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Transcript of Kyla Alanna McMullen, Ph.D.

Date: April 26, 2023

Case: Eight kHz, LLC -v- Meta Platforms, Inc., et al.

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WORLDWIDE COURT REPORTING & LITIGATION TECHNOLOGY

Transcript of Kyla Alanna McMullen, Ph.D.
Conducted on April 26, 2023

1 (1 to 4)

1	1	1	3
2	IN THE UNITED STATES DISTRICT COURT	2	A P P E A R A N C E S
3	FOR THE WESTERN DISTRICT OF TEXAS	3	
4	WACO DIVISION	4	ON BEHALF OF PLAINTIFF:
5	-----x	5	Kyle L. Elliott, Esquire
6	EIGHT KHZ, LLC, :	6	SPENCER FANE LLP
7	Plaintiff, :	7	1000 Walnut Street
8	v. : Civil Action No.	8	Suite 1400
9	META PLATFORMS, INC.; : 6:22-cv-575-ADA-DTG	9	Kansas City, Missouri 64106
10	META PLATFORMS :	10	Telephone: (816) 474-8100
11	TECHNOLOGIES, LLC; and :	11	Email: kelliott@spencerfane.com
12	TWISTED PIXEL GAMES, LLC, :	12	-AND-
13	Defendants. :	13	
14	-----x	14	Patrick M. Dunn, Esquire
15		15	SPENCER FANE LLP
16	VIDEOTAPED DEPOSITION OF KYLA ALANNA MCMULLEN. PH.D.	16	9442 North Capital of Texas Highway
17	Washington, D.C.	17	Plaza I - Suite 500
18	Wednesday, April 26, 2023	18	Austin, Texas 78759
19	9:01 a.m. EDT	19	Telephone: (512) 840-4550
20		20	Email: erobinson@spencerfane.com
21		21	pdunn@spencerfane.com
22		22	
23	Job No.: 490388	23	
24	Pages 1 - 241	24	
25	Reported By: Joan V. Cain	25	
2	2	4	4
1	Videotaped Deposition of KYLA ALANNA	1	A P P E A R A N C E S C O N T I N U E D
2	MCMULLEN. PH.D., held at the law offices of:	2	
3		3	ON BEHALF OF DEFENDANTS:
4	LATHAM & WATKINS LLP	4	Christopher Henry, Esquire
5	555 Eleventh Street, Northwest	5	LATHAM & WATKINS LLP
6	Washington, D.C. 20004-1304	6	200 Clarendon Street
7	(202) 637-2200	7	Boston, Massachusetts 02116
8		8	Telephone: (617) 948-6000
9	Pursuant to Notice, before Joan V. Cain,	9	Email: christopher.henry@lw.com
10	Court Reporter and Notary Public in and for the	10	
11	District of Columbia.	11	
12		12	ALSO PRESENT:
13		13	Kyanna Sabanoglu, Lead Counsel
14		14	IP Litigation, Meta
15		15	Julio Mendieta, Legal Videographer
16		16	
17		17	
18		18	
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2 (5 to 8)

5	7
1 C O N T E N T S	1 P R O C E E D I N G S
2 EXAMINATION OF KYLA ALANNA MCMULLEN, PH.D. PAGE	2 - - -
3 By Mr. Elliott 8, 237	3 9:01 a.m. EDT
4 By Mr. Henry 236	4 April 26, 2023
5 E X H I B I T S	5 - - -
6 (Attached to the Transcript.)	6 THE VIDEOGRAPHER: Here marks Media No. 1
7 MCMULLEN DEPOSITION EXHIBITS PAGE	7 in the videotaped deposition of Dr. Kyla McMullen in
8 EXHIBIT 2 Declaration of Dr. McMullen 9	8 the matter of Eight kHz LLC v. Meta Platforms, Inc.,
9 in Support of Defendants'	9 et al., in the United States District Court for the
10 Opening Claim Construction	10 Western District of Texas, Waco Division, Case No.
11 Brief, 4/12/23	11 6:22-cv-575-ADA-DTG.
12 EXHIBIT 3 The Processor Processing 9	12 Today's date is April 26, 2023. The time
13 Terms Compiled by	13 on the video monitor is 9:02 a.m. The videographer
14 Dr. McMullen	14 today is Julio Mendieta representing Planet Depos.
15 EXHIBIT 4 U.S. Patent No. 10,917,737 54	15 This video deposition is taking place at 555
16 B2	16 Eleventh Street, Northwest, Suite 1000, Washington,
17 EXHIBIT 5 Quantitatively Validating 83	17 D.C. 20004.
18 Subjectively Selected HRTFs	18 Would the counsel please voice identify
19 for Elevation and Front-Back	19 themselves and state whom they represent.
20 Distinction, a Scholarly	20 MR. ELLIOTT: Kyle Elliott and Patrick Dunn
21 Paper by Fan, et al.	21 on behalf of Eight kHz, the plaintiff.
22	22 MR. HENRY: Chris Henry of Latham & Watkins
23	23 for the Meta defendants, and with me today is Kyanna
24	24 Sabanoglu, Meta's in-house counsel.
25	25 THE VIDEOGRAPHER: The deposition officer
6	8
1 E X H I B I T S C O N T I N U E D	1 today is Joan Cain, representing Planet Depos. The
2 (Attached to the Transcript.)	2 witness will now be sworn.
3 MCMULLEN DEPOSITION EXHIBITS PAGE	3 Whereupon,
4 EXHIBIT 6 Audio Engineering Society 86	4 KYLA ALANNA MCMULLEN, PH.D.,
5 Convention Paper Presented	5 having been duly sworn under penalties of perjury by
6 at the 133rd Convention,	6 the Notary Public, was examined and did testify as
7 October 2012: Subjective	7 follows:
8 Selection of Head-Related	8 THE COURT REPORTER: Thank you.
9 Transfer Functions (HRTFs)	9 Please begin.
10 Based on Spectral Coloration	10 EXAMINATION BY COUNSEL FOR PLAINTIFF
11 and Interaural Time	11 BY MR. ELLIOTT:
12 Differences (ITD) Cues	12 Q So if you would, please, state your full
13 EXHIBIT 7 University of Florida Online 90	13 name for the record.
14 Newsletter Article:	14 A Kyla Alanna McMullen.
15 Doctoral Student Receives	15 Q And my name's Kyle Elliott. I'm here on
16 Meta Ph.D. Fellowship,	16 behalf of Eight kHz.
17 3/3/22	17 Have you ever had your deposition taken
18 EXHIBIT 8 U.S. Patent No. 9,226,090 B1 96	18 before?
19 EXHIBIT 9 Snapdragon 8 Gen 2 Mobile 129	19 A I have not.
20 Platform Information,	20 Q Okay. I noticed you brought some documents
21 Specifications, and Features	21 with you. Okay. Are there any handwritten notes or
22	22 anything in those?
23	23 A No, there aren't.
24	24 Q Okay. What I'm going to ask to do, though,
25	25 since you brought a document with you, is I want to

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9 1 get it marked it for the deposition. If you hand it 2 to the reporter, she'll mark it. Do you have one or 3 two documents there? 4 A There are a few documents here, but one is 5 bound and the other is stapled. 6 Q Okay. That's perfect, yeah. She can mark 7 them for you. 8 --- 9 (McMullen Exhibits 2 and 3 were 10 marked for identification.) 11 --- 12 THE COURT REPORTER: These will be 13 Exhibits 2 and 3. 14 MR. ELLIOTT: Right. 15 THE COURT REPORTER: Do you want them, 16 Counsel? 17 MR. ELLIOTT: No. You can hand them back 18 to the witness. That's fine. 19 BY MR. ELLIOTT: 20 Q Have you ever given any other testimony 21 before, Dr. McMullen? 22 A I have not. 23 Q Okay. Well, this is first time, you know, 24 it's not an endurance test. So if you have to use 25 the restroom, those kind of things, need a drink or	11 1 P-O-S-I-T-A. 2 A Yes. 3 Q Let me just ask a question about a POSITA. 4 Is this a real person or a fictitious person? 5 A I understand it to mean a person of skill 6 in the art, and it seems to be a fictitious person. 7 Q Mm-hmm. 8 A We're not referring to an actual person 9 that's named. 10 Q Right. Perfect. 11 So in the context of your declaration -- 12 and actually let me pause for a second. What's been 13 marked as Exhibit 2, can you identify that for the 14 record so we know what Exhibit 2 is? 15 A Yes. This is my declaration. 16 Q Okay. And what is Exhibit 3? 17 A Exhibit 3 is -- it's the processor, 18 processing term, since the term comes up in many 19 different instances, just to sort of keep it 20 together. 21 Q Okay. So does Exhibit 3 come out of your 22 declaration that's Exhibit 2? 23 A It is a -- it's a representation of some of 24 the things in Exhibit 2, just in a more compact 25 format.
10 1 a break, just let me know. One thing I'll ask you 2 is if there's a pending question, that we answer 3 that question before we go on a break. 4 Does that make sense? 5 A Yes. 6 Q Okay. And how did you prepare for this 7 deposition today? 8 A Can you be a bit more specific about how 9 did I prepare? 10 Q Did you meet with counsel? 11 A Yes, I did meet with counsel. 12 Q How long did you meet with counsel? 13 A It depends on the time frame that you're 14 referring to. If I assume that you mean the entire 15 extent of this, we've been talking since late 2022, 16 but what do you mean by preparation? 17 Q Preparation for this specific testimony. 18 A For this specific testimony. We did meet 19 to talk about strategies since I'm not a lawyer, 20 familiar with the legalese of these things so, yes. 21 Q Mm-hmm. Regarding legalese, and, you know, 22 we've got a lot of acronyms we're going to be 23 throwing around today, which Joan will work with us 24 on. But do you know what I refer to -- who I'm 25 referring to if I say a POSITA or a POSA? It's	12 1 Q Okay. Perfect. Thank you for that. 2 And so in context of your declaration, you 3 cite to a whole lot of references in some of the 4 later paragraphs. Is a POSITA aware of all of those 5 references that are in that paragraph? 6 MR. HENRY: Objection to form. 7 THE WITNESS: It seems as though we're 8 talking about a hypothetical person. So it's -- 9 it's impossible to say what a hypothetical person 10 would be aware of. 11 BY MR. ELLIOTT: 12 Q So it's impossible to say what the POSITA 13 is aware of? 14 MR. HENRY: Objection to form. 15 Mischaracterizes Dr. McMullen's testimony. 16 THE WITNESS: As I said, a POSITA is a 17 hypothetical person, so it's impossible to say what 18 they may or may not be aware of since they don't 19 exist. 20 BY MR. ELLIOTT: 21 Q Okay. And just to the format, you're 22 already kind of picking up on it. I'll ask a 23 question, your counsel's going to offer objections. 24 You'll go ahead and answer the question. If 25 something's honestly ambiguous to you, please ask me

13 1 to clarify -- right? -- otherwise, try and proceed 2 and answer the question. All right? 3 So if we can't define what a POSITA knows, 4 how can we determine if claims are definite or 5 indefinite? 6 MR. HENRY: Objection to form. Lacks 7 foundation. 8 THE WITNESS: We're not saying that we 9 don't know -- well, we already said, and I can point 10 us to the point in the document where we define the 11 skill set of the POSITA, which is someone who has -- 12 who would have a bachelor's degree in computer 13 science or engineering and audio -- sorry. I 14 skipped down. 15 A person who would have had a bachelor's 16 degree in computer science or engineering or related 17 fields with coursework in computer programming, 18 virtual/augmented reality, and audio engineering and 19 at least two years of industry experience or 20 academic research experience in virtual 21 reality/augmented reality, audio engineering or an 22 equivalent. Additionally, in my view, additional 23 education can compensate for less experience and 24 vice-versa. 25 So my reason for saying that a POSITA -- I	15 1 understand it? 2 BY MR. ELLIOTT: 3 Q Please go ahead. 4 A You're asking if a person with the degrees 5 stated would know about every single patent and 6 reference related to this work? 7 Q I'm asking if the POSITA, okay, would know 8 about every single reference related work -- related 9 to this work, the patents-in-suit, understanding 10 that this is, as you testified before, a fictitious 11 person. 12 MR. HENRY: Objection to form. 13 THE WITNESS: Explain what you mean 14 by "know about." 15 BY MR. ELLIOTT: 16 Q They know the content of it. 17 MR. HENRY: Same objection. 18 THE WITNESS: It's possible to know the 19 content, meaning the -- the technical content of the 20 work without having read it. So the -- a person of 21 skill in the art could have come across this paper 22 or other papers during their education and training, 23 educational experience, but there's no way to 24 guarantee that this exact information was presented 25 to them. However, the substance of the information
14 1 would not know exactly what papers and references 2 they would be familiar with -- is that various 3 educational trainings would harp upon different -- 4 different papers or different references; however, 5 they would have the requisite knowledge in the 6 papers but may not be familiar with the exact 7 references. 8 BY MR. ELLIOTT: 9 Q Right. And going forward, sometimes I may 10 ask you to refer to one of the exhibits. Sometimes 11 I may ask you not to. 12 A Okay. 13 Q I just want to test your knowledge and see 14 where we're at. Okay? 15 But looking at the POSITA, is a POSITA not 16 aware of all of, for example, what we call the prior 17 art to the patents-in-suit here? 18 MR. HENRY: Objection to form. 19 THE WITNESS: Can you clarify what you mean 20 by "all of the prior art"? 21 BY MR. ELLIOTT: 22 Q I think "all" means all here. 23 MR. HENRY: Same objection. 24 THE WITNESS: Can you restate your 25 questions -- well, may I restate your question as I	16 1 could have been presented. 2 BY MR. ELLIOTT: 3 Q So this is -- if you want to turn there, 4 this is -- one of the sample paragraphs is 193 -- 5 A Okay. 6 Q -- in Exhibit 2 there. 7 And I think the first reference that you 8 have there is Begault, and then there's a Bauer and 9 Battuea -- 10 A Yes. 11 Q -- pardon me if I'm mispronouncing that. 12 Are any -- and then there's a Rodgers, the next one. 13 Are any of these people known to you 14 personally? 15 A I have met one of the authors. 16 Q Which one? 17 A The first author. 18 Q Begault? 19 A Yes. 20 Q Okay. And who is Begault? I assume he's a 21 doctor as well? 22 A His profession -- 23 Q Ph.D.? 24 A Yeah, he has a Ph.D., but not a medical 25 doctor.

17 1 Q Yeah. Right. Right. In this room, we're 2 talking Ph.D.s, not the M.D.s. Got a good joke 3 about that when we're on break later. 4 So you know Dr. Begault? 5 A I've met him once. 6 Q Okay. Is Dr. Begault -- I assume 7 Dr. Bauer, Dr. Battuea, Dr. Rodgers, are these all 8 experts in their fields? 9 MR. HENRY: Objection to form. Calls for 10 speculation. Ambiguous. 11 THE WITNESS: I would not be able to 12 certify because I have not met them, but I -- one 13 could assume, if you have written a seminal paper in 14 this area, that you have some expertise in this 15 area. 16 BY MR. ELLIOTT: 17 Q Is the reference that Dr. Begault has, is 18 that a seminal reference? 19 A I definitely regard this as a seminal 20 reference. Not the only, but it is one of the 21 seminal references for this field. 22 Q Okay. What about the reference by Bauer 23 and Battuea? 24 A These are also seminal references in the 25 beginnings of this -- of this research, but as we	19 1 Q 2014. 2 A "Commercially" implies purchasing in 3 commerce, correct? 4 Q Were they available for use? 5 MR. HENRY: Objection to form. 6 THE WITNESS: There are many HRTFs that are 7 widely available in repositories and various things 8 in various locations in the internet. 9 BY MR. ELLIOTT: 10 Q Mm-hmm. And that was true in 2014, 11 correct? 12 A Yes, that's true in 2014. 13 Q Okay. So would the POSITA be able to use 14 those available HRTFs to implement an SLP in 2014? 15 MR. HENRY: Objection to form. Ambiguous. 16 Incomplete hypothetical. 17 THE WITNESS: A POSITA, assuming that they 18 had the requisite knowledge to create the 19 specialized software that would be needed to in -- 20 along with the HRTF, be able to create the SLP. The 21 SLP could be created with the use of the HRTF, but 22 not by itself. 23 BY MR. ELLIOTT: 24 Q What other specialized software would the 25 programmer have to have or create?
18 1 know, time evolves. Things, technology evolves. 2 Q And what about the reference by Rodgers? 3 A I would say the same, same answers. 4 Q Okay. So this fictitious person, this 5 POSITA, let's say that they are aware of, they have 6 knowledge of the content of, all the references that 7 you cite throughout paragraph 193. 8 Would that POSITA be able to use the 9 available HRTFs at the time of the invention to 10 practice the invention? 11 MR. HENRY: Objection to form. Ambiguous. 12 Incomplete hypothetical. 13 THE WITNESS: What do you mean by "use"? 14 BY MR. ELLIOTT: 15 Q I'm sorry? 16 A What do you mean by "use the HRTF"? 17 Q Well, HTRFs [sic] in 2014 were commercially 18 available, correct? 19 A HTRFs were not commercially available. 20 HRTFs -- 21 Q Oh, did I transpose? Sorry. 22 A -- but what do you mean by commercially 23 available? 24 Q Just available for a programmer to use. 25 A Can you repeat the year that you --	20 1 A So the programmer would actually need to 2 create specialized software that could do a number 3 of things. One is to detect the type of sound. 4 Let's imagine that we are creating an SLP that is an 5 arbitrary point in space. The programmer would 6 first need to have software that could take in a 7 sound source, determine if it is already binaural or 8 monaural. 9 Let's assume that it's binaural and let's 10 also assume that we want to use an HRTF to create 11 the binaural audio. So this is a different case of 12 it. Let's assume that it is something that is using 13 an HRTF and that we know that it is binaural if we 14 make sure there's the same sound in both channels, 15 if not, mix down. But if its monaural, double the 16 channels. So there's a lot of -- I don't think we 17 need to -- need to go through all of the steps here, 18 but there are many steps aside from using an HRTF 19 that are involved. 20 There's convolution, picking a convolution 21 method, deciding on distance factors, reverberation 22 factors, attenuation. There's -- there's many 23 different -- many different choices to make, and 24 it's -- and also let's say that our arbitrary point 25 in space isn't an actual point that we have a

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21 1 requisite left and right ear HRTF for. Then we'd 2 have to do interpolation to figure out, okay, how do 3 we now approximate the sound source, and so that 4 interpolation, it can be linear, it can be 5 exponential. There's a bunch of different 6 interpolation factors as well. 7 So -- and then talking to the audio device 8 driver to be able to actually render it in a way 9 that's -- that it is in the signal processing terms, 10 you know, we don't have any clipping or we don't 11 have any sort of distortion or any unintended 12 artifacts. So just using the HRTF is -- 13 Q What -- what is audio -- what was the word 14 you used? Audio signal? 15 A Audio signal processing? 16 Q Yeah. What is audio signal processing? 17 A It is -- I don't have a prepared definition 18 for audio signal processing; however, colloquially 19 it's meant as the act of -- and it's a very generic, 20 very generic term. It's not understood to mean 21 exactly one thing, but we understand that audio 22 exists in waves and digital signals inside of a 23 computer, inside of a circuit. 24 So it can refer to any of hundreds of 25 algorithms or transformations that would happen to	23 1 need to hear a different sound in space, you would 2 need to use a different head-related transfer 3 function, or you would need to interpolate in order 4 to actually render for -- correctly for that space. 5 Q Mm-hmm. And so would that change the sound 6 that the user's perceiving? 7 MR. HENRY: Objection to form. Ambiguous. 8 THE WITNESS: Because you're using a 9 different head-related transfer function -- this is 10 a little hard to answer because sound is subjective, 11 and all of these are perceptual experiments. 12 So there is a signal processing component, 13 where we know the actual signal delivered to the 14 person; however, it's difficult to say if this 15 person will hear these two sounds as different 16 sounds. Like, there's laws called, for example, the 17 just noticeable difference. For some people in some 18 directions, it can be one degree. Some directions, 19 it can be up to five degrees, but the just 20 noticeable difference is how far or how much does my 21 head need to rotate to one side or another in order 22 to notice the sound has changed. 23 So when you asked the question in order -- 24 if I rotate, will the person know that the sound has 25 changed -- because we're all individual and these
22 1 this sort of digital signal inside of a system to 2 change its output. 3 Q Will positioning an SLP to a different 4 location require changing the sound for the user? 5 MR. HENRY: Objection to form. Incomplete 6 hypothetical. 7 THE WITNESS: So change -- can you give an 8 example? 9 BY MR. ELLIOTT: 10 Q Well, you just used the word 11 "transforming." 12 A Yes. 13 Q So am I going to have to transform the 14 sound as a user shifts their head relative to an 15 SLP? 16 MR. HENRY: Objection to form. Incomplete 17 hypothetical. 18 THE WITNESS: Can you -- so you -- just 19 want to make sure I understand your question. 20 BY MR. ELLIOTT: 21 Q Mm-hmm. 22 A If a person is -- or if a sound is being 23 rendered at a point in space -- 24 Q Mm-hmm. 25 A -- and the person shifts their head and we	24 1 things are subjective and I don't know the amount of 2 the rotation, I can't reliably -- I don't want to 3 guess. 4 BY MR. ELLIOTT: 5 Q Well, if the person's hearing impaired -- 6 A Okay. 7 Q -- if they're deaf, they're not going to 8 perceive it, correct? 9 MR. HENRY: Objection to form. 10 THE WITNESS: Hearing impaired and deaf 11 aren't the same thing. 12 BY MR. ELLIOTT: 13 Q Correct. Correct. The question was if 14 they're deaf, they're not going to perceive the 15 change, right? 16 MR. HENRY: Objection to form. 17 THE WITNESS: I don't want to -- not being 18 a person who is deaf or hearing impaired, I don't 19 want to comment on what that person may perceive. 20 For example, I've known many people who are deaf who 21 perceive the low frequencies that are in sound 22 because they actually vibrate our body. So I'm not 23 comfortable saying what a deaf person or a hard of 24 hearing person would perceive. 25 BY MR. ELLIOTT:

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25 1 Q But the intent of changing the R -- HRTF is 2 to make sure they perceive something different, 3 correct? 4 MR. HENRY: Objection to form. 5 BY MR. ELLIOTT: 6 Q Even as you -- even as you said, if a 7 person's deaf? 8 MR. HENRY: Objection to form. Calls for 9 speculation. 10 THE WITNESS: So, generally speaking, when 11 you are rendering sound over headphones, it is 12 assumed that the person has sensitivity in the 13 audible frequency region. So I would assume for a 14 person who is hearing and can perceive sounds within 15 the frequency region of the convolved sound or of 16 the -- 17 THE COURT REPORTER: Of the what sound? 18 I'm sorry. 19 THE WITNESS: -- convolved or the created 20 sound, if a person is able to perceive a sound that 21 is in that frequency range, then it would be 22 reasonable to assume that -- that they could 23 perceive the sound, that they could hear the sound, 24 and perhaps hear a change if that is within their 25 own just noticeable difference.	27 1 BY MR. ELLIOTT: 2 Q Okay. And would that also be modifying the 3 sound within the larger piece of software? 4 MR. HENRY: Objection to form. 5 THE WITNESS: What is the word "that" in 6 that sentence? 7 BY MR. ELLIOTT: 8 Q The changed HRTFs. 9 MR. HENRY: Objection to form. Ambiguous. 10 THE WITNESS: So just to restate, you're 11 asking if the HRTF would change the sound? 12 BY MR. ELLIOTT: 13 Q I had asked that question, whether the HRTF 14 changed the sound. You said that it doesn't, but 15 you said it would within the larger software 16 program, and so I'm just asking if the HRTFs within 17 the larger software program would modify the sound. 18 MR. HENRY: Objection to form. 19 Mischaracterizes Dr. McMullen's testimony. 20 Ambiguous. 21 THE WITNESS: Within the larger software 22 program, the HRTF, along with other factors that are 23 mentioned as before: Reverberation, attenuation, 24 interpolation, all of these other things in 25 compilation change the sound and are used to change
26 1 BY MR. ELLIOTT: 2 Q Let's make a more extreme example. 3 A Okay. 4 Q I'm going to -- this time, instead of 5 tilting the head of the user, I'm going to change 6 the SLP from being three feet away from you on your 7 right to three feet away from you on your left. 8 A Okay. 9 Q Okay. Would you have to use a different 10 HRTF for that? 11 A Yes. 12 MR. HENRY: Objection to form. 13 THE WITNESS: Oh, sorry. 14 Yes, you would need to use a different 15 HRTF. 16 BY MR. ELLIOTT: 17 Q And would that different HRTF transform the 18 sound? 19 MR. HENRY: Objection to form. 20 THE WITNESS: That different HRTF would be 21 a different function that would be able to -- that 22 you would use within a larger piece of software. 23 The HRTF itself does not transform within a larger 24 piece of software. The original sound is 25 transformed.	28 1 the sound. 2 BY MR. ELLIOTT: 3 Q Is adjusting a binaural voice, would that 4 be transforming sound? 5 MR. HENRY: Objection to form. 6 THE WITNESS: Adjusting a binaural voice 7 without knowing the manner of the adjustment, how 8 can we say that it is transformed? 9 BY MR. ELLIOTT: 10 Q What's the -- what does the word 11 "adjusting" mean to you? 12 A Adjusting has various meanings in different 13 contexts. So can you qualify what you -- what form 14 of adjustment -- 15 Q In the context -- in the context of the 16 patents, what does adjusting mean to you? 17 A In the context of the patent, the 18 word "adjusting," in my opinion, is inappropriate 19 there because there isn't an adjustment that is 20 made. I wouldn't call it an adjustment. 21 Q What would you call it? 22 A I would call it any of the words that I've 23 described previously. I'd call it a -- literally, 24 it's a calculation. It's something that we're doing 25 within a larger software program that you have a

29 1 sound coming in, the specialized software is able to 2 use various tools to change the sound, and then at 3 its output, we have our -- our spatial -- our SLP 4 that -- that's been created, but adjusting doesn't 5 capture what's happening. 6 Q Does the word "transforming" capture what's 7 happening? 8 MR. HENRY: Objection to form. Ambiguous. 9 THE WITNESS: Transforming in the context 10 of the word head-related transfer function, is that 11 the -- so transfer versus transforming, by 12 definition, a transfer function -- you could sort of 13 split hairs there. By itself it does not. It 14 characterizes the trans- -- one of the 15 transformations that needs to happen to the sound, 16 but it is not the actual thing that changes the 17 sound. 18 BY MR. ELLIOTT: 19 Q So say there's a sound and it's recorded in 20 one environment, and the invention wants to 21 reproduce that sound in another environment remote 22 from that originating environment. Does the 23 invention want that sound to take on characteristics 24 of the remote environment that it's reproducing it 25 into or rendering it into?	31 1 MR. HENRY: Objection to form. Ambiguous. 2 Calls for speculation. Don't know what hypothetical 3 invention we're talking about. I don't know. I'm 4 lost. If you could clarify, it would help. 5 MR. ELLIOTT: Objection to the speaking 6 objection. 7 BY MR. ELLIOTT: 8 Q Please answer the question. It's 9 relatively straightforward. 10 MR. HENRY: Object. Same objections. 11 THE WITNESS: I -- I still am unsure what 12 you mean by takes on the characteristics -- "the 13 sound takes on the characteristics of the room." 14 BY MR. ELLIOTT: 15 Q Well, what characteristics might be present 16 in a room? 17 A In an auditory sense? In an object sense? 18 What -- can you define more what you mean by the 19 characteristics of a room? 20 Q Well, there's objects around on the table, 21 correct? 22 A This is correct. 23 Q Computers? Laptops, right? 24 A Yes. 25 Q Are they going to have an impact on the
30 1 MR. HENRY: Objection to form. Ambiguous. 2 Incomplete hypothetical. 3 THE WITNESS: Can you qualify this question 4 a bit more? As in -- what do you mean by take on 5 the characteristics? How is it recorded? 6 BY MR. ELLIOTT: 7 Q Well, you under -- you've been through a 8 lot of the characteristics, reverberation, et 9 cetera. Okay? There may be objects in the room, 10 right? So do we want it to take on the 11 characteristics of that remote environment? 12 MR. HENRY: Same objections. 13 THE WITNESS: The question's a bit -- it's 14 hard to answer this question. What do you mean 15 by take on the characteristics of the room? So as 16 you mentioned, we're recording the sound or sound is 17 recorded in one context and it needs to be 18 reproduced in another context. 19 What do you mean by the room needs to take 20 on the characteristics? 21 BY MR. ELLIOTT: 22 Q Well, the room doesn't take on the 23 characteristics. The sound takes on the 24 characteristics of the room, other objects, other 25 people, et cetera, correct?	32 1 auditory environment? 2 MR. HENRY: Incomplete hypothetical. 3 Objection to form. 4 THE WITNESS: It depends on the object. 5 BY MR. ELLIOTT: 6 Q Mm-hmm. But if I am rendering a sound into 7 a remote environment and there are objects there, do 8 I want that sound to take into account the objects 9 that are in that new remote environment? 10 MR. HENRY: Objection to form. Incomplete 11 hypothetical. Calls for speculation about what you 12 want. 13 THE WITNESS: This -- it's impossible to 14 answer without knowing the context. You can render 15 whatever you want as a -- as a designer of a room. 16 I can't impose that it must have -- it's really hard 17 to answer this question with -- with not a lot of 18 information. This is very up in the air. 19 BY MR. ELLIOTT: 20 Q Let's try a little -- little different way. 21 A Okay. 22 Q Is it possible for me to have that sound 23 take on the characteristics of the remote 24 environment? 25 MR. HENRY: Same objections.

