source to power and operate the various components contained within the earpieces 134. For example, *DiCenso641* discloses "active or powered reproduction of the ambient environment to the loudspeakers of the wearable device." Ex. 1005 (*DiCenso641*), [0032] A

person of ordinary skill in the art would thus have been motivated to look at techniques for providing a power source for *DiCenso641*'s earpieces, and would have readily identified *Smith*'s teaching of disposing a power source (e.g., a battery) within the housing of the earpieces. A person of ordinary skill in the art would have been motivated to incorporate a battery within *DiCenso641*'s earpieces because, as taught by *Smith*, this would permit *Di Dencso*'s earpieces 134 to "be autonomous or fully self-contained." Ex. 1006 (*Smith*), [0034]. A person of ordinary skill in the art would have thus found the combination to be obvious because it would have amounted to no more than an application of a known technique (including a battery within an earpiece as taught by *Smith*) in a similar device (*DiCenso641*'s earpieces 134) to obtain predictable results (to power the components of earpieces 134).

230. A person of ordinary skill in the art would also have had a reasonable expectation of success in incorporating *Smith*'s teaching in this regard to *DiCenso641*. *DiCenso641* and *Smith* both disclose earpiece(s) that include at least one microphone and a speaker. See Ex. 1005 (*DiCenso641*), [0022] ("Wearable device 130 may be implemented by [earpieces 134]¹⁵ that each contain an associated speaker and one or more microphones or transducers, which may include an ambient

¹⁵ As I stated previously, *DiCenso641* interchangeably refers to component 134 as "headphones or ear buds," "earpieces," "ear pieces," and "devices." See footnote 3.

microphone to detect ambient sounds within the ambient auditory environment"); Ex. 1006 (*Smith*), [0020] ("[E]arpiece 101 can substantially contain a microphone 102, electronics 103, a connector 104, and a speaker 105. The microphone 102 can pick up ambient sound and can transduce the sound into a signal, such as an analog electronic signal."). *DiCenso641* and *Smith* both also describe modifying select sounds within the ambient environment captured by the microphones and providing the modified sounds via the earpiece speakers. See Ex. 1005 (*DiCenso641*), [0042] ("DSP 310 receives user preferences 322 corresponding to each of the plurality of types of sounds and modifies the signal for each type of sound in the ambient auditory environment based on the corresponding user preference. The modified signal is output to amp(s) 314 and speaker(s) 316 to generate the auditory environment for the user."); Ex. 1006 (*Smith*), [0020] ("The signal can be provided to the electronics 103. The electronics 103 can process the signal and provide a processed signal to the speaker 105. The speaker 105 can transduce the processed electronic signal to provide sound to the user's eardrum."), [0112] ("The digital signal processor 202 can attenuate noise in the signal from the communications system and can also modify the signal from the communications system to compensate for hearing loss."). In my opinion, modifying *DiCenso641*'s earpieces 134 to include *Smith*'s battery would have been straightforward and well

within a person of ordinary skill in the art's ordinary skill, as *Smith* confirms by incorporating a battery in earpieces similar to *DiCenso641*'s.

231. Accordingly, the *DiCenso641-Smith* combination teaches a second earpiece 134 including a battery (“a power source”) for powering and operating at least the speaker and the one or more microphones or transducers of the earpieces 134 (“for operating the output device”).

(ii) “a speaker for outputting sound; and”

232. *DiCenso641* in combination with *Smith* teaches this feature.

233. As I discussed in §X.D.1.a, *DiCenso641* discloses a second earpiece 134 having a speaker. With respect to figure 3, which illustrates a representative embodiment of wearable device 130, *DiCenso641* explains that “[s]ystem 300 includes a microprocessor or digital signal processor (DSP) 310 in communication with one or more microphones 312, one or more amplifiers 314 and one or more speakers 316.” Ex. 1005 (*DiCenso641*), [0038]; *see also id.*, [0022] (describing figures 2-6 as illustrating and describing in greater detail the DSP of wearable device 130). *DiCenso641* discloses that system 300 “generates a customized or personalized user controllable auditory environment based on sounds from the ambient auditory environment by receiving a signal representing the sounds in the ambient auditory environment of the user from one or more microphones 312.” *Id.*, [0042]. *DiCenso641* explains that signals captured by one or more microphones 312

are processed and modified based on user preferences, and “[t]he modified signal is output to amp(s) 314 and speaker(s) 316 to generate the auditory environment for the user.” *Id.*

234. Accordingly, the *DiCenso641-Smith* combination teaches a second earpiece 134 having a speaker 316 (“a speaker”) for outputting a modified signal (“for outputting sound”) to generate an auditory environment for a user.

