

1 UNITED STATES PATENT AND TRADEMARK OFFICE
2 BEFORE THE PATENT TRIAL AND APPEAL BOARD
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4 _____
5 QSC AUDIO PRODUCTS, INC.,)
6 Petitioners,)
7 vs.) Case No. IPR2014-00129
8 CREST AUDIO, INC.,) U.S. Patent 5,652,542
9 Patent Owner.)
10 _____)

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14 VIDEO DEPOSITION OF DANIEL P.W. ELLIS, Ph.D.
15 Seattle, Washington
16 Thursday, June 26, 2014
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19
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21 Reported by:
22 Donald W. McKay, RMR, CRR, CCR 3237
23
24 Job No. 54822
25

CREST 2003

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15 Video deposition of DANIEL P.W. ELLIS, Ph.D.,
16 taken on behalf of Patent Owner, at 1201 Third Avenue,
17 Suite 4900, Seattle, Washington, beginning at 9:09 a.m.
18 and ending at 6:43 p.m., on Thursday, June 26, 2014,
19 before Donald W. McKay, RMR, CRR, CCR No. 3237.

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1 A P P E A R A N C E S

2

3 FOR THE PETITIONERS:

4 KAUSTUV M. DAS, ESQ.

5 RODNEY C. TULLETT, ESQ.

6 Perkins Coie LLP

7 1201 Third Avenue

8 Suite 4900

9 Seattle, Washington 98101

10 206.359.8000

11 kmdas@perkinscoie.com

12 rtullett@perksinscoie.com

13

14 FOR THE PATENT OWNER:

15 N. ANDREW CRAIN, ESQ.

16 VIVEK A. GANTI, ESQ.

17 ROBERT D. GRAVOIS, ESQ. (by telephone)

18 Thomas Horstemeyer LLP

19 400 Interstate Parkway SE

20 Suite 1500

21 Atlanta, Georgia 30339

22 770.933.9500

23 andrew.crain@thomashorstemeyer.com

24 vivek.ganti@thomashorstemeyer.com

25 robert.gravois@thomashorstemeyer.com

1 A P P E A R A N C E S (continued)

2

3 ALSO PRESENT:

4 DANIEL OSBORNE (by telephone)

5 Technical Advisor

6 Thomas Horstemeyer LLP

7

8 PATRICK NORTON

9 Videographer

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I N D E X

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E X H I B I T S

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1 Seattle, Washington; Thursday, June 26, 2014

2 9:09 a.m.

3

4 THE VIDEOGRAPHER: We're on the record.

5 This is the beginning of media No. 1 in the
6 deposition of Dr. Daniel Ellis. In the matter of QSC
7 Audio Products, Inc., versus Crest Audio, Inc., Case
8 No. IPR2014-00129.

9 Today's date is June 26, 2014 and the time is
10 9:09 a.m. My name is Patrick Norton and I am the
11 videographer. The court reporter is Donald McKay. We
12 are with Huseby Court Reporting.

13 Counsel please introduce yourselves, after which
14 the court reporter will swear in the witness.

15 MR. CRAIN: This is Andrew Crain and Vivek Ganti
16 for Crest Audio. We have appearing remotely, Robert
17 Gravois. We may have one other, I forget, in that
18 e-mail. I'll let you go and I'll come back.

19 MR. DAS: Kaustuv M. Das and Rodney Tullett,
20 appearing on behalf of petitioner, QSC Audio Products
21 LLC.

22 If we could have folks on the phone introduce
23 themselves, that would be good.

24 MR. CRAIN: That's fine.

25 MR. GRAVOIS: This is Robert Gravois on behalf

1 of patent owner, Crest Audio.

2 MR. OSBORNE: This is Daniel Osborne on behalf
3 of patent owner, Crest Audio.

4

5 DANIEL P.W. ELLIS, Ph.D. called as a witness in the
6 above-entitled cause, being
7 first duly sworn, testified
8 as follows:

9

10 E X A M I N A T I O N

11 BY MR. CRAIN:

12 Q. Good morning, Dr. Ellis.

13 A. Good morning.

14 Q. As I said a moment ago, my name is Andrew Crain.
15 I'll be taking your deposition today.

16 Would you please state your name, address, and
17 telephone number for the record.

18 A. I'm Daniel Ellis. I live at 456 Riverside
19 Drive, Apartment 8B, New York, New York. My phone
20 number there is (212) 665-1755.

21 Q. Dr. Ellis, have you ever been deposed before?

22 A. I have not.

23 Q. Well, you may already understand what will
24 happen today, but I'll go ahead and share it for you as
25 well. I will ask you questions. Your answers, as well

1 as my questions, will be both recorded by the court
2 reporter to my right, your left, as well as recorded by
3 the videographer at the end of the table.

4 One of the things I'll ask you to do is while
5 the videographer will be able to record your non-verbal
6 communication cues, like the head nod there, our court
7 reporter cannot. So it's oftentimes the case that
8 either a witness or even the person asking the question
9 will fall into that non-verbal area.

10 A. Right.

11 Q. So if you'll help me, I'll help you so that we
12 can communicate orally so our responses can be recorded.
13 Is that okay?

14 A. That's okay.

15 Q. Thank you.

16 On occasion, I may ask you a question that I do
17 not state very well, or for any reason, maybe you don't
18 understand it.

19 If that's the case, I ask that you please do not
20 answer the question. Instead, I would ask that you let
21 me know what the issue may be with the question, the
22 point of unclarity, and I'll do my best to try to clear
23 it up so that you can answer the question. Is that
24 okay?

25 A. Great.

1 Q. So I'll understand that if I ask you a question
2 and you answer it, I'll understand that you understood
3 the question. Is that fair?

4 A. All right.

5 MR. DAS: Dr. Ellis, I'm going to interrupt and
6 say that you're going to have to speak up a little bit.

7 THE WITNESS: Okay. Sorry. Yes, I will.

8 BY MR. CRAIN:

9 Q. During the course of the deposition today and,
10 of course, into tomorrow as well -- and I'll try -- we
11 won't have to go back through this tomorrow -- plan to
12 go for about an hour to hour and a half at a time,
13 depending upon the tape or whatever recording media
14 needs to be changed. But if you need any other breaks
15 at any time, certainly we'll do our best to accommodate
16 you. Just let me know. My only request to you is that
17 if a question is pending to you, that you go ahead and
18 please provide a full and complete response to the
19 question; and when we've concluded with the question and
20 the answer, then we can proceed to the break. Is that
21 okay?

22 A. Yes.

23 MR. DAS: I'm going to add a clarification on
24 that, Dr. Ellis. As you know, some of the questions may
25 raise an issue of privilege. Or if you're asked a

1 question where you're like, is this getting into
2 privilege, I'm not sure, and you need to talk to us,
3 that's the one exception where you can sort of say,
4 "Hey, can I consult with my attorneys before answering
5 that question?" So I just wanted you to be clear on
6 that.