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33 1 THE WITNESS: It's a really difficult 2 question to answer because without knowing the 3 environment, without knowing what you mean by the 4 characteristics, without knowing what objects we're 5 referring to, this hypothetical situation, it's -- 6 it's hard to give you an exact answer about this. 7 BY MR. ELLIOTT: 8 Q Mm-hmm. Well, you're -- you're an expert 9 witness, correct? 10 A That is correct. 11 Q Yeah. 12 And you're an expert -- well, actually, let 13 me back up. Let's go back to some other perfunctory 14 kind of things. 15 Is there anything today that would keep you 16 from giving complete and accurate testimony? 17 A No. 18 Q Okay. And what is your current job? 19 A I am -- I have a few jobs, but the -- 20 Q Sure. 21 A -- most prevalent one is an associate 22 professor at the University of Florida in computer 23 and information science and engineering. 24 Q Okay. And what are your responsibilities 25 as the associate professor there?	35 1 Q Okay. Anything else? 2 A That is it -- well, sorry. I have a 3 nonprofit, but it's kind of in that middle -- in 4 between a company and a not company space. It's 5 called Modern Figures Inc. 6 Q And are those all formed in what states? 7 A They're all in Florida. 8 Q And so how would you characterize your 9 expertise? 10 A What do you mean by "characterize"? 11 Q How would you state your expertise, if you 12 will? 13 A Specifically in the 3D audio -- 14 Q Sure? 15 A -- domain and realm? 16 I would state that my expertise -- that's a 17 really difficult question to -- to answer. I'm 18 someone who's been studying this for over ten years, 19 you know, almost 15 at this point -- how much? 20 Yeah, about 15, 16 at this point. Someone who's 21 thoroughly read, involved in the research community. 22 Yeah. I'm not sure what -- how else I can state my 23 expertise. 24 Q Well if somebody asked you what you do on 25 the elevator, what would you tell them?
34 1 A Oh, man, that's a lot. So the three 2 buckets are research, teaching, and service. I 3 conduct research, as you can see, in 3D audio 4 perception, application, and development, among 5 other things. Teaching is -- I teach various 6 classes as needed by the department. Service, 7 various activities to help the profession. 8 Q Okay. And you mentioned you had other 9 jobs. What other jobs do you have? 10 A Other jobs are like smaller things like, 11 you know, design websites. Little fun things. So 12 sometimes I'm a videographer. 13 Q Okay. 14 A So, yeah, just small things. 15 Q Do you have a -- like, a business setup or 16 a company setup to do those other little things? 17 A Yes. 18 Q What's the name of that company? 19 A Fresh To Tech LLC. 20 Q Do you have any other companies set up 21 besides Fresh to Tech LLC? 22 A Yes. 23 Q What are those? 24 A It's called Zazla Properties. We also run 25 an Airbnb.	36 1 A To keep things short because it is an 2 elevator, I'd probably just say I'm a 3 professor/researcher. 4 Q You wouldn't mention the audiology piece? 5 A Elevator rides are pretty short. 6 Offentimes they may not know what I'm talking about. 7 So -- 8 Q So if the person asks and says, "Oh, I'm an 9 audiologist," what would you tell them -- what do 10 you do? What would you tell them? 11 A Yeah. I would tell them that, "Oh, wow. 12 I'm also an audio signal processor. I work at the 13 intersection of computer science/human computer 14 interaction. Perceptual -- perceptual 15 psychology" -- they call it psycho acoustics, the 16 psychology of how you hear. 17 Digital signal processing, audio signal 18 processing, there's lots of -- it's a very 19 interdisciplinary field, but I would ask them what 20 they did to perhaps see if there was any overlap. 21 Q Mm-hmm. Okay. So now that we've kind of 22 got, you know, your expertise out there and we're 23 talking about, you know, we're taking sound in one 24 environment -- okay? -- it's recorded there and we 25 want to render that sound into a different

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37 1 environment. 2 A Okay. 3 Q When we do that, to give the user a real 4 experience, do we want that sound to -- you're 5 struggling with the word "characteristics of the 6 room," so maybe help me with a different word that 7 might work. 8 Do we want that sound to take on features, 9 characteristics -- you know, pick a term -- of the 10 room that's it's been rendered in -- 11 MR. HENRY: Objection. 12 BY MR. ELLIOTT: 13 Q Sorry -- to make the experience real for 14 the user? 15 MR. HENRY: Objection to form. 16 Incomplete -- incomplete hypothetical. 17 Argumentative. And Dr. McMullen is not struggling 18 with anything. So object to that phraseology in the 19 middle of that long narrative and then a question. 20 MR. ELLIOTT: My apologies for the 21 "struggling." 22 BY MR. ELLIOTT: 23 Q Go ahead. 24 A Can you repeat the question? 25 MR. ELLIOTT: Why don't you go ahead and	39 1 THE WITNESS: So if I interpret your 2 question correctly, the person -- if -- I have a 3 person who is in a room and they are walking around. 4 Is this a person who -- this is the listener in this 5 scenario, and we want them to walk around and hear 6 sound; is that correct? 7 BY MR. ELLIOTT: 8 Q Yes. 9 A It depends on the context. It really 10 depends on the context. 11 Q Is there a context in which you would want 12 to have the sound change? 13 A There can be context in which that may be 14 beneficial. 15 Q Okay. And what would one of those contexts 16 be? 17 A So the question you're asking is: Would I 18 want the sound to move around with me. There's some 19 context where -- for example, if there's a concept 20 called stream segregation, where different auditory 21 sources of information are spatially separated so 22 that they can be more intelligible. 23 Q So that's one context in which you wouldn't 24 want the sound to change? 25 A That is one context where, by having -- and
38 1 read it back for us, Joan, please. 2 (The reporter read the record as 3 requested.) 4 MR. HENRY: Same objections. 5 THE WITNESS: As I said, it's a 6 hypothetical question that has way too many 7 variables to answer definitively. 8 BY MR. ELLIOTT: 9 Q What about an indefinite answer? 10 MR. HENRY: Objection to form. 11 THE WITNESS: There are too many -- as I 12 stated, there are too many variables that occur when 13 recording and rendering to give you -- and also it's 14 context dependent. There's many things that have to 15 be considered to answer that question without more 16 information. This is going -- it doesn't make sense 17 to answer this question. 18 BY MR. ELLIOTT: 19 Q If a person in the environment in which the 20 sound is rendered gets up and moves around the room, 21 are you going to want the sound, for the purpose of 22 realism, to change for that person as they move 23 around the room? 24 MR. HENRY: Objection to form. Incomplete 25 hypothetical.	40 1 when we say "sound changing," am I assuming that 2 we're talking about the position of the sound 3 changing? What -- what is changing about the sound? 4 Q Well, how does a person, a listener with 5 headphones, perceive that the location of the sound 6 has changed, that the SLP has changed? 7 MR. HENRY: Objection to form. 8 THE WITNESS: In ordinary audio context 9 outside of, you know, any sort of digital domain, 10 the way that we know the position of a sound has 11 changed is by detecting this with our interaural 12 cues. 13 So if you're familiar, our ears, we have 14 two of them, that's how they're able -- and they're 15 on both sides of our head, which is very important, 16 in allowing us to receive two different signals, and 17 our brain compares those signals to determine the 18 difference between the signals and that helps us to 19 determine location. 20 So if we're determining that something is 21 moving in the natural sense, that means that the 22 signals that we're receiving at our ears are also -- 23 that they're changing and also motion helps with 24 that. So there's another concept called absolute 25 motion parallax, where either moving the sound or

41 1 moving your head allows you to determine the 2 location or the direction of the change. 3 BY MR. ELLIOTT: 4 Q Mm-hmm. And so within the rendered 5 environment, what context would the user want the 6 sound to change so that it is a reality -- you know, 7 more of a real experience for them? 8 MR. HENRY: Objection to form. Lacks 9 foundation. Ambiguous. 10 THE WITNESS: Yeah, it's -- I can't answer 11 for a hypothetical user. 12 BY MR. ELLIOTT: 13 Q Why can't you answer for a hypothetical 14 user? 15 MR. HENRY: Objection to form. 16 THE WITNESS: It's impossible to know what 17 a hypothetical person would want. You asked would a 18 hypothetical user -- when would they want the sound 19 to change. If I don't know who it is, their 20 intention, or the context, it's impossible to 21 speculate. 22 BY MR. ELLIOTT: 23 Q When would a programmer of one of these 24 systems that's rendering sound into a remote 25 environment -- when would the programmer want the	43 1 A Sure. If I were in some sort of, let's 2 say, immersive game and there are many elements of 3 the game and it's very interactive. It's, you 4 know -- maybe it's like -- I don't know -- some 5 alien game or something and there's lots of things 6 happening all around. Maybe I would want the sound 7 to change as I'm moving in the environment so I can 8 locate where things are. 9 Q And would the POSITA that's aware of all of 10 these references in paragraph 193 of your 11 declaration be able to use HRTFs in the context of a 12 broader program to be able to change that sound the 13 way you wanted it changed? 14 MR. HENRY: Objection to form. Incomplete 15 hypothetical. 16 THE WITNESS: A POSITA would have available 17 to them with all of these references many different 18 ways to be able to -- to change the sound in this 19 sort of environment, and they would need to, you 20 know, depending on the context, depending on the 21 purpose, depending on the sound, depending on how 22 it's recorded -- like, depending on lots of 23 different factors, they would have the requisite 24 tools at their hands to make some choices, but it 25 wouldn't be exactly clear what choices. It's not a
42 1 sound to change? 2 A It's the same point. A hypothetical 3 programmer is also a user of the environment if they 4 are listening to it. So the same point. It's 5 impossible to know what a hypothetical programmer -- 6 when they would want a sound to change. 7 Q Okay. So you don't know when a programmer 8 would want a sound to change when rendering it into 9 a remote environment? 10 MR. HENRY: Objection to form. 11 Mischaracterizes Dr. McMullen's testimony. 12 THE WITNESS: I'm saying that it's 13 impossible to give a context for when a person who 14 doesn't exist would want something to change in a 15 hypothetical environment without the context, 16 without any sort of other detail, yes, it is not 17 possible to speculate that. 18 BY MR. ELLIOTT: 19 Q Okay. When would you want it to change? 20 A It depends on the context. 21 Q Which context? 22 A Can you please provide a context that -- 23 Q I'm asking you which -- 24 A Okay. 25 Q -- context you would like it to change in.	44 1 straightforward choice. They would have to make 2 some decisions. 3 BY MR. ELLIOTT: 4 Q Would one of those choices available be 5 using HRTFs? 6 MR. HENRY: Objection to form. 7 THE WITNESS: One of the choices -- they 8 actually don't have to use HRTFs to create binaural 9 audio, so that's another choice. 10 BY MR. ELLIOTT: 11 Q Mm-hmm. But is HRTFs -- that's the 12 question: Are HRTFs an available choice to them? 13 MR. HENRY: Objection to form. Asked and 14 answered. 15 THE WITNESS: HRTFs are a tool in a larger 16 toolbox of possible options, possible functions, to 17 be able to create this SLP. 18 BY MR. ELLIOTT: 19 Q So the basic answer to the question is, 20 yes, it's a tool that they have available to them? 21 MR. HENRY: Objection to form. 22 Mischaracterizes Dr. McMullen's testimony. Asked 23 and answered. 24 THE WITNESS: So HRTFs are with -- among 25 other things that we've talked about, attenuation,

45 1 reverberation, detecting the type of sound that's 2 being rendered -- what else? -- distance factors, 3 all sorts of other pieces in this process among 4 which HRTFs -- and not just any HRTFs as well. 5 There's also changes that you can apply to the HRTF 6 as well to -- to enhance or to give other desired 7 effects. 8 So, again, without the context, it's hard 9 to definitively say, yes, this HRTF does this 10 because there are many, many choices when utilizing 11 an HRTF within the context of a larger program with 12 other tools, with specialized programming to create 13 this 3D sound. 14 BY MR. ELLIOTT: 15 Q When would you -- what context would you 16 use an HRTF in? 17 A I would use an HRTF in any program in which 18 I wanted to render 3D audio digitally. The type of 19 HRTF would render -- whether or not I actually 20 choose that HRTF for binaural sound could differ, 21 but I would choose an HRTF, yeah, if I was trying to 22 create 3D sound in an environment. 23 Q Okay. And if an SLP was changing in your 24 environment, what context would you use an HRTF in 25 to adjust the sound for the changing SLP?	47 1 Q Looking at paragraph 180 of your Exhibit 2 2 there -- which is your declaration, correct, 3 Dr. McMullen? 4 A Yes. 5 Q -- what is in paragraph 180 once you get 6 there, please? 7 A This is my opinion of the term "HRTF." 8 Q And the last part of that phrase says: 9 "...which I understand is how Defendants have 10 proposed this term be interpreted." 11 A Yes. 12 Q So did you develop this definition 13 yourself? 14 A Yes. 15 Q Did this definition exist prior to you 16 developing it? 17 A Prior to me -- the word "develop," like, 18 HRTFs have been around a long time. 19 Q Sure. 20 A For the purposes of this document, yes, 21 HRTFs have been described this way, or they've been 22 defined this way prior to me writing them here -- 23 writing them here. 24 Q So when's the first time you saw this exact 25 definition?
46 1 MR. HENRY: Objection to form. 2 THE WITNESS: What do you mean by what 3 context an H -- 4 BY MR. ELLIOTT: 5 Q Well, context -- 6 A Mm-hmm. 7 Q -- is the term we've started using -- 8 A Correct. 9 Q -- to try and figure out this environment, 10 right? 11 A Right. 12 Q So if, in that context, I change the SLP -- 13 okay? -- in what context would you want to use an 14 HRTF -- okay? -- to render the sound differently for 15 that changed SLP? 16 MR. HENRY: Objection to form. 17 THE WITNESS: Again, the HRTF itself does 18 not render the sound. I would use a program that 19 would select a different HRTF or interpolate an HRTF 20 depending on the location -- the intended location 21 of the sound, but I would not choose an HRTF to 22 render. I would choose an HRTF that would help in 23 the overall specialized software programming that 24 renders the 3D sound. 25 BY MR. ELLIOTT:	48 1 MR. HENRY: Objection to form. 2 THE WITNESS: It's impossible to know. 3 I've been doing this since, like, 2008. I can't 4 remember the exact time I saw these exact words; 5 however, it's consistent with all of the research, 6 all of the education, all the information and 7 training that I've had, but I cannot pinpoint a 8 point in time when these exact words crossed my 9 eyes. 10 BY MR. ELLIOTT: 11 Q But you have seen these exact words? 12 MR. HENRY: Objection to form. 13 THE WITNESS: I've seen these words or 14 words that mean -- meaning the same thing, things 15 that have the same meaning. 16 BY MR. ELLIOTT: 17 Q Mm-hmm. But these exact words, which is 18 functions of frequency and three spatial 19 variables -- 20 A Mm-hmm. 21 Q -- distance as with angle, and elevation 22 angle that represent how sound reaches the ears of a 23 listener -- 24 A Mm-hmm. 25 Q -- those exact words, when did you first

49 1 see those exact words? 2 MR. HENRY: Objection to form. Asked and 3 answered. 4 THE WITNESS: This is an 5 impossible-to-pinpoint question because I've read 6 many books, articles, scholarly journals, attended 7 many presentations, learned from many scholars this 8 subject. So it's nearly impossible to determine 9 when this set of -- the subset of words first 10 crossed my eyes. 11 BY MR. ELLIOTT: 12 Q You said you started working on this in 13 2022 with Meta; is that correct? 14 A Yes. 15 Q What month? 16 A It's -- I don't want to guess on -- on the 17 record, but late 2022. 18 Q Late. Okay. 19 And have you seen that exact phrase from 20 paragraph 180 since late 2022? 21 A Counting me looking at it right now? 22 Q Mm-hmm. 23 A Yes. 24 Q Yeah. 25 And when was it first -- when did you first	51 1 Q -- do you know if you're permitted to add 2 limitations to a claim from a specification? 3 MR. HENRY: Objection to form. Calls for 4 speculation. Calls for a legal conclusion. 5 THE WITNESS: As I -- as I mentioned 6 before, legalese, I'm a professor -- 7 BY MR. ELLIOTT: 8 Q Sure. 9 A -- not a lawyer. 10 Q And so you don't know the answer to that? 11 MR. HENRY: Objection to form. 12 THE WITNESS: I don't want to speculate the 13 answer to it. 14 BY MR. ELLIOTT: 15 Q Do you think you -- well, go ahead, please. 16 If you can, speculate the answer to that. 17 MR. HENRY: Objection to form. Calls for 18 speculation expressly. Calls for a legal 19 conclusion. 20 THE WITNESS: I'm not inclined to guess 21 under oath. 22 BY MR. ELLIOTT: 23 Q So you're essentially refusing to answer 24 the question even though I've given you full freedom 25 to speculate?
50 1 see it since late 2022? 2 MR. HENRY: Objection to form. Asked and 3 answered. 4 THE WITNESS: Again, I -- it's 5 impossible -- 6 BY MR. ELLIOTT: 7 Q Don't know? 8 A -- to know when that -- 9 Q Okay. 10 A It's impossible to ascertain that. 11 Q Was this exact phrase given to you by 12 counsel for Meta? 13 MR. HENRY: Objection to form. 14 THE WITNESS: This exact phrase, no. 15 BY MR. ELLIOTT: 16 Q Okay. Did Meta give you any indication of 17 what they think a head-related transfer function 18 should be defined as? 19 MR. HENRY: Objection to form. Calls for 20 speculation. 21 THE WITNESS: This exact -- so this exact 22 phrasing was not given to me. 23 BY MR. ELLIOTT: 24 Q Legal question, just to be fair to you -- 25 A Mm-hmm.	52 1 MR. HENRY: Objection to form. Same 2 objections as previously stated. Argumentative. 3 Harassing the witness. Asked and answered. 4 THE WITNESS: As I understand, I'm supposed 5 to give my expert opinion on things that I am 6 knowledgeable about. That consists of 3D audio 7 perception, application, and technology. I 8 understand that you're asking me a question that has 9 to do with the judicial system, with things that I 10 am not trained in. 11 So it would be in poor practice for me as a 12 scholar and a researcher to give you an answer 13 knowing that I'm not formally trained in the 14 question that you're asking me. 15 BY MR. ELLIOTT: 16 Q Did you look through the patents-in-suit to 17 see if there were any examples given that did not 18 use one of the three spatial variables referred to 19 in paragraph 180? 20 A I read through the patents, not 21 specifically with that lens, but I did read through 22 the patents, and there -- there are examples where 23 they're mentioned, but they're not used in the 24 definition given. 25 Q So there are examples in the patents that

53 1 you recall where less than the three spatial 2 variables were used? 3 MR. HENRY: Objection to form. 4 Mischaracterizes Dr. McMullen's testimony. 5 THE WITNESS: There are places in the 6 specification where these variables are mentioned. 7 BY MR. ELLIOTT: 8 Q Mm-hmm. And are there examples in the 9 specifications where it uses less than all three of 10 these variables? 11 A Without re-looking at the patent, it would 12 be impossible to -- to make that decision, to tell 13 you yes or no. 14 MR. ELLIOTT: You can go ahead and mark 15 this as Exhibit 1, if you would, please. 16 THE COURT REPORTER: We marked something 17 else earlier. 18 MR. ELLIOTT: Okay. This is Exhibit 4. 19 What we'll do is we'll just scratch Exhibit 1, 20 because Exhibit 2, the declaration, is the same 21 thing. 22 MR. HENRY: Would you mind just making that 23 clear on the record what the exhibits are, because 24 you said to Joan you're going to scratch Exhibit 1, 25 so if you could identify Exhibits 2, 3, and 4 and we	55 1 Figure 17, is this software code? What -- what is 2 it? 3 A No. I wouldn't refer to this as code. I 4 would refer to this as what we call markup. Markup 5 is something that describes language or how to 6 interpret other things. Markup isn't -- so code is 7 something that could be executed, and markup simply 8 provides, as you can see, these brackets to denote 9 sections of a piece of data. 10 Q Okay. Is there an algorithm depicted 11 anywhere in Figure 17? 12 A Figure 17 -- let me -- I'll read through it 13 again. 14 Q Yeah, please. 15 A Yeah. 16 No, there does not appear to be an 17 algorithm here. 18 Q Is there one that's described there? 19 A No. 20 Q Okay. Looking at the bottom of Figure 17, 21 do you see the SLP position? 22 A I see a list of SLP positions at different 23 time stamps or time codes. 24 Q Mm-hmm. And one of -- do you know which 25 variable is which in that particular chart of time
54 1 don't have a one anymore, that would be helpful. 2 MR. ELLIOTT: Yeah, I think that will make 3 the record clear. We don't have an Exhibit 1, which 4 is the same as Exhibit 2, the declaration. 5 --- 6 (McMullen Exhibit 4 was marked for 7 identification.) 8 --- 9 BY MR. ELLIOTT: 10 Q If you would, Dr. McMullen, take a look at 11 what's been marked as Exhibit 4 and if you would 12 please just give us a brief identification for the 13 record so we know what we're working with. 14 A This is Exhibit 4. It looks like it is 15 patent -- referred to as patent '737, defining a 16 zone with an HPED, and providing binaural sound in 17 the zone. 18 Q Okay. If you would, go to Figure 17. And 19 in Figure 17 -- well, actually, would you please 20 tell me what is depicted in Figure 17? 21 A Well, figure -- the description that's 22 written here says that: "Figure 17 is an example of 23 a sound localization information configuration in 24 accordance with an example embodiment." 25 Q Okay. And specifically, you know, in	56 1 codes? 2 MR. HENRY: Objection to form. 3 THE WITNESS: In this chart, it's not 4 labeled. There is no legend. I would have to 5 speculate. I'd have to speculate which variable 6 corresponds to -- to each of the positions in the 7 SLP. 8 BY MR. ELLIOTT: 9 Q If you look back at column 62 -- 10 A Okay. 11 Q -- Figure 17 is discussed, and I'd say 12 toward the bottom of the column, to try and 13 short-circuit so you don't have to do too much 14 reading, but if you'd look at that probably 15 beginning at line 55 of column 62. 16 A Okay. 17 Q Does that tell you which variable's which 18 in Figure 17? 19 A Allow me a chance to read it -- 20 Q Oh, yeah. Sure. 21 A -- again. 22 One thing that I can point out is on line 23 63, it has added the word -- the letter M next to 24 1.3. So now we can assume that M means meters. So 25 that gives the distance.

57 1 So in reference to the three spatial 2 variables that we were referring to in 180 of my 3 declaration, that is the distance. There are two 4 angles that are listed for SLP position. 5 Q And perhaps maybe a better spot is column 6 64, line 46. There's a paragraph there that I think 7 denotes which variables are which. 8 A Okay. Now we have it, yes. So the theta 9 is the -- which is the second element in the SLP 10 position parenthesis, and that is the angle on the 11 horizontal plane as it extends forward from the 12 listener -- or actually I'm assuming, but we'll just 13 say conventionally as it extends forward from the 14 listener at zero. 15 And then the last angle that's listed seems 16 to be the elevation. 17 Q Mm-hmm. And the elevation is listed as 18 what in the Figure 17? 19 A In Figure 17 the elevation is the third 20 element. So it's the -- in this case, it's the zero 21 degrees elevation. So it means it's on the ear -- 22 it's assumed to be on the ear-level plane of the 23 listener. 24 Q And that's true for all the time codes in 25 Figure 17?	59 1 examples, let's assume the dot, dot, dot -- it stays 2 zero throughout in Figure 17. Doesn't that mean 3 that the elevation angle is not impacting the SLP? 4 MR. HENRY: Objection to form. Lacks 5 foundation. Ambiguous. 6 THE WITNESS: I'm not sure what you mean by 7 the elevation angle is not impacting the SLP. Every 8 angle -- like, what do you mean by not impacting the 9 SLP? 10 BY MR. ELLIOTT: 11 Q So if the elevation angle remains zero -- 12 A Okay. 13 Q -- that's not contributing to a change in 14 the SLP from time code zero to time code one, where 15 the theta changed by one degree, correct? 16 MR. HENRY: Objection to form. Incomplete 17 hypothetical. 18 THE WITNESS: You're -- I'm trying to 19 understand your question. So by having the sound 20 that is one meter -- 1.3 meters away from the 21 listener and it's changing at three different time 22 stamps from 9 degrees to 8 degrees to 7 degrees, all 23 occurring on the ear-level plane, you're asking does 24 the elevation not impact the sound? 25 BY MR. ELLIOTT:
58 1 A All of the time codes listed in Figure 17, 2 that seems to be -- 3 Q Okay. 4 A -- but also there is a dot, dot, dot that I 5 cannot account for, but everything that's written 6 there, yes. 7 Q Yeah, the dot, dot, dot is in between 3 -- 8 A Between 3 and T, correct. 9 Q And what impact does it have on the use of 10 the elevation variable, the fact that they're all 11 zero? 12 MR. HENRY: Objection to form. Ambiguous. 13 THE WITNESS: What do you mean by "impact"? 14 BY MR. ELLIOTT: 15 Q Well, because it's zero, is this example 16 using an elevation angle? 17 A Mm-hmm. 18 Q It's using zero? 19 THE COURT REPORTER: Is that a yes? 20 THE WITNESS: Oh, sorry. Yes. 21 BY MR. ELLIOTT: 22 Q Oh, yeah, one of those deposition things 23 about answering, but you've been doing that great, 24 so thank you. 25 By having it be zero throughout all the	60 1 Q Correct. 2 A What do you mean by "impact"? 3 Q Doesn't change it. Doesn't have an impact 4 on changing it. 5 A Elevation doesn't change things. Like, I 6 don't -- the word "elevation" -- elevation doesn't 7 have the ability to change things, so that's why I'm 8 asking what you mean by the elevation does not 9 impact. 10 Q Well, the elevation -- if there's a change 11 in elevation -- 12 A Yes. 13 Q -- okay, that's going to be used by a 14 programmer to change the SLP and, you know, in the 15 rendered environment change the sound so that the 16 user in your immersive gaming environment can 17 perceive that there's been a change, elevation, it's 18 gone up or it's gone down. So here in this example 19 from 0 to T, it changes from -- the theta changes 20 from 9 to 4 and the elevation stays at zero the 21 entire time. 22 A Mm-hmm. 23 Q Okay. So the SLP's going to stay on even 24 elevation with the listener's ears, correct? 25 A Correct.