(iii) “a communication mechanism, for receiving electronic information from the data source; and”

235. In my opinion, *DiCenso641* in combination with *Smith* teaches this feature.

236. For the reasons I discussed in §X.A.1.d(ii), *DiCenso641* teaches earpieces 134 each sending an unprocessed audio stream captured by the microphones on the respective earpiece 134 to mobile device 320 and receiving back a modified audio stream from mobile device 320 for outputting on the speaker(s) of the respective earpiece 134. A person of ordinary skill in the art would thus have understood each of *DiCenso641*’s earpieces 134 to include a wireless transceiver to wirelessly communicate with mobile device 320.

237. Accordingly, the *DiCenso641-Smith* combination teaches a second earpiece 134 including integrated Bluetooth or Wi-Fi technology (“a communication mechanism”) for sending an unprocessed audio stream and receiving back a

modified audio stream (“for receiving electronic information”) from mobile device 320 (“from the data source”).

(iv) “a display.”

238. In my opinion, *DiCenso641* in combination with *Smith* and *DiCenso645* teaches this feature.

239. *DiCenso645* is generally directed to “a method for providing audio enhancement to a user of a listening device” that “includes, in response to detecting the voice trigger, pausing or attenuating the first audio stream and reproducing a second audio stream associated with ambient sound.” Ex. 1009 (*DiCenso645*), [0007]. *DiCenso645* explains that “the listening device 100 may include a pair of headphones, such as the over-the-ear headphones However, any type of wired or wireless headphones, including circumaural headphones, supra-aural headphones, and in-ear headphones, may be used” *Id.*, [0024].

240. *DiCenso645* discloses a “do-not-disturb mode 705” in which “the listening device 100 does not enter the conversation mode 105 in response to voice triggers. Thus, when someone uses a voice trigger, the listening device 100 continues to play the audio stream and the optional noise-cancellation function remains enabled.” *Id.*, [0051]. *DiCenso645* explains that “the listening device 100 may include one or more visual indicators and/or auditory indicators that indicate to others that the user does not want to be disturbed.” *Id.*, [0052]. For example, “the

listening device 100 may display text (e.g., ‘Do Not Disturb!’) using various display technologies, such as an organic light-emitting diode (OLED) display, when the do-not-disturb mode 705 is enabled.” *Id.*

241. A person of ordinary skill in the art would have been motivated to modify *DiCenso641*’s earpieces 134 in view of *DiCenso645* to include a display (such as an OLED display) that displays text to indicate when a user does not want to be disturbed. More particularly, similar to *DiCenso645*, *DiCenso641* discloses that wearable device 130 (comprising earpieces 134) may operate in various modes. Ex. 1005 (*DiCenso641*), [0023]. For example, *DiCenso641* discloses that wearable device 130 may operate in a transparent mode in which “the system does not alter the auditory field or environment experienced by user 120 relative to the current ambient auditory environment” or “a default mode that attenuates all sounds or amplifies all sounds from the ambient environment, or attenuates or amplifies particular frequencies of ambient sounds similar to operation of more conventional noise cancelling headphones or hearing aids, respectively.” *Id.* *DiCenso641* also discloses a “focus mode” (e.g., for use when the user is in the office), in which “the system blocks any office noises as well as the people voices and conversations happening around him.” Thus, a person of ordinary skill in the art would have recognized that *DiCenso645*’s teaching of providing a display to visually indicate that the user does not want to be disturbed would have advanced, or at a minimum

been consistent with, *DiCenso641*'s goal of allowing the user to focus without being disturbed by other people's voices.

242. A person of ordinary skill in the art would have found it obvious to further modify the *DiCenso641-Smith* combination to incorporate a display (such as an OLED display) in earpieces 134 as taught by *DiCenso645* because it would have amounted to use of a known technique (*DiCenso645*'s teaching of using a display to show a message to others that the user does not want to be disturbed) to improve similar devices (the *DiCenso641-Smith* combination's earpieces which may be used in a focus mode when the user does not want to be distracted) in the same way (the *DiCensor641-Smith-DiCenso645* combination in which the earpieces include a display to show a message when the user does not want to be disturbed/distracted). A person of ordinary skill in the art would have had an expectation of success because *DiCenso645* already implements a display in in-ear headphones similar to *DiCenso641*'s earpieces.

243. Accordingly, the *DiCenso641-Smith-DiCenso645* combination teaches a display ("a display") on at least a second earpiece 134 for displaying text to indicate to others that the user does not want to be disturbed.

2. Claim 22

a. “The system of claim 21, wherein the power source and the display are varied outputs.”