7 THE WITNESS: Thank you.

8 BY MR. CRAIN:

9 Q. KM actually stole my thunder. That was actually
10 the very next point I was going to get to. Just in case
11 there is any unclarity from KM stepping in there, if, at
12 any time, you need to talk to an attorney, you feel like
13 a question may get into the area of attorney-client
14 privilege, certainly, we can accommodate that. Again,
15 in similar fashion, my request is going to be to you
16 that to the extent that you can answer a question
17 without getting into the nature of the privilege, then I
18 do want to try to go ahead and do that. We can deal
19 with it as it comes up. Because each instance will
20 probably be unique unto itself based on the facts of the
21 question. Is that clear? Does that make sense?

22 A. Yeah. You know, you may need to bear with me,
23 because understanding the boundaries of privilege is not
24 my expertise.

25 Q. You've got two capable counsel over here. I'm

1 sure, as he just jumped in a moment ago, he'll probably
2 do so as well. I'm confident that we won't have a
3 problem with that. If we do, we'll deal with it.

4 A. Great.

5 Q. This always happens in deposition that a witness
6 will remember some information -- or at least it usually
7 happens -- will remember some information that may be
8 responsive to a question asked earlier that maybe wasn't
9 provided to that question. If that happens today, what
10 I would like to do is this: Let's kind of set a ground
11 rule for how we'll do that. If you remember information
12 that may be responsive to an earlier question that you
13 didn't share with me for any reason, would you please
14 stop me wherever we are and say, "Andrew, I remember you
15 asked me this question an hour, two, three, four, six
16 hours ago. I remember some additional information."
17 What we'll do is we'll go ahead and talk about that
18 additional information until you feel like you've
19 provided a full and complete response to that question
20 based on what you can remember. Then, when we've
21 finished that and exhausted that, then we'll just jump
22 back to wherever we were. That way, I don't want you to
23 feel like you've got to try to remember something and
24 then remind your attorney or me at a break or something
25 like that. If you remember it, let's go right to it.

1 Okay?

2 A. Okay.

3 Q. Same thing for corrections. It's not abnormal
4 for a witness to realize that maybe a piece of testimony
5 given earlier was either incomplete or maybe even
6 incorrect if the witness remembered something later that
7 helped the witness remember something. Same thing.
8 Let's stop what we're doing and go back and speak to
9 that issue that may need further clarification or
10 correction. Then once we've done that and you feel
11 satisfied that your response to that question or issue
12 is full and complete, then we can go back to where we
13 were. Is that okay?

14 A. That sounds good.

15 I have a question. Forgive me again, because
16 this is my first time in this kind of experience. Do I
17 have access to the transcript, so that if I think maybe
18 I said something which was incorrect, can I check, or is
19 it just my memory --

20 Q. Your counsel can certainly reserve the right for
21 you to review the transcript --

22 A. Okay.

23 Q. -- after the conclusion of today's deposition.
24 There is a process where you can go back, and if you
25 realize that your testimony needs to be further

1 modified, the rules do provide for such a process. But
2 I'm talking -- my question -- covering that with you
3 today was while we're here --

4 A. Yes.

5 Q. -- if you remember something.

6 A. No, I understand. But I'm just imagining how
7 that would work. So that, you know, we're talking about
8 something else, then suddenly I'm thinking about
9 something I said earlier, and it's like, wait, did I get
10 that right? Then it's like, oh, I don't remember
11 exactly if I got that right. So do I need to correct
12 it? I can't imagine that that's going to work, but I'm
13 just asking.

14 Q. Well, let's do this. I think we understand each
15 other. If it comes up, we'll deal with it. Again, it's
16 somewhat of a factual-specific situation, depending upon
17 whatever it is. I'm confident that we can deal with it
18 in a way that's mutually acceptable to everyone.

19 A. Okay.

20 Q. When answering a question, you may think of some
21 documents that may help you in framing a response to a
22 question. Of course, I brought some documents here with
23 me. And if you think a document would be helpful to
24 you, if you would please identify -- tell me what
25 document you think might be helpful. If I have it,

1 perhaps we can access it and talk about it. If I don't
2 have it, we can still identify it and talk about it to
3 the extent that you're aware of. Is that okay?

4 A. Yes.

5 Q. Did you happen to bring any documents with you
6 today?

7 A. No.

8 Q. To the deposition, you brought no documents?

9 A. To the deposition --

10 Q. Yes.

11 A. -- meaning like into this room?

12 Q. Yes.

13 A. No.

14 Q. Did you bring any documents to this building?

15 A. Yes, I did.

16 Q. Can you tell me what documents you brought to
17 this building.

18 MR. DAS: I'm going to object to that on work
19 product and attorney-client privilege grounds.

20 MR. CRAIN: Can he at least identify the
21 documents, without getting into the substance of what
22 they may be?

23 MR. DAS: No. Because again, the documents that
24 he brought can give relevance or can expose work product
25 issues as to what documents we had asked him to review.

1 MR. CRAIN: We'll come back to that. We'll hold
2 that thought. I want to get through these introductory
3 questions.

4 BY MR. CRAIN:

5 Q. Dr. Ellis, do you happen to be taking any
6 medication today that, in any way, might make it
7 difficult to you to understand and answer the questions
8 that we've asked of you?

9 A. No.

10 Q. Can you think of any reason why you might not be
11 able to answer the questions that will be posed to you
12 fully and completely and truthfully today?

13 A. Yes.

14 Q. Okay.

15 A. If the question is something that I don't know
16 the answer to, then I'm not going to be able to answer
17 it.

18 Q. Okay. Can you think of any other reasons?

19 A. Well, if it's something that I don't remember;
20 that I, in some sense, do know the answer to, but don't
21 remember the answer to. That would also be a fact --
22 that could be a situation.

23 Q. Let me see if I can parse it out for you this
24 way:

25 A. Okay.

1 Q. Can you think of any reason why you cannot
2 answer my questions truthfully?

3 A. No. Well, okay. There is this issue of
4 privilege. Right? So I guess if you ask me a question
5 that falls into privilege, then I can't answer it
6 truthfully -- I can't answer it at all. Right?

7 Q. Okay. Let's flip it. Can you think of any
8 reason or scenario where you may give a response that is
9 not truthful?

10 A. No.

11 Q. I didn't think so.

12 A. Right.

13 Q. I just want to make sure.

14 Dr. Ellis, do you understand that you're under
15 oath?

16 A. Yes.

17 (Exhibit 1 marked for identification.)

18 BY MR. CRAIN:

19 Q. I'll go ahead and hand you what has been marked
20 as Exhibit 1. Would you please take a moment to review
21 the document that has been marked as Exhibit 1 and let
22 me know when you're ready to proceed.

23 A. Okay.

24 Q. Are you able to identify what has been marked as
25 Exhibit 1?

1 A. I think so.

2 Q. Please do.

3 A. This -- it's the Notice of Deposition. It's my
4 Notice of Deposition. Notice of my deposition.

5 Q. Have you ever seen Exhibit 1 or a copy of it
6 before?

7 A. I think so.

8 Q. Is that why you're here today?

9 A. I'm here today for this deposition.

10 Q. Good enough.

11 Dr. Ellis, would you please describe what you
12 have done in preparation for today's deposition.

13 MR. DAS: Dr. Ellis, I'd caution you not to get
14 into any privileged communications in responding to that
15 answer -- in responding to that question.