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61 1 MR. HENRY: Objection to form. Compound. 2 THE WITNESS: So to the -- to -- which 3 question would you like me to answer there? 4 BY MR. ELLIOTT: 5 Q Well, the last one. It's going to stay 6 even with the ears? 7 A Yes, in this example -- 8 Q Yes. 9 A -- it stays even with the ears or it stays 10 on the same plane that the ears are located. 11 Q And so because the elevation does not 12 change, the SLP is not going to change because there 13 was a change in -- there was no change in elevation? 14 A So let's just back up to, like, the 15 definition of point. Because -- 16 Q Okay. 17 A -- an SLP is a sound localization point in 18 space. 19 Q Right. 20 A This point is described by these three 21 variables here. We have a distance, we have -- 22 because it exists in 3D space, this is what 23 pinpoints exactly where -- 24 THE COURT REPORTER: I'm sorry. "Because 25 it is"?	63 1 detect a change in SLP if a sound were to move from 2 4 degrees on the ear-level plane to -- I'm sorry -- 3 from 9 degrees on the ear level plane at time zero 4 to 4 degrees on the ear level plane at time T. 5 Also, assuming that -- we don't know that this 6 time -- what are -- what are the units? There's no 7 units here. If it's milliseconds, it's a blip. So 8 we're assuming a lot to answer this question. 9 BY MR. ELLIOTT: 10 Q Let me delve back into kind of deposition 11 preparation. Then we're at about an hour. We can 12 take a quick break. 13 A Okay. 14 Q So in your preparation for the deposition, 15 were there any documents generated? 16 A In the preparation, yes. 17 Q Okay. And are those documents going to be 18 produced? 19 MR. HENRY: It's Exhibit 3. 20 BY MR. ELLIOTT: 21 Q That's the Exhibit 3, okay. 22 Were there any other documents that were 23 produced? 24 A There were other documents that were 25 produced that won't be used to -- I don't believe
62 1 THE WITNESS: Exists -- it exists. Sorry. 2 In 3D space we have range, we have elevation, and we 3 have angle. So in this example, the angle is 4 changing, so the point is changing. So, yes, even 5 though the elevation is not changing, the sound is 6 moving on the horizontal plane. 7 BY MR. ELLIOTT: 8 Q And the elevation variable doesn't change 9 and the perception to the user from the SLP is that 10 it stays on that same level plane as it moves 11 around, correct? 12 MR. HENRY: Objection to form. 13 THE WITNESS: Again, we talked about how 14 sound is a perceptual task. So in this example, the 15 sound's only moving about 5 degrees. From the data, 16 one could assume that a person would be able to 17 perceive a change in location on the ear-level plane 18 because it's moved from 9 degrees to 4 degrees 19 because the just noticeable difference that we spoke 20 about earlier, when it's in front of -- and I'm 21 assuming this coordinate system here, but in our 22 coordinate system that's directly in front of us, 23 we're a bit more sensitive to change. 24 So it would -- one could assume that under 25 normal circumstances a person would be able to	64 1 they'll be used today. 2 Q All right. 3 MR. ELLIOTT: And those won't be produced, 4 Counsel? 5 MR. HENRY: It's unclear to me what you're 6 asking for. 7 MR. ELLIOTT: Well, I'm wondering if the 8 other documents that she used in preparation for her 9 testimony -- if those will also be produced or not. 10 MR. HENRY: We produced all the documents 11 that Dr. McMullen viewed in preparing for her 12 testimony today if that's the question. You have it 13 all. 14 BY MR. ELLIOTT: 15 Q Okay. Well, did you take any notes in 16 preparation for your testimony today? 17 MR. HENRY: Oh, sorry. Allow me real 18 quick. The -- some of them have the Bates numbers 19 on them because they were produced. Others are 20 publicly available articles that are available to 21 you, and they're cited in Dr. McMullen's list of 22 materials considered. That might be where the 23 divide is, but you have access to all of the 24 information that Dr. McMullen reviewed. 25 MR. ELLIOTT: Okay.

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65 1 BY MR. ELLIOTT: 2 Q And were there any draft reports that were 3 generated before the final one? 4 A As with -- 5 MR. HENRY: Objection to form. 6 THE WITNESS: As with any other -- any 7 document that's created, the first one isn't the 8 best, so you do go through an iterative process to 9 revise. So -- 10 BY MR. ELLIOTT: 11 Q Right. 12 A -- there are versions. 13 MR. ELLIOTT: And I'm assuming those 14 haven't been produced? 15 MR. HENRY: And they won't be. 16 MR. ELLIOTT: That's fine. 17 BY MR. ELLIOTT: 18 Q And same with, did you take any notes, you 19 know, personal notes either on the computer or 20 handwritten? 21 A I mean, yeah. You take notes to -- 22 Q Mm-hmm. 23 MR. ELLIOTT: And those won't be produced 24 either, right? 25 MR. HENRY: No, they will not. As you	67 1 40 through 45, and you just referred to 40 through 2 50. 3 Q Yeah. 4 A So I'll read the other five. 5 Q Yeah, that's good. Thank you. 6 A Okay. 7 Q And so you see where in line 45 it says: 8 "...but without a distance?" 9 A Mm-hmm. 10 Q So is this an example of sound localization 11 information that does not include one of the three 12 variables? 13 MR. HENRY: Objection to form. 14 THE WITNESS: So you're asking is the SLI 15 that is defined in the patent an example of 16 localization minus -- minus the three variables? 17 BY MR. ELLIOTT: 18 Q Minus one of the variables. 19 A Sorry. Minus one of the three variables. 20 That's hard to answer because, one, a 21 sound -- sound localization information is not a 22 standard term in the 3D audio HRTF space. Two, 23 the -- as it reads here that it has -- where'd it 24 go? -- partial localization information. With 25 partial information, it's difficult to localize
66 1 know, you're not entitled to them. 2 MR. ELLIOTT: Let's take a break. 3 THE VIDEOGRAPHER: We are going off the 4 record. The time is 10:07 a.m. 5 (Recess.) 6 THE VIDEOGRAPHER: We are going back on the 7 record. The time is 10:24 a.m. 8 BY MR. ELLIOTT: 9 Q Dr. McMullen, if you would continue to look 10 at what's been marked as McMullen Exhibit 4. 11 A Okay. 12 Q It's the '737 patent. And if you would 13 turn to column 5. Looking at lines -- if you would 14 just to yourself, read lines 40 through 50, and not 15 out loud so we take it easy on our reporter here. 16 A Okay. 17 Q Thank you, Dr. McMullen. 18 Is what's described at column 5 and 19 basically those lines 40 through 50, a little 20 different acronym here, an SLI. 21 Do you know what an SLI is? It's right 22 there. 23 A I realize that in this patent SLI is used 24 as sound locational information. However, may I 25 request a couple more minutes. I thought you said	68 1 where something is. 2 So -- but this -- as given, this SLI, which 3 is a term that has been created for the purposes of 4 this patent, yes, it is missing one of the three 5 terms. 6 Q Looking at Figures 1 through 12, I 7 believe -- no. I'm sorry -- Figures 1 through 10 -- 8 A Okay. 9 Q -- are these flow diagrams? 10 A Figures 1 through 10, so Figure 1, 2, 3, 11 5 -- no. Sorry -- 6 -- so 1, 2, 3, 6, 8, and 10, by 12 definition, a flow diagram, boxes with steps and 13 arrows pointing in sequence. I would say that by 14 definition these are. Are they substantial enough 15 to provide enough structure to create 3D audio? I 16 would disagree. 17 Q Is Figure 7 also a flow diagram? I'm not 18 sure if you listed Figure 7. 19 A Yeah. Let's see. Yes, 7 does appear to be 20 a flow diagram -- or flowchart. Are we using those 21 interchangeably? 22 Q Flow diagram, flowchart, sure. Yeah. 23 A Okay. 24 Q What is Figure 5A? 25 A Figure 5A, and give me one second to

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69 1 refamiliarize myself. 2 It looks like a chart that -- and actually 3 we have -- we don't have to speculate. The 4 definition of 5A is actually given -- or the 5 description, rather, of 5A. And it says: "An 6 example" -- I'm sorry -- "Figure 5A shows a table of 7 example historical audio information that can be 8 stored for a user in accordance with an example 9 embodiment." 10 So as we're looking at it, 5A just looks 11 like exemplary types of sounds and their sources and 12 information about the sound. 13 Q And the sound type, it has speech and music 14 and sound effects I think were the three listed 15 there? 16 A Yes. 17 Q Which of those would you include in the 18 meaning of voice? 19 A Typically, the understanding of voice is a 20 sound that is produced by your vocal cords, by the 21 vocal folds in your throat. So among others, speech 22 would be something that I would -- and also perhaps, 23 depending on the content of the music, if it's 24 someone singing and there's no music behind it, 25 music could also be interpreted as voice perhaps,	71 1 A To voice a piano? 2 Q Mm-hmm. 3 A In what context? 4 Q Just any context musically. What does it 5 mean to voice a piano? 6 MR. HENRY: Objection to form. 7 THE WITNESS: Can you use it in a sentence 8 or give some context? 9 BY MR. ELLIOTT: 10 Q Well, why do you think the term "voice" is 11 used in both speech and music other than singing? 12 MR. HENRY: Objection to form. 13 THE WITNESS: I'm not privy to why the 14 choice of the word "voice" is used there. So 15 without adequate context, it would be difficult to 16 answer that question. 17 BY MR. ELLIOTT: 18 Q So you're not familiar with somebody 19 saying, "To voice a musical instrument"? 20 A Again, without context, I can't infer the 21 meaning of what you're -- of what you're saying. 22 Because there's -- I can think of many different 23 meanings; however, on the surface without context, 24 immediately I'm not able to determine which meaning 25 you speak of.
70 1 but without knowing the context, it's hard to -- 2 it's hard to know. 3 But speech generally comes from your mouth, 4 which includes vibrating your vocal folds in a 5 frequency that's audible to humans, so I would 6 consider that voice. 7 Q Are you familiar with musical synthesizers? 8 A I have some familiarity with musical 9 synthesizers. 10 Q Do you know what it means to have a 11 four-voice synthesizer? 12 A To have a four-voice synthesizer? 13 Q Mm-hmm. 14 A I can only speculate what that means. 15 Again, it's more so in music production more so than 16 research. 17 Q Do you know what it means to have a 18 four-voice synthesizer versus, say, an eight-voice 19 synthesizer? 20 A On the surface, having four more voices 21 than the four-voice synthesizer sounds like an 22 eight-voice synthesizer or the capability. But, 23 again, I'm speculating because that's not something 24 that I typically use in my 3D audio research. 25 Q What does it mean to voice a piano?	72 1 Q Are you familiar with the concept of 2 cross-synthesis? 3 A Cross-synthesis? 4 Q Yeah. It's a hard one to say, at least for 5 me. 6 A No. This isn't something that we do. 7 That's also more a music production, like, more on 8 the artistic side of -- music side of the house. 9 Q So you wouldn't know either where you can 10 convolve a human singing or speech with an 11 instrument sound? They call them a talking 12 orchestra. 13 MR. HENRY: Objection to form. 14 THE WITNESS: So I am aware that you can 15 convolve any two sound signals, and I'm not familiar 16 with that terminology, but I -- I do believe that 17 you can convolve a person's voice with -- with any 18 sound you would like to. You can convolve any two 19 sounds you'd like to that are represented as digital 20 signals and create a third signal. 21 BY MR. ELLIOTT: 22 Q Well, would you agree that if you have a 3D 23 audio system that takes speech as an input, produces 24 a binaural version of that speech, is that a 25 binaural voice?

73 1 MR. HENRY: Objection to form. 2 THE WITNESS: Can you qualify what you mean 3 by takes the -- repeat the question again. Sorry. 4 BY MR. ELLIOTT: 5 Q Let me -- I'll rephrase it. 6 A Okay. 7 Q Now, if you have a 3D audio system that 8 takes speech as an input and produces a binaural 9 version of that speech, would you agree that this is 10 a binaural voice? 11 A Creates a binaural version of that speech. 12 Well, depending on the context. Depending on where 13 it's rendered. Depending on a lot of different 14 factors. It could be -- it could be interpreted as 15 binaural speech to the person or -- there's too many 16 factors to consider about what a human will 17 ultimately perceive at the end -- 18 Q Is there -- 19 A -- of the blockchain. 20 Q I'm sorry. I didn't mean to interrupt. 21 Is there a context in which you would 22 consider it binaural voice? 23 MR. HENRY: Objection to form. 24 THE WITNESS: By itself, the term "binaural 25 voice," if we think about binaural voice, it's	75 1 left and right ears of the listener which a listener 2 can localize. 3 So in the context of this system, if this 4 voice is rendered in such a way that they're 5 received by the left and the right ears in the exact 6 way that they would naturally in the air or similar 7 to how they would actually travel through the air 8 through this 3D audio system -- this hypothetical 9 system, then we could possibly consider this a 10 binaural -- a rendered -- an artificially rendered 11 binaural voice. 12 Q Okay. If you use cross-synthesis and 13 produce a sound that is a combination of speech and 14 orchestra sounds, is that a binaural voice? 15 MR. HENRY: Objection to form. Incomplete 16 hypothetical. 17 THE WITNESS: So without ever hearing this 18 sort of sound, I'm inclined to say no; however, with 19 binaural voice, any time that you are convolving it 20 with something that -- it is no longer purely a 21 voice once you're adding or augmenting the voice 22 with something else. 23 BY MR. ELLIOTT: 24 Q So is there some line that you would draw 25 between when it's -- there's enough speech involved
74 1 literally how our two ears hear voice or how voice, 2 you know, impacts our two ears, how the sound waves 3 travel through the air so that our ears can hear 4 them. 5 So if I am processing speech to make 6 binaural -- to make it binaural or to put it into 3D 7 space, without knowing the underlying mechanisms of 8 this fictitious or this example system that you're 9 speaking of, it's hard to -- to say if this is now 10 binaural voice. 11 BY MR. ELLIOTT: 12 Q Well, I'm asking you to define that context 13 for me. 14 What would the context look like where that 15 3D audio system that takes speech as an input and 16 produces a binaural version of speech, what context 17 would that be considered binaural voice? 18 A You could consider -- if we -- speech 19 generally comes from your mouth and is regarded as a 20 voice. However -- I'm just thinking -- trying to 21 think of every context because this is a very 22 open-ended question. 23 But on the surface, as we have here in the 24 declaration, that -- we want binaural voice to mean 25 vocal sound waves as they would be received by the	76 1 that it becomes binaural voice and when there's not 2 enough speech and it's no longer binaural voice? 3 A I would say it's -- I haven't prepared an 4 opinion on this new thing that you're presenting 5 here. So I wouldn't want to -- to speculate. But 6 on the surface, any time you change a voice, then 7 it's no longer -- and you change it to include 8 something that's not also a voice, it's no longer a 9 voice. 10 Q So if it includes a little bit of speech, 11 is it binaural voice? 12 MR. HENRY: Objection to form. Asked and 13 answered. 14 THE WITNESS: Again, it's impossible to 15 know without -- without hearing this. I haven't 16 prepared an actual opinion on this new term that is 17 being -- being brought today. So I'm cautious to 18 make an opinion. 19 BY MR. ELLIOTT: 20 Q Well, what's -- what's the new term? 21 A The new term is -- well, the new -- I 22 wouldn't say new term. I would actually describe it 23 as just this alternate way of -- of convolution 24 that's outside of how 3D audio is actually rendered, 25 where you're convolving two input sounds rather than

77 1 convolving with the actual elements that create 3D 2 audio. 3 So there's -- it seems that there is some 4 sort of step before the sound signal where you're 5 now changing the sound that's put in with some other 6 sound that we'll call X. So that's not something 7 that's typically done in the field. 8 Q Is -- is it a bright-line distinction 9 between sound and speech? 10 MR. HENRY: Objection to form. Asked and 11 answered. 12 THE WITNESS: There's definitely a 13 difference between sound and speech. Sound can be 14 anything that is within our audible regions, 20 15 hertz to 20 kilohertz, and voice is only noises that 16 are made with our vocal folds that are audible to 17 people. So all voices are sounds, but not all 18 sounds are voices. 19 BY MR. ELLIOTT: 20 Q Have you ever heard musical instruments 21 imitate speech? 22 A I've heard musical instruments that can -- 23 they can replicate frequencies that are within the 24 frequency of human speech, but I have never heard an 25 instrument that I thought was talking or was	79 1 A Hypothetical person, what are we -- what 2 are we assuming about this non-POSITA? 3 Q I'll have to say that I'd never heard 4 binaural before I read these patents. 5 A Okay. 6 Q Do you think I'd understand it after I 7 heard it? 8 A You tell me. I don't know. I would hope 9 so. 10 Q Yeah. Yeah. 11 Okay. What about, do you think that 12 non-POSITAs have encountered the term "azimuth" 13 before? 14 A Again, a non-POSITA is an extreme -- like, 15 you have everybody who does 3D audio and then a 16 non-POSITA is the entire world minus that. So 17 there's a subset of non-POSITAs who may have 18 encountered azimuth in a mathematical clause that 19 has nothing to do with 3D audio. They could know 20 about it in construction. They could know about it 21 in lots of other fields. 22 So I'm not inclined to guess what random 23 dot you're picking in this non-POSITA space, what 24 they would actually know. 25 Q So a non-POSITA that's never encountered
78 1 speaking. 2 Q Do you believe non-POSITAs have commonly 3 encountered the term "binaural"? 4 A Non-POSITAs? I would -- I would -- I would 5 speculate no. It is a very specialized term that if 6 you're not in this field, you may not have come 7 across this. Like, maybe binoculars, but, you know. 8 Q Mm-hmm. Do you believe that the non-POSITA 9 would understand it after they were given a 10 definition of binaural, though? 11 MR. HENRY: Objection to form. Calls for 12 speculation. 13 THE WITNESS: It depends on the definition 14 they were given. So -- 15 BY MR. ELLIOTT: 16 Q What definition would you give if you 17 wanted, you know, a non-POSITA to be able to 18 understand what binaural meant? 19 A I would give the definition that's listed 20 in my declaration that says binaural voice should be 21 interpreted to mean: "...vocal sound waves as they 22 would be received by each of the left and right ears 23 of a listener, which a listener can localize." 24 Q And once they received that definition, you 25 think they'd understand it okay?	80 1 azimuth before, what definition would you give them 2 of azimuth? 3 A Haven't prepared a definition, but if I 4 were just speaking ordinarily to someone who never 5 encountered it, I would say the angle of a sound -- 6 and are they familiar with planes? With math? 7 Like, how do we -- you know, assuming that they're 8 familiar with the planes and fields, I would 9 probably go like this (indicating) if they could see 10 me, you know, that on the ear-level plane, the angle 11 leading from -- out from your nose standardly on the 12 ear-level plane of a sound as it rotates around your 13 head on that plane. 14 Q And how would you define elevation? 15 A I would define elevation similarly; 16 however, with a different plane. With an 17 intermediate plane that -- basically, imagine a 18 plane going through my head vertically and it is the 19 vertical angle, usually originating at the horizon, 20 but it can -- either going up or down of that sound 21 on this vertical plane (indicating.) 22 Q And what's the third spatial variable? 23 A Distance. 24 Q And how would you define distance? 25 A The distance would be the straight line

81 1 distance from the center of the head to the sound 2 source. 3 Q Okay. And so the person trying to 4 understand the definition that you've given for an 5 HTRF [sic] would have to know what all three of 6 those mean, correct? 7 MR. HENRY: Objection to form. Calls for 8 speculation. 9 THE WITNESS: So a person -- I -- I 10 can't -- I can't call -- I can't say what they would 11 understand hypothetically after this HRTF, after 12 describing this HRTF. 13 BY MR. ELLIOTT: 14 Q Let's see. 15 Switching back for your declaration, just 16 from perfunctory things. You said you're being 17 compensated at a customary rate of \$500 per hour? 18 A Correct. 19 Q Is that through an agency or are you 20 retained directly by Meta? 21 A This, as I understand, I am being retained 22 by Meta but through Latham -- with Latham & Watkins. 23 I'm not sure the exact inner workings but, yes. 24 Q Sometimes there's like an expert search 25 agency that's involved. Is there an expert --	83 1 Q Okay. And what's one of those projects 2 you're working on? 3 A One of those projects that I have worked on 4 is with Cengage Learning, Inc., and they are an 5 electronic textbook company, and I have co-authored 6 three titles with them. 7 Q Okay. And do they pay you per title? 8 A Yes. 9 THE COURT REPORTER: Careful. 10 MR. ELLIOTT: I'm notoriously bad at 11 forgetting my microphone. Sorry. 12 Ask you to mark that as Exhibit 5, please. 13 --- 14 (McMullen Exhibit 5 was marked for 15 identification.) 16 --- 17 THE WITNESS: Thank you. 18 BY MR. ELLIOTT: 19 Q And if you would, please, Dr. McMullen, 20 identify for us what's been marked as Exhibit 5. 21 A Exhibit 5 is a paper that was published by 22 myself and two of my former Ph.D. students entitled 23 "Quantitatively Validating Subjectively Selected 24 HRTFs for Elevation and Front-Back Distinction." 25 Q And if you look at the top of the second
82 1 A Got you. There -- 2 THE COURT REPORTER: One at a time. 3 THE WITNESS: Sorry. 4 BY MR. ELLIOTT: 5 Q Is there an expert search agency involved 6 in your retention with Meta? 7 A No, not to my knowledge. 8 Q Now, you indicate this is your customary 9 rate. Who else are you doing expert work for that 10 you're billing that to? 11 A In terms of doing expert witness work -- 12 Q Mm-hmm. 13 A -- or -- currently, I'm not an expert 14 witness for anyone else. 15 Q Have you served as an expert witness for 16 anyone else before? 17 A I have not. 18 Q Who else do you charge your \$500 customary 19 rate to? 20 A The \$500 customary rate is currently being 21 charged here. I have other consulting -- consulting 22 positions, but those are more so on a 23 project-by-project basis. So it's not hourly. 24 Q So is it a flat fee for the project or -- 25 A Yes.	84 1 column -- 2 A Okay. 3 Q -- it talks about is it: "...possible to 4 measure the entire acoustic transformation of a 5 sound by the listener's body." 6 A I would like to read the entire sentence in 7 context. 8 Q Please. That's fine. 9 A So just give me one second. 10 Q Please go right ahead. 11 A Yes. 12 Q And does this speak to the transformation 13 of a sound by a listener's body? 14 A This speaks to the way that sound scatters 15 as it impinges a listener's body and is picked up by 16 the ear canal, yes. 17 Q So -- yes. 18 So is transformation accurate here? 19 A In this context, literally, the word 20 "transformation" is here, so, yes, it is accurate. 21 Q And the meaning of transformation here 22 would be clearly understood? 23 A By whom? Or is that a question? I don't 24 know. 25 Q Yeah, it was a question.

85 1 It would be clearly understood, correct? 2 A Clearly understood by whom? 3 Q The audience. 4 MR. HENRY: Objection to form. 5 THE WITNESS: So there -- there's two 6 audiences for this paper. One is the general 7 public, anyone who can download this paper, and the 8 second is the audience at the International 9 Conference on Auditory Display. So which audience 10 are you referring to? 11 BY MR. ELLIOTT: 12 Q Give me the answer for both, please. 13 A I would expect that most people at the 14 International Conference on Auditory Display, who 15 also do work in 3D audio or 3D audio-adjacent 16 topics, would understand what transformation means 17 here. People who are outside of this research area, 18 I cannot speak on. 19 Q What about a POSITA? Would a POSITA 20 understand what transformation means there? 21 A I would -- I think it's reasonable, but 22 also -- I think it's reasonable to expect a POSITA 23 to -- to understand what that means here. 24 MR. ELLIOTT: Exhibit 6, please. 25 - - -	87 1 Q And so what is used to create the 2 customized HRTF as illustrated in Table 1? 3 A Okay. All right. This is -- thank you for 4 recalling this. As you can see, this was a paper we 5 wrote ten years ago. So this is -- I'm remembering 6 now what we did. 7 So to understand this, I'll have to explain 8 subjective selection. So subjective selection is a 9 way -- another way of arriving upon an HRTF where -- 10 since HRTFs are really hard to measure because it 11 describes the entire, you know, transformation of 12 sound at lots of different locations around a user, 13 so we all have different anthropometric features. 14 So your HRTF is different from mine. Everybody has 15 different ones. They're kind of like fingerprints. 16 So since not everyone has access to a huge 17 anechoic chamber to be able to do these 18 measurements, we -- people publish databases of 19 HRTFs, and we conduct a series of listening 20 experiments. So the listening experiments, I'm 21 allowed to render sounds using HRTFs and other 22 things to different locations in space, and you can 23 click a button to tell me, "Yes," you know, "I heard 24 it where I'm supposed to hear it. I did not hear it 25 where I'm supposed to hear it." So that's
86 1 (McMullen Exhibit 6 was marked for 2 identification.) 3 - - - 4 BY MR. ELLIOTT: 5 Q And if you would, Dr. McMullen, please 6 identify what's been marked as McMullen Exhibit 6. 7 A Yes. Exhibit -- Exhibit 6 is a convention 8 paper that was published by myself, Dr. Agnieszka 9 Roginska, Dr. Gregory Wakefield, and it's called 10 "Subjective Selection of Head-Related Transfer 11 Functions...Based on Spectral Coloration and 12 Interaural Time Differences...Cues." 13 This was published at the Audio Engineering 14 Society convention in 2012. 15 Q Let me direct your attention to page 8. 16 A Okay. 17 Q There's a table back there. 18 And in Table 1, how -- what is used to 19 define the HRTFs that are there? 20 A The HRTFs in Table 1, what do you mean 21 by "define the HRTFs"? 22 Q Well, the heading in Table 1 says that 23 certain things are used to create each customized 24 HRTF. 25 A Yes.	88 1 subjective selection. 2 So we do three different phases. The first 3 is externalization, can you hear it outside of your 4 head? The second phase here was -- the second -- 5 the last two are elevation distinction, can you 6 distinguish up from down, and then also, can you 7 distinguish front from back. So the HRTFs that made 8 it through all three of those, those are the ones 9 that we determined were suitable to use within a 10 larger algorithm. 11 So this paper specifically, we were looking 12 at which HRTF spectrum could we -- does it matter if 13 we change the ITD that's given. So the HRTF, 14 depending on the representation, because, again, 15 when we're using HRTFs within a software system, we 16 have to determine if it's represented in the time 17 domain, if it's represented in the frequency domain. 18 If it's represented in the frequency 19 domain, there is no time characteristic. So the 20 time has to be added back in. So we took a 21 frequency domain spectrum, or representation of the 22 HRTF, and they're just numbered, and those numbers 23 correspond to just, like, an internal numbering 24 scheme that we had, and we let people perform the 25 analysis with that spectrum, and then we gave them

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89 1 also different ITDs with their preferred spectrum. 2 So we're basically mixing cues from 3 different HRTFs, which is another way to -- to use 4 HRTFs within a larger specialized system. So this 5 table here is basically saying participant 1 used 6 the spectrum from HRTF No. 21 and they used the ITD 7 of HRTF No. 14, and that's how we combined both of 8 those pieces of data within the MATLAB program -- to 9 render within the larger MATLAB program. 10 Q And what is an ITD? 11 A An ITD stands for interaural time 12 difference. So as I mentioned before, our ears hear 13 two different sounds. As we hear them, they're 14 separated by -- so, for example, the closer ear 15 receives the sounds milliseconds before the farther 16 away ear. So the ITD is a number. It's in 17 milliseconds oftentimes, or samples if you're on the 18 time domain. 19 It's a number depicting for a specific 20 angle what is the difference between the two ears. 21 Conventionally, if it is a delay for the left ear, 22 the number's negative. If it's a delay for the 23 right ear, the number's positive. 24 Q Did not know that. 25 So the ITD has to do with the time of	91 1 relationship with Meta outside of this case. 2 BY MR. ELLIOTT: 3 Q Okay. And if you would, please, go ahead 4 and identify what's been marked as McMullen 5 Exhibit 7, please. 6 A What has been marked as McMullen Exhibit 7 7 is an article that I believe is featured on our 8 department website or our university website. It's 9 entitled "Doctoral Student Receives Meta Ph.D. 10 Fellowship." 11 Q And who is the Ph.D. fellow here? 12 A The Ph.D. fellow is Armisha Roberts. 13 Q And is she one of your fellows? 14 A She is my Ph.D. student. She's not my 15 fellow. She's Meta's fellow. 16 Q Oh, thank you for the clarification. 17 And she received the fellowship from Meta, 18 correct? 19 A Yes. 20 Q Did you assist her in gaining that 21 fellowship with Meta? 22 A What do you mean by "assist"? 23 Q Help her in any way. 24 A In her preparation, to my recollection, she 25 wrote the application. So assist her was -- wasn't
90 1 arrival at the ear? 2 A The difference in the time of arrival at 3 both ears. 4 Q Is it improper to say the difference in 5 time of arrival between the two ears? 6 A That's fine. 7 Q Okay. 8 A Or it's the absolute. Because if it's a 9 negative number, it's the absolute value of that 10 number. 11 Q Sure. Okay. 12 A But, yeah. 13 Q I'll ask the reporter to hand you what's 14 going to be marked as Exhibit 7. 15 --- 16 (McMullen Exhibit 7 was marked for 17 identification.) 18 --- 19 THE WITNESS: Thank you. 20 BY MR. ELLIOTT: 21 Q And do you have any -- do you have any 22 relationship with Meta outside of your retention as 23 an expert witness in this case? 24 MR. HENRY: Objection to form. 25 THE WITNESS: I personally do not have a	92 1 outside of my duties as a faculty member. So assist 2 by providing the mentorship and providing all of the 3 research training that she would need to create 4 this, yes, but this is completely her own -- her own 5 work, her own submitted application. 6 Q Do you know how she found out about the 7 potential fellowship with Meta? 8 A We have departmental emails that go out 9 with various fellowships from various companies. So 10 I imagine that -- I'm pretty sure this was one of 11 the emails that came out advertising this -- this 12 fellowship. 13 Q Did you recommend that she apply for this 14 fellowship? 15 A She actually brought it to me and said she 16 was interested in applying. 17 Q And do you know what the annual tuition is 18 for a graduate student at University of Florida? 19 A I don't know the exact number -- 20 Q Of course not. 21 A -- on the top of my head. I don't even 22 want to ballpark it because she's -- I know 23 out-of-state, but she's in-state, so that's a 24 different number. So I -- I don't want to guess 25 under oath.