244. In my opinion, *DiCenso641* in combination with *Smith* and *DiCenso645* teaches this claim.

245. For the reasons I discussed in §§X.D.1.a(i) and X.D.1.a(iv), a person of ordinary skill in the art would have been motivated to modify *DiCenso641*’s earpieces to include a battery as taught by *Smith* and a display as taught by *DiCenso645*. Neither the claim nor the ’736 patent further specify what is meant by a power source and a display having “varied outputs.” Nevertheless, a person of ordinary skill in the art would have understood that a power source, such as a battery, and a display, such as an OLED display, can vary their outputs as needed. A person of ordinary skill in the art would have understood that the amount of power provided by the battery to the components of the earpiece would vary depending on the operation of the earpiece. For example, when the transceiver is “active” and transmitting/receiving data the battery would provide more power to the transceiver than when the transceiver is “idle.” Additionally, *DiCenso645* describes the OLED display displaying text while do-not-disturb mode 705 is enabled, suggesting that the OLED display does not display such text when do-not-disturb mode 705 is **not** enabled, irrespective of the output of a battery used to power such components.

246. Accordingly, the *DiCenso641-Smith-DiCenso645* combination teaches a display adjusting based on a mode of earpieces 134 irrespective of a battery used to power such components (“wherein the power source and the display are varied outputs”).

3. Claim 23

**a. “The method of claim 11, further comprising:
providing the at least one output device, including:”**

247. In my opinion, *DiCenso641* in combination with *Smith* teaches this feature for the reasons I discussed in §X.D.1.a.

(i) “a power source for operating the output device;”

248. In my opinion, *DiCenso641* in combination with *Smith* teaches this feature for the reasons I discussed in §X.D.1.a(i).

(ii) “a speaker for outputting sound; and”

249. In my opinion, *DiCenso641* in combination with *Smith* teaches this feature for the reasons I discussed in §X.D.1.a(ii).

(iii) “a communication mechanism, for receiving electronic information from the data source; and”

250. In my opinion, *DiCenso641* in combination with *Smith* teaches this feature for the reasons I discussed in §X.D.1.a(iii).

(iv) “a display.”

251. In my opinion, *DiCenso641* in combination with *Smith* and *DiCenso645* teaches this feature for the reasons I discussed in §X.D.1.a(iv).

4. Claim 24

a. “The method of claim 23, wherein the power source and the display are varied outputs.”

252. In my opinion, *DiCenso641* in combination with *Smith* and *DiCenso645* teaches this feature for the reasons I discussed in §X.D.2.

E. Ground 1E: *DiCenso641*, *Smith*, and *Goldstein873* Render Obvious Claim 32

1. Claim 32

a. “A system comprising:”

253. I understand “[a] system comprising” is the preamble to claim 32. I have been asked to assume that the preamble is a claim limitation. Under that assumption, in my opinion, *DiCenso641* teaches this feature for the reasons I discussed in §X.A.1.a.

b. “a data source;”

254. In my opinion, *DiCenso641* teaches this feature for the reasons I discussed in §X.A.1.b.

c. “at least one cluster of at least one computing device,”

255. In my opinion, *DiCenso641* teaches this feature for the reasons I discussed in §X.A.1.c.

d. “the at least one computing device including: a noise sensing mechanism configured to sense a noise; wherein the sensed noise includes infrasonic, ultrasonic, visible, audio or radio waves; an electronic bus which is configured to transmit and receive data from the data source, wherein the data source is in electronic communication with at least one cluster and at least one output device;”

(i) “a noise sensing mechanism configured to sense a noise; wherein the sensed noise includes infrasonic, ultrasonic, visible, audio or radio waves;”

256. In my opinion, *DiCenso641* teaches this feature.

257. While the term “noise sensing mechanism” does not appear in the specification of the ’736 patent, in my opinion, a person of ordinary skill in the art would have understood that “a noise sensing mechanism configured to sense a noise” as used in claim 32, and “a sound sensing mechanism, configured to sense a noise” as used in claim 1 have sufficiently congruent scope such that they both encompass a microphone. More particularly, a person of ordinary skill in the art would have understood the ’736 patent uses the terms “audio,” “sound” and “noise” interchangeably such that a mechanism for sensing noise is congruent with a mechanism for sensing audio or sound. *See, e.g.*, Ex. 1001 (’736 patent), 13:59-61

(“At step 305, audio/noise is sensed by one or more audio sensing devices. According to an embodiment, the one or more sensing devices are microphones.”). Claim 1 of the ’736 patent further equates sound and noise by reciting “a **sound** sensing mechanism, configured to sense a **noise**.”