16 THE WITNESS: I've -- I've reviewed some
17 documents. I've reviewed my declaration. I've reviewed
18 the patent at issue. And I've reviewed the references
19 that I referred to in my declaration.

20 MR. CRAIN: Let's go off the record for just a
21 moment.

22 THE VIDEOGRAPHER: We're going off the record.
23 The time is 9:23 a.m.

24 (Recess taken from 9:32 to 9:37.)

25 THE VIDEOGRAPHER: We're back on the record at

1 9:37 a.m.

2 BY MR. CRAIN:

3 Q. Dr. Ellis, before the break, I had asked you a
4 question. Let's just go back through it again.

5 A. Great.

6 Q. Dr. Ellis, can you describe what you have done
7 in preparation for today's deposition.

8 MR. DAS: Again, I'd caution you not to get into
9 any privileged communications.

10 THE WITNESS: Okay. So as I said, I reviewed a
11 number of documents related to my declaration. The
12 declaration, the patent at issue, and the various
13 documents I had referred to in my declaration I had used
14 as references. I also met with Mr. Das and Mr. Tullett
15 yesterday.

16 BY MR. CRAIN:

17 Q. Let's go back through that. The first item that
18 you mentioned was that you had reviewed some documents.

19 A. Yes.

20 Q. What were those documents?

21 A. So I said what the documents were.

22 Q. So that was the umbrella.

23 A. Exactly.

24 Q. Then you gave me the declaration, the patent,
25 the references.

1 A. Yes.

2 Q. And just so I'm clear, were there any other
3 documents that you reviewed other than your declaration,
4 the patent, and the references in either the petition or
5 that are spoken about in your declaration?

6 A. So there is -- there are some other things that
7 I have looked at which, you know, arise from this work.
8 For instance, I did a web search on power amplifiers,
9 but there were no substantial documents that I reviewed
10 in depth.

11 Q. Do you remember any particular documents that
12 you reviewed to any degree with regard to this web
13 search?

14 A. There was a document discussing -- I don't
15 remember what the document was, but I just remember --

16 Q. That's fine.

17 A. Okay. But I remember seeing a diagram of safe
18 operating areas for power transistors, which is --

19 Q. Which is what?

20 A. Which is related to power amplifier protection
21 circuits.

22 Q. Why did you do a web search for power
23 amplifiers?

24 A. Because the patent deals with power amplifiers.

25 Q. What were you searching for?

1 A. I was -- I was interested to see if there were
2 techniques in power amplifier protection that I didn't
3 otherwise know about.

4 Q. What did you find as a result of the web search
5 with respect to power amplifier protection that you did
6 not otherwise know about?

7 MR. DAS: Objection, lacks foundation.

8 MR. CRAIN: You can answer.

9 THE WITNESS: Yes, I will.

10 I found out more detail about the way that
11 these -- you know, the way that this problem is
12 systematized in terms of safe operating area. I was not
13 aware in detail of how that was done before.

14 BY MR. CRAIN:

15 Q. Why were you not aware in detail of how that had
16 been done before?

17 A. It's never been something that's come up. I've
18 never had a need to study that in that level of detail.

19 Q. Again, we're talking about power amplifier
20 protection technologies?

21 A. We're talking about -- actually, the specific
22 thing is how do you -- how do you specify this. Right?
23 If you're trying to build a protection circuit, what is
24 the theoretical basis for your design? And I had sort
25 of -- I knew what the principle was, but there are a

1 variety of ways you could try and turn it into formulae.

2 I was just interested to see how that had been done.

3 Q. Did you discover any approaches to this issue
4 that had been -- or have been done and manufactured?

5 A. I don't know. I don't know anything about -- I
6 don't -- I don't know whether the documents that I saw
7 related to things that had been manufactured.

8 Q. Again, to be clear, I don't believe you remember
9 any specific document that you may have reviewed with
10 respect to amplifier protection.

11 A. Right.

12 Q. Did you do a similar web search for digital
13 signal processors?

14 A. No.

15 Q. Why not?

16 A. I didn't -- I was not curious about issues that
17 were related to digital signal processors.

18 Q. Why were you not curious about them?

19 A. The question just never occurred to me.

20 Q. Was it not a subject area of interest to you?

21 A. Oh, no. The area of digital signal processing
22 is of interest to me.

23 Q. But why did you not do any searching on digital
24 signal processing like you did on power amplifiers?

25 A. My curiosity, as a result of reviewing these

1 documents, was specifically in the area of power
2 amplifier protection circuits.

3 Q. How do you consider your level of understanding
4 of digital signal processors in comparison to power
5 amplifier protection circuits?

6 MR. DAS: Objection, vague.

7 BY MR. CRAIN:

8 Q. You can answer.

9 A. I consider myself an expert in digital signal
10 processors. I teach a class in digital signal
11 processing. I consider myself -- because I teach in a
12 department of electrical engineering, I am somewhat
13 responsible for all the material that we would teach to
14 undergraduate and, to a lesser extent, graduate students
15 in that area, which includes amplifier design. So I
16 consider myself competent to analyze and understand
17 amplifier design, but I would not represent myself as an
18 expert.

19 Q. Are you the dean of the electrical engineering
20 program at --

21 A. No.

22 Q. How do you come to the conclusion that you
23 consider yourself responsible for the content that you
24 just spoke about?

25 A. That's my understanding of taking a faculty

1 position in a department, that ultimately departmental
2 affiliation, one of the -- one of the responsibilities
3 is this is where -- we have -- the department has a
4 responsibility for organizing the classes and for
5 delivering the classes in that area.

6 Q. If this is an incorrect statement, please
7 correct me. Would it be true of any of the faculty
8 teachers like yourself at Columbia, that you would
9 consider each one of them to be similarly responsible
10 for the content taught? Is that the basis of where
11 you're going?

12 A. I can't speak for other departments. Within
13 electrical engineering, there is a presumption that each
14 of the faculty is -- is properly trained in the material
15 that we're covering in our syllabus.

16 Q. All of the material.

17 A. Yes.

18 Q. That's helpful to understand. Thank you.

19 Okay. We were talking about some of the -- a
20 web search that you did. Sorry to get off on chasing a
21 rabbit here. But did you do any other web searches
22 other than just for power amplifier protection circuits?

23 MR. DAS: Objection, form.

24 THE WITNESS: I have to say, I wasn't paying
25 careful attention, because I wasn't expecting this to be

1 a material. I don't remember. The only -- the document
2 that I've described is the only one I can recall
3 actually looking at.

4 BY MR. CRAIN:

5 Q. Okay. Fair enough. Fair enough. If you can't
6 remember any others, I understand that. If today --
7 this is a good example -- if during the course of today,
8 maybe something sparks a memory and you remember a
9 search, that would be a great example to come back and
10 remind me. But I understand your testimony is that you
11 just don't remember any others right now. Is that --

12 A. That's right.

13 Q. Okay. Good enough.

14 I think you mentioned that in preparation for
15 today's deposition, you met and talked -- spoke with an
16 attorney. Is that correct?