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93 1 Q Do you know what the out-of-state is? 2 A I know another range for out-of -- I know 3 it's triple the in-state. So -- 4 Q Okay. 5 A -- just about triple the in-state. 6 Q Is in-state somewhere around 10,000? 7 A What's the plus or minus that we're -- 8 Q Plus or minus three, 3K. 9 A I think that's reasonable. I think that's 10 reasonable to assume for in-state. 11 Q And she's got tuition for two years and 12 she's got 42,000 per year in expenses; is that 13 right? 14 A I would need -- 15 MR. HENRY: Objection to form. 16 THE WITNESS: I would need to double check 17 that. 18 BY MR. ELLIOTT: 19 Q It's at the top. 20 A Yes. Two years of paid tuition and fees 21 and stipends, yes. 22 Q Now, I had asked you earlier, you know, 23 what date you were retained by Meta. 24 A Mm-hmm. 25 Q Do you recall what month it was you were	95 1 referring to? 2 BY MR. ELLIOTT: 3 Q The ones that are in Figure 1, 2 -- sorry. 4 The ones that are in Figure 1, 2, 3, 6, and 5 7 through 10. 6 A And you're asking do all of them -- can you 7 repeat the question about all of these figures? 8 Q Do any of these figures disclose an 9 algorithm? 10 MR. HENRY: Objection to form. Compound. 11 THE WITNESS: It's my opinion that none of 12 these give an algorithm that would give a person 13 reasonable certainty to actually render 3D sound, 14 sufficient structure. 15 BY MR. ELLIOTT: 16 Q But they do have an algorithm disclosed? 17 MR. HENRY: Objection to form. Asked and 18 answered. 19 THE WITNESS: This algorithm -- it's not 20 even an algorithm actually, so strike that. The -- 21 the sequence of steps would not -- I would not refer 22 to this as an algorithm. It's a -- or at least it's 23 not a detailed -- it's a very high-level sequence of 24 steps. 25 BY MR. ELLIOTT:
94 1 retained by Meta for this work? You had said late 2 2022 I believe before, but feel free to 3 recharacterize if I've got that wrong. 4 A No, still late 2022. 5 Q October/November late or December late? 6 A I don't want to guess the month and be 7 incorrect. So if you'd like, I can -- I can look up 8 the date of my first email from someone to contact. 9 Q Okay. Yeah, that'd be great. Appreciate 10 it. 11 A Okay. Actually, my stuff is downstairs. 12 Q When you have a chance. When you go to 13 lunch. It's no problem. 14 And I'm sure I know the answer to this 15 question already, but I've got to ask it. Are you 16 receiving any compensation in connection with her 17 fellowship? 18 A No, I'm not. 19 Q Going back to Exhibit 4, which is the '737 20 patent, the flow diagrams that are there, you had, I 21 believe, testified that you didn't think they had 22 sufficient structure, but do these flow diagrams 23 disclose algorithms at all? 24 MR. HENRY: Objection to form. 25 THE WITNESS: Which flow diagram are you	96 1 Q Mm-hmm. And why would that not be an 2 algorithm? 3 MR. HENRY: Objection to form. 4 THE WITNESS: So by definition, an 5 algorithm includes the word "unambiguous," and I do 6 not think that this provides enough structure for 7 the -- for the rendering to be unambiguous. A 8 finite, definite, unambiguous series of executable 9 instructions, or some version of that, you know, is 10 in the definition for algorithm. 11 So I do not think that it holds up to the 12 definition of algorithm. It's a sequence of steps 13 at a very high level. 14 MR. ELLIOTT: I believe we're on Exhibit 8, 15 aren't we? 16 THE COURT REPORTER: Yes. 17 MR. HENRY: Thank you. 18 BY MR. ELLIOTT: 19 Q So I'll ask the reporter to mark Exhibit 8 20 and hand it to you. When you get it, please take a 21 moment, review it, and identify it for the record, 22 please. 23 A Okay. 24 --- 25 (McMullen Exhibit 8 was marked for

97 1 identification.) 2 - - - 3 THE WITNESS: All right. Exhibit 8 appears 4 to be patent -- the '090 patent as it's referred to 5 in the declaration. And it's called "Sound 6 Localization for an Electronic Call." 7 BY MR. ELLIOTT: 8 Q And do the first 12 figures contain flow 9 diagrams? 10 A By definition of a flow diagram, which is 11 steps inside of boxes with arrows, yes, it is that; 12 however, it's not very detailed. 13 Q Is there anything that would qualify as an 14 algorithm in your opinion in Figures 1 through 12? 15 MR. HENRY: Objection to form. Compound. 16 Ambiguous. 17 THE WITNESS: So for Figure 1, I would not 18 say that this is an algorithm. If you look at 19 the -- at the second box, which is labeled 110: 20 Designate a point in space that is away from and 21 proximate to such that the sound localization point 22 stimulates an origin of the sound that the listener 23 hears. That is not sufficient structure to 24 determine the algorithm for that entire box. 25 So I would not call this an algorithm	99 1 A We talked about those earlier, but I'll go 2 through those again. So -- 3 Q Please. 4 A It is, among other things, first 5 determining what sound is needed to be -- to be -- 6 what is the sound that you're trying to put into 7 space and is it monaural, is it binaural. If it's 8 monaural, then you can -- you have to duplicate it, 9 but we'll handle that later. 10 If it's binaural, we'll need to determine 11 whether or not each of the -- we think of them as 12 columns, like, the left ear's a column, the right 13 ear's a column, and the one on the left goes to the 14 left ear, the one on the right goes to the right 15 ear. 16 If they have -- if it's already mixed, then 17 we need to mix it down so that they have the same 18 content in both of them. Sometimes that's done by 19 averaging. Sometimes that's done by selecting one 20 of the channels. Again, not sufficient structure to 21 determine which one. 22 So now that you figured out you have -- you 23 have two channels of sound, either the monaural one, 24 you just duplicate it twice for the left and right 25 ear -- sorry duplicate it once for the left and
98 1 for -- for Figure -- I'm sorry. This is -- and 2 that's the first part of Figure 1. 3 BY MR. ELLIOTT: 4 Q Let me ask you a question here before you 5 go on to Figure 2. Sorry. 6 A Yes. 7 Q So in the box 110, is there structure 8 that's disclosed in box 110? 9 MR. HENRY: Objection to form. Ambiguous. 10 THE WITNESS: I do not see sufficient 11 structure in 110. 12 BY MR. ELLIOTT: 13 Q Is there structure in 110? Insufficient or 14 sufficient, is there structure? 15 MR. HENRY: Same objection. 16 THE WITNESS: 110 gives a function, but it 17 does not give actual structure. 18 BY MR. ELLIOTT: 19 Q What would structure be in the context of 20 the '090 patent? 21 A In the context of this patent, structure 22 would be sufficient information, sufficient amount 23 of steps to actually execute what is listed here 24 functionally. 25 Q And what would those steps be?	100 1 right ear, for the monaural case from stereo you've 2 mixed it down using one of several mixing 3 operations. 4 Next you would need to determine where in 5 space you would like to -- to render this sound and 6 also determine what HRTF -- if you are using HRTF 7 rendered 3D audio, determine what HRTF and what 8 point do you have an HRTF for this measured point. 9 If you do, you can readily select something from the 10 HRTF database that corresponds to that location. If 11 you don't, then you would need to interpolate using 12 one of many interpolation algorithms. 13 After that, you, if -- depending on the 14 distance, you may need to give a reverberation. So 15 that's another -- sometimes it's a whole 16 reverberation engine. Sometimes it's approximated. 17 Sometimes we don't add it at all. You would need to 18 have attenuation. Meaning that determining if the 19 measured distance also is not a distance that is 20 measured in the database. You also have to do some 21 scaling of the sound. It can be linear. It can be 22 exponential. It can use inverse-squared law. It 23 can be used lots of different -- different ways but 24 determining how to attenuate the sound. 25 What else? We talked about -- I think we

101 1 talked about those features among other features. 2 These aren't the only ones. Then rendering to the 3 actual output device. Because we're doing math to 4 figure this out -- and also using convolution, do we 5 want to use linear convolution or circular 6 convolution with the HRTFs. 7 Is it -- also, is the HRTF -- is it on the 8 frequency domain? We need software to figure out if 9 it's on the frequency domain, that's one convolution 10 algorithm. If it's on the time domain, that's a 11 different convolution algorithm. 12 So these -- this is an example -- these are 13 many examples of -- and it's not exhaustive, of the 14 types of structure that I would expect from the box 15 in 110. 16 Q What causes reverberation? 17 A Reverberation is caused from a sound -- 18 well, let's -- let's step back and talk about sound 19 waves. 20 Q Okay. 21 A So sound waves emanate from a location 22 that's producing sound. So reverberation happens 23 when the sound waves bounce off of rigid objects in 24 such a manner that -- well, I'll use this room as an 25 example.	103 1 reverberation possibilities -- would an HRTF be used 2 to transform that sound for that particular 3 environment where you're rendering the sound? 4 MR. HENRY: Objection to form. 5 THE WITNESS: This question is vague 6 because when you say "if I'm capturing a sound," I 7 don't know how you're capturing the sound. So -- 8 BY MR. ELLIOTT: 9 Q If I capture it bi- -- binaurally? 10 A Binaurally or by orally? 11 Q Bi- -- pardon me if I misspoke. Bi- -- 12 binaurally. Sorry. 13 A Okay. And what I understand is you are 14 capturing a voice using binaural microphones, and 15 for this example the voice you're capturing is 16 outside of your body. It's not you. Okay? Just 17 making sure. And you are the person wearing the 18 binaural microphones. By definition, you would not 19 use an HRTF to capture binaural sound and render 20 that sound for another environment. 21 Q So I've rendered in another environment and 22 let's say there's actually a wall between us. So 23 you're looking through, you know, something, a board 24 that maybe people are writing on. Would you have to 25 transform the sound so that it would be real in that
102 1 So you're receiving -- you're hearing my 2 voice as it is in natural space, but there's some 3 amount of reverberation that comes from the window. 4 Like, when you snap, you hear a little bit of the 5 sound afterwards. It's because -- it's afterwards 6 because it's bouncing off of something and then 7 arriving to you as well. Because sound isn't just 8 directional. It's omnidirectional. 9 So a sound, for all intents and purposes, 10 extends from all directions, so most of the 11 direction that goes towards you, you hear it first. 12 Most of the direction that goes out, if there is a 13 near enough wall or something for it to -- even the 14 table has some amount of reverberation. So if 15 there's some amount of reflection, then it reaches 16 your ears a little bit slower because it had a 17 longer path to travel. 18 Oftentimes the reverberation can happen a 19 little bit lower. Like, reverberation's most likely 20 going to be a lot quieter than the original sound, 21 but reflection off of hard surfaces in a room 22 generally causes natural reverberation. 23 Q Mm-hmm. And if I'm capturing a sound and 24 I'm going to render that sound in a different 25 environment that has lots of -- we call them	104 1 environment, that there's actually a board between 2 the two of us? 3 MR. HENRY: Objection to form. 4 THE WITNESS: It's a very ambiguous 5 question. What does "real" mean in that case? 6 BY MR. ELLIOTT: 7 Q Well, your immersive video environment, 8 same thing that you were doing there. It stays real 9 so you can see that -- or hear that, well, there's 10 something in between us. 11 MR. HENRY: Objection to form. 12 THE WITNESS: So realness actually is not a 13 term that we use. It's actually a term that we stay 14 away from -- 15 BY MR. ELLIOTT: 16 Q Okay. What term do you use? 17 A -- in this area, so I won't use "real." 18 Perceptual probability is what the agreed-upon word 19 is. Also, it's difficult to answer that question 20 because depending on the context, depending on the 21 room, I may or may not want to render every single 22 thing -- or a sound, rather, that in this case 23 reverberates off of everything in the room. 24 But to answer your previous question, you 25 don't necessarily have to use an HRTF to

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105 1 transform -- to -- to give binaural voice in another 2 location other than where it was rendered. 3 Q But would HRTFs be one way of doing that? 4 MR. HENRY: Objection to form. 5 THE WITNESS: This is also a very -- it's 6 context dependent. Like, it's -- 7 BY MR. ELLIOTT: 8 Q In what context would you use an HRTF? 9 MR. HENRY: Excuse me. Dr. McMullen, were 10 you finished? 11 MR. ELLIOTT: Oh, did I interrupt? 12 MR. HENRY: You interrupted the witness. 13 If you could try not to. 14 MR. ELLIOTT: Oh, I apologize. My -- I 15 certainly apologize. 16 MR. HENRY: It's fine. 17 THE WITNESS: Yeah, so I was going to 18 reiterate that it's very much context dependent what 19 is the sound, what is the -- what is the voice, what 20 is the purpose, what is -- there's -- it's just very 21 much context dependent. How is it recorded on the 22 binaural mics? Like, there's -- there's a lot of 23 context that goes into answering that question. 24 BY MR. ELLIOTT: 25 Q Well, let's assume that we want it to	107 1 at the beginning of your -- 2 BY MR. ELLIOTT: 3 Q Where my SLP is I mean. 4 A So the -- 5 MR. HENRY: Same objections. 6 THE WITNESS: Yeah, you still need to 7 qualify how are you capturing this binaural voice in 8 the room that you are in. 9 BY MR. ELLIOTT: 10 Q With the two microphones. 11 A Where are the two microphones? Again, this 12 is -- 13 Q On a headset. 14 A On any generic headset? 15 Q Mm-hmm. 16 A Where is the headset placed? 17 Q Over my eyes. Around my head. 18 A So you're capturing your own voice inside 19 of headphones? 20 Q Mm-hmm. 21 A Inside of these microphones inside of 22 headphones on a headset? 23 Q Mm-hmm. 24 A Okay. And you're -- 25 Q And virtually, then, you and I are -- I'm
106 1 represent the wall, the -- the see-through pane 2 that's between us that we're writing on. 3 MR. HENRY: Objection to form. 4 THE WITNESS: I'm not sure if I understand 5 the scenario that you're painting. 6 BY MR. ELLIOTT: 7 Q Well, the -- you and I are in two different 8 rooms, okay, remote from each other. We're 9 capturing binaural sound from me, and you and I in 10 our -- in your environment, I'm across from you and 11 there's a whiteboard, essentially a transparent 12 whiteboard, between us. So we've got something 13 that's going to cause reverberation between us. 14 What would I do to make sure that there's a 15 real experience between you and I that we are 16 hearing the fact that there's a reverberation 17 between us and with a perceptual plausibility factor 18 thrown in? 19 MR. HENRY: Objection to form. Compound. 20 Ambiguous. 21 THE WITNESS: This is a very contrived -- 22 very contrived scenario that kind of also 23 contradicts itself. If we're in different rooms, 24 how are we only separated by a whiteboard? How -- I 25 don't think I'm understanding this case. And also	108 1 virtually across from you in your room, where you're 2 physically present, and the SLP's going to be -- for 3 me, my voice is going to be on the other side of the 4 transparent whiteboard. 5 Would you use HRTFs to transform that sound 6 to give the real impression, the perceptual 7 plausibility, that there is a reverberation object 8 in between the two of us? 9 MR. HENRY: Objection to form. Incomplete 10 hypothetical. Ambiguous. 11 THE WITNESS: This hypothetical question 12 has too many variables to actually answer. One is 13 that it's not standard to capture the binaural voice 14 of a person who's speaking with two microphones in 15 their own ears. 16 So I wouldn't because I can't -- you can 17 only use -- or it's most prudent to use HRTFs when 18 you know that the two sound sources contain the same 19 information so that when you do all these algorithms 20 you know the source. You know that the difference 21 that you're creating between the two ears started 22 off with the same sound. 23 If you're recording your own voice with two 24 microphones, both of these microphones are going to 25 receive two different signals. So --

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109 1 BY MR. ELLIOTT: 2 Q I appreciate -- 3 A -- the sound source itself would not be 4 something that I would want to convolve with HRTFs 5 because it already has some degree of bias 6 between -- I can't readily assume that the HRTF -- 7 sorry -- that the sounds that were captured at both 8 of the microphones on the headset, that they have 9 the same content. 10 Q Mm-hmm. Let's change the -- change it to 11 one microphone on the headset that's capturing the 12 sound. 13 A Where is -- 14 MR. HENRY: Same objections. 15 THE WITNESS: Where's the microphone 16 placed? 17 BY MR. ELLIOTT: 18 Q Where -- do you have a headset that you use 19 for this at all? 20 MR. HENRY: Objection to form. 21 THE WITNESS: What is "this"? 22 BY MR. ELLIOTT: 23 Q For portraying yourself virtually into 24 another environment. 25 A I don't portray myself -- I mean, I Zoom.	111 1 Oculus. That's outside of the scope of the patents 2 in question today. 3 BY MR. ELLIOTT: 4 Q Sorry. But that was ambiguous to me. 5 You have -- you said "outside the scope of 6 the patents," but have you evaluated just any Oculus 7 device? 8 MR. HENRY: Objection to form. 9 THE WITNESS: I have not evaluated the 10 Oculus or its microphones in any form. 11 BY MR. ELLIOTT: 12 Q Okay. Where is the microphone in the '737 13 patent? 14 MR. HENRY: Objection to form. 15 THE WITNESS: We can take a look at the 16 '737 patent to determine if it's -- at Exhibit 4 to 17 determine if that is disclosed, or would you like to 18 point me to that? I'm looking through the figures. 19 BY MR. ELLIOTT: 20 Q Actually, I apologize. Let's change to the 21 '090 patent. 22 A Okay. 23 Q I think that will be better. 24 A That's -- yeah. 25 MR. HENRY: Do you want to repeat or
110 1 That's how I portray myself virtually across the 2 world. But what do you mean by a headset for 3 portraying myself virtually? 4 Q Something that goes over your eyes that 5 senses -- you know, takes data about you and can be 6 displayed in a place where you are not. 7 MR. HENRY: Objection to form. 8 THE WITNESS: Specifically something that's 9 over my eyes that portrays -- I do not personally 10 own any device that does that. 11 BY MR. ELLIOTT: 12 Q Well, do you know where the microphone is 13 in the Oculus device? 14 A This is not a feature of one of the patents 15 that I analyzed to provide opinions on, so I do not 16 wish to speculate where the microphone is. 17 Q Do you know where the microphone -- have 18 you evaluated an Oculus device? 19 MR. HENRY: Objection to form. 20 THE WITNESS: This was not part of my -- 21 forming my opinions of the claims of the patents. 22 BY MR. ELLIOTT: 23 Q Mm-hmm. But have you evaluated one? 24 MR. HENRY: Objection to form. 25 THE WITNESS: I have not evaluated the	112 1 rephrase the question? 2 MR. ELLIOTT: Yeah, when she pulls it up. 3 Thanks. 4 BY MR. ELLIOTT: 5 Q So looking at the '090 patent, Figure 22 6 for example -- actually, make it 20. Just make it 7 20. 8 Where is the microphone located in Figure 9 20? 10 MR. HENRY: Objection to form. 11 THE WITNESS: You said in figure? I'm 12 sorry. Can you repeat which figure. 13 BY MR. ELLIOTT: 14 Q Figure 20. 15 A 20. Okay. 16 In Figure 20 there isn't a microphone 17 labeled; however, if we read Figure 20's 18 description -- 19 Q Is element 2005 not a microphone? 20 A I'm sorry? 21 Q Is element 2005 in Figure 20 not a 22 microphone? 23 A Well, let's -- let's read the description 24 to see. 25 Q Okay. Sure.

113 1 A So Figure 20 says: "Figure 20 is an 2 electronic system in which electronic devices of two 3 individuals communicate during an electronic call in 4 accordance with an example embodiment." 5 Without -- I mean, there's no label there. 6 There doesn't -- there's no mention of a microphone 7 in the description. It says: "...two individuals 8 communicate during a call in accordance with the 9 example embodiment." But -- 10 Q So looking at column 31 -- 11 A Okay. 12 Q -- down at the bottom starts the 13 discussion -- detailed discussion of Figure 20. 14 A Okay. Let's see. 15 On which line would you like to point my 16 attention to? 17 Q Oh, 66 is where it starts. 18 A Okay. 19 It doesn't explicitly say. At least I'm 20 not seeing readily where it explicitly says 21 "microphone." 22 Q Mm-hmm. 23 A It says: "The wearable electronic device 24 of the speaker captures binaural sound and 25 transmits" -- sounds to the -- or transmits --	115 1 THE WITNESS: I would say that, I mean, a 2 transducer is another word for a microphone, but 3 also transducer is not mentioned here. 4 BY MR. ELLIOTT: 5 Q So how do you think that -- this headset 6 here that's described as capturing sound, how do you 7 think it captures sound? 8 MR. HENRY: Objection to form. 9 THE WITNESS: I don't believe that's up for 10 me to interpret. I thought that the patent's job 11 was to explain. 12 BY MR. ELLIOTT: 13 Q Well, you're the expert witness -- 14 A Yeah. I can -- 15 Q -- and so are you saying that the patent 16 doesn't capture sound? It doesn't do what it says 17 it's supposed to do? 18 MR. HENRY: Objection to form. Compound. 19 Ambiguous. 20 THE WITNESS: I'm saying that it's not 21 explicit about how it captures sound. 22 BY MR. ELLIOTT: 23 Q Mm-hmm. Is -- is a microphone one way of 24 capturing sound? 25 A A microphone is one way of capturing sound.
114 1 "sound to the listener." 2 Q So if it captures it, it does have to have 3 a microphone, correct? 4 A There's ways to capture sound without a 5 microphone. 6 Q What would be the common way of capturing 7 sound? 8 MR. HENRY: Objection to form. 9 THE WITNESS: I mean, we can infer, but it 10 doesn't say. Like, the word "microphone," is not 11 used here. 12 BY MR. ELLIOTT: 13 Q This is depicting a headset in Figure 20, 14 correct? 15 A That is correct. That is a headset. 16 Q Mm-hmm. And do headsets typically include 17 microphones? 18 MR. HENRY: Objection to form. 19 THE WITNESS: I'm not a headset 20 manufacturer. I haven't done a detailed analysis of 21 headset specifications. 22 BY MR. ELLIOTT: 23 Q Well, let's use a different term. 24 Would it include a transducer? 25 MR. HENRY: Objection to form.	116 1 Q What other ways of capturing sound? 2 A Another way of capturing sound, you can use 3 a tape recorder, like, analog. So a microphone is a 4 way of digitally capturing sound. There's analog 5 ways, like, with a -- with a recorder. But, yeah, 6 those are two -- that's an example. 7 Q Would a tape recorder work with what's 8 depicted in Figure 20? 9 MR. HENRY: Objection to form. Calls for 10 speculation. 11 THE WITNESS: I mean, technology changes 12 every day. I mean, it's -- you never know. 13 BY MR. ELLIOTT: 14 Q You're saying it could? 15 MR. HENRY: Objection to form. 16 THE WITNESS: I'm not saying either way. 17 I'm just saying that that's -- there's more than one 18 way to capture sound, and it's not listed here. 19 BY MR. ELLIOTT: 20 Q Would a microphone work with what's 21 depicted in Figure 20? 22 A A microphone could work there. 23 Q Okay. So let's go back to my 24 hypothetical -- okay? -- where I'm in one room being 25 virtually portrayed into a room where you are.

117 1 A Mm-hmm. 2 Q There is a transparent whiteboard between 3 us. Okay? And the microphone is on a mouthpiece, 4 and that's where we're capturing the sound. 5 A Okay. 6 Q And then that is being -- there's an SLP in 7 front of you on the opposite side of the transparent 8 whiteboard between us. 9 A Okay. 10 Q Would an HRTF be used in order to transform 11 the sound so that you perceive -- plausibly 12 perceive the reverberation obstacle in between us? 13 MR. HENRY: Objection to form. Incomplete 14 hypothetical. Asked and answered. 15 THE WITNESS: As I said before, one, 16 HRTF -- HRTF is part of a larger system that creates 17 3D audio. The second is that we don't know what 18 kind of microphone. Some stereo mics record in 19 multiple channels. So, again, I would not be able 20 to determine if I could readily use an HRTF to -- 21 among other things, to involve it in the complex 22 software process of creating this 3D sound. 23 BY MR. ELLIOTT: 24 Q What other ways would you use besides an 25 HRTF?	119 1 Q Oh, just to clarify, it would still be a 2 transfer function -- 3 A Yes. It -- 4 Q -- it just wouldn't be a head-related 5 transfer function? 6 A Correct. 7 Q And so can you explain to me, just in 8 layman's terms, what a head-related transfer 9 function is? 10 A Yeah. In layman's terms, and I'm not sure 11 if we covered this already, but in a head-related 12 transfer function, and, again, in layman's terms 13 without using something that a POSITA wouldn't be 14 familiar with, HRTF is a characterization of the way 15 sound travels in the air before it reaches your ears 16 at various -- from various locations. 17 Q And how is that related to the head? 18 A Your head is in the way of the sound as it 19 reaches your ears, because your ears on your head, 20 and also your torso, your shoulders. Like, 21 basically, everything from here (indicating) up is a 22 pretty big factor in how the HRTF is formulated. 23 Q Okay. You note in paragraph 192 of your 24 declaration, if you want to refer to it -- I don't 25 know that you'll have to -- that the processor
118 1 A To capture and render 3D audio? 2 Q Mm-hmm. 3 A Oh, yeah, there's lots of ways. So another 4 way involves HRTF estimation or modeling, where you 5 can use physical properties of how sound generally 6 travels in the air and creates artificial filters, 7 but they're not actually created using someone's 8 head. They're created basically just using math. 9 So that's one way. 10 You could use a machine learning to come up 11 with or artificially manufacture these transfer 12 functions as well based on what we know. These HRTF 13 databases are very big, and they contain information 14 for lots of subjects. So you could feed this into a 15 machine learning algorithm and then just look at the 16 proportions of someone's head or just -- it's one 17 feature, even the width of their head. You could 18 use any number of features to then predict what 19 would be a good transfer function for them. But we 20 can't call it head-related because there is no 21 actual head involved. 22 So that's another way that you could do 23 this without an actual transfer function. You can 24 still create the mathematical representations 25 without the head.	120 1 that's referred to can be a central processing unit. 2 A Yes. 3 Q What is a central processing unit? 4 A One second. 198? Was it 198 that you 5 said? 6 Q Oh, 192. 7 A 192. Okay. 8 MR. HENRY: Objection to form. 9 THE WITNESS: So it says that the '090 10 patent discloses a processor can be a central 11 processing unit, CPU, microprocessor, 12 application-specific integrated circuit, et cetera, 13 but a general processor for executing 14 construction -- instructions cannot perform the '090 15 processor's term recited function without special 16 programming. 17 Where -- where would you like me to turn my 18 attention? 19 BY MR. ELLIOTT: 20 Q What I've -- the actual question was: 21 What's a central processing unit? 22 A A central processing unit? 23 Q Mm-hmm. 24 A Okay. It's basically the CPU. It is a 25 generic term for the -- the processing unit of a