258. Accordingly, *DiCenso641* teaches this feature for the same reasons I discussed in §X.A.1.d(i).

(ii) **“an electronic bus which is configured to transmit and receive data from the data source,”**

259. In my opinion, *DiCenso641* teaches this feature for the reasons I discussed in §X.A.1.d(ii).

(iii) **“wherein the data source is in electronic communication with at least one cluster and at least one output device;”**

260. In my opinion, *DiCenso641* teaches this feature for the reasons I discussed in §X.A.1.d(iii).

e. **“a memory, containing computer-executable instructions; and”**

261. In my opinion, *DiCenso641* teaches this feature for the reasons I discussed in §X.A.1.e.

f. “a processor configured to execute the computer-executable instructions to cause the processor to perform functions including:”

262. In my opinion, *DiCenso641* teaches this feature for the reasons I discussed in §X.A.1.f.

(i) “identifying one or more frequencies within the noise;”

263. In my opinion, *DiCenso641* teaches this feature.

264. This element is substantially identical to element 1[e][i] in claim 1 (*see* §X.A.1.f(i)), except that this element recites “frequencies” instead of “sounds.” In my opinion, a person of ordinary skill in the art would have understood that “frequencies” as used in claim 32 and “sounds” as used in claim 1 have sufficiently congruent scope such that “frequencies” encompasses “sounds.”

265. More particularly, a person of ordinary skill in the art would have known that different sounds are characterized by the frequency(ies) of the waves that form the sound. Thus, for example, a person of ordinary skill in the art would have known that the sound waves comprising a car horn would have different frequency(ies) from the sound waves comprising a person speaking. A person of ordinary skill in the art would have also known that identifying sounds and/or separating sounds in an ambient environment entails identifying and/or separating the sounds based on their frequencies. *E.g.*, Ex. 1015 (*Snow*), 1:14-17 (“One known method of audio signal processing is to process the audio signal in the frequency

spectrum by separating the audio signal into multiple audio signals that fall within spaced audio frequency bands.”).¹⁶

266. Consistent with this understanding, the ’736 patent discloses that different sounds are characterized by the frequency(ies) that comprise them. *See, e.g.,* Ex. 1001 (’736 patent), 13:56-58 (“sounds are associated with different frequencies and/or are associated with one or more instruments”), 13:63-64 (“one ore more instruments and/or frequencies are identified and isolated from the senses audio”), 16:13-14 (“like frequencies in the sensed audio are separated”), 16:39-40 (“the present system senses and analyzes audio frequencies”). Thus, a person of ordinary skill in the art would have understood “one or more frequencies” as recited here and in subsequent elements of claim 32 encompasses “one or more sounds” as recited in corresponding elements of claim 1.

267. Accordingly, *DiCenso641* in combination with *Smith* teaches this feature for the reasons I discussed in §X.A.1.f(i).

(ii) “isolating the one or more frequencies; and”

268. In my opinion, *DiCenso641* teaches this feature for the reasons I discussed in §§X.A.1.f(ii) and X.E.1.f(i).

¹⁶ I rely on *Snow* to demonstrate a person of ordinary skill’s knowledge. It is not part of the unpatentability ground.

- (iii) **“determining if one or more of the isolated one or more frequencies includes a frequency outside of a predetermined threshold,”**

269. In my opinion, *DiCenso641* in combination with *Smith* teaches this feature for the reasons I discussed in §§X.A.1.f(iii) and X.E.1.f(i).

- (iv) **“wherein if one or more of the isolated one or more frequencies includes the frequency outside of the predetermined threshold, transmitting an alert to another computing device regarding the frequency of the one or more of the isolated one or more frequencies being outside of the predetermined threshold.”**

270. In my opinion, *DiCenso641* in combination with *Smith* and *Goldstein873* teaches this feature.

271. *Smith* discloses that its system “can **alert** the user to otherwise **inaudible sounds**. Such sounds can be inaudible due to their **frequency content** and/or amplitude.” Ex. 1006 (*Smith*), [0027]. *Smith* also discloses that “inaudible sounds can be replaced with other sounds, such as a **warning**, voice identification or **other identification**.” *Id.* As I discussed in §X.A.1.f(iii), a person of ordinary skill in the art would have found it obvious to implement *Smith*’s teachings for processing/replacing inaudible sounds via *DiCenso641*’s DSP 310 to enable such sounds to be processed or heard by the user, or to otherwise alert a user to their presence.