17 A. Yes.

18 Q. I believe you mentioned Mr. Das and Mr. Tullett.
19 Is that correct?

20 A. Yes.

21 Q. Were there any other attorneys that you met with
22 in respect to preparation for your deposition?

23 A. Yes.

24 Q. Could you identify them by name, please.

25 A. No. I don't remember his name.

1 MR. DAS: But I can. If that helps.

2 MR. CRAIN: No, that's okay.

3 BY MR. CRAIN:

4 Q. When did you first meet with your attorneys with
5 respect to today's deposition?

6 A. So you're not asking when I first met them under
7 any circumstances, only with respect to today's
8 deposition.

9 Q. Well, we're going to get into that. This is as
10 good a time as any. So, I mean, if you want to start
11 from --

12 A. Well, actually, the funny thing is that the
13 first time that I actually met them in person was
14 yesterday.

15 Q. But you obviously communicated with them prior
16 to yesterday.

17 A. Correct.

18 Q. We'll come back to that.

19 A. Sure.

20 Q. Let's just talk about really this deposition,
21 then we'll jump back.

22 A. Um-hmm.

23 Q. How long do you recall meeting with your
24 attorneys yesterday?

25 A. I came into this building around 8:30 in the

1 morning and I left around 4:30 in the afternoon.

2 Q. And from that, can I understand that to mean
3 that from 8:30 until 4:30, you communicated with one or
4 more of your attorneys?

5 A. That was what we were doing.

6 Q. Keep in mind, I want to remind you, I'm not
7 asking you for the substance of your communication.

8 A. Absolutely.

9 Q. If you feel like I am, let's deal with it. If
10 there is a disagreement, we can deal with it.

11 Do you recall speaking to anyone else about
12 being deposed today?

13 MR. DAS: Objection, form.

14 THE WITNESS: Yes.

15 BY MR. CRAIN:

16 Q. Can you identify who those other individuals
17 are.

18 A. I mentioned it to my wife.

19 Q. Okay.

20 A. That's why I'm not at home.

21 I mentioned it to one of my colleagues who I was
22 otherwise going to have a teleconference with today.

23 Q. I think we spoke earlier, in some of the
24 introductory questions, about a document that may or may
25 not have been brought by you to this building today. Do

1 you remember that?

2 A. I remember something about that.

3 Q. Again, I'm not wanting to get into the substance
4 of the document, because I understand that Mr. Das has
5 indicated that it may pertain to work product. But I
6 would like to get an understanding of the document at
7 least so we can get a fair evaluation of the document to
8 test the work product assertion. So as a foundation to
9 you, can you give me any understanding of what the
10 document pertains to?

11 A. So we've established that I carried a document
12 into the building. What does a document mean in this
13 sense?

14 Q. Well, what did you bring with you today to this
15 building?

16 MR. DAS: Objection, form. Objection,
17 relevance.

18 THE WITNESS: Sorry. What was the question?

19 BY MR. CRAIN:

20 Q. What did you bring with you to the building
21 today? Other than your person.

22 A. I brought a folder containing some documents.

23 Q. Can you identify those documents, please.

24 A. This doesn't -- this has no privilege issue?

25 MR. DAS: No, you can identify the documents.

1 THE WITNESS: Okay. They were the documents
2 that I described as having reviewed.

3 BY MR. CRAIN:

4 Q. Okay. Did it include all of the documents that
5 you -- I think it was your declaration, the patent, and
6 some references.

7 A. Yes. There may have been some additional
8 documents. The references that I've described in my
9 declaration. There may have been some additional
10 documents. I think it had the patent history, the
11 prosecution history. Is that what it's called?

12 Q. Right.

13 A. I think that's it.

14 Q. Nothing else other than what you've described?

15 A. It has this thing as well.

16 Q. This notice?

17 A. Yes. Exhibit 1.

18 Q. One more time, can you remember anything else?

19 A. I think that's it.

20 Q. Have you made notes or markups in any of the
21 documents that you brought with you in this folder?

22 A. No. As it happens.

23 Q. Dr. Ellis, do you recall when you were first
24 contacted by anyone about potentially being retained by
25 QSC?

1 A. I recall it to some extent.

2 Q. Could you describe it, please.

3 MR. DAS: Again, without going into any
4 privileged communications, please.

5 THE WITNESS: I'm not sure. I believe I was --
6 I received -- I either received a telephone call or an
7 e-mail message.

8 BY MR. CRAIN:

9 Q. Do you recall when that was?

10 A. It was sometime in 2013.

11 Q. Can you be a little bit more specific of when in
12 2013.

13 A. I think it was -- it certainly wasn't late 2013.
14 I assume it must have been sometime during the summer or
15 early fall.

16 Q. Do you recall who that contact was from?

17 A. As I recall, it was from Mr. Tullett.

18 Q. When were you formally engaged by QSC Audio?

19 A. I don't know. It would have been sometime
20 subsequent to that -- you know, some -- maybe a few days
21 later than that. I don't -- maybe a few weeks. I'm not
22 sure.

23 Q. Do you recall entering into an engagement
24 agreement -- a written engagement agreement?

25 A. Yes.

1 Q. Does that help you remember when you might have
2 entered into that agreement?

3 A. No.

4 Q. I think, according to your report, you're being
5 compensated for your time. Is that correct?

6 A. That's correct.

7 Q. How much are you being compensated?

8 A. \$250 an hour.

9 Q. Is there any variance in that rate depending on
10 any particular type of activity?

11 A. No.

12 Q. How many hours have you worked with regard to
13 your arrangement with QSC to date?

14 A. I'm not sure. I haven't -- I mean, I have
15 records, of course.

16 Q. Sure.

17 A. I haven't been keeping it carefully to mind.
18 I -- would you --

19 Q. I'm sorry? Is there anything else?

20 A. Well, do you want to, you know -- sorry. I'll
21 let you ask the questions.

22 Q. So you were done. You had nothing else to say?
23 I wasn't sure if you were finished or not with the last
24 question.

25 A. I'm finished.

1 Q. Okay. Have you issued any invoices to QSC since
2 you were engaged?

3 A. I have issued invoices related to this work.

4 Q. Have you collected the amounts in the invoices
5 yet?

6 A. Yes.

7 Q. Approximately how much have you collected?

8 A. I'm not sure, but it's -- the number 20 hours is
9 coming to mind, which would be \$5,000.

10 Q. Okay. When you say "20 hours," are you
11 referring from your very beginning through some point in
12 time? Can you help me understand the reference for that.

13 A. Yes. So we're talking about an invoice that
14 I've issued and been paid for. So it's the time prior
15 to that.

16 Q. Do you remember about the approximate times that
17 invoice covered?

18 A. I think it would have covered the -- the latter
19 part of 2013.

20 Q. Do you recall what activities that you performed
21 that would have been invoiced for in that particular
22 invoice?

23 A. Yes.

24 Q. What activities would you have invoiced for in
25 that invoice?

1 A. This is the work relating to the preparation of
2 my declaration and the writing of the declaration.

3 Q. Okay. Let me see if I can tie this up. Did you
4 do some work in 2013 that led up to your declaration for
5 which you invoiced?