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121 1 device, a machine, anything that has calculating 2 capabilities. 3 Q Mm-hmm. What's a GPU? 4 A A GPU is a graphical processing unit. It 5 is a specialized -- specialized version of a 6 processor that is specifically optimized to render 7 high quality, high data visual graphics usually to a 8 screen or some sort of display. But GPUs have also 9 been used as well in other applications because of 10 this optimization. It's not just graphics. 11 Q What's a microprocessor? 12 A A microprocessor is generally referred to 13 as a processor that's inside of a small device. So 14 that could be something like a smartwatch. It could 15 be your phone, but -- but, yeah, microprocessors are 16 usually programable. They're, like, printed. So 17 those are -- they're, like, small processors for 18 small devices. 19 Q And what type of programming do 20 microprocessors have on them? 21 A Microprocessors have to be programmed 22 usually using a low -- a low-level programming 23 language such as assembly, sometimes C, depending -- 24 depending on the flavor of what you're doing. 25 Q And what's an ASIC, the	123 1 A Okay. 2 Q If you can just read that sentence through 3 the ASIC would be pertinent, but, obviously, you can 4 read all if you would like. 5 A Okay. 6 Q So does the patent say that the processor 7 unit, i.e., the processor unit that's claimed, can 8 be an ASIC? 9 A It says it includes a processor, and it 10 gives the example of lots of different kinds of 11 processors. It does not say specifically that it's 12 an ASIC. 13 Q But it says one of those types of 14 processors is an ASIC? 15 A It says "such as." So we can infer that 16 it's one or more, but it does not specifically say 17 that it is. 18 Q Mm-hmm. Could an ASIC be programmed to 19 perform some of the steps that you highlighted 20 early -- earlier, such as reverberation, the other 21 missing things? 22 A So -- let's take a step back. So 23 processors need software in order to perform their 24 actions. So a processor by itself cannot just 25 randomly execute the algorithm or the instruction.
122 1 application-specific integrated circuit? 2 A So that is kind of similar to, like, the 3 way the GPU is specialized for graphics. There's 4 other applications that need specific opti -- 5 optimization. 6 So like the ASIC is a -- just a -- not a 7 catch-all, but, you know, a general term for 8 circuits that have been optimized or created to 9 perform a specific function in a -- in an optimal 10 or -- I don't want to keep saying "optimal," but in 11 a -- in a fast or desirable manner for the person 12 who's programming it depending on the context. 13 Q Okay. So the processor that's recited in 14 the claims, though, it could be an ASIC? 15 MR. HENRY: Objection to form. 16 THE WITNESS: The processor that is recited 17 just says "processor." It's not -- it's not 18 actually specified what kind of processor it is. 19 BY MR. ELLIOTT: 20 Q Well, this comes from, I believe, a quote 21 out of the patent. Let me see if I -- make sure 22 I've got the right one. Column 41. 23 A Which patent are you referring to? 24 Q This is the '090 patent and column 41, line 25 20.	124 1 So you could create a circuit, which is 2 what this is, so that once the data is actually in 3 memory and it's on the device, it's in an optimized 4 location so that when you call functions and 5 functionality like reverberation within your 6 software program, it's in an optimal space where the 7 transactions are low cost for the system, but it's 8 not performing these. It's not optimized to perform 9 these actions. It's optimized that on disk it's -- 10 it's a very quick -- these things that are common 11 operations are very quick. 12 Q Mm-hmm. Well, is it possible to program an 13 ASIC to perform the transformation that occurs 14 through HRTFs in the broader program? 15 MR. HENRY: Objection to form. Compound. 16 Lacks foundation. 17 THE WITNESS: It's possible to write a 18 piece of software that uses an ASIC that has been 19 optimized, but the piece of software is what would 20 dictate the HRTF that's needed, not the -- the ASIC 21 wouldn't just have it at its disposal to just 22 convolve. Like, that's -- it's the tool, not the 23 actual data. 24 BY MR. ELLIOTT: 25 Q Mm-hmm. Do you have any patents yourself

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125 1 or pending patent applications? 2 A I don't have any. 3 Q Want to someday? 4 A No. 5 Q Now this will definitely put you off of it, 6 won't it? 7 A Could we take a break? 8 Q Oh, yes. Certainly. 9 THE VIDEOGRAPHER: Stand by. 10 We are going off the record. The time is 11 11:40 a.m. 12 (Recess.) 13 THE VIDEOGRAPHER: We are going back on the 14 record. The time is 11:54 a.m. 15 BY MR. ELLIOTT: 16 Q Can you give me a definition of an ASIC, 17 please, Dr. McMullen? 18 A A definition of an ASIC? 19 Q Uh-huh. 20 A As we were referring to earlier -- I don't 21 want to botch the letters -- it's application 22 specific, and I'll tell you the other two words in a 23 second. 24 THE COURT REPORTER: Application? I didn't 25 hear you.	127 1 THE WITNESS: It depends. 2 BY MR. ELLIOTT: 3 Q Is that one possibility? 4 MR. HENRY: Objection to form. 5 THE WITNESS: I mean, it's not a guarantee 6 that it's going to be programmed. 7 BY MR. ELLIOTT: 8 Q Are there ASICs that are preprogrammed with 9 special software? 10 A I'm not an ASIC professional, but I don't 11 want to -- to guess under oath. 12 Q So you don't know, as you sit here today, 13 whether ASICs have a specialized program on them? 14 MR. HENRY: Objection to form. 15 Mischaracterizes Dr. McMullen's testimony. 16 THE WITNESS: What I'm saying is that you 17 can't just assume that an ASIC has specialized 18 programming already on it if you commercially buy it 19 off the shelf. 20 BY MR. ELLIOTT: 21 Q Do ASICs exist with specialized programming 22 on them? 23 A I would imagine, yes, they do exist. They 24 can -- they can be preprogrammed, but also 25 without -- in this hypothetical question without
126 1 THE WITNESS: Specific. 2 Application-specific integrated circuit. 3 BY MR. ELLIOTT: 4 Q And what is an application-specific 5 integrated circuit? 6 A It is an integrated circuit that has been 7 produced in such a way that the location of the 8 registers, the different components of the circuit, 9 are optimized for the actual task at hand. So one 10 example could be a hearing aid. 11 Q Do application-specific integrated circuits 12 have special programming already on them to perform 13 tasks? 14 A The application-specific integrated 15 circuits need to be programmed -- 16 Q Mm-hmm. 17 A -- by software. So they're not just, by 18 nature, come off the -- the belt programmed. They 19 have to have programming applied to them, specialty 20 programming. 21 Q Right. 22 But when I buy an ASIC, I'm going to buy it 23 for a specific purpose, and it's going to have the 24 programming on it when I buy it, correct? 25 MR. HENRY: Objection to form.	128 1 knowing where you are getting it from and what has 2 been done to it or hasn't been done to it between 3 the shelf and you, it's hard to -- to say. 4 Q Can a general processing unit perform audio 5 functions? 6 MR. HENRY: Objection to form. Ambiguous. 7 THE WITNESS: The processing unit itself 8 does not perform; however, software can be written 9 that uses the processor, and the software creates 10 the code that is then interpreted as -- depending on 11 the system, but processor makes the code that's 12 interpreted into machine code that allows the 13 processor to perform the action, but the processor 14 itself does not. 15 BY MR. ELLIOTT: 16 Q So my laptop sitting in front of me here, 17 I've got a CPU in there, right? 18 A I don't know what you have in your laptop. 19 Q Let's assume there's a CPU in there. Is 20 the CPU performing auditory functions? 21 MR. HENRY: Objection to form. Ambiguous. 22 THE WITNESS: I mean, currently as is, 23 there's no sound coming out of your CPU, so it's not 24 performing auditory functions. 25 BY MR. ELLIOTT:

129 1 Q Does it have the software on there to do 2 so? 3 MR. HENRY: Objection to form. Calls for 4 speculation. 5 THE WITNESS: Again, I'm not an expert in 6 your HP laptop. I'm more of a Mac person, so I 7 can't speculate for how your laptop is -- the inner 8 workings, the hardware specifications of this 9 laptop, I've not seen or analyzed. 10 BY MR. ELLIOTT: 11 Q Do typical laptops have the capability to 12 process audio signals? 13 A Generally speaking, yes, laptops do come 14 with the capability to write software that is able 15 to talk to the sound device to create audio signals 16 that are then output to the listener -- or to the 17 user. 18 Q Let me hand you what will be Exhibit 9. 19 --- 20 (McMullen Exhibit 9 was marked for 21 identification.) 22 --- 23 BY MR. ELLIOTT: 24 Q And if you would, take a moment to review 25 Exhibit 9 and just give us a brief description for	131 1 Is this describing an ASIC? 2 A This is describing a platform that is -- so 3 an ASIC is specifically an integrated circuit. It 4 seems as though, in addition to a circuit, there's 5 other pieces on this, such as a camera, a visual 6 subsystem, memory, et cetera. But by definition, 7 ASIC is an integrated circuit, so it is not, by 8 definition, an ASIC because it has more components 9 than an ASIC. 10 Q It has -- so there is an ASIC here, but 11 there's just additional components to it? 12 MR. HENRY: Objection to form. 13 THE WITNESS: I didn't say that there was 14 an ASIC here. It is -- without having any sort of 15 prior knowledge of this or time to do an extensive 16 review of this marketing material that doesn't 17 really give the inner workings, it's hard to know. 18 It's marketed as a special purpose platform 19 that helps with captur.ai, but one could also argue 20 that the processors that are mentioned under the AI 21 portion, that they are using these processors to do 22 these tasks, but it's hard to determine if they are 23 specific -- if the integrated circuits within the 24 processor are programmed specifically for these 25 tasks.
130 1 the record when you're ready, Dr. McMullen. 2 A So this is Exhibit 9 that is entitled 3 "Snapdragon 8, Gen 2 Mobile Platform." 4 Q And I didn't want to cut short your review, 5 but are you ready to answer questions? 6 A I'm not -- 7 Q Okay. Go right ahead. 8 A -- because I'm not familiar with 9 Snapdragon. 10 Q Okay. I perceived correctly. I will wait 11 for you. 12 MR. HENRY: My Exhibit 9 seems to have 13 highlighting on it. Is this something your team 14 annotated? 15 MR. ELLIOTT: Yeah, that's highlighting 16 that was placed on it by us. 17 THE WITNESS: Okay. 18 BY MR. ELLIOTT: 19 Q So is the -- did we get an identification 20 of it in the record? I apologize. 21 A I can do it again. 22 Q Yeah, go ahead, please. I'm sorry. 23 A We have Exhibit 9 that is Snapdragon 8 Gen 24 2 Mobile Platform. 25 Q Thank you.	132 1 Because this seems to be marketing material 2 and not like a huge, like, text specification, so 3 it's hard to determine what's happening under the 4 hood or what has happened under the hood. 5 BY MR. ELLIOTT: 6 Q Okay. In the highlighted material that was 7 referenced a moment ago, do you see where that's at 8 under "Next-level audio experiences"? 9 A Yes. 10 Q Does this Snapdragon 8 Gen 2 platform have 11 the capability to use spatial audio? 12 MR. HENRY: Objection to form. Calls for 13 speculation. 14 THE WITNESS: Again, this isn't something 15 that I have extreme expertise with, but on the 16 surface, I would say -- if you call your attention 17 to the No. 2 footnote -- 18 BY MR. ELLIOTT: 19 Q Mm-hmm. 20 A -- it says: "...featuring spatial audio 21 with head-tracking..." It says: "When used with 22 compatible Snapdragon Sound products." So I would 23 imagine those products have specific programming, 24 specialized programming, to -- to enable this 3D 25 sound, but it's coupled with an external product

133 1 that is perhaps a piece of software, perhaps a piece 2 of hardware. 3 It's hard to know from here, but by its 4 own, by nature of the footnote that's here, it says 5 it has the spatial audio with head-tracking only 6 when used with other compatible products that aren't 7 listed here. 8 BY MR. ELLIOTT: 9 Q But when used with those other products, 10 it's going to have the spatial audio with 11 head-tracking? 12 MR. HENRY: Objection to form. Calls for 13 speculation. Asked and answered. 14 THE WITNESS: It's not something that I can 15 determine from this alone. 16 BY MR. ELLIOTT: 17 Q Doesn't this document say that when it's -- 18 as you note in the footnote, when used with certain 19 compatible Snapdragon sound products: "Now features 20 spatial audio with head-tracking..."? 21 MR. HENRY: Objection to form. Document 22 speaks for itself. 23 THE WITNESS: The document says that it 24 needs other products, perhaps with other software 25 programmed onto them, or that program to use spatial	135 1 and arrows, yes. 2 Q Is -- is there an algorithm that's 3 disclosed here in the flow -- flow diagram of Figure 4 2? 5 A There is not an algorithm for 3D sound 6 creation disclosed here. 7 Q So the three steps that are here in 200, 8 210, and 220 are designate, determine, and adjust. 9 A Okay. 10 Q Are those steps that would be implemented 11 by a computer program? 12 A At a high level, you could characterize all 13 of the steps that the computer would -- and actually 14 adjusting isn't even the proper word, but designate 15 for the listener a sound source localization, that's 16 basically deciding where in space it would need to 17 go. 18 Even that in itself is a complicated 19 question because is this designation generated by 20 the user, is it generated by the environment, is it 21 something that the programmer has already decided 22 the user is going to hear, but let's pretend that we 23 already know where it needs to be designated. 24 Then determine head location orientation of 25 the listener with respect to the sound localization
134 1 audio, but, also, I can't make a huge claim about 2 these because I don't have knowledge of those 3 products or what they are. It is very ambiguous 4 here what they're referring to. 5 BY MR. ELLIOTT: 6 Q Do you know if Meta uses the Snapdragon? 7 MR. HENRY: Objection to form. Calls for 8 speculation. Ambiguous. 9 THE WITNESS: That's not information that 10 I'm privy to. 11 BY MR. ELLIOTT: 12 Q If you would, take a look again at the '090 13 patent. 14 And what exhibit number did we put on 15 there, Dr. McMullen? 16 A That is Exhibit 8. 17 Q Exhibit 8. Thank you. 18 So we'd talked a little bit before about 19 Figure 1, so let's look at Figure 2, and to avoid 20 the compound objections, we'll just step through 21 them one by one. 22 Is Figure 2 a flow diagram? 23 A By definition of words in boxes with steps, 24 yes. Is it enough to actually render with 25 structure? No. But by definition, words with boxes	136 1 point, this does mention a -- some sort of 2 head-tracking system. So assume the head-tracking 3 system -- I mean, even with the head -- orientation 4 with the head-tracking system, head-tracking is 5 oftentimes a finicky sort of thing where you have to 6 apply other algorithms to, like, smooth the location 7 or sometimes jitter. So you can't always use the 8 head-tracking data as is. So this is another point 9 where this is not an algorithm because there's more 10 steps to -- to that piece. 11 And then the third, it's just describing -- 12 minus the word "adjust," it's saying the function of 13 what needs to happen, but it does not give the 14 structure of how that happens. 15 Q And what would the structure be for step 16 220? 17 A So I believe this is another piece that 18 we've talked about, but I'll -- I'll go through it 19 again. 20 The structure would be -- and this one 21 specifically says: "Adjusting [sic] the sound as 22 the listener moves with respect to the sound 23 localization point in empty space such that the 24 location...that the listener hears continues to" -- 25 sorry -- "originate from the sound localization

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137 1 point even as the listener moves and changes the 2 location and the head orientation with respect to 3 the sound localization point." 4 So in layman's terms, that means there's a 5 sound in space. As the person moves, the world does 6 not move with them. You know, the sound appears to 7 come from the same spot. In order to do this, one, 8 let's assume we already know everything we need to 9 know about where the sound came from. You know, we 10 already were giving it a prescribed sound. We need 11 to figure out what is the interpolation algorithm. 12 Because HRTF databases are notoriously sparse, we 13 don't know what kind of HRTF we have. Are we 14 dealing with an impulse response, finite -- infinite 15 impulse response -- infinite impulse response or -- 16 THE COURT REPORTER: Slow down. 17 THE WITNESS: Sorry. 18 THE COURT REPORTER: "Are we dealing with?" 19 THE WITNESS: A finite impulse response, 20 infinite impulse response, or -- and those two are 21 on the time domain, or are we dealing with an HRTF 22 represented on the frequency domain? So, again, two 23 different convolutions there. 24 And then as the head -- let's assume we can 25 decide which one it is there with code. Then we --	139 1 been physically, acoustically measured on actual 2 people, where you sit in an anechoic chamber, and I 3 don't think we've talked about how HRTFs are 4 measured. So just, you know, to make sure we're all 5 on the same page, you have probe microphones that 6 are at the entrance of your ear canal and you're 7 usually in a room that has no reflections, nothing 8 that the sound can bounce off of because you don't 9 want the sound to actually be affected by, you know, 10 any reflections in the room. 11 So a sound -- and depending on the setup, a 12 sound is played at a number of locations around the 13 listener, and it's recorded in the mics. The mics 14 then take the signal. They're -- and the sound 15 that's played can be any number of sounds. They can 16 be Golay codes. They can be -- 17 THE COURT REPORTER: Say that again. 18 THE WITNESS: Sorry. Golay, G-O-L-A-Y. 19 They can be Golay codes. They can be sine sweeps, 20 S-I-N-E sweeps. They can be any number of sounds 21 that basically span the spectrum of human hearing, 22 but, regardless, they're played in different 23 locations. And as they're picked up, a computer 24 then gets the signal that is received at both of the 25 ears, and it -- and it creates a database of all the
138 1 as we turn the head, we have to now calculate the 2 angle in real time as it moves. Then more times 3 than not, all of the angles that the head is 4 traveling over are not represented in the HRTF 5 database. 6 So then we need to do a number of -- one 7 or -- you know, an interpolation algorithm 8 basically. And as it says, this person isn't just 9 turning in the -- in the room. They are move -- 10 they are moving in the room. So as they move, 11 there's reverberation differences around the room. 12 If they kneel down, there's elevation differences. 13 So there's lots of differences that have to 14 be accounted for and factored into the algorithmic 15 code here, and none of that is stated, among other 16 things. 17 BY MR. ELLIOTT: 18 Q You had said, I thought, before that these 19 HRTF databases were vast, but then you just said -- 20 said it was sparse. 21 Did I miss something there? 22 A Yes. 23 Q Okay. Help me out, please. 24 A So there are lots of HRTF databases, and 25 what we mean by HRTF databases are HRTFs that have	140 1 different locations, and it's impossible to measure 2 every possible azimuth elevation and distance that 3 you would need to render. 4 So when I say that the databases are vast, 5 I mean that there are lots of people who have had 6 this procedure done to them and have had them 7 published; however, the sampling within the HRTF 8 measurement can be sparse. So the number of 9 locations and the granularity of the measurements is 10 the part that I'm referring to as often being 11 sparse. 12 BY MR. ELLIOTT: 13 Q Thanks for clarifying that. 14 Looking at Figure 3, is Figure 3 a flow 15 diagram? 16 A By definition, it is boxes around 17 high-level words. 18 Q So yes? 19 A Yes, we'll say -- I mean, it's not the 20 detail. It's a high-level flow diagram. 21 Q Okay. Is there any algorithm disclosed in 22 Figure 3? 23 A No. 24 Q And why not? 25 A For the reasons previously mentioned, among

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141 1 others, for Figure 2. 2 Q Okay. Now, step 300 has something 3 additional to what we've seen before. It has: 4 "Commence an electronic call..." 5 Do you see that? 6 A Mm-hmm. 7 THE COURT REPORTER: Is that a yes? 8 THE WITNESS: Oh, sorry. Yes. 9 BY MR. ELLIOTT: 10 Q Is commencing an electronic call something 11 that's going to be done with software? hardware? by 12 a person? 13 MR. HENRY: Objection to form. Compound. 14 THE WITNESS: Which question would you like 15 me to answer? 16 BY MR. ELLIOTT: 17 Q Start with the software program. Is 18 commencing an electric -- electronic call going to 19 be done with a computer program? 20 A An electronic call -- an electronic call -- 21 I'm thinking of all the possible types of electronic 22 calls. In the simplest form, let's say Zoom is 23 performed by a computer program by nature of an 24 electric -- an electronic call, rather. There would 25 have to be some sort of device with processing	143 1 of different ways. 2 BY MR. ELLIOTT: 3 Q How can -- what are the different ways it 4 can be interpreted? 5 A Maintaining the origin of the voice can 6 mean keeping track of where it is. It can mean 7 always rendering it in the same position. It could 8 mean holding it in memory, in some sort of 9 three-element coordinate system. So maintaining the 10 voice -- the origin of the voice -- and it could 11 also be a hardware thing, where it's continuously 12 tracking or triangulating the origin. 13 So without sufficient detail here, 14 maintaining the origin of the voice could be a 15 hardware thing. Could be a software thing. 16 Q Is the meaning of "Maintain the origin of 17 the voice..." keeping it in place as the listener 18 moves around the room or turns their head? 19 MR. HENRY: Objection to form. 20 THE WITNESS: As I said before, this is a 21 very high-level description, and it's impossible 22 to -- I mean, the purpose, I thought, of the patent 23 is to give sufficient detail. So without reading 24 into this and without giving it extra information 25 that's not already stated, I don't want to speculate
142 1 capabilities to be able to do that. 2 Q Okay. And then the step 320 in the flow 3 diagram: "Execute the electronic call..." would a 4 computer program execute the electronic call? 5 A When you say "computer program," you mean 6 the software within the computer program? 7 Q Yes. 8 A Okay. Also, there isn't sufficient detail 9 here for execute the electronic call such that -- 10 it's basically a very high-level way of saying have 11 the electronic phone call do all of the things that 12 were described in the last box of Figure 2. I would 13 imagine that since it is an electronic call and not 14 analog or anything like that, that a computer 15 program would be somewhere in the mix. 16 Q And then in step 330 you have: "Maintain 17 the origin of the voice..." Is that going to be 18 something implemented by software in a computer 19 program? 20 A What is meant by, "Maintain the origin of 21 the voice..."? 22 Q Can I ask you what does it mean to you to 23 maintain the origin of the voice? 24 MR. HENRY: Objection to form. 25 THE WITNESS: That can be interpreted a lot	144 1 what they mean by "Maintain the origin of the 2 voice..." 3 The Figure 3 description says: "FIG. 3 is 4 a method to adjust sound in an electronic call in 5 response to a listener moving a location and a head 6 orientation with respect to a sound localization 7 point in accordance with an example embodiment." 8 So it doesn't talk about how -- how that 9 voice would be maintained throughout the -- the 10 step. 11 BY MR. ELLIOTT: 12 Q Is Figure 4 a flow diagram? 13 A By definition, yes. 14 Q Now let me back up. I apologize. 15 "Commence an electronic call," what are the 16 types of electronic calls? 17 A There are electronic calls that can occur 18 over Zoom. There -- or any other, you know, 19 teleconferencing platform. Electronic calls that 20 can happen with a cellular device. Electronic calls 21 that can be -- I don't own an Apple Watch, so 22 someone would need to tell me. I believe you can 23 call on your Apple Watch, correct? 24 Q I know I can answer phones. 25 A Okay.

145 1 Q But only because it's tied to a cell phone; 2 however, I've been told -- my nine-year-old wants an 3 Apple Watch so she can receive calls on it without a 4 cell phone, so I think you're correct. 5 A Yeah, that's another example of -- of an 6 electronic call. 7 Q Any others? 8 A There's probably others I'm not thinking 9 of, but those are some examples. 10 Q What are examples of nonelectronic calls? 11 A So electronic calls -- not electronic 12 calls. I would say any -- I don't know. Maybe -- I 13 feel like -- and I'll back up too. 14 I think electronic call is an umbrella term 15 for any call that's mediated through, like, digital 16 technology. So any call that's not mediated by 17 digital technology, I would say it's not an 18 electronic call. 19 Q So the distinction between an electronic 20 call and a nonelectronic call is whether it's 21 digital or analog? 22 MR. HENRY: Objection to form. 23 THE WITNESS: I would say -- I mean, by 24 definition, an electronic call is two parties 25 speaking on a call through a digital medium, through	147 1 but also this is an imagined thing with not a lot of 2 structure. So there's -- it's open for 3 possibilities. 4 Q And then the last step of Figure 4 is: 5 "Adjust sound that the listener hears." Is that a 6 step that's going to be performed by software in a 7 computer program? 8 A There would need to be specialized 9 programming to -- to change the sound. Maybe not 10 adjust, but to take a monaural sound to create 3D 11 audio that the listener hears the talker speak as 12 the talker moves. Adjust wouldn't be the -- but, 13 again, there's no structure there. 14 Q And what structure would need to be there? 15 A The structure mentioned in two, in -- among 16 other things, but specifically we can start with the 17 structure that I mentioned about figure 220 -- or 18 sorry -- box 220 of Figure 2. 19 Q Is Figure 5 a flow diagram? 20 A By definition, yes. 21 Q Is there an algorithm disclosed in 22 Figure 5? 23 A No. 24 Q And why not? 25 A Same reasons as -- some of the same reasons
146 1 some sort of electrical mechanism, and everything 2 else isn't. Everything else is -- is a 3 nonelectronic call. 4 BY MR. ELLIOTT: 5 Q Okay. All right. Now shifting to 6 Figure 4, is Figure 4 a flow diagram? 7 A By definition, yes. 8 Q And is an algorithm disclosed in Figure 4? 9 A No. 10 Q The first step in Figure 4 of designating a 11 virtual microphone point, is that something that's 12 performed by software? 13 A "Designate a virtual microphone point." In 14 most cases, it -- software would mediate this 15 designation in this virtual space, but because -- it 16 sounds like it's something that would be set as a 17 preference of the listener. 18 Q And the second step, 410 of Figure 4, 19 determining -- excuse me -- "Determine a location 20 and a head orientation of the talker," is that 21 something that's going to be performed by software 22 in a computer program? 23 A On its surface, it's ambiguous. Head 24 orientation usually involves hardware as well. So 25 it could be a combination of hardware and software,	148 1 as described by Figure 2. It doesn't give a method, 2 steps, concrete structure for what it's doing. It 3 only provides function. 4 Q Well, the -- the structure that we're 5 talking about, though, they are -- it is 6 functionality implemented by computer programs; is 7 that right? 8 A It is implemented by a structured computer 9 program especially -- you know, especially 10 programmed to do this, but just saying a computer 11 program does this does not provide sufficient 12 structure to be able to implement what's listed here 13 in the boxes. 14 Q So the step 520: "Adjust sound that the 15 listener hears," is that something that's going to 16 be implemented by computer software and a computer 17 program? 18 A Among other pieces. 19 Q I'm sorry. Say that again. Among other? 20 A Among other pieces. 21 Q Okay. Pieces. 22 Okay. And Figure 6, is this also a flow 23 diagram? 24 A Yes. 25 Q That was -- I'm sorry.