272. *Goldstein873* is similar to *DiCenso641* because it is generally directed to “a method and device for personalized hearing” (Ex. 1010 (*Goldstein873*), [0007]), and discloses “an earpiece and method of operating an earpiece that monitors and safely adjusts audio delivered to a user’s ear” (*id.*, [0002]). Similar to *DiCenso641*, *Goldstein873* describes its earpiece as including “an Ambient Sound Microphone (ASM) to capture ambient sound, an Ear Canal Receiver (ECR) to deliver audio to an ear canal, an ear canal microphone (ECM) to measure a sound pressure level within the ear canal, and a processor to produce the audio from at least in part the ambient sound.” *Id.* *Goldstein873* discloses that “earpiece 100 can continually monitor the environment for warning sounds” (*id.*, [0066]) and also can “send a warning message to nearby people (e.g., list of contacts) that are within a vicinity of the user, thereby allowing them to receive the warning” (*id.*, [0067]).

273. A person of ordinary skill in the art would have found it obvious to further modify the *DiCenso641-Smith* combination based on *Goldstein873*’s teachings so that the alert/warning generated by the *DiCenso641-Smith* system—when processing, for example, an ultrasonic sound that is otherwise inaudible to the user—is also transmitted to nearby people so that they, too, can be made aware of the alert/warning as taught by *Goldstein873*. A person of ordinary skill in the art would have recognized that *Goldstein873*’s teachings are compatible with the *DiCenso641-Smith* combination because *DiCenso641* discloses that its wearable

device 130 can wirelessly connect with “other similar wearable devices.” Ex. 1005 (*DiCenso641*), [0025]. Thus, a person of ordinary skill in the art would have understood *DiCenso641*’s disclosure to encompass wearable device 130 communicating with other similar wearable devices worn by other people, and to be well-suited for implementing *Goldstein873*’s teaching of transmitting warnings/alerts to people nearby.

274. A person of ordinary skill in the art would have understood similar wearable devices to encompass devices similar to *DiCenso641*’s wearable device 130 having a DSP. A person of ordinary skill in the art would also have understood that a device that includes a DSP comprises a “computing device.” By September 2014, a person of ordinary skill in the art would have understood that a computer was “[a]ny device capable of processing information to produce a desired result.” Ex. 1016 (*Computer Dictionary*), 3 (definition of “computer”).¹⁷ A person of ordinary skill in the art would have also recognized that computers may use integrated circuits. *Id.* (disclosing computers “in which **integrated circuits** replaced transistors.”). A person of ordinary skill in the art would have further understood that “computers typically perform their work in three well-defined steps: (1)

¹⁷ I rely on *Computer Dictionary* to demonstrate the knowledge of a person of ordinary skill in the art. It is not part of the unpatentability ground.

accepting input, (2) processing the input according to predefined rules (programs), and (3) producing output.” *Id.*

275. By September 2014, a person of ordinary skill in the art would have understood that DSPs were “[a]n **integrated circuit** designed for high-speed data manipulation and used in audio, communications, image manipulation, and other data acquisition and data control applications.” *Id.*, 4. In my opinion, a person of ordinary skill in the art would have therefore considered *DiCenso641*’s wearable device 130 with a DSP to comprise a computing device. *See also* Ex. 1017 (*Oshana*), 7 (“[A]n embedded system is a specialized computer system that is integrated as part of a larger system. Many embedded systems are implemented using digital signal processors.”)¹⁸

276. *DiCenso641* also discloses the wearable device 130 performs the tasks of a computer. For example, the wearable device 130 includes earpieces 134 receiving input from microphones to “detect ambient sounds within the ambient auditory environment” and “for cancellation of user selected sounds.” Ex. 1005 (*DiCenso641*), [0022]. The device’s DSP 310 processes the input to identify the sounds. *Id.*, [0042], [0044] (disclosing DSP 310 analyzing signals, identifying

¹⁸ I rely on *Oshana* to demonstrate the knowledge of a person of ordinary skill in the art. It is not part of the unpatentability ground.

sounds, and separating sounds or dividing signals). In accordance with user preferences, the DSP modifies and outputs the signal. *Id.*, [0042]; *see also id.*, [0025] (“earpieces 134 may isolate the user from the ambient auditory environment through passive and/or active attenuation or cancellation, while, at the same time, **reproducing only the desired sound sources either with or without enhancement or augmentation.**”). In my opinion, a person of ordinary skill in the art would have therefore considered *DiCenso641*’s wearable device with a DSP comprises a computing devices.

277. A person of ordinary skill in the art would have found the combination obvious because it would have amounted to nothing more than the application of a known technique (*Goldstein873*’s teaching of an earpiece sending a warning message to nearby people) to improve similar devices (*DiCenso641-Smith* combination’s similar earpieces that can connect to other similar wearable devices worn by other people) in the same way.