6 A. Yes.

7 Q. Is that this first invoice that we're speaking
8 about?

9 A. Yes.

10 Q. Have you done any work subsequent to the first
11 invoice that you've already invoiced for as well?

12 A. I don't think so.

13 Q. And the first invoice was for about 20 hours of
14 time. Is that correct?

15 A. That's my recollection.

16 Q. Subsequent to the first 20 hours that, if I
17 understand you correctly, led to the completion of your
18 declaration, do you have an understanding of how many
19 hours you've spent since that time with regard to your
20 involvement in this matter?

21 A. Roughly.

22 Q. Roughly, how many then?

23 A. So, roughly, I was reviewing documents on
24 Tuesday, and I met with Mr. Das and Mr. Tullett
25 yesterday.

1 Q. So you reviewed some documents on Tuesday, which
2 you will presumably bill for.

3 A. I will do, yes.

4 Q. Yes. I'm sorry. What did you say?

5 A. I will bill for. I wasn't sure whether you said
6 have billed for or will bill for.

7 Q. Will bill for.

8 A. Yes.

9 Q. You met with your attorneys yesterday and you
10 will bill for that.

11 A. That's right.

12 Q. And obviously your time today.

13 A. Yes.

14 Q. Let's jump back to Tuesday. Tell me what you
15 did on Tuesday, please.

16 MR. DAS: Objection, form.

17 THE WITNESS: How much detail do you want?

18 BY MR. CRAIN:

19 Q. Well, I think you mentioned you reviewed some
20 documents.

21 A. That's correct.

22 Q. Let's start there. Can you let me know what
23 documents you identified on Tuesday.

24 A. I knew that I was coming to this deposition and
25 that the subject was going to be my declaration, so I

1 reviewed my declaration and the documents that it refers
2 to.

3 Q. Do you remember reviewing anything else other
4 than what you just shared with me?

5 A. The web search that we just discussed. That was
6 on Tuesday as well.

7 Q. I didn't ask you that. Thank you for reminding
8 me.

9 Is there anything else that you did as part of
10 your review on Tuesday, the 24th of June?

11 A. Anything other than reviewing documents. Is
12 that what you're asking?

13 Q. No. Thank you for letting me know. That was
14 probably a bad question.

15 I think you mentioned that you reviewed some
16 documents.

17 A. Yes.

18 Q. And your declaration, the references, the
19 documents that are referred to in it.

20 A. That's right.

21 Q. I believe you also mentioned a web search.

22 A. Yes.

23 Q. Do you recall doing anything else as part of
24 that review on Tuesday that you've not already shared
25 with me?

1 A. I recall -- I was interested in the question of
2 calculating the power output of a power amplifier. I
3 did some calculations and some -- I manipulated some
4 formulae.

5 Q. Describe that for me in more detail. Where did
6 you go to do this?

7 A. I didn't. I just got out a piece of paper and
8 did it.

9 Q. Were you looking at any other information with
10 respect to the calculations you ran?

11 A. No.

12 Q. Why were you interested in calculating the power
13 output of a power amplifier on Tuesday?

14 A. Because there is this -- because I was
15 interested in the question of how you could control the
16 performance characteristics of a power amplifier.

17 Q. Why were you interested in that on Tuesday?

18 A. Because it's discussed in the patent.

19 Q. What did you learn as a result of your
20 calculations?

21 A. Not much. I -- I'm still thinking.

22 Q. Take your time.

23 A. Yeah. I was trying to improve my understanding
24 of how varying the power supply might be advantageous in
25 power amplifier design.

1 Q. Were you successful in improving your
2 understanding?

3 A. I think I improved my understanding, yes. I
4 clarified my understanding.

5 Q. What was the point of unclarity that you had
6 before you ran these calculations?

7 A. So the patent, the '542 patent, mentions the
8 idea of manipulating the power supply. And I was just
9 trying to -- I was trying to improve my understanding of
10 why that might be useful.

11 Q. Where did you get the information to run the
12 calculations?

13 MR. DAS: Objection, lacks foundation.

14 BY MR. CRAIN:

15 Q. Do you understand the question?

16 A. I think so.

17 The basis of my calculations was my underlying
18 knowledge of electrical engineering and of amplifier
19 circuitry.

20 Q. When you say you ran calculations, maybe I'm
21 mistakenly presuming that you actually had actual
22 numbers and real data. Is that --

23 A. No. That's not how it is. It was more like a
24 mathematical -- an algebraic manipulation.

25 Q. I see. Were there any sources that you used as

1 part of this calculation?

2 MR. DAS: Objection, form.

3 BY MR. CRAIN:

4 Q. Do you understand what I'm asking?

5 A. You're asking if I'm somehow looking at some
6 reference or something to set up my calculation.

7 Q. Yes. I'm trying to find out, either you were or
8 you weren't looking at some external source of
9 information with respect to this calculation that you
10 were interested in learning more about. So let me
11 ask -- based on that, let me ask the question.

12 Were there any sources of information that you
13 looked to with respect to these calculations you ran?

14 A. There was nothing I looked at. It was more
15 like -- the basis of the calculation are the things that
16 I already know that are in my head.

17 Q. Sure. Okay. Fair enough.

18 We got off on this when we were talking about
19 the time that you spent.

20 A. Yeah.

21 Q. We spoke about what you've done, of course,
22 today, yesterday, and on Tuesday. And we also spoke
23 about the work that you did leading up to a report.

24 A. That's right.

25 Q. I want to talk about the time from whenever the

1 first invoice was issued up until Tuesday.

2 A. Yep.

3 Q. Anything that you did during that period of time
4 related to this matter?

5 A. Firstly, there is very little involved.

6 Q. Okay.

7 A. There was some -- I had some -- some limited
8 communication with the attorneys.

9 Q. Can you ballpark maybe a number of occasions?
10 Was it more than five?

11 A. No. Five or fewer.

12 Q. Five or fewer. Okay.

13 I may have asked this. Please forgive me if I
14 did. Since your first invoice, do you recall how many
15 hours you devoted to your involvement in this matter
16 leading up to today?

17 A. I think about two days worth of work.

18 Q. So about 16 hours?

19 A. Yes. Although possibly a little bit more. They
20 were quite long days.

21 Q. Fair enough. So we're going as to go back in
22 time again to 2013. I want to talk about the work that
23 you did that may have been included in that first
24 invoice.

25 A. Um-hmm.

1 Q. I understand that you shared with me that you
2 were contacted by Mr. Tullett, perhaps; and ultimately,
3 you produced a report. Let's talk about the activities
4 or the events between those two bookends.

5 A. Yeah.

6 Q. Are those appropriate bookends?

7 A. Yes.

8 Q. If you will, please share with me what happened
9 with respect to your involvement subsequent to your
10 initial contact by Mr. Tullett.

11 MR. DAS: Dr. Ellis, again, be careful not to
12 get into privileged communications or work product
13 issues when answering that question.

14 THE WITNESS: Yeah.

15 BY MR. CRAIN:

16 Q. Again, I'm not asking for the substance of any
17 communications that you had with counsel. I'm asking
18 for what you did.

19 A. I communicated with counsel.

20 Q. Okay.

21 A. I reviewed documents and I prepared a
22 declaration.

23 Q. Okay.

24 A. And not -- the communication with counsel
25 happens on more than one occasion. So it's not like,

1 okay, I talked to them and then that's it.