149 1 Was that a yes? 2 A Yes. 3 Q Okay. My apologies. I had my -- I had my 4 head turned. 5 A See, those HRTFs messing up. 6 Q That's right. 7 So does Figure 6 disclose an algorithm? 8 A It does not. 9 Q The designate step, 610, for the first 10 individual, sound localization points that stimulate 11 [sic] locations in empty space, is that a step 12 that's going to be implemented by computer software? 13 MR. HENRY: Objection to form. 14 THE WITNESS: It's hard to say because it 15 has not been created, but it could be software, 16 hardware and software. 17 BY MR. ELLIOTT: 18 Q Figure 7, is this figure a flow diagram? 19 A By definition of flow diagram, yes, this 20 is. 21 Q And then in step 700 it says to: "Capture 22 sound at a first geographical location." What's 23 necessary to perform that step? 24 MR. HENRY: Objection to form. 25 THE WITNESS: Can you rephrase by what is	151 1 microphones. 2 Q Anything else? 3 A The microphones have to feed into a 4 computer, some sort of capturing device, a recorder. 5 So either analog tape recorder or digital, you know, 6 computer or some sort of processing device -- 7 Q Mm-hmm. 8 A -- that can capture and store the sound. 9 Q Mm-hmm. And Figure 8, is that a flow 10 diagram? 11 A Yes, by definition, high-level flow 12 diagram. 13 Q Is an algorithm disclosed in Figure 8? 14 A No. 15 Q In step 820, it says: "Adjust, based 16 on...artificial environmental conditions." 17 What would be an artificial environmental 18 condition? 19 A An artificial? I mean, I can only -- give 20 me one second -- 21 Q Yeah. Sure. 22 A -- to go and take a look in here. 23 It seems as though having the artificial 24 environment conditions refer to creating or -- 25 creating an auditory scene in which the person
150 1 necessary? 2 BY MR. ELLIOTT: 3 Q What would you need to be able to capture 4 the sound at a first geographical location? 5 A It's a bit ambiguous because every 6 location's a geographic location. So you would need 7 things that would be customarily used to capture 8 sound at geographic locations or any location, but 9 let's take a look at the description for Figure 7. 10 And it says: "A method to adjust sound based on a 11 physical environment of an individual in accordance 12 with an example embodiment." 13 They're making a distinction here about 14 the -- the geographical location having first 15 environmental conditions. The having first 16 environmental conditions part, can you expound on -- 17 you know, since it is sort of vague. Because every 18 location's a geographic location, that -- every 19 place is an environment and there are conditions 20 there. So I'm not readily understanding the reasons 21 for this distinction. 22 Q Well, what would be the customary things 23 that you mentioned that would be needed to capture 24 sound? 25 A Ordinarily, one or more transducers or	152 1 appears to sound as though they're in a different 2 environment than they are actually in. 3 Q And would that be something that's done via 4 computer software? 5 A You could say that. 6 Q Okay. Is Figure 9 a flow diagram? 7 A By definition. 8 Q And the middle step, 910: "Monitor, during 9 the electronic call, movements of a head location 10 and/or head orientation," is that going to be a 11 combination of hardware and software? 12 A Most likely. In most situations. 13 Q Okay. Figure 10, is Figure 10 a flow 14 diagram? 15 A Yes, by definition. 16 Q The step of 1010, one zero one zero: 17 "Provide a sound localization point," is that 18 something that's going to be done by computer 19 software? 20 MR. HENRY: Objection to form. 21 THE WITNESS: "Provide a sound localization 22 point," is a very vague term. So it's hard to tell 23 what that means. It's provided in what manner? 24 digitally? Is it pointed out? 25 So that's -- you know, it's a little

153 1 difficult to know exactly what the underworkings -- 2 the inner workings would be. 3 BY MR. ELLIOTT: 4 Q What about the step 1000: "Record sound"? 5 What would that require, to record sound? 6 A Conventionally, we use microphones or 7 transducers to -- to record sound. 8 Q Is Figure 11 a flow diagram? 9 A Yes, by definition a flow diagram. 10 Q And does it disclose an algorithm? 11 A No. 12 Q In step 1100, it says to: "Determine one 13 or more physical attributes of a listener." What 14 would be required to do that? 15 A It's hard to know without knowing how they 16 would like to determine or what the attributes are 17 that are in question to contribute to the HRTF. 18 Q In this context, would the shape of the 19 head be a possibility for physical attribute? 20 A At a high level, but there's also many 21 smaller pieces that -- you know, your head is a 22 complex thing. So our ears, the angle of our ears, 23 the depth of your cavum conchae, so just saying 24 "shape of the head" is too general for this, and 25 there's lots of ways to determine the shape of your	155 1 and/or similarity between the one or more physical 2 attributes of the listener and the one or more 3 physical attributes of the individuals with stored 4 HRTFs." 5 Would that be performed by computer 6 software? 7 A Conventionally, I would say that's the most 8 efficient way to do it rather than writing it out 9 and doing a, you know, math line-by-line comparison. 10 Q The latter would be impractical; would it 11 not? 12 A Yeah, it would be very impractical. I'm 13 thinking if there's a hardware way to -- to do this, 14 but the hardware's more so involved in the capturing 15 of the data, not necessarily the processing to 16 determine similarity in the most optimal form. 17 Q Mm-hmm. So, basically, the way this would 18 be done in the real world would be with computer 19 software? 20 MR. HENRY: Objection to form. 21 THE WITNESS: I would say that's the most 22 prudent way to do this in the real world, would 23 involve specialized -- specially coded computer 24 software to do this for this specific function. 25 BY MR. ELLIOTT:
154 1 head or the dimensions of various features of your 2 head, neck, torso, shoulders, et cetera, that 3 impacts an HRTF. 4 Q Okay. And how would you collect those 5 physical attributes you just described? 6 A Many different ways. One way is by literal 7 physical feature analog measurements. Like, I have 8 a -- I forget what it's called, but it almost looks 9 like a vise and you, like, can measure -- 10 Q Calipers? 11 A Yeah, like calipers. You can use that. 12 You could scan a person's head and have a frame of 13 reference and then digitally measure the points that 14 you'd like to. You could create a head mesh of the 15 person. 16 It just depends on, one, what is the 17 algorithm that you're using for these attributes. 18 Because there's tons of features that we can measure 19 on your head. There's tons of ways to correlate 20 those features with HRTF. So I can't give you a 21 straightaway, like, this is how it's done, because 22 there's many ways to perform this. 23 Q Mm-hmm. Fair enough. 24 Then step 1120, we've got: "Determine, 25 based on the comparison of," step 1110: "A match	156 1 Q And is Figure 12 a flow diagram? 2 A By definition, yes. 3 Q And is an algorithm disclosed in Figure 12? 4 A No. 5 Q And why not? 6 A Numerous reasons. One that I can pick out 7 here is: "Measure, with the microphones of the 8 wearable electronic devices of the talking person 9 and the listening person, sound impulses from the 10 talking person." 11 You don't measure sound impulses. People 12 don't create sound impulses. A sound impulse is 13 like a slam, like a really -- no one makes that with 14 their mouth. Number one, that's incorrect. Number 15 two, even if we removed sound impulses that's there 16 incorrectly and just say, you know, vocal data or, 17 you know, sound from the talking person -- measure 18 is also an unconstrained -- unconstrained thing 19 because in recording with the microphone there, you 20 have to know the sample rate of the microphone. You 21 have to -- in order to create what I think they're 22 trying to do, and this is -- actually, this doesn't 23 even make sense. I'm sorry. 24 But it says, in the next step, that they're 25 calculating from the measured sound impulses from

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157 1 the talking person, HRIRs for the listening person. 2 HRIRs are impulse responses. They are these 3 transients. They are these noises that a person 4 can't create. 5 So I would say it's -- it's ambiguous. 6 It's unclear. It invites a lot of scrutiny here. 7 But if you're just -- if you just want an example of 8 how it does not provide an algorithm, well, go to 9 1200: "Determine a sound location of a talking 10 person..." -- Is that hardware? Is it software? 11 What are we using? -- "that wears...an [sic] 12 electronic device with microphones with respect to a 13 listening person..." 14 By wears an electronic device with 15 microphones, like, I think I spoke about determining 16 the location in general in a previous step. So it 17 has some of those same flaws in the algorithm with 18 what do we do about jitter. What do we do about 19 drift. What do we do about -- what kind of 20 smoothing algorithm do we use in order to have a 21 reliable depiction of the location. So those are 22 some algorithmic things that are missing from 23 Figure 12. 24 Q This is kind of a gross question, but would 25 a belch be an impulse?	159 1 software system to create 3D sound with other 2 effects. But on the time domain -- we'll start 3 there -- it is slower. It is a multiply and add, 4 for the most part, operation for convolution. 5 But on the frequency domain, since time 6 isn't a factor, we don't have to consider all the 7 previous samples before like traditional 8 convolution. We can do a direct multiplication in 9 the frequency domain. So that's why you need to 10 know is the HRTF that's being referred to either 11 time domain or frequency domain, which domain does 12 it lie in. Because I either do this frequency 13 multiplication, or I do a multiply and add, a longer 14 calculation on the other side. 15 Q Okay. So the HRIRs are also -- like FIT 16 [sic]? Is that acronym, finite impulse -- 17 A FIR? 18 Q Oh, FIR. 19 A Yeah, finite impulse response. That's 20 usually the -- what it can be referred to as. Like, 21 in -- HRIR is an impulse response in the 3D audio 22 community, but in the digital signal community it's 23 an impulse response -- it's a type of impulse 24 response. So HRIR is a special type of impulse 25 response. You know, we can have all kinds of
158 1 A No. It's more like white noise. Because 2 it's like a -- it's like a low frequency kind of 3 sound. Like, it's very deep like (making noise). 4 Like, it's a low -- low-frequency sound, a sound 5 that we would think of as being an impulse. It 6 covers all frequencies at once. So it's like -- 7 yeah. So -- 8 Q What's an HRIR? 9 A An HRIR is a head-related impulse response. 10 Q And what's an example of a head-related 11 impulse response? 12 A A head-related impulse response is the 13 inverse -- is the inverse Fourier transform of the 14 HRTF. So we talked earlier about knowing whether or 15 not the HRTF is in the time domain or in the 16 frequency domain. Sometimes, and as in this patent, 17 they're used interchangeably. But the time domain 18 representation of the HRTF is the HRIR, the 19 head-related impulse response, and they have two 20 different ways of dealing with them mathematically 21 in the software program. 22 Q How are they dealt with differently? 23 A So there's different math to convolve them 24 with a sound source. So they're both regarded as 25 HRTFs because you can use them within a larger	160 1 impulses responses in programming logic. 2 Q What's an example of a finite impulse 3 response? 4 A I'm not sure how to answer that question 5 because it's a digital signal. Like, other than 6 drawing what it would look like, it's hard to -- but 7 it's -- if I were to depict it drawing, it is a flat 8 signal and it has a -- it spikes. It has basically 9 this onset where it spikes. It'll do some little 10 bit of bouncing around, and then it just smooths out 11 at the end. 12 So it's like -- almost like if you've ever 13 seen on a -- like at a doctor's office where they do 14 the EEG sort of graph and it has these random 15 spikes, the spikes for an impulse response look like 16 that. They resemble it visually. 17 Q Okay. What about an infinite impulse 18 response? 19 A An infinite impulse response is more so a 20 conceptual sort of thing. So, you know how with an 21 integral -- integral integrates from zero to 22 infinity -- 23 THE COURT REPORTER: I'm sorry. Say 24 that -- say that again. Start over. You lost me. 25 THE WITNESS: An integral integrates from

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161 1 zero to infinity or sometimes negative infinity to 2 positive infinity. So the mathematical description 3 of an infinite impulse response, is that integral, 4 but of course we can't compute infinitely. So 5 that's why we use this finite impulse response. 6 Because the problem has to stop. The calculation 7 has to stop somewhere. 8 BY MR. ELLIOTT: 9 Q Gotcha. 10 MR. ELLIOTT: We ready to break for lunch? 11 MR. HENRY: Sure. 12 THE WITNESS: All right. 13 MR. ELLIOTT: Thanks, Dr. McMullen. 14 THE VIDEOGRAPHER: We are going off the 15 record. The time is 12:45 p.m. 16 (Whereupon, at 12:45 p.m., the 17 proceedings in the above-entitled matter were 18 recessed, to reconvene at 1:48 p.m., this same day.) 19 AFTERNOON SESSION 20 (1:48 p.m.) 21 THE VIDEOGRAPHER: We are going back on the 22 record. The time is 1:48 p.m. 23 CONTINUED EXAMINATION BY COUNSEL FOR PLAINTIFF 24 BY MR. ELLIOTT: 25 Q Welcome back, Dr. McMullen.	163 1 BY MR. ELLIOTT: 2 Q And looking at that highlighted section 3 again, do you think it's likely that this chip uses 4 HRTFs for the spatial audio? 5 MR. HENRY: Objection to form. Calls for 6 speculation. Asked and answered. 7 THE WITNESS: It could be doing anything. 8 I don't work there for Snapdragon. I -- they could 9 employ, as I've mentioned, a wide number of 10 techniques to create spatial audio. 11 BY MR. ELLIOTT: 12 Q What's -- do you know what a DSP is? 13 A I do. 14 Q What is a DSP? 15 A It is a digital signal processor. 16 Q What makes a DSP a DSP? 17 A A DSP, I mean, by definition what makes it 18 a DSP is that it's a specialized sort of processor. 19 DSPs mostly have their claim to fame because they've 20 been optimized to perform lots of different kinds of 21 mathematical functions. 22 So you'll see DSPs utilized in situations 23 where there are real time or complex or both, among 24 other things, types of calculations that need to 25 happen. Sometimes in real time, but DSPs are
162 1 Did you discuss your testimony with counsel 2 at all over lunch? 3 A No, I did not. 4 Q A couple of follow-up questions on 5 Exhibit 9. It's the Snapdragon 8 Gen 2 Mobile 6 Platform. 7 Can this Snapdragon chip perform the task 8 listed in the spec sheet or would the buyer need to 9 program it from scratch? 10 MR. HENRY: Objection to form. Calls for 11 speculation. 12 THE WITNESS: I wouldn't be able to know 13 without having the technology. 14 BY MR. ELLIOTT: 15 Q Would you think that the normal purchaser 16 would expect to have -- have to do any programming 17 of this when they purchased it? 18 MR. HENRY: Objection to form. Calls for 19 speculation. 20 THE WITNESS: Again, without having the 21 technology, without knowing the inner workings of 22 this platform that's just been shown to me today 23 that I wasn't able to provide opinion on prior to 24 this moment, it would be impossible for me to 25 determine with certainty.	164 1 specialized to perform certain operations, like 2 mathematical operations, quickly. 3 Q Are DSPs designed for handling just a 4 stream of video or a stream of audio data? 5 MR. HENRY: Objection to form. 6 THE WITNESS: So specialized DSPs, which 7 are a special form of general processors, they can 8 be, but they are often used in situations where 9 there are streams of digital data like audio, video, 10 graphics. Things like that. 11 BY MR. ELLIOTT: 12 Q Okay. If you would, turn to page 3, 13 paragraph 9 of Exhibit 2, and at the end of 14 paragraph 9, you indicate that these various claims 15 are indefinite. 16 Do you see where I'm at? 17 A One second. 18 Q Yeah. Sure. Take your time. 19 A There's a clip exactly where I need to 20 read. 21 Yes. 22 Q So at the bottom there, it says these 23 various claims are indefinite. Do you know if that 24 is a factual finding or a legal conclusion? 25 MR. HENRY: Objection to form.

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165 1 THE WITNESS: I think that this is -- can 2 you repeat the question? Is it a factual finding? 3 BY MR. ELLIOTT: 4 Q Yeah. 5 Is it a factual finding or a legal 6 conclusion? 7 A What does "factual finding" mean? 8 Q Well, I guess maybe I'll rephrase it to 9 say: Is this a technical opinion of yours, or is 10 this a legal conclusion? 11 A And what you mean by "legal conclusion" is? 12 Q A legal conclusion. 13 Do you not know what a legal conclusion is? 14 MR. HENRY: Objection to form. 15 Argumentative. 16 MR. ELLIOTT: No, I'm just asking if she 17 knows or not. 18 THE WITNESS: I can imagine that it is a 19 conclusion that the law has determined, but I guess 20 you asking if it is a fact or a legal conclusion, 21 are there times when legal conclusions aren't facts, 22 or what are we -- 23 BY MR. ELLIOTT: 24 Q It's -- believe it or not, it's rather a 25 confusing thing where you can have mixed questions,	167 1 Q Okay. 2 A This is where I learned what the actual 3 technical -- technical jargon or legalese for -- for 4 this means. 5 Q Did you check the file histories to see if 6 there are any Section 112 rejections of the patents? 7 A I did not see the file histories of that -- 8 or if I do, I don't recall what the actual rejection 9 may have been, but would you like to point our 10 attention to that? 11 Q Well, let me back -- back up. 12 Do you know what the file -- what I'm 13 referring to when I say "the file history"? 14 A I do know what you're referring to. 15 Q Okay. All right. So the question just is: 16 Did you search it to see if there were any Section 17 112 rejections that were made against the patent 18 applications? 19 A I did not search it specifically for that. 20 Q Do you know if any Section 112 rejections 21 were made? 22 A As I didn't see the -- that part of the 23 file history, I'm not aware of a rejection there. 24 Q Okay. Do you think that you or a patent 25 examiner would be more qualified to determine if
166 1 et cetera. 2 So as you sit here today, you don't know 3 whether it's a factual finding, a technical 4 conclusion, or a legal conclusion? 5 MR. HENRY: Objection to form. 6 Mischaracterizes Dr. McMullen's testimony. 7 THE WITNESS: I did not say I didn't know 8 whether or not it was one of those. I was asking 9 for clarification on the point. 10 What I can say is that at the bottom, where 11 it says that the claims are indefinite, that it is 12 indefinite under 35 U.S.C. 112, where it has to 13 provide a person with ordinary skill in the art, the 14 scope of the -- of the invention with reasonable 15 certainty. So this is one of the pieces of 16 indefiniteness. 17 So with that term, this is what I applied 18 to -- I believe it's paragraph 9 that we're 19 referring to. 20 BY MR. ELLIOTT: 21 Q Mm-hmm. Where did you first learn about 22 claims being potentially indefinite, that concept? 23 A I would say through my conversations with 24 the lawyers with whom I expressed my opinions about 25 the patents.	168 1 there's a Section 112 indefinite -- indefiniteness 2 issue with a claim? 3 MR. HENRY: Objection to form. 4 THE WITNESS: Do I think I or a patent 5 examiner would be more qualified? 6 BY MR. ELLIOTT: 7 Q Mm-hmm. 8 A What do you mean by "more qualified"? 9 Q Who would be better at it? 10 MR. HENRY: Objection to form. 11 THE WITNESS: I believe that I have the 12 requisite knowledge in this field that if we're 13 assuming a patent examiner is not a POSIT or a 14 person of skill in the art, I may have the requisite 15 knowledge to know more details about the 16 indefiniteness. 17 BY MR. ELLIOTT: 18 Q Can you explain to me the difference 19 between augmented reality and virtual reality? 20 A Absolutely. 21 Q Please. 22 A So I'll start with virtual reality. 23 Virtual reality is a technique by which a person is 24 given, usually, a piece of hardware that they wear 25 at or around their eyes. The viewer in this case is

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169 1 given two different pictures to their eyes, and our 2 magical brains combine the pictures to give us the 3 depiction of space and depth. 4 So even though the pictures are really 5 close on our eyes, it's very similar to the 6 fundamentals of 3D sound, where we mimic the way 7 that sound travels in the air. 3D -- 3D -- sorry. 8 Visual -- virtual reality mimics the way that our 9 eyes -- the angle that our eyes receive things that 10 are all around us so that we get that perception. 11 Virtual reality systems tend to allow you 12 to perceive an entire world. Sometimes they're 13 motion tracked so that when you turn your head, the 14 world moves with you. Sometimes they're not. So, 15 yeah, that's VR. You can write tons of VR 16 applications for various contexts. And augmented 17 reality -- also, VR can have -- it can be just 18 visual, or it can be purely visual and audio and any 19 combination. 20 Augmented reality involves also putting on, 21 usually, some sort of headset, and instead of the 22 outside world being occluded, as with virtual 23 reality, you're able to see through to the actual 24 world; however, holograms are projected into the 25 virtual space. The holograms may or may not	171 1 A Yes. 2 Q And where did that understanding come from? 3 A This also came from my experience with -- 4 with the lawyers as I formed my opinion. 5 Q Did you review any case law yourself? 6 A I did not. 7 Q Do you know if there's any case law that's 8 contrary to this principle of having to disclose an 9 algorithm? 10 A I'm aware that there are -- or let me -- 11 I'll backtrack. 12 Q Sure. 13 A I'll backtrack. 14 So you're asking -- can you repeat the 15 question again? 16 MR. ELLIOTT: Can you read it back, please, 17 Joan. 18 (The reporter read the record as 19 follows: 20 "QUESTION: Do you know if there's any 21 case law that's contrary to this 22 principle of having to disclose an 23 algorithm?") 24 THE WITNESS: I don't know of any that is 25 contrary.
170 1 interact with objects in the virtual -- in the 2 physical space as in the virtual space. 3 So, for example, there could be a window 4 that you need to close, so it could detect your 5 hands, which are in the virtual space, and allow you 6 to -- to close a window by detecting the position of 7 your hand and the -- the position where it believes 8 that it has rendered the -- the visual object. But 9 passthrough, holograms -- 10 Q Okay. Yeah. Thanks. 11 Referring to paragraph 44 of your 12 declaration, Exhibit 2, at the top of page 12, 13 you've got the statement: "...specification must 14 disclose an algorithm for performing a claimed 15 function..." 16 Do you see that? 17 A I'm sorry. Your voice was a little low 18 when you -- 19 Q Oh, I apologize. You're right. I ducked 20 down. 21 Paragraph 44 of Exhibit 2, your 22 declaration, at the top of page 12, it says: 23 "...the specification must disclose an algorithm for 24 performing a claimed function..." 25 Do you see where that's at?	172 1 BY MR. ELLIOTT: 2 Q Do you know what items have qualified as 3 algorithms in case law? 4 MR. HENRY: Objection to form. Calls for 5 speculation. Witness is not an attorney. 6 THE WITNESS: As I said, I didn't study 7 case law. I'm a researcher. So -- 8 BY MR. ELLIOTT: 9 Q No. That's fair enough. 10 A Yeah. I do know what the definition of an 11 algorithm is. 12 Q Yeah, I'll bet you do. Far better than I 13 do as an engineer. Let's see. 14 Let's look at Exhibit 8, the '090 patent. 15 If you would, turn to column 17, please. 16 Column 17. Sorry. 17 A Okay. 18 Q Are there any algorithms listed in column 19 17? 20 MR. HENRY: Objection to form. 21 THE WITNESS: Column -- column 17 -- give 22 me one second to read the entire column. 23 BY MR. ELLIOTT: 24 Q Yeah. If you want to, that's fine. 25 MR. ELLIOTT: Could we go off the record

173 1 for a quick second while she's reading that. 2 THE VIDEOGRAPHER: Stand by. 3 We are going off the record. The time is 4 2:02 p.m. 5 (Recess.) 6 THE VIDEOGRAPHER: We are going back on the 7 record. The time is 2:03 p.m. 8 BY MR. ELLIOTT: 9 Q And I forgot to ask: Did you -- were you 10 able to look up the date that you actually started 11 to work with Meta? 12 A I was. 13 Q Yeah. And what date was that? 14 A So I am an aggressive inbox cleaner, but I 15 have a beginning email with them from 16 September 2022. 17 Q Okay. Thank you very much. 18 A Yeah. 19 Q So is there an algorithm in column 17 of 20 the '090 patent? 21 A There is not an algorithm. 22 Q What is -- is there an equation in column 23 17? 24 A Yes, there are equations in column 17. 25 Q And the first equation in column 17, about	175 1 It talks about the reverberation time. There would 2 be further -- further calculations that would need 3 to happen to take that reverberation time, actually 4 add it to the original signal in such a way that it 5 is perceived as the entire signal's reverberation. 6 This calculation only calculates the 7 reflection. It does not together add the reflection 8 into the original signal, which is how a person in 9 whole perceives reverberation. 10 Q And would a POSITA know to do that? 11 MR. HENRY: Objection to form. 12 THE WITNESS: It depends. 13 BY MR. ELLIOTT: 14 Q Are you a POSITA? 15 A I would consider myself to be a POSITA. 16 Q Actually, a little more than a POSITA? 17 A Sure. 18 Q I'll give that to you. 19 And obviously you know to do it, correct? 20 A Yes. 21 Q Would the person that you've defined as a 22 POSITA with the four-year degree and two years of 23 experience know to do that? 24 MR. HENRY: Objection to form. 25 THE WITNESS: Again, it depends. Not all
174 1 line 33, what's that equation for? 2 A This one appears to be Sabine's equation, 3 S-A-B-I-N-E, for reverberation in a virtual room -- 4 Q And -- 5 A -- or actual or virtual room. 6 Q And why is that not an algorithm? 7 A It is a calculation and not an algorithm 8 because, one, the -- the calculation doesn't 9 describe what the actual software needs to do. It 10 describes the math, but this exists within a larger 11 context of -- of other calculations within the 12 system because this is just -- and I'll add this is 13 the reverberation time. 14 The reverberation time needs to be added 15 back into the original signal, and there's no 16 calculation for that here, and there's no 17 description of that here. 18 Q Reverberation was one of the items you 19 listed as was missing from the structure of some of 20 the claims or the flow diagrams -- pardon me -- is 21 that correct? 22 A Correct. 23 Q And so does this equation provide structure 24 to -- to a person of ordinary skill? Sorry. 25 A It does not provide sufficient structure.	176 1 virtual environments need reverberation. For 2 example, in some situations, reverberation actually 3 makes the sound source unintelligible. So let's say 4 that we have someone who's a POSITA and they work 5 in, let's say, the Air Force Research Lab, and 6 they're in charge of spatializing the voices of 7 people. This is an example of a POSITA who may not 8 be trained to do reverberation because we don't 9 reverberate voices because it adds -- it makes the 10 signal unintelligible. 11 So, as I said, it's hard to determine if a 12 POSITA would -- what they would hypothetically know 13 because this may or may not be something that they 14 employ in their work. So it is context dependent. 15 BY MR. ELLIOTT: 16 Q Would a POSITA that is dealing with virtual 17 reality, including both visual and audio, know to 18 perform that function back into the time? 19 A Would they know to perform it? 20 Q Mm-hmm. Would they know that it needs to 21 be done? 22 MR. HENRY: Objection to form. 23 THE WITNESS: Again, hypothetical person, 24 hypothetical knowledge, if -- reverberation is a 25 context-by-context, preference-by-preference

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177 1 implementation. 2 BY MR. ELLIOTT: 3 Q If you would, Doctor, look at column 18. 4 A Okay. 5 Q Are there any algorithms in column 18? 6 A There are not any algorithms in column 18. 7 Q Are there equations in column 18? 8 A Yes. Column 18 contains several equations. 9 Q And starting with the equation in column 5 10 [sic], why is that not an algorithm? 11 A Because column 5 -- sorry -- column 18, 12 line 5-ish is not an algorithm because it only gives 13 you the equation for -- for calculating the 14 intensity level and how to change it. It's not -- 15 it doesn't give you how you would actually do this 16 to a signal. 17 Also, this intensity -- dB, as you know, is 18 a relative scale, so it's hard -- it's like a 19 conceptualization of how this would need to change. 20 So the intensity level of the sound, yes, it is 21 described by 10 log 10, this whole thing here; 22 however, without knowledge of the reference sound, 23 it's impossible to construct an algorithm that can 24 reliably attenuate sounds like this. 25 Q And what's the definition of an algorithm	179 1 at about 28. Is that an algorithm? 2 A Again, it's not an algorithm. 3 Q And the reason why? 4 A Similar to the previous reasons. 5 Q And there's an equation at line 35-ish. Is 6 that equation an algorithm? 7 A It is not an algorithm. 8 Q And the reason why it's not an algorithm? 9 A For similar reasons as cited for the 10 previous equations. 11 Q Okay. Let's run column 19 and column 20 12 together. 13 A Okay. 14 Q And the question that I'll put out while 15 reviewing it is whether there are any algorithms 16 disclosed within columns 19 and 20. 17 A Give me a second to read it. 18 Okay. 19 Q Are there any algorithms disclosed in 20 columns 19 and 20? 21 A There are not algorithms disclosed in 19 22 and 20. 23 Q Looks like there are four equations 24 expressed. 25 Do you see those?
178 1 again? 2 A Algorithm -- algorithm has a few different 3 requirements, some of which include finite series of 4 steps that are unambiguous, that result in a 5 conclusion or finite end. I think those are the -- 6 some of the pieces of the algorithm definition 7 and -- yeah. 8 Q There's another equation at line 10 9 approximately? 10 A Yes. 11 Q Is that an algorithm? 12 A This is not an algorithm. 13 Q And why is it not an algorithm? 14 A For the same reasons mentioned for the -- 15 the equation by line 5. 16 Q Okay. And then there's an equation about 17 17, the AT, or tau. 18 Do you see that one? 19 A Yes. 20 Q Is that equation an algorithm? 21 A It is not an algorithm. 22 Q And why not? 23 A The same reasons given for the previous 24 two. 25 Q And then there's a spherical wave equation	180 1 A Yes. 2 Q At the risk of drawing a compound 3 objection, is -- are any of those equations 4 algorithms? 5 A All of these are calculations and not 6 algorithms. 7 Q And why is that? 8 A They're calculations that don't provide the 9 steps by which these calculations need to occur. 10 Yes, mathematical operations do happen in a 11 prescribed order; however, for example with the 12 sound attenuation metric here, that sound -- let's 13 go with the sound attenuation equation. 14 This is an equation that talks about the 15 theoretical method, and all of these are how things 16 happen theoretically, but there's not an actual 17 step-by-step sequence how to determine all of these 18 and how it would be carried out in the code. 19 Q And the attenuation equation you're 20 referring to, that's at column 19, about line 21 53-ish? 22 A Correct. 23 Q Okay. So looking at page 15 of your 24 report, claim 15 of what I believe to be the '090 25 patent is reproduced there.