278. A person of ordinary skill in the art would have also found the combination obvious because it would have amounted to applying a known technique (*Goldstein873*’s teaching of an earpiece sending a warning message to nearby people) to a known device (*DiCenso641-Smith* combination’s similar earpieces that can connect to other similar wearable devices worn by other people) ready for improvement to yield predictable results (the *DeCenso641-Smith-*

Goldstein873 combination having earpieces that send a warning to similar wearable devices worn by people nearby).

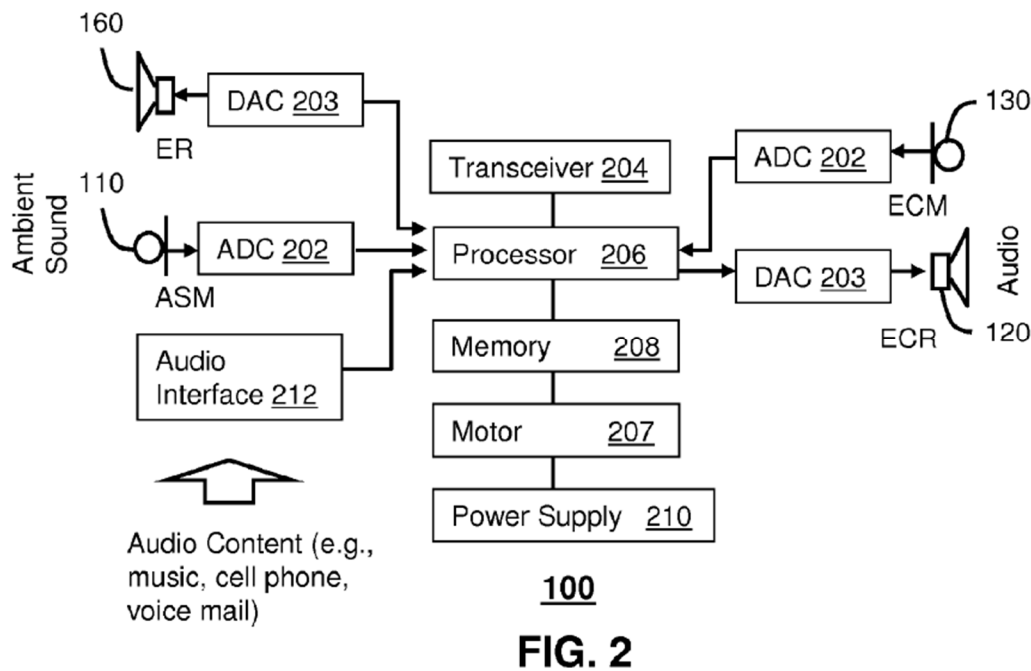
279. Accordingly, the *DiCenso641-Smith-Goldstein873* combination teaches if an inaudible sound is detected that corresponds to a frequency for which user preferences indicate that an alert should be provided (“if one or more of the isolated one or more frequencies includes the frequency outside of the predetermined threshold”), DSP 310 of earpieces 134 transmitting the alert to at least one device similar to *DiCenso641*’s wearable device 130 having a DSP that is worn by another person nearby (“transmitting an alert to another computing device regarding the frequency of the one or more of the isolated one or more frequencies being outside of the predetermined threshold”).

F. Ground 2A: *DiCenso641*, *Goldstein873*, and *Smith* Render Obvious Claims 1, 4-11, 13-20 and 25-28

280. To the extent that the Patent Owner argues and the Board finds that *DiCenso641* does not disclose earpieces 134 including a wireless transceiver and/or a memory storing computer readable instructions accessible to the DSP 310, in my opinion, claims 1, 4-11, 13-20 and 25-28 nevertheless would have been obvious in view of the combination of *DiCenso641*, *Goldstein873*, and *Smith*.

281. In my opinion, by the earliest alleged priority date of the ’736 patent, it was known to include a transceiver in earpieces to implement wireless

communication with external devices. *Goldstein873* is exemplary, and it is analogous to the '736 patent, as it is within the same field of endeavor and reasonably pertinent to one or more problems addressed by the '736 patent. *Goldstein873* is generally directed to an earpiece for “continually monitor[ing] the environment for warning sounds” Ex. 1010 (*Goldstein873*), [0066]. *Goldstein873* discloses that “[e]arpiece 100 includes an Ambient Sound Microphone (ASM) 110 to capture ambient sound, an Ear Canal Receiver (ECR) 102 to deliver audio to the ear canal, and an ear canal microphone (ECM) 130 to assess a sound exposure level within the ear canal.” *Id.*, [0024]. As illustrated in figure 2, *Goldstein873*’s earpiece 100 includes “ **a transceiver 204 that can support singly or in combination any number of wireless access technologies** including without limitation Bluetooth™, Wireless Fidelity (WiFi), Worldwide Interoperability for Microwave Access (WiMAX), and/or other short or long range communication protocols .” *Id.*, [0028].