2 Q. So there was a give and take?

3 A. Yes.

4 Q. All right. Do you recall if your counsel
5 provided any documents for you to review as part of your
6 involvement in this matter?

7 A. Yeah.

8 MR. DAS: I was going to say, again, yes or no
9 questions.

10 THE WITNESS: Okay.

11 BY MR. CRAIN:

12 Q. Are you able to identify those documents that
13 your counsel provided to you?

14 MR. DAS: Again, I'll object on work product
15 grounds and privilege grounds and instruct you not to
16 answer that question.

17 MR. CRAIN: Okay. So if -- let's play this out.
18 So if you provided him the patent, for example, you're
19 going to take the position that's work product and he
20 can't tell me, "Oh, he provided me the patent." Is that
21 your position?

22 MR. DAS: I'm going to take the position that
23 whatever documents --

24 MR. CRAIN: Because that's not work product.

25 MR. DAS: No. But it is work product and

1 attorney-client privilege, because it goes to our
2 strategy, if you get into all of the documents we
3 provided him.

4 MR. CRAIN: Well, to the extent that he looked
5 at any documents that form the basis of his opinion, I
6 think we are allowed to get into that.

7 MR. DAS: You can ask -- that's not the question
8 you've asked him, though.

9 MR. CRAIN: Well, that's certainly what -- I
10 think it is implicit in that.

11 MR. DAS: No, but that's not the question you
12 asked him, and that's why I've instructed him not to
13 answer. If you can ask that question without getting
14 into work product or privilege, I'm not going to object
15 to that.

16 MR. CRAIN: All right. I'm not sure we agree on
17 this, but we'll see if we can work around it in a way.

18 BY MR. CRAIN:

19 Q. What information was provided to you, at any
20 point in time, by your attorneys, that formed the basis
21 of your opinion?

22 MR. DAS: Again, I will instruct you not to
23 answer that question on the basis of work product and
24 attorney-client privilege.

25 BY MR. CRAIN:

1 Q. Were you asked to make any assumptions?

2 MR. DAS: Again, I will instruct you not to
3 answer that question on attorney-client privilege and
4 work product basis.

5 MR. CRAIN: That's clearly allowed by the rules.
6 So you're going to take the position that if he was
7 asked to make an assumption by his counsel, he cannot
8 state what that assumption is? The rules clearly --

9 MR. DAS: I will take -- you're entitled to ask
10 him what was the basis of his opinions.

11 BY MR. CRAIN:

12 Q. Okay. Let's try it this way: Were you asked to
13 make any assumptions by counsel?

14 MR. DAS: I will instruct you not to answer that
15 on the basis of attorney-client privilege and work
16 product.

17 MR. CRAIN: What is the exact basis?

18 MR. DAS: The exact basis is whatever
19 assumptions we may have asked him may not be what he
20 relied on --

21 MR. CRAIN: Rule 26 clearly says assumptions
22 asked by counsel of the expert are discoverable.

23 MR. DAS: No. It says that what the expert
24 relied on are discoverable.

25 MR. CRAIN: I think assumptions that are part of

1 his opinion are as well.

2 MR. DAS: No, you're --

3 BY MR. CRAIN:

4 Q. Okay. Let's just get it clear. You're not
5 going to tell me any assumptions that you were asked to
6 make with respect to your opinion. Is that a fair
7 understanding?

8 MR. DAS: I'm instructing him not to answer, on
9 the basis of privilege and work product, what
10 assumptions he may have been asked. That is privileged.
11 I'm also saying -- stating fairly clearly on the record
12 that what assumptions he may have relied on in forming
13 his opinions may be discoverable. The question is --
14 the way the question is being phrased goes into
15 attorney-client privilege and work product, and that's
16 our position.

17 BY MR. CRAIN:

18 Q. Dr. Ellis, would you please identify assumptions
19 that QSC's attorney provided and that you relied upon in
20 forming the opinions that you expressed.

21 A. I don't -- I don't recall any assumptions. I'm
22 not -- can you give me an example of the kind of thing
23 you're talking about.

24 Q. I can't guess. If no is an appropriate
25 response, Mr. Das is just wasting our time.

1 MR. DAS: I object. I resent the way that's
2 being presented.

3 MR. CRAIN: Okay.

4 MR. DAS: Mr. Crain, there is no need to get
5 personal about this. You asked a question --

6 MR. CRAIN: I asked a question --

7 MR. DAS: So if I can finish, Mr. Crain. You
8 asked a question that went into privilege and work
9 product and I objected on it. It is not me wasting the
10 time. If anyone is wasting time, it's you by asking
11 questions that seek privileged and work product
12 information.

13 MR. CRAIN: Well, we're going to have to agree
14 to disagree. But I think we finally got what we wanted.
15 BY MR. CRAIN:

16 Q. Would you please identify any facts or data that
17 QSC's attorneys provided and that you considered in
18 forming the opinions that you expressed in your
19 declaration.

20 A. So I don't -- I'm not entirely sure what you
21 mean by facts and data. That sort of makes me think
22 that there are -- I don't recall anything that would --
23 that I would consider data; that is, like tables of
24 numbers or stuff like that. I don't recall anything
25 that would -- you know, sounds like would be best

1 described as a fact, as in a stand-alone statement.

2 Q. What documents were provided to you by QSC's
3 attorneys that you considered in forming the opinions
4 that you expressed in your declaration?

5 A. As far as I recall, the documents that I
6 reference in my declaration fall into that category.

7 Q. Okay.

8 A. And there may have been others that did not
9 ultimately appear in the declaration.

10 Q. What documents are those that ultimately did not
11 appear in your declaration?

12 A. I don't recall.

13 Q. Were there some?

14 A. I think there were, yes.

15 Q. Can you give me an idea of how many,
16 approximately.

17 A. I'm thinking like three or four.

18 Q. Do you recall the general nature of what those
19 documents were?

20 A. As I recall, they're very similar to the ones
21 that we -- that I did include in the declaration.

22 Q. For example, could they have been patents?

23 A. For example, patents.

24 Q. But you don't understand -- you don't recall
25 them specifically?

1 A. I don't recall them specifically. I can recall,
2 you know, the general nature of them; that they were
3 patents about power amplifiers and control and
4 protection, and possibly other documents like
5 publications. You know, technical articles.

6 Q. Do you recall if any of the documents that were
7 provided to you by counsel that you may have considered
8 included any of the filings in litigations between QSC
9 Audio and Crest Audio?

10 A. I don't recall -- I don't recall any of that. I
11 certainly don't recall any documents of that kind, and
12 it's my recollection there were no documents of that
13 kind.

14 Q. And just want to make sure we're talking about
15 the same thing.

16 A. Yeah.

17 Q. Litigation-type documents, what do you
18 understand that to be that you're not recalling having
19 reviewed?

20 A. Yes. By that, I mean something that's like
21 primarily generated by lawyers rather than by say
22 engineers.

23 Q. Okay.

24 A. Although, I guess a patent fits into that. But
25 whose content is primarily about the legal issues at

1 stake rather than the technical issues. Although I
2 don't mean at stake. Primarily about legal issues
3 rather than technical issues.