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181 1 Do you see that? 2 A Yes, I do see it. 3 Q And can you give me the definition of an 4 electric -- excuse me -- an electronic phone call? 5 MR. HENRY: Objection to form. Calls for a 6 legal conclusion. 7 THE WITNESS: An electronic call, I believe 8 we -- I don't have a formal definition for 9 electronic call. 10 BY MR. ELLIOTT: 11 Q We explored this a little bit earlier when 12 we had our conversation about the Apple Watch. 13 Would a radio call, communication over 14 two-way radio, would that be an electronic call? 15 A Without knowing the inner workings of the 16 wave radio without the -- the -- I would need to 17 take a look at the technical specs. 18 Q Of the radio itself? 19 A Yeah, to determine how the actual sounds 20 are being transmitted from one person to another. 21 Q Would the difference between an electronic 22 call and a nonelectronic call, again, be whether 23 it's digital or analog? 24 A That could be one distinction. 25 Q What would be another distinction?	183 1 Q Okay. Is there a difference between an 2 electronic call and an electronic phone call? 3 A Absolutely. 4 Q And what difference would that be? 5 A Well, electronic call seems to be a super 6 class, and electronic phone call, the word "phone" 7 is a modifier there, where it is an electronic call 8 that uses a phone. 9 Q And what phones can complete electronic 10 calls? 11 A Can you be more specific with your 12 question? 13 Q Well, we're saying that it's an electronic 14 call that uses a phone when we say "electronic phone 15 call," and so I'm just wondering what types of phone 16 that are available -- all the way from, if you will, 17 two cans and a string out to our modern day mobile 18 devices -- would be able to make an electronic phone 19 call? 20 MR. HENRY: Objection to form. 21 THE WITNESS: Without exhaustively naming 22 every type of cell phone or digital phone 23 technology, it's impossible to say all of the types 24 of phones. 25 BY MR. ELLIOTT:
182 1 MR. HENRY: Objection to form. Asked and 2 answered. 3 THE WITNESS: That could be one distinction 4 of a prepared -- other distinctions for the 5 electronic call. 6 BY MR. ELLIOTT: 7 Q Okay. So pardon me. I'm confused. 8 Are there other distinctions between an 9 electronic and a nonelectronic call? 10 MR. HENRY: Asked and answered. Objection 11 to form. 12 THE WITNESS: It's possible. 13 BY MR. ELLIOTT: 14 Q Do you know what they would be? 15 A Currently, at this moment, I haven't done a 16 deep dive into electric versus nonelectric calls. 17 When we spoke about this earlier, I gave a 18 colloquial response to that, but without having some 19 sort of technical definition, I'm not inclined to 20 guess. 21 Q What about a call over a CB radio? Would 22 that be an electronic call? 23 A I would offer the same conclusion as the 24 previous. I -- that's not a piece of technology 25 that I readily use. So I'm not inclined to guess.	184 1 Q Mm-hmm. But, generally, cell phones would 2 be capable of making an electronic phone call? 3 A I would consider cell phones being able to 4 create electronic phone calls. 5 Q Can a cell phone record binaural sound? 6 A A cell phone is a very general term. Also, 7 I'm not a cell phone manufacturer. As you know, 8 binaural sounds need to have two microphones. 9 Usually, the binaural microphones need to be spaced 10 a distance that's about a head's width apart. 11 So a cell phone could be outfitted with two 12 microphones that recorded things. Whether or not 13 it's perceived as binaural sound, because, again, a 14 phone is smaller than a head, it would be very 15 difficult to -- to actually have the microphones and 16 the phone be the width of the head and record 17 binaural sound. So it just -- it depends. 18 I don't know every single phone and all the 19 capabilities and if -- but to my knowledge, I don't 20 know of any, but I'm -- again, it's impossible to 21 say. 22 Q Well, I could, I guess, USB another 23 microphone into it, and we could do it that way; is 24 that correct? 25 MR. HENRY: Objection to form.

185 1 THE WITNESS: I'm not aware of phones with 2 USB ports. 3 BY MR. ELLIOTT: 4 Q Do you know what a POSITA would consider a 5 phone call to be? 6 A A POSITA, again, someone who has these 7 degrees, we could expect them to know what a phone 8 is, and I would assume that they'd also posit it to 9 be the same definition that I gave. 10 Q Well, phone call, it could mean many 11 things, right? 12 A Yeah. 13 Q And what do you think the POSITA would 14 consider to be a phone? 15 A A POSITA would consider a phone a device 16 through which two people can speak into, listen 17 from, and hear each other over some sort of medium: 18 network, et cetera. 19 Q If I call into my bank and I push the 20 numbers interacting with the synthesized voice, 21 would you consider that a telephone call? 22 A If you call into your bank and press the 23 numbers? 24 Q Yeah. I'm just interacting with the 25 automated attendant.	187 1 So if I use a telephone to call into a Zoom 2 or similar computer program while the other parties 3 are participating over their computer, would the 4 POSITA be able to distinguish which of the three 5 terms applies to that particular call? 6 MR. HENRY: Objection to form. 7 THE WITNESS: So you're asking if the 8 POSITA would be able to distinguish if the call 9 coming in over Zoom to the people who are on Zoom, 10 would they be able to distinguish if it is an 11 electronic call, electronic phone call, or a phone 12 call? 13 BY MR. ELLIOTT: 14 Q Telephone call. 15 A Telephone call. 16 Q You got it. 17 A One is we haven't qualified what you're 18 calling in on. You just said call into a Zoom call. 19 Q What if I'm calling in on an analog device? 20 MR. HENRY: Objection to form. 21 THE WITNESS: I believe a POSITA would 22 likely be able to -- to determine the difference 23 between these. 24 BY MR. ELLIOTT: 25 Q Do you know what he would call it, which
186 1 A On the surface, communication has happened, 2 be it between -- but, no. It's -- I have to think 3 about that a bit because also we don't have the 4 dictionary definition of a call and if it strictly 5 requires two people or -- but in the colloquial 6 sense of the word "call," yes, you did make -- you 7 pressed the buttons on your phone to ring another 8 entity. 9 Q Okay. If you use a telephone to call into 10 a Zoom or similar computer program where the other 11 party's participating over a computer, would the 12 POSITA be able to distinguish, you know, which one 13 of those three terms that are used in the patent 14 claims apply? And those three terms are electronic 15 call, electronic phone call, and then telephone 16 call. 17 MR. HENRY: Objection to form. 18 THE WITNESS: Can you simplify your 19 question? 20 BY MR. ELLIOTT: 21 Q Well, I don't know that I can simplify it, 22 but let's take it in reverse order where, you know, 23 the three potential terms -- or the three terms in 24 the claims are electronic call, electronic phone 25 call, and telephone call.	188 1 one of the three? 2 MR. HENRY: Objection to form. Ambiguous. 3 THE WITNESS: You haven't stipulated 4 what -- they'd be able to distinguish between the 5 three. They would call it what each of them were 6 correctly. 7 BY MR. ELLIOTT: 8 Q So they would use multiple terms to 9 describe the event? 10 A No. 11 MR. HENRY: Objection to form. Ambiguous. 12 THE WITNESS: They would not use multiple 13 terms to describe the same event. They would be 14 able to distinguish which event was occurring 15 depending on, in this hypothetical situation, which 16 type of call was occurring. 17 BY MR. ELLIOTT: 18 Q And if one of the callers -- everybody's on 19 the computer except for one of the callers, and the 20 one caller is calling in on an analog phone -- old 21 Ma Bell hanging on the wall in the kitchen, 22 right? -- what name would the POSITA assign to it? 23 MR. HENRY: Objection to form. 24 THE WITNESS: Typically, we would regard 25 this as -- as a telephone call. It is one type of

189 1 telephone call. 2 BY MR. ELLIOTT: 3 Q Let me go ahead and point you to paragraph 4 148 of your declaration, Exhibit 2 for our 5 deposition today. 6 There in paragraph 148 I believe you state 7 that the claims do not provide a definition for what 8 away from and approximate -- excuse me. Let me 9 start that over. 10 Your paragraph 148 says that: "...the 11 claims do not provide a definition for what 'away 12 from and proximate to' means; is that correct? 13 A That's correct. 14 Q Is it necessary that the claim provide the 15 definition? 16 MR. HENRY: Objection to form. 17 THE WITNESS: The term "away from 18 and proximate to" should be unambiguous. So away 19 from and proximate to do not provide that. A person 20 of skill in the art would not know what was being 21 claimed here in this patent. 22 BY MR. ELLIOTT: 23 Q What does away from mean to you? 24 A Away from, the conventional meaning, not 25 the dictionary definition, is something being apart	191 1 people -- because, again, HRTFs vary for every 2 person. 3 So if I'm listening over an HRTF or with 4 audio that's been created using an HRTF and other 5 things and it has not been individualized for me or 6 it's something that I'm not exactly -- just it 7 doesn't jibe with me. My brain doesn't interpret it 8 that way if that happens, then you may hear the 9 sound inside of your head. So those are -- those 10 are examples. 11 Q Just a curiosity question: A person that's 12 deaf in one ear, would they be able to perceive an 13 SLP as being outside of their head? 14 A I am unable to speculate for a deaf person. 15 I would assume that having -- and, actually, I'm -- 16 it's -- I can't speculate for a deaf person. I have 17 had a person who was hard of hearing in one ear to 18 use the technology, and they did have some 19 externalization cues for some locations and not for 20 others. 21 But, again, not having been in that 22 position, I'm not in a place to say what a person -- 23 and we also haven't said what degree of deafness 24 they have in that ear. So I'm not in a place to 25 say, one way or another, what they're able to hear.
190 1 from a person. 2 Q So are -- 3 A Some distance. Without using the 4 word "away," but some distance apart from a person. 5 Q Are SLPs ever positioned inside of the 6 listener's head? 7 A They can be. 8 Q When would you do that? 9 A So that's another fun question with 10 perception. So as we went into in Exhibit 6 -- yes, 11 Exhibit 6 -- the subjective selection procedure, if 12 we -- if you look at Figure 1, the experiment that's 13 described in Figure 1, this is an experiment where 14 we localized a sound inside of a person's head for 15 reference -- 16 Q Mm-hmm. 17 A -- and then they're able to compare that to 18 other sounds to determine whether or not they hear 19 the sound coming outside of their head. 20 In addition, remember, sound perception is 21 a subjective experience. Just because I rendered a 22 sound using all of these fancy techniques that we've 23 talked about today, that doesn't mean that someone 24 actually hears the sound as coming from outside of 25 their head. Like, there are a good section of	192 1 Q Does it change any if I say they're totally 2 deaf in one ear? 3 A Again, I'm not a person who has ever 4 experienced deafness, so I would not be able -- I 5 can -- I can guess, but I'm not inclined to guess. 6 Q Have you ever tried to capture HRTFs on a 7 person that's deaf in one ear? 8 A A person who's deaf in one ear still has 9 ears. So the HRTFs would still be accurate for 10 them; however, they would not be able to -- they may 11 not be able to hear the cues as measured if rendered 12 using the specialized system. 13 I have not captured the HRTFs, to my 14 knowledge, of anyone who was deaf in one ear. 15 Typically, HRTFs are captured in a laboratory 16 setting or a very clinical environment, and we're 17 generally doing hearing tests there, and one of the 18 screening criteria is that you have to have normal 19 hearing. So -- 20 Q Okay. 21 A -- or hearing above a certain threshold. 22 So not -- not to my knowledge. I've not calculated 23 or measured the HRTF of a person with a degree of 24 deafness that didn't fall -- that fell below our -- 25 our criteria.

193 1 Q Okay. So in the context of spatial audio, 2 could away from mean outside the head of the 3 listener? 4 MR. HENRY: Objection to form. 5 THE WITNESS: In the context of spatial 6 audio, away from, using the typical definition, 7 could mean away from, like, outside of the head of 8 the person, yes. 9 BY MR. ELLIOTT: 10 Q Okay. Sure. 11 Now, if you look at column 4 of Exhibit 8, 12 the '090 patent, lines 38 through 41, it refers to 13 the term "proximate," and says: "... (such as in a 14 same room)..." 15 Do you see that? 16 A Which line are you referring to? 17 Q 38. It's the paragraph beginning with: 18 "Further yet..." 19 A Yes, I see it. 20 Q And it says, basically: "...proximate to 21 the listener (such as in a same room)..." 22 Do you see that as well? 23 A Yes, I do see that. 24 Q So is that a definition of what proximate 25 is in the patent?	195 1 A Or sorry -- having an actual definition of 2 proximate. 3 Q Is he in the same room as I am? 4 A He is in the same room that you're in. 5 Q And is he away from me? 6 A I would say that he is away from you, but 7 also this is relative. Is this in the context of 8 normal definitions of proximate and away, or in the 9 context of the definitions as stated here -- or the 10 words as stated here and examples are given? 11 Q Well, isn't there an example of people 12 being 2 to 3 feet apart? 13 A There are a few examples. Away from has 14 been described as being 2 feet or 30 feet. 15 Q And that's not a definition of away from? 16 A 2 feet or 30 feet? 17 Q Well, is 2 feet a definition of away from? 18 A It's an example. 19 Q What would a definition of away from be? 20 A A definition of away from would include a 21 distinct boundary in some amount of measurable units 22 that a person would be able to distinguish as 23 readily away from or proximate to. There would be 24 some boundary. There is no upper and lower boundary 25 in this case.
194 1 A It is not a definition of the 2 word "proximate." It is an example, albeit 3 conflicting, but it is an example of a location that 4 is proximate, but it does not give any sort of 5 bounds or region that we can regard as proximate 6 versus not. 7 Q Is not the room a boundary? 8 A Well, by nature of a room, a room is a 9 natural boundary; however, there's also a part that 10 says proximate can mean several kilometers away. So 11 if you have a room that's 7 kilometers wide, you 12 know, this is a conf- -- confusing example. 13 Q Well, do the claims -- there in the spec 14 where we're talking about it, it says: "...far away 15 from the listener..." 16 Do any of the claims use the term "far 17 away," or just "away from"? 18 A I would need to double check. 19 I do not observe a place where I see "far 20 away from." 21 Q So my colleague sitting next to me here, 22 Mr. Dunn, is he proximate to me? 23 A It's impossible to know without having an 24 actual example. 25 Q Is --	196 1 Q So what you're saying is it's not a 2 definition unless it basically says there's a 3 minimum of 2 feet of space between them? 4 MR. HENRY: Objection to form. 5 Mischaracterizes Dr. McMullen's testimony. 6 THE WITNESS: That's not what I'm saying. 7 I'm saying -- 8 BY MR. ELLIOTT: 9 Q And that's okay. I'm just asking for 10 clarification. I'm not trying to mischaracterize 11 anything, obviously. 12 MR. HENRY: Same objections. 13 THE WITNESS: I'm saying that any numbers 14 need to be given with units to tell what the upper 15 and lower boundary are, not just examples of numbers 16 that are not -- they're not given. 17 BY MR. ELLIOTT: 18 Q So would the patentee have to say the 19 definition of "away from" is 2 to 3 feet? 20 MR. HENRY: Objection to form. 21 THE WITNESS: The patentee would need to 22 provide a certain boundary region that was not 23 ambiguous. 24 BY MR. ELLIOTT: 25 Q Can you give me an exemplary boundary

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197 1 region for away from? 2 A An exemplary boundary region would say the 3 term "away from" refers to a sound that is within X 4 feet and as far as Y feet, or something that's like 5 it's between X and Y feet away from the listener, 6 where X and Y are the numbers that they imagine are 7 away from the listener. 8 Q Could there be different values of X and Y 9 within the definition? 10 A A definition is supposed to be pretty 11 concise and definitive. So if there's different 12 numbers, then that makes the definition not 13 reliable. 14 Q Can there be different embodiments that 15 would have different boundaries for the definition 16 of "away from"? 17 MR. HENRY: Objection to form. 18 THE WITNESS: In this case, it seems as 19 though the patentee has defined their own 20 terminology that, again, isn't terminology that 21 anyone who does 3D sound research uses. So as 22 they've defined their own meaning here, anyone can 23 define anything to mean anything. 24 So, yes, you could define it to mean 25 different things, but the meaning is not standard	199 1 MR. HENRY: Objection to form. Calls for 2 speculation. 3 THE WITNESS: Depends on the size of the 4 room. Depends on lots of different factors in that 5 hypothetical scenario. 6 BY MR. ELLIOTT: 7 Q Is it about 12 feet where people kind of 8 start to feel the need to start raising their voice? 9 MR. HENRY: Objection to form. Calls for 10 speculation. 11 THE WITNESS: Again, I can't give you 12 hypothetical information about how a hypothetical 13 person feels about whether or not they should raise 14 their voice. 15 BY MR. ELLIOTT: 16 Q There's nothing in just a standard accepted 17 practice and distance in audiology that, you know, 18 you observe when people typically feel the need to 19 raise their voice? 20 A I would say that I'm not aware of any 21 literature because, again, I -- my work is not in 22 voice and voice perception. That's actually a 23 different field. We deal with the creation, you 24 know, of audio. 25 So if there is an audio perception piece of
198 1 across all of the different contexts. 2 BY MR. ELLIOTT: 3 Q Envision with me, if you will, a low 4 background noise environment. Typically, how many 5 feet apart do two people converse with one another 6 using a normal voice level? 7 A A low -- 8 MR. HENRY: Objection to form. 9 THE WITNESS: So you said, "a low 10 background noise environment." We haven't qualified 11 what low is. Can you continue the rest? 12 BY MR. ELLIOTT: 13 Q How -- how far apart are two people that 14 converse with one another in a normal voice? And 15 let's just consider current right here. We can hear 16 the HVAC. We'll call this our low background noise 17 environment. 18 MR. HENRY: Objection to form. 19 THE WITNESS: There can be any amount of 20 distance that people are comfortable conversing with 21 each other. 22 BY MR. ELLIOTT: 23 Q Well, eventually you reach a distance where 24 I feel a need to start raising my voice. Is that 25 true?	200 1 literature, I'm not aware of it because it's not 2 something that we standardly use in this area of 3 work to figure out -- because this is an audio 4 perception question that you're asking, not an audio 5 signal processing question. 6 Q If you and I are 12 feet apart in this 7 room, am I going to raise my voice to be more 8 clearly understood as if we are right now, 4 or 5 9 feet apart -- 5 feet apart? 10 MR. HENRY: Objection to form. Calls for 11 speculation. 12 THE WITNESS: I don't know what you'd be 13 inclined to do if we were 12 feet apart. I can't 14 speculate. 15 BY MR. ELLIOTT: 16 Q We touched a little bit earlier on HRTFs 17 and HRIRs, right? 18 A Mm-hmm. I'm sorry. Yes. 19 Q Let me kind of set up a room and ask some 20 questions about it. 21 So -- and I always have to -- I always have 22 to pause before I pronounce this word. Anechoic, 23 have I got it? The chamber that you record sound 24 in? 25 A Anechoic.

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201 1 Q Anechoic. Thank you. Hopefully, one day 2 I'll be able to do that without ever thinking about 3 it. Anechoic. 4 So consider a large anechoic chamber, 20 by 5 20 by 20, if I put a microphone in each entrance of 6 the ear canals of a human sitting in the middle and 7 put a loudspeaker 2 meters directly to the left side 8 and produce a measurement signal, somewhere between 9 350 hertz, 16 kilohertz, and make two-channel 10 digital recording -- 11 THE COURT REPORTER: I'm sorry. You lost 12 me. Can you slow down a bit? I'm sorry. 13 MR. ELLIOTT: I'm sorry. I just started to 14 realize I was going too fast. 15 BY MR. ELLIOTT: 16 Q -- so the signal being somewhere between 17 350 hertz to 16 kilohertz and make a two-channel 18 digital recording of the output, what would you call 19 the resulting measured signal in the recording? 20 A Well, number one, this is missing a lot of 21 information. You said you would play a signal 22 that's between -- and what were the -- what was the 23 frequency range that you gave. 24 Q 350 hertz to 16 kilohertz. 25 A So a signal -- can you explain what you	203 1 What would you call the resulting 2 measured -- measured signal in the recording? 3 MR. HENRY: Objection to form. 4 THE WITNESS: So what would I call it, or 5 what is it typically regarded as in the -- 6 BY MR. ELLIOTT: 7 Q Sure. Yeah. 8 What is it typically regarded as? 9 A -- literature? 10 A person of skill in the art would not 11 regard it as anything because, as you specified, it 12 is a 1 kilohertz sound, and the measurement sound 13 actually needs to contain a wide bandwidth. So you 14 specified that it's only 1 kilohertz tone. So it 15 would need to have -- it would actually need to be 16 an excitation signal or measurement signal that went 17 preferably from 20 hertz to 20 kilohertz or some 18 loud -- louder range. 19 So recording a sine wave doesn't help us 20 with anything. 21 Q Okay. 22 A You're not able to create an HRTF using 23 that. It's because of phase differences. With a 24 cycle, it's impossible to tell the timing difference 25 between the two ears because they have peaks.
202 1 mean by the signal is between there? 2 Q Well, so the signal is in the range of 350 3 hertz to 16 kilohertz? 4 A So does the signal contain all of the 5 frequencies between there, or is it one -- is one 6 frequency contained in the signal? 7 Q Let's just go with one frequency. 8 Somewhere in that range. 9 A Okay. So now we know what the sound is. 10 Let's just say -- we'll pick 1k, 1 kilohertz for 11 simplicity's sake, and usually we refer to them as 12 sine waves when we know there's only one frequency. 13 So 1 kilohertz sine wave, perfect. That is the 14 measurement signal. There's a few pieces missing. 15 The person's in the room, 20 by 20, they have -- 16 sorry -- they have their headphones on. We're 17 playing 1 kilohertz sound -- can you please repeat 18 all the premise of your -- 19 Q Yeah. 20 A Yes. 21 Q Putting a loudspeaker 2 meters directly to 22 their left side and produce the measurement, the 1 23 kilohertz measurement signal, and the other piece of 24 this is make a two-channel digital recording of the 25 output.	204 1 There's a time when the sound can wrap around the 2 ear and they have same -- they have similar peaks. 3 So actually localizing or creating an HRTF 4 using a measurement signal that is only one 5 frequency, we wouldn't regard it as anything. We'd 6 regard it as an error so, yeah. 7 Q So -- so let's introduce the band then that 8 you proposed, the 20 to 20k kilohertz. What does 9 that mean, that the measured signal would be called? 10 MR. HENRY: Objection to form. 11 THE WITNESS: The measured signal in -- in 12 an HRTF procedure, it would be the measured signal. 13 It's a signal that would need some clean up to 14 now -- to determine, you know, what its HRTF -- 15 corresponding HRTF would be for that location. But 16 it is a measurement signal to -- it's exactly what 17 you called it, a measurement signal from two ears at 18 the ear canal of a listener in an anechoic 19 20-by-20-by-20 room. 20 BY MR. ELLIOTT: 21 Q So in this situation -- and help me if I'm 22 misunderstanding what the HRIR is. 23 A Mm-hmm. 24 Q Would this be an HRIR? 25 A No.

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205 1 Q Okay. Why wouldn't it be an HRIR? 2 A The HRIR is an impulse response. You 3 suggested a sound that has a bandwidth of 20 to 20. 4 We also haven't even qualified what the sound is. 5 So by definition, it's not an impulse response. We 6 haven't qualified what that sound is. We just know 7 its bandwidth. 8 Q I believe I called it a measurement signal. 9 Is there anything different between a measurement 10 signal and a sound? 11 A Yes. 12 Q Okay. Yeah. 13 So this -- what we're producing here out of 14 the loudspeaker 2 meters directly to the left side 15 is a measurement signal from the 20 hertz to the 16 20,000 kilohertz. So is that change what we would 17 call the resulting measured signal? 18 A Yes. 19 MR. HENRY: Objection to form. 20 THE WITNESS: Sorry. 21 Yes. 22 BY MR. ELLIOTT: 23 Q And what would that change it to? 24 A It depends on what the measurement signal 25 is that determines what we call it.	207 1 Golay codes at the ear that have some amount of 2 difference between the two ears. There's further 3 processing that needs to happen in order to turn it 4 into an HRIR or an HRTF. 5 We talked about there being a frequency 6 domain and a time domain. So all of these signals 7 are created -- or measured, rather, on the time 8 domain. So what would happen is you could do a 9 frequency domain transformation called a fast 10 Fourier, F-O-U-R-I-E-R, fast Fourier transform, and 11 that would convert it to -- to the frequency domain 12 so that it could -- it could be used that way. 13 Q Thanks for answering the next two 14 questions. 15 And for the noise, if the measurement 16 signal is noise, what would the resulting measured 17 signal be called then? 18 A Noise received at both ears as modified by 19 a person's head yet to be processed. 20 Q Okay. And what about the sine sweep, for a 21 measurement signal? 22 A Same. Same thing. 23 Q It would still be called a sine sweep? 24 A Well, it would be called a sine sweep 25 received at both ears yet to be processed.
206 1 Q Okay. And what are the different types of 2 measurement signals? 3 A I think we talked about these earlier, but 4 measurement signals usually have a broad frequency 5 range. One we called Golay codes that I talked 6 about earlier. Another you can play noise, just a 7 broad-spectrum noise. Another is doing -- 8 performing a sine sweep, which is basically playing 9 all of the frequencies in the bandwidth one after 10 another and sort of in escalating or de-escalating 11 manner or both, just to, you know, have a good -- 12 have a good depiction. 13 But those are different examples of 14 measurement signals. 15 Q Okay. 16 A Or you can also use impulse responses as 17 measurement signals, but that's not usually 18 performed. 19 Q Well, for the Golay codes -- I'm probably 20 saying that wrong. You know what I'm talking about? 21 A I know what you're talking about. 22 Q Thank you. 23 What would you call the resulting measured 24 signal for those? 25 A The Golay codes would just be the received	208 1 Q Now, if I've got two different binaural 2 HRTFs, what would you call the difference between 3 the two HRTFs? 4 MR. HENRY: Objection to form. 5 THE WITNESS: In what way are you asking 6 how they differ? 7 BY MR. ELLIOTT: 8 Q Well, maybe just cut to the chase on this 9 one. As far as the difference between HRTFs, would 10 I call that a spectral modification? 11 MR. HENRY: Objection to form. 12 THE WITNESS: I would not call it a 13 spectral modification. This HRTF itself does not 14 modify anything. 15 BY MR. ELLIOTT: 16 Q If I switch from the use of one HRTF in a 17 program to the use of a different HRTF in the 18 program, is that a spectral modification? 19 A On its surface, it would modify -- the 20 resulting sound's spectrum would be modified, but 21 it's not a spectral modification that the HRTF 22 created. The HRTF in conjunction with other signal 23 processing tools, such as we said, distance, 24 reverberation, et cetera, would also contribute in 25 that modification that the software program, the

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209 1 specialized program that's created, would need to do 2 in order to render that. 3 Q Mm-hmm. So now if I take the loudspeaker 4 and move it to 4 meters away instead of two, same 5 line. Does that -- does the spectral modification 6 change as a function of the frequency? 7 MR. HENRY: Objection to form. 8 THE WITNESS: Without actually performing 9 the measurement, and I don't have the measurement in 10 front of me or an HRTF database at -- measured at 11 those specific locations, I don't want to -- I'm not 12 inclined to guess. 13 Yes, the HRTFs will look different, but I 14 would not call that the HRTF spectral modification. 15 I would call that a difference in the -- the 16 mathematical representation of the transformation. 17 BY MR. ELLIOTT: 18 Q Here's another word you're going to have to 19 help me with pronouncing. What frequency range is 20 affected by the pinnae? 21 A Pinna, pinnae. 22 Q Okay. 23 A What frequency range? 24 Q Mm-hmm. 25 A So this is another highly contested sort	211 1 could mean different things. A function is 2 mathematical. A function is digital. Like 3 function's -- the word "function" itself has many 4 meanings. If you add the word "auditory" to it, 5 it's not a precise -- there isn't a precise way to 6 interpret what you're asking. 7 Q What's the definition of auditory? 8 A Generally speaking, the definition of 9 auditory means something along the lines of 10 pertaining to the ears or audition, but not like an 11 audition, the act of audition. 12 Q Yes. Helpful clarification. 13 Is auditory different from acoustical? 14 A I've not prepared an opinion on that. I 15 know they can sometimes be used interchangeably. I 16 would say they're not exactly the same. There may 17 be small differences that I'm not aware of. 18 Q Fair enough. I'm ready for a break if 19 everybody else is okay with that. 20 A Yeah, that's fine. 21 MR. ELLIOTT: Thank you. 22 THE VIDEOGRAPHER: Stand by. 23 We are going off the record. The time is 24 2:59 p.m. 25 (Recess.)
210 1 of -- sort of thing in 3D audio research. If you 2 look it up, you'll see various ranges specified. 3 But it is agreed that the pinna definitely help with 4 elevation cues, and elevation cues are known to rely 5 in the higher frequency range, generally 10k and 6 above, or you may see 12k and above mentioned. 7 Q Okay. What is an auditory function? 8 MR. HENRY: Objection to form. 9 THE WITNESS: Can you provide some context 10 for the term? 11 BY MR. ELLIOTT: 12 Q Well, within audiology. 13 A I'm sorry? 14 Q Within audiology. 15 So what's a -- so auditory function doesn't 16 give you enough to know what a definition is without 17 a context? 18 MR. HENRY: Objection to form. 19 THE WITNESS: I would say that auditory 20 function is a phrase that can be used in various 21 contexts and mean various things. So without the 22 context, I can't tell you what it means. 23 BY MR. ELLIOTT: 24 Q In the context of the patents? 25 A Also, in the context of the patents, it	212 1 THE VIDEOGRAPHER: We are going back on the 2 record. The time is 3:16 p.m. 3 BY MR. ELLIOTT: 4 Q Dr. McMullen, what's the primary acoustic 5 effect when a sound source moves into the distance? 6 A What do you mean by primary acoustic 7 factor? There's lots of different acoustic features 8 of a sound. So which acoustic feature are you 9 asking about? 10 Q Well, is there a main or primary one that 11 changes as the sound source moves into the distance? 12 A As the sound source moves into the 13 distance, there are many factors that change that 14 give us the cues that -- that something has changed 15 and moved into the distance, but without more 16 information, one would be inclined to -- to think 17 that -- attenuation is one. 18 Another is the spectral modification of the 19 actual -- or the spectral change, rather, of the 20 sounds as a function of distance, but without 21 knowing that distance, you know, it's -- it's hard 22 to really say. 23 Q What is attenuation? 24 A Attenuation is basically a sound losing 25 power or intensity as it moves further away from a