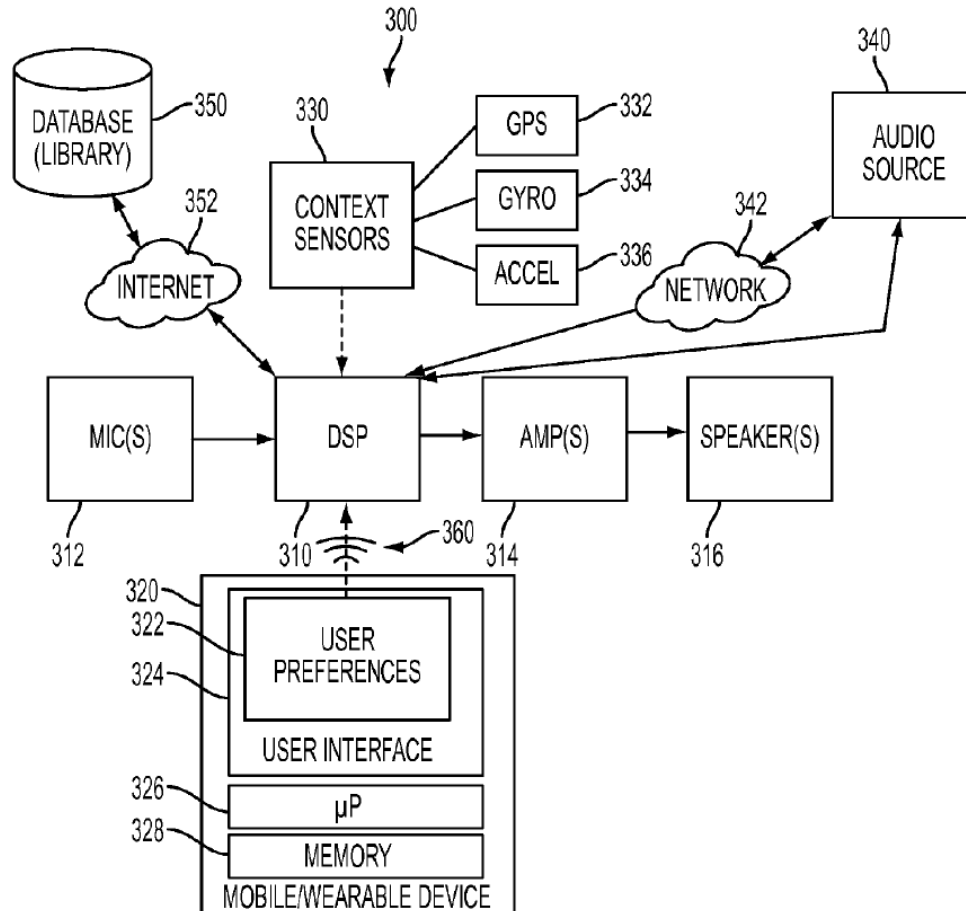


Ex. 1010 (*Goldstein873*), FIG. 2

282. *Goldstein873* explains that “[t]he transceiver 204 can also provide support for dynamic downloading over-the-air to the earpiece 100.” *Id.*

283. As I discussed in §§X.A.1.d(ii) and X.D.1.a(iii), *DiCenso641* discloses earpieces 134 wirelessly communicating with mobile device 320. *See* Ex. 1005 (*DiCenso641*), [0025] (“Wearable device 130, which may be implemented within earpieces 134, may also be equipped with wireless communication (integrated Bluetooth or Wi-Fi) to connect with various external sound sources, an external user interface, or other similar wearable devices.”), [0027] (“[T]he user interface may be implemented within a separate mobile or wearable device, such as a smartphone”). *DiCenso641* also discloses (and depicts in FIG. 3 (reproduced

below)) a wireless link 360 communicating between mobile device 320 and DSP 310. *Id.*, [0039].



Ex. 1005 (*DiCenso641*), FIG. 3

284. Thus, to the extent the Patent Owner argues, and the Board finds, that *DiCenso641* does not disclose the earpieces 134 each having a wireless transceiver, a person of ordinary skill in the art would have been motivated to modify *DiCenso641*'s earpieces 134 to incorporate a transceiver in each—as taught by *Goldstein873*—to effectuate wireless communication with mobile device 320. A

person of ordinary skill in the art would have found the combination obvious because it would have amounted to an application of a known technique (including a wireless transceiver in a headphone or earbud as *Goldstein873* teaches) to improve a similar device (*DiCenso641*'s earpieces that use a wireless link) in the same way (providing components supporting wireless communication between devices as *Goldstein873* teaches).