4 Q. I understand.

5 Have you ever heard of the term, invalidity
6 contentions?

7 A. Yes.

8 Q. Do you recall, as part of the documents that you
9 may have received and considered in forming the basis of
10 the opinions that you express in your declaration,
11 including a document pertaining to invalidity
12 contentions?

13 A. Okay. So you're asking me about the documents
14 that were provided to me in preparation of my
15 declaration. Right?

16 Q. Correct.

17 A. And you're asking if there were any -- your
18 previous question was, were there any documents relating
19 to the legal process. Now --

20 MR. DAS: Dr. Ellis, I will clarify that you
21 were asked documents that you were provided that you
22 considered in forming your opinion.

23 BY MR. CRAIN:

24 Q. Can you finish your response now.

25 A. Sorry. What was the question? So the

1 question -- yeah, you tell me what the question was.

2 It's better. You were asking about invalidity something.

3 Q. I was asking about a document that may be known
4 as invalidity contentions.

5 A. Yes.

6 Q. You at least seem to have some familiarity with
7 it, but I may be mistaken.

8 A. That's right. And the reason that I responded
9 like that is I think I probably -- I could believe that
10 I had access to that document, but I guess the point is
11 that it was not something that I have a recollection of
12 studying in any depth.

13 Q. Just so you're clear, when I asked you the
14 question about what did you consider --

15 A. Yes?

16 Q. -- as I understand the way the term is legally
17 understood, it would include documents not only that's
18 specifically a part of your declaration.

19 A. Yes.

20 Q. But documents that are not, but you still
21 reviewed.

22 A. Yes.

23 Q. So have we covered the universe of those
24 documents that were considered by you, as provided by
25 counsel, that led to forming the basis of your opinions

1 expressed in your declaration?

2 A. You're asking if we've -- if there are any other
3 documents that we haven't somehow touched upon that were
4 the basis of --

5 Q. Basically, yes.

6 A. -- that I have considered and that were provided
7 by counsel. I think we have covered them all, yes. I
8 don't recall any documents that we haven't touched on
9 already.

10 Q. We've spoken today about a particular patent. I
11 think you or maybe I referred to it as the '542 patent.
12 I'll introduce it shortly. I just want to make sure you
13 understand that to be patent No. 5,652,542. I can go
14 ahead and introduce it if it will be helpful to you.

15 A. 5,652,542 is what it says on the Notice of
16 Deposition.

17 Q. Perfect. Thank you.

18 So when I refer to the '542 patent, will you
19 understand that we're referring to patent 5,652,542?

20 A. Yes.

21 Q. I can give you the copy now if you prefer, but
22 we'll get to it later.

23 A. Okay.

24 Q. Could you describe for me the research you did
25 with respect to the '542 patent, going again back to

1 when you first became involved.

2 MR. DAS: Objection, form.

3 THE WITNESS: I'm trying to -- I'm thinking
4 back.

5 BY MR. CRAIN:

6 Q. Sure.

7 A. When I'm given a patent to study, obviously what
8 I do is I read the patent and try and understand what's
9 really being described. And then it's -- then it's a
10 question of okay, do I know what's going on here? Do I
11 have the background to understand what's involved? So
12 that's what I remember. I remember reading it and
13 forming a basic idea of what it was about. As I recall,
14 I was pretty comfortable at that time that I understood
15 what it was about.

16 Q. So is it an accurate understanding then that at
17 least you don't recall, back during your initial
18 involvement in the case, doing any research with respect
19 to the '542 patent like you may have done on Tuesday
20 with respect to the web search on power amplifier
21 protection circuits?

22 A. No. I definitely wanted to review my
23 understanding of power amplifier design; and I remember
24 pulling the textbook that I had used in college, which I
25 still had in my office, to look at the section on

1 amplifier design.

2 Q. Can you identify that textbook that you looked
3 at.

4 A. Yes. It's The Art of Electronics by Horowitz
5 and Hill.

6 Q. Horowitz and Hill? That's the author or the
7 publishers?

8 A. That's the authors. Horowitz and Hill.

9 Q. Other than referring to the Horowitz and Hill --
10 what was the title again? Start there.

11 A. The Art of Electronics.

12 Q. The Art of Electronics.

13 A. Yes.

14 Q. I'm sorry. I misunderstood you that it was a
15 power amplifier design --

16 A. Right. Being that power amplifier design is
17 actually a fairly significant part of electronics.

18 Q. Was that textbook solely directed toward power
19 amplifier design?

20 A. No.

21 Q. So it maybe had a section or chapter or chapters
22 about power amplifier design?

23 A. Yes. It has a chapter on amplifier design,
24 which is really the core of electronics. And a power --
25 I couldn't say for sure whether it actually has a

1 chapter on power amplifiers, because a power amplifier
2 is within the scope of general amplification circuits.

3 Q. So that I understand you correctly, that you
4 reviewed a textbook entitled "The Art of Electronics"
5 that has at least a chapter on amplifier design.

6 A. Yes.

7 Q. Is this chapter basically like general
8 operational amplifier design?

9 A. It's transistor amplifier design. Yes. So the
10 point being that when -- in the amplifiers that we're
11 looking at, it's down to the final transistors. They're
12 kind of like the key elements.

13 Q. Did you share with me that The Art of
14 Electronics textbook also specifically deals with audio
15 power amplifiers or not?

16 A. I don't recall. I would -- I'm pretty sure it
17 would deal with the specific issues of power amplifier,
18 high-current, high-voltage outputs. It probably -- I
19 don't recall whether it specifically -- whether it deals
20 with any issues specific to audio power amplifiers. But
21 there is not -- because they're not particularly -- you
22 know, there aren't that many considerations that are
23 different from general amplifier design that are
24 specific to audio power amplifiers.

25 Q. I'm going to ask you to really reach back now.

1 A. Yeah.

2 Q. Do you remember when that book was published?

3 A. Well, the book has gone through a number of
4 editions. It's a standard reference in electronics.
5 The edition that I had --

6 Q. Yes.

7 A. -- was from my undergraduate. I probably bought
8 it in 1986. No -- yes.

9 Q. Do you happen to remember the version or edition
10 number?

11 A. No.

12 Q. Did you reference it in your declaration?

13 A. No.

14 Q. Why not?

15 A. Because as I said, it was me just making sure
16 that -- just refreshing my memory on the basics of
17 amplifier design, which I consider to be part of the
18 repertoire of any properly trained electrical engineer.

19 Q. Did you conduct your own search for prior art
20 with respect to the '542 patent as a part of the work
21 that you did?

22 A. I don't recall the details, but I think it's
23 very likely I would have done some kind of search to
24 try -- yes, actually, I do remember trying to -- trying
25 to find -- you know, looking through different technical

1 publications to see what the -- what exactly was being,
2 you know, discussed in the technical literature, but
3 around the right time, late 1980s, early 1990s.

4 Q. Do you recall any specific documents or
5 references that you would have reviewed in that
6 category?

7 A. I remember there were several papers that I
8 looked at. I remember there was an AES paper which was
9 like an overview paper on sort of the prospects for
10 using digital signal processors in amplifiers. I don't
11 remember more than that. But probably it was -- I could
12 probably find it again, because it was -- it was that --
13 that was the general idea. It was very much a
14 high-level paper about how DSPs are going to be -- you
15 know, are going to change the way amplifiers are built.