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213 1 person or from ears that can listen. 2 Q And so what's the spectral change? 3 A In attenuation? 4 Q Well, you mentioned two factors -- 5 A Oh, yeah. 6 Q -- attenuation and a spectral change. So I 7 think I've got a handle on attenuation. 8 What's spectral change? 9 A So spectral change is the amount to which 10 each frequency is attenuated. Because -- just 11 because a sound moves -- and we're just going to 12 assume, for the purposes of this hypothetical 13 question, that the sound is moving along a straight 14 line that lies on the same azimuth and at the same 15 elevation, you would say that that spectral change 16 is how various frequencies are attenuated at 17 different rates as the sound moves. 18 It's not an all-the-cross-the-board, you 19 know, equal movement. Sounds -- sound waves travel 20 at different speeds. So that would be the spectral 21 change that characterizes how -- from point A to 22 point B -- excuse me -- it would be modified. 23 Q So would a high-pitched sound be less 24 attenuated? 25 A A high-pitched sound would actually be more	215 1 A There's also Doppler, the Doppler effect. 2 Q Any others? 3 A There's also reverberation if a sound 4 moves. If it -- and also we haven't defined the 5 bounds of the sound. So if it is inside of a room, 6 if it's in free space, there could be reverberation 7 that is a factor as well. Because the reflections 8 at one point in this imaginary space would be 9 different than the reflections at a further point. 10 It may be moving closer to a wall and having a 11 quicker reverberation time. 12 Q Is there a primary acoustic cue to auditory 13 distance? 14 A Again, there are many cues. I would not 15 call one primary. 16 Q Okay. What are the cues to auditory 17 distance? 18 A The cues to auditory distance? That's not 19 a terminology that we typically use. Could you 20 rephrase what you mean by that? 21 Q Well, we as humans perceive how far away, 22 you know, a sound is. 23 A Mm-hmm. 24 Q What are the cues for me to perceive how 25 far away a sound is?
214 1 attenuated because high-pitched sound waves are 2 smaller, and low-pitched sound waves are larger. 3 One way to think about this is think about, like, a 4 movie theater, and you're in one theater and 5 someone's in another theater. You hear a loud -- 6 like, a really loud explosion or a boom. You kind 7 of feel the wall shake. 8 You hear those low, longitudinal -- you 9 know, just big waves, but you don't hear, like, a 10 high-pitched scream in the movie. You only hear the 11 really low things because they're much larger and 12 they can travel through media. Because the concept 13 of wavelength is how we determine pitch. 14 So a high-pitched sound means that it has a 15 very short wavelength. It's kind of 16 counterintuitive. High-pitched means a really small 17 wavelength because it oscillates many times per 18 second. And then a low-pitched sound does not 19 oscillate as often per second, so it's a very large 20 wave. So, no, a high-pitched sound would not be 21 more -- it would -- it would attenuate more, not 22 less. 23 Q Understood. 24 What other factors are there that change 25 when the sound source moves into a distance?	216 1 A So previously, in the previous example, we 2 had two sounds to compare. You know, there's sound 3 A at one distance and sound B at another distance, 4 and we could tell relative distance change. As 5 humans we're actually really bad at telling how far 6 things are away. 7 So in asking that question: What is the 8 primary cue for distance, there's actually research 9 that says we're -- we're really bad at it, and also 10 if you don't have any prior knowledge of the sound 11 and it's at a far distance, it's really also hard 12 to -- to characterize. So answering that question, 13 I -- I'm not quite sure how to answer that because 14 perceptually, we're not good -- we're not good 15 virtually and in real life. We don't make good 16 judgments of distance. 17 Q Is volume a cue for auditory distance, or 18 is that bound up with attenuation? 19 MR. HENRY: Objection to form. 20 THE WITNESS: So you asked is -- so, one, 21 auditory distance, we still haven't said what that 22 means because it's not a term that we typically use. 23 I'm assuming in my answers that what you mean by 24 auditory distance is judging the absolute distance 25 of an auditory object or sound. Is that correct?

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217 1 BY MR. ELLIOTT: 2 Q Yes. 3 A Okay. Again, attenuation is relative the 4 same way a lot of the equations that we spoke about 5 previously. You need two sounds in order to know 6 relative from one to the other if something 7 attenuated. If I hear a sound at a certain level 8 and I've never heard the sound before, I can't 9 purely use attenuation to judge how far away it is 10 because I'm not familiar with that sound. 11 Q Well, and my other question, I think, is: 12 Is volume part of attenuation or is that something 13 separate? 14 A Volume is the colloquial term or a change 15 in volume overall is how people would perceive 16 attenuation. Sometimes we call it intensity. 17 Power. Just depending on the -- the venue. 18 Q Here's another one of those legal 19 questions, so if you don't know, you don't know. 20 That's fine. 21 Are you aware of what the standards of 22 patentability are? 23 MR. HENRY: Objection to form. Calls for a 24 legal conclusion. 25 THE WITNESS: That is not part of my	219 1 included? 2 MR. HENRY: Objection to form. Calls for a 3 legal conclusion. 4 THE WITNESS: I'm not aware of what is 5 required, but I do know, just anecdotally, that 6 patents should provide claims that are clear and 7 don't contradict those. So for a person who is a 8 POSA in the art, there isn't a reasonable amount of 9 certainty of what that term would mean. 10 BY MR. ELLIOTT: 11 Q So in paragraph 159, also your declaration, 12 Exhibit 2, you cite a couple of dictionary 13 definitions there. 14 A Mm-hmm. 15 Q What do you know about the standard for use 16 of dictionary definitions to construe claim terms? 17 A Can you explain what you mean by the use of 18 the dictionary to construe? 19 Q Well, use of dictionary definitions. 20 You've got a couple of them used there. 21 A Yeah. So I know that there is a term 22 called plain and ordinary meaning. So the 23 dictionary could be helpful in determining the plain 24 and ordinary meaning of words that are -- that are 25 in claims.
218 1 prepared opinion today. 2 BY MR. ELLIOTT: 3 Q Okay. Have you ever heard the 4 terms "novelty" -- ever heard the term "novelty"? 5 A I have heard the term "novelty" and in 6 context to grants. So as professors we write 7 grants, and one of the criteria is novelty. So I 8 know of it in the grant-writing context and -- 9 Q Mm-hmm. What about non-obviousness? Do 10 you know that term as well from the grant writing? 11 A The term "non-obvious" is not used 12 typically in the grant-writing domain. The word 13 that may be used sometimes is incremental, but 14 non-obvious is not something that is typically used 15 in my line of work. 16 Q Okay. If I can take you in Exhibit 2, your 17 declaration -- 18 A Mm-hmm. 19 Q -- to paragraph 150. In the second 20 sentence of paragraph 150, it says: "The 21 specifications also fail to explain what distances 22 would not be 'away from and proximate to' a person." 23 Do you see that sentence? 24 A Yes, I see that sentence. 25 Q Are patents required to say what is not	220 1 Q Are dictionaries generally favored for 2 obtaining definitions of plain and ordinary meaning 3 or disfavored? 4 MR. HENRY: Objection to form. Calls for a 5 legal conclusion. 6 THE WITNESS: I would not have a way of 7 knowing that. 8 BY MR. ELLIOTT: 9 Q Also here you refer to a couple of synonyms 10 when you're trying to construe "away." Are synonyms 11 considered definitions? 12 MR. HENRY: Objection to form. 13 Mischaracterizes the document. 14 THE WITNESS: Synonyms are synonyms. 15 Definitions define. 16 BY MR. ELLIOTT: 17 Q In paragraph 164 -- we've come back to the 18 binaural voice. The definition of binaural voice 19 that you provide there, is that a definition that 20 you independently developed? 21 A Yes. 22 Q And independently developed those exact 23 words? 24 A These exact words were what my -- was my 25 opinion of what a binaural voice is, yes.

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221 1 Q And at the end of the phrase, it says you 2 just -- you understand defendants have proposed this 3 term to be interpreted. 4 Did defendants come up with this 5 independently of you? 6 MR. HENRY: Objection to form. Asked and 7 answered. 8 THE WITNESS: As I said, this is my opinion 9 of what the term "binaural voice" should mean. 10 BY MR. ELLIOTT: 11 Q Sure. 12 However, defendants have also adopted this 13 term. Did they derive it independently, or did they 14 derive it from you? 15 MR. HENRY: Objection to form. Asked and 16 answered. 17 THE WITNESS: Again, this is what I think 18 that -- and came up with how binaural voice should 19 be regarded in this context. 20 BY MR. ELLIOTT: 21 Q Well, was this -- was it just like a 22 pleasant surprise the first time you see this 23 definition exactly the same as yours coming from the 24 defendants? 25 MR. HENRY: Objection to form. Asked and	223 1 considered part of the written description of the 2 patent? Is that your -- 3 Q That's the question. You got it. 4 A -- question? 5 I would imagine that the abstract 6 summarizes the things inside of the patent. What do 7 you mean by "written description"? Is that a 8 technical term? 9 Q It is. 10 A Okay. 11 Q In fairness to you, yes. 12 A On the surface, the abstract seems to be a 13 summary of what's there, but not the actual 14 description. 15 Q Taking us back to -- we'll transition here 16 to our three terms of electronic call, electronic 17 phone call, and telephone call. 18 A Okay. 19 Q Did you look through the specification of 20 the '090 and the '628 patents to see if these three 21 terms were indeed used interchangeably to describe 22 the same call in any given situation? 23 MR. HENRY: Objection to form. Lacks 24 foundation. 25 THE WITNESS: While looking at the patent,
222 1 answered. 2 THE WITNESS: Again, this is -- this is my 3 opinion of how this term "a binaural voice" should 4 be defined, and it is my construction of the 5 definition. 6 BY MR. ELLIOTT: 7 Q That's not exactly the question. 8 The question is whether defendants, who 9 have also adopted this construction, received this 10 construction from you or if they independently 11 developed it themselves. 12 MR. HENRY: Objection to form. Asked and 13 answered. Incomplete hypothetical. Argumentative. 14 THE WITNESS: Again, this is -- this is not 15 something developed independent of me. 16 BY MR. ELLIOTT: 17 Q So did defendants adopt this before or 18 after you were involved? 19 A If it was adopted before I was involved, 20 then it would be independent of me. Of course it 21 was adopted after I was involved. 22 Q Okay. Do you know if the abstract is 23 considered part of the written description of a 24 patent? 25 A If the -- if the abstract of the patent is	224 1 I looked at all the places in which they were used. 2 I didn't go through it with that specific -- I went 3 through with that in mind, but maybe not as close 4 with that specific lens, to see if they were used 5 interchangeably. 6 BY MR. ELLIOTT: 7 Q If you can, go ahead and pick up Exhibit 8 8 for me again, please, Doctor. 9 A Okay. 10 Q It's the '090 patent. 11 A Yeah. 12 MR. ELLIOTT: Can we go off the record for 13 a quick second? I'd like a sidebar with Pat, 14 please. 15 MR. HENRY: Okay. 16 THE VIDEOGRAPHER: Stand by. 17 We are going off the record. The time is 18 3:32 p.m. 19 (Recess.) 20 THE VIDEOGRAPHER: We are going back on the 21 record. The time is 3:47 p.m. 22 BY MR. ELLIOTT: 23 Q If I can, Dr. McMullen, direct your 24 attention to paragraph 36 of Exhibit 2, your 25 declaration.

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225 1 A You said paragraph? 2 Q 36. 3 A 36. Thank you. 4 Q Please. 5 So there in paragraph 36 you provide the 6 principle of claim construction, and I'll just quote 7 it, that: "...you cannot interpret the claim term 8 such that it would make another part of the claim 9 meaningless." 10 Is that an accurate representation of 11 what's there? 12 A That is what it says. 13 Q Now, is this principle of claim 14 construction mandatory? 15 MR. HENRY: Objection to form. Calls for a 16 legal conclusion. 17 THE WITNESS: This is not an aspect of the 18 legal process or this process that would have -- it 19 seems it should be mandatory, but also I can't 20 speculate because it would call for a conclusion I 21 can't make. 22 BY MR. ELLIOTT: 23 Q Okay. Let me ask the question a little bit 24 differently. Probably get the same answer, which is 25 fine.	227 1 not say that they have the same meaning. One is a 2 special case of the other. The language here does 3 use them in a way that is intended, from my reading, 4 to refer to it as the -- the larger level of, you 5 know, a type of, you know, a telephone call that -- 6 something that encompasses all types of telephone 7 calls. 8 Q Mm-hmm. In the -- right after it says: 9 "...electronic telephone call," what does it refer 10 to both of the people in the call wearing? 11 A "People wear headphones with speakers and 12 microphones to capture and transmit binaural sound." 13 Q So is this specifically referring to an 14 electronic telephone call? 15 A In the sentence it says that they -- they 16 are engaging in an electronic telephone call, where 17 they both have on headphones, speakers, and 18 microphones. There is not a mention of the 19 telephone, but one could infer that they are using a 20 telephone because it's qualified -- instead of 21 saying electronic call, it said electronic telephone 22 call specifically here. 23 Q Isn't it also possible that they're simply 24 using these three terms interchangeably as generic 25 term for communication?
226 1 So is this principle of claim construction 2 mandatory, or is it a statement of preference for 3 claim construction? 4 MR. HENRY: Same objections. Asked and 5 answered. 6 THE WITNESS: Yeah, same -- like, this is 7 something that would require me to have a bit more 8 knowledge than -- than what I've been asked to 9 comment on. 10 BY MR. ELLIOTT: 11 Q Okay. Shifting to Exhibit 8, and if I can 12 direct your attention to column 11 and line 52, and 13 it starts the paragraph starting: "Consider an 14 example..." and it refers to there an electronic 15 telephone call. 16 A Mm-hmm. 17 Q Do you see that? 18 A I see that. 19 Q And then down below, it refers to it during 20 the telephone call. So is this an example where the 21 terms "electronic telephone call" and "telephone 22 call" are used to refer to the same call? 23 A Again, telephone call, the way I see it, is 24 an overarching term. An electronic telephone call 25 is a special case of a telephone call. So I would	228 1 MR. HENRY: Objection to form. Calls for 2 speculation. 3 THE WITNESS: I don't know what the writers 4 of this patent had in mind when they chose to use 5 three different words, and if they meant one word, 6 they could have just used one. They've chosen to 7 designate a difference between these. 8 BY MR. ELLIOTT: 9 Q Mm-hmm. In the example that's given there 10 in column 11 that carries over to column 12, is -- 11 is there a phone that anywhere appears in this 12 example? 13 A I'm going to read this long paragraph -- 14 Q Yeah. Yeah. 15 A -- so give me one second. 16 Q That's why I gave you the column 12 too, so 17 you know where to go to. 18 A So the word "telephone" is used here in -- 19 in this description that is at the end of column 11 20 going into column 12. When they say an "electronic 21 telephone call," telephone is used as the modifier 22 to specify what type of call is being made. 23 Q Mm-hmm. But it's not referring to there 24 being an actual telephone present; is that correct? 25 MR. HENRY: Objection to form.

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229 1 THE WITNESS: One would assume that if I 2 was making a telephone call, that I was using a 3 telephone. 4 BY MR. ELLIOTT: 5 Q But, again, up above, after it talks about 6 the electronic telephone call, it talks about two 7 parties engaged in it, and they wear headphones with 8 speakers and microphones. 9 So they're not using telephones, correct? 10 MR. HENRY: Objection to form. 11 THE WITNESS: There's no way to know that. 12 For example, through my laptop, I can put a 13 headphone -- a pair of headphones on with speakers 14 and microphone, and my MacBook can use my 15 telephone -- my iPhone telephone to create a call 16 with someone else. 17 So, again, without -- there are still ways 18 to still use that exact same technology with a 19 telephone in that case that I mentioned here. The 20 given hardware that's listed here isn't 21 sufficient to -- well, it could. The given hardware 22 here isn't the only thing that could be used. You 23 could also use a telephone to do this exact same 24 purpose. 25 BY MR. ELLIOTT:	231 1 where the next example picks up, I believe. 2 A I'm sorry. You said column 32 through 34? 3 Q Yeah. The -- at least the last part of 32 4 starting at, like, line 49, when it begins the 5 discussion of Figure 21. 6 A Okay. 7 Q Then through line 5 of column 34. So -- 8 and, thankfully, you are a very fast reader. And as 9 you read it, I'll give you kind of the general gist 10 of my question so you kind of know what you're 11 looking for. Hopefully, you won't have to redo it, 12 but if you do, that's obviously fine. 13 A As I'm reading? 14 Q What's that? No. I was going to give you 15 kind of what my question is so that as you're 16 reading it, you know what you're looking for, and 17 then you don't have to reread it after I give you 18 the question. 19 Does that make sense? 20 A That's fine. 21 Q So you'll see, at line 53, that it refers 22 to that they communicate during an electronic call. 23 A Line 53 of which column? 24 Q 32. 25 A Okay.
230 1 Q But, again, it's -- nowhere in this 2 language does it actually refer to an actual phone; 3 is that right? 4 MR. HENRY: Objection to form. Document 5 speaks for itself. Asked and answered. 6 THE WITNESS: Again, it says "electronic 7 telephone call." And we do know that you can use 8 headphones, speakers, and microphones with your 9 telephone to communicate with another person. 10 BY MR. ELLIOTT: 11 Q Well, let me ask this question: Are you 12 using the spec to define these terms, or are you 13 selecting a definition and applying it here to 14 insinuate that there could be a phone being used? 15 MR. HENRY: Objection to form. Compound. 16 Ambiguous. 17 THE WITNESS: The terms here are read as 18 they appear in the document, the ordinary meaning of 19 telephone and call here. 20 BY MR. ELLIOTT: 21 Q If you would, go ahead and look at column 22 32 of the '090 patent, please. And specifically 23 where it begins the discussion of Figure 21, and 24 you're probably going to end up wanting to read this 25 all the way down through column 34, line 5. That's	232 1 Q And then on column 33, down at line 57-ish, 2 it refers to it as an electronic telephone call, 3 again, referring still to Figure 21. 4 And so what I'm looking for is to see if 5 there's any specific reference to a phone within 6 there or if this is referring to an electronic 7 telephone call where the first and second persons 8 are utilizing again, you know, the headsets with the 9 speakers and the microphone. 10 MR. HENRY: Objection to form. 11 THE WITNESS: So in Figure 21, if I can 12 call our attention to that, even though it is not 13 labeled, it appears that the person is holding a 14 telephone, correct? 15 BY MR. ELLIOTT: 16 Q Is that -- let's see. Let's see what Item 17 2105 is in the spec. Is that an HPED? 18 A I'm looking at Figure 21. The box is 2165 19 labeled. 20 Q Mm-hmm. 21 A So there is a picture of a telephone in 22 this example. But I'll go ahead and read the -- the 23 commentary about -- 24 Q Perfect. 25 A -- 21, but the depiction here -- a

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233 1 picture's worth a thousand words -- there is a 2 telephone here. 3 Q You ready? 4 A Yes. 5 Q Okay. So is a phone anywhere mentioned in 6 that passage in reference to Figure 21? 7 A The telephone is mentioned in the term -- 8 give me one second -- "electronic telephone call." 9 Q So the word "telephone" is used as part of 10 the term "electronic telephone call," correct? 11 A It is a modifier for electronic 12 telephone -- it tells the type of electronic call, 13 which is an electronic telephone call. 14 Q But it doesn't actually reference a 15 telephone? 16 MR. HENRY: Objection to form. 17 THE WITNESS: Telephone seems to be implied 18 in this sense. 19 BY MR. ELLIOTT: 20 Q Okay. And as you pointed out, Figure 21 21 does include what's actually defined at the 22 beginning of that passage as an HPED. 23 MR. HENRY: Objection to form. Lacks 24 foundation. Mischaracterizes the document. 25 MR. ELLIOTT: I don't know that I actually	235 1 So, again, an electronic phone call is a 2 special case of an electronic call. 3 Q Mm-hmm. And in Figure 21 it shows a phone 4 being used that uses the term "electronic call" 5 without a reference to phone, correct? 6 MR. HENRY: Objection to form. 7 THE WITNESS: Again, electronic phone call 8 is used throughout the rest of this. The telephone 9 is implied. There's some sort of handheld object 10 the shape of a phone in Figure 21. 11 BY MR. ELLIOTT: 12 Q Mm-hmm. But the inventors also use just 13 the phrase "electronic call" without a telephone 14 modifier, correct? 15 A They do use that there. 16 MR. ELLIOTT: I've got no further questions 17 for the witness. 18 MR. HENRY: Why don't we take ten minutes 19 off the record. I'll check my notes, and then if I 20 have any questions, we'll finish up. 21 THE VIDEOGRAPHER: Stand by. 22 We are going off the record. The time is 23 4:09 p.m. 24 (Recess.) 25 THE VIDEOGRAPHER: We are going back on the
234 1 asked a question yet. 2 MR. HENRY: I thought you were done. Go 3 ahead. 4 MR. ELLIOTT: No, you're fine. 5 BY MR. ELLIOTT: 6 Q So column 32, line 49 to 50, do you see 7 where it references 2105 being HPED? 8 A It says it includes: "...electronic system 9 that includes a handheld portable electronic 10 device." 11 Q Mm-hmm. And you indicated, when you looked 12 at Figure 21, that 2105's a phone, correct? 13 A It looks to be. It has similar shape, 14 size, as a telephone. 15 Q Mm-hmm. And even though it's a telephone 16 there, the first reference to this call is called 17 merely an electronic call; is that correct? 18 A The first reference -- can you point me to 19 the line that you're referring to? 20 Q Yeah. It's, like, 54. It's just in that 21 same -- it's in that same first paragraph. 22 A Column 32? 23 Q Yeah. Column 32 and it's line 53. Line 53 24 carrying over onto 54. 25 A Okay. I see it.	236 1 record. The time is 4:13 p.m. 2 EXAMINATION BY COUNSEL FOR DEFENDANTS 3 BY MR. HENRY: 4 Q All right. I just have a few questions for 5 you, Dr. McMullen. 6 If you don't mind, could you take Exhibit 7 7 out of your pile and bring that back in front of 8 you? 9 A All right. 10 Q And what is Exhibit 7 again? 11 A Exhibit 7 appears to be an article from 12 either my university's -- my department's website or 13 my university. It looks like it's my department's 14 website, in which it's announcing that one of the 15 Ph.D. students under my advisorship/advisement 16 received the Meta Ph.D. Fellowship. 17 Q And under that title, what's the date of 18 the article? 19 A The date of the article is March 3rd, 2022. 20 Q Okay. Thank you, Dr. McMullen. 21 And, Dr. McMullen, are Meta's Oculus 22 devices telephones? 23 A Meta's Oculus devices, to my knowledge, are 24 not telephones. 25 MR. HENRY: I don't have any further

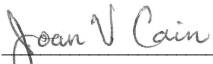
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237 1 questions. 2 FURTHER EXAMINATION BY COUNSEL FOR PLAINTIFF 3 BY MR. ELLIOTT: 4 Q Do the Oculus devices have the capability 5 of placing a call? 6 A Again, without being privy to the inner 7 workings in source code and hardware and software of 8 this, it's impossible to -- to determine. 9 Q How do you know they're not telephones? 10 A I know they are not telephones. They're -- 11 in terms of -- number one, telephones, you typically 12 need to buy a plan to use to call people from. 13 People with Oculus devices, I don't know of any of 14 them that have bought an extra line for their Oculus 15 device. So that's one reason. That's one way. 16 Q Is it possible to complete an electronic 17 call with an Oculus device? 18 A Again, as a person who's not owned an 19 Oculus, I'm not privy to speculate what is possible 20 with the Oculus device. 21 Q So were you speculating when you said it's 22 not a telephone? 23 A Again, I mentioned that some of the 24 features of a telephone include having a telephone 25 plan on which to make a telephone call. I'm not	239 1 interaction. 2 I can't account for what other people may 3 do with their Oculus devices, the software they may 4 have, or the games that they may play with the 5 device. 6 Q Has anyone that has an Oculus device ever 7 told you that they are able to make -- they wouldn't 8 use this word obviously, an electronic call, but 9 have they told you they can make a call over the 10 Oculus device? 11 MR. HENRY: Objection to form. 12 THE WITNESS: No one's ever said that they 13 could make a call over the Oculus device to me. 14 BY MR. ELLIOTT: 15 Q Have they ever said that they can play with 16 other live people with the Oculus device? 17 A I've never heard someone tell me that they 18 can play with other live people. I don't doubt that 19 this could happen. However, no one has said this to 20 me, but there are multiplayer, I would imagine, 21 games over the Oculus. I'm not aware of any because 22 I don't have any, and the times I've used it I've 23 not played anyone else. 24 MR. ELLIOTT: No further questions. 25 MR. HENRY: Nothing further from me.
238 1 aware of an Oculus phone plan. So this is one of 2 the reasons that I determined that an Oculus is not 3 a telephone. 4 Q And how did you determine that there's not 5 an Oculus phone -- phone plan available? 6 A From knowing people who have one. I've not 7 heard anyone mention that they had to purchase a 8 separate Oculus phone plan to make calls on an 9 Oculus phone. I do keep up with tech news and 10 things like that, and I feel like it may have been 11 something I would have read. So -- 12 Q Have they ever told you that they are able 13 to communicate with other people that have Oculus 14 devices? 15 MR. HENRY: Objection to form. Ambiguous. 16 THE WITNESS: I know it's possible to play 17 a virtual game with any number of simulated virtual 18 humans. 19 BY MR. ELLIOTT: 20 Q Is there the capability for two humans to 21 play a game together? 22 A Again, I don't own an Oculus. The times 23 that I have used an Oculus, I've never played with 24 another person. It's always been an app that was on 25 the Oculus, and there was no human-to-human	240 1 THE VIDEOGRAPHER: This marks the end of 2 the deposition of Dr. Kyla McMullen. We're going 3 off the record at 4:17 p.m. 4 (The following proceedings were held 5 off the video record:) 6 THE COURT REPORTER: Counsel, I just want 7 to confirm your orders. 8 MR. HENRY: Do we not have a standing order 9 in this case? I hate this. I always say, "Please 10 look at the standing order." 11 You can start with them (indicating). I 12 think they are more interested in ordering an 13 expedited copy. 14 MR. ELLIOTT: Yeah, we'll want to get 15 expedited. Rough and final as soon as we can get 16 it, please. As I said, briefing is due in a very 17 short period of time ahead. One week. 18 THE COURT REPORTER: Do you want the same? 19 MR. HENRY: I'll take the rough for sure. 20 Yeah, that's fine. Let's get it so we can have it. 21 (Signature having not been discussed, 22 the deposition of Kyla Alanna McMullen, Ph.D. was 23 concluded at 4:18 p.m. EDT.) 24 25

Transcript of Kyla Alanna McMullen, Ph.D.
Conducted on April 26, 2023

61 (241 to 244)

241 1 CERTIFICATE OF SHORTHAND REPORTER - NOTARY PUBLIC 2 I, Joan V. Cain, the officer before whom 3 the foregoing proceedings were taken, do hereby 4 certify that the foregoing transcript is a true and 5 correct record of the proceedings; that said 6 proceedings were taken by me stenographically and 7 thereafter reduced to typewriting under my 8 supervision; and that I am neither counsel for, 9 related to, nor employed by any of the parties to 10 this case and have no interest, financial or 11 otherwise, in its outcome. 12 IN WITNESS WHEREOF, I have hereunto set my 13 hand and affixed my notarial seal this 27th day of 14 April 2023. 15 16 My commission expires: 17 July 31, 2024 18  19 _____ 20 NOTARY PUBLIC IN AND FOR THE 21 DISTRICT OF COLUMBIA 22 23 24 25	
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