285. Accordingly, the *DiCenso641-Goldstein873* combination teaches earpieces 134 including a first earpiece having a wireless transceiver to implement wireless communication (“a wireless transceiver”) for sending an unprocessed audio stream and receiving back a modified audio stream (“which is configured to transmit and receive data”) from mobile device 320 (“from the data source”). The *DiCenso641-Goldstein873* combination also teaches earpieces 134 including a second earpiece having a wireless transceiver to implement communication (“communication mechanism”) for receiving a modified audio stream (“for receiving electronic information”) from mobile device 320 (“from the data source”).

286. While as I discussed in §§X.A.1.e and X.A.1.f, *DiCenso641* teaches earpieces 134 having a microprocessor-based DSP 310 and computer readable storage medium storing code executable by a processor to perform the indicated function, it does not provide additional implementation details for the storage medium that stores the code executed by the DSP 310. A person of ordinary skill in

the art would have thus searched for references to supply such implementation details and would have readily found *Goldstein873*.

287. *Goldstein873* discloses that its earpiece includes a processor 206 which can be implemented as a DSP, and also includes memory 208 “for controlling operations of the earpiece device 100.” Ex. 1010 (*Goldstein873*), [0027]. Thus, when implementing *DiCenso641*’s earpieces, a person of ordinary skill in the art would have found it obvious to incorporate a DSP and a memory storing code executable by the DSP on the same earpiece as taught by *Goldsteing873*.

288. A person of ordinary skill in the art would have found the combination obvious because it would have amounted to mere use of a known technique (*Goldstein873*’s teaching to incorporate a DSP and memory on the same earpiece) to improve similar devices (*DiCenso641* which has an earpiece similar to *Goldstein873*’s and also discloses a computer readable storage medium to store code) in the same way.

289. A person of ordinary skill in the art would have also found the combination obvious because it would have amounted to applying a known technique (*Goldstein873*’s teaching to incorporate a DSP and memory on the same earpiece) to a known device (*DiCenso641*’s earpiece that also has a DSP) ready for improvement to yield predictable results (*DiCenso641*’s earpiece having a DSP and associated memory on the same earpiece as taught by *Golstein873*).

290. Aside from the features I discussed in this section, the analysis of how the *DiCenso641-Goldstein873-Smith* combination renders claims 1, 4-11, 13-20, and 25-28 obvious is otherwise the same as I discussed in §§X.A.1-X.A.21.

G. Ground 2B: *DiCenso641, Goldstein873, Smith, and Holland* Render Obvious Claims 2 and 12

291. In my opinion, *DiCenso641* in combination with *Goldstein873, Smith,* and *Holland* render claims 2 and 12 obvious for the same reasons I discussed in §§X.B and X.F.

H. Ground 2C: *DiCenso641, Goldstein873, Smith, and Warren* Render Obvious Claim 3

292. In my opinion, *DiCenso641* in combination with *Goldstein873, Smith,* and *Warren* render claim 3 obvious for the same reasons I discussed in §§X.C and X.F.

I. Ground 2D: *DiCenso641, Goldstein873, Smith, and DiCenso645* Render Obvious Claims 21-24

293. In my opinion, *DiCenso641* in combination with *Goldstein873, Smith,* and *DiCenso645* render claims 21-24 obvious for the same reasons I discussed in §§X.D and X.F.

J. Ground 2E: *DiCenso641*, *Smith*, and *Goldstein873* Render Obvious Claim 32

294. In my opinion, *DiCenso641* in combination with *Smith*, and *Goldstein873* render claim 32 obvious for the same reasons I discussed in §§X.E and X.F.

XI. SECONDARY CONSIDERATIONS

295. I see no evidence in the '736 patent prosecution history or elsewhere supporting any secondary considerations arguments, or evidence of nexus of such alleged evidence to the challenged claims. To the extent the Patent Owner asserts the existence of any secondary considerations in its responses, I reserve the right to address any such evidence.

XII. CONCLUSION

296. The findings and opinions set forth in this declaration are based on my work and examinations to date.

297. I may continue my examinations. I may also receive additional documentation and other factual evidence over the course of this IPR that will allow me to supplement and/or refine my opinions. I reserve the right to add to, alter, or delete my opinions and my declaration upon discovery of any additional information. I reserve the right to make such changes as may be deemed necessary.

298. In signing this declaration, I recognize that the declaration will be filed as evidence in an IPR before the PTAB. 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 of me, I will appear for cross-examination within the United States during the time allotted for cross-examination.

299. 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 are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Date: November 3, 2025



Chris Kyriakakis, Ph.D.