16 I also remember finding a technical document
17 describing an early DSP audio processor that was
18 produced by the BBC in the mid 1980s. I remember
19 looking at that. Those are examples. There was nothing
20 tremendously that stands out in my mind.

21 Q. There was nothing tremendously that stands out
22 in your mind. What do you mean by that?

23 A. There was nothing that like, wow, this is a
24 surprise. It was more or less, okay, this is what I
25 expected.

1 Q. You mentioned what you believed to be an AES
2 paper.

3 A. Yes.

4 Q. Do you remember the title of the paper?

5 A. (No response).

6 Q. Let me ask you another question.

7 A. Yeah.

8 Q. What information do you remember about it that
9 could help you identify it again?

10 A. I remember that it was -- it was a broad title,
11 and it was a very broad paper, and it was like -- you
12 know, a lot of the papers that you would see at a
13 conference like AES would be talking about very specific
14 technical points. It's less common to have a paper
15 which is typically, you know, from an invited current
16 expert, to sort of say what's the -- what's going on, to
17 give us an overview of the field, and it was that kind
18 of paper.

19 Q. Do you remember the author?

20 A. No.

21 Q. And do you remember the year that it was dated?

22 A. I don't recall, but it was, you know, sometime
23 between '87 and '92, as I recall.

24 Q. Do you recall how you came about discovering it?

25 A. I did a web search.

1 Q. Do you remember the search you ran?

2 A. No. But I was looking for -- I was looking -- I
3 don't remember exactly what it was, but what I was
4 looking for was the use of DSPs in audio amplifiers.

5 Q. Why did you not include the AES paper that
6 you're referencing now that you can't remember
7 specifically into your declaration?

8 A. It didn't provide any particular -- it was not
9 very detailed. Right? So the references in the
10 declaration, I chose because they have very clear and
11 distinct instances of some of the ideas involved. And
12 obviously, in the interest of efficiency, I didn't want
13 to include every possible document that could have been
14 relevant. The purpose of the documents is to indicate
15 the state of knowledge and the things that people knew
16 about and were thinking about at the relevant time, and
17 I felt that the other documents that I didn't include
18 were not adding anything to that.

19 Q. Does that mean that they weren't as good as the
20 references that you did reference?

21 MR. DAS: Objection, form.

22 THE WITNESS: No. No, just that -- they were --
23 they were redundant.

24 MR. DAS: Is this a good time for a break?

25 We've been going --

1 MR. CRAIN: Let me ask a couple questions about
2 the other document, if that's okay.

3 MR. DAS: Sure.

4 MR. CRAIN: Just a couple minutes.

5 BY MR. CRAIN:

6 Q. There were two documents that you somewhat were
7 able to identify. One was the AES paper and I forget
8 what the other one was.

9 A. A technical report on an experimental digital
10 audio signal processor developed at the BBC in the mid
11 1980s.

12 Q. Do you remember -- that's pretty good.

13 A. Yeah.

14 Q. Can you remember anything else that might help
15 us identify it now?

16 A. It was not -- as I recall, it was like a BBC
17 technical report rather than say a journal publication.
18 It was not in some journal or something like that. As I
19 recall, there were two parts to it. I'm not sure if I
20 was able to locate both parts. It had a photograph of
21 the device on the front. It was a black and white scan
22 that was quite low quality.

23 Q. What was the device on the front?

24 A. Of some 19-inch rack unit, which was their
25 prototype audio signal processor -- digital audio signal

1 processor.

2 Q. Again, we'll get to the break. Is there
3 anything else that you remember about this that might
4 help you identify it today?

5 A. It was something that I was able to find on the
6 web.

7 MR. CRAIN: All right. We can go off the
8 record.

9 THE WITNESS: Okay.

10 THE VIDEOGRAPHER: This is the end of Media
11 No. 1 in the deposition of Dr. Daniel Ellis. The time
12 is 10:38. We are off the record.

13 (Recess taken from 10:38 to 10:54.)

14 THE VIDEOGRAPHER: This is the beginning of
15 Media No. 2 in the deposition of Dr. Daniel Ellis. The
16 time is 10:54 a.m. We are back on the record.

17 BY MR. CRAIN:

18 Q. Dr. Ellis, from our earlier time speaking this
19 morning, is there any testimony that you feel you need
20 to go back and address and either change or add to?

21 A. There is nothing that comes to mind.

22 Q. I believe, before our break, we were talking
23 about searches or a search -- I don't know if it was one
24 or more -- but searches that you did with respect to the
25 '542 patent toward the beginning of your involvement and

1 engagement. Does that sound correct?

2 A. That's right. Yes.

3 Q. I believe you referenced an old Art of
4 Electronics textbook from your undergraduate days that
5 you referenced.

6 A. Yes.

7 Q. Then I believe you also referenced a couple of
8 technical papers that you couldn't specifically
9 identify, but that you had a general recollection of.
10 Is that correct?

11 A. That's right.

12 Q. Do you remember any other documents or other
13 books that you may have considered or any type of
14 reference that you would have considered during that
15 same time frame?

16 A. So as I recall -- I mean, it's not like I did a
17 web search and I found these two documents and they're
18 the ones I've mentioned and that's it. The way that
19 that -- the way that that proceeds is I'll do a web
20 search. I might see a number of documents which I will
21 scan through. Some of them, you know, based on what
22 information you get from the web search, maybe seem
23 like, oh, I wonder what's in that. I'll look at that.
24 And then once I found out, oh, okay, no, it's not
25 anything interesting or anything new, then I will

1 immediately discard it. You know, because I don't want
2 to spend a long time reading it, so I'll look briefly at
3 it.

4 The two that I mentioned, I don't really know
5 why those are the ones that I'm remembering. Right? I
6 wasn't particularly paying attention. I wasn't
7 expecting to be asked this question. The reason that
8 I -- I think I probably read the AES overview paper, I
9 probably read the whole thing, because it seemed like it
10 was a helpful way to find out, okay -- well, to remind
11 me -- remind myself of like what was the state of
12 knowledge with regards to using DSPs at that point.

13 And the BBC one, I may be -- I remember it and I
14 read it because I was actually curious about it. It's
15 like, oh, that's really cool, they had this thing. And
16 I've done some work -- in the past, I've had some
17 contact with the BBC research labs, so it was
18 particularly interesting to me. That -- yeah.

19 Q. So again, you're not -- today at least, you're
20 not able to specifically recall any other document that
21 you would have reviewed as a part of what you just
22 described?

23 A. That's correct. I don't remember any other
24 specific documents.

25 Q. Just for your benefit, I'm just trying to

1 understand what you recall.

2 A. Sure.

3 Q. If you recall it, great. If you don't, then I
4 understand.

5 As a result of this research that we're speaking
6 about that you may have performed in preparation of your
7 declaration submitted in this case, were any of the
8 documents that you've spoken about or that you can
9 remember included in your declaration specifically?

10 A. I don't think so. I mean, so we're talking --
11 to be specific, we're talking about documents that I
12 found just -- so there is the process -- I read the
13 patent. I got some idea of what the topics were. I did
14 some searching to find some related information. And of
15 the documents found there, I don't think any of them
16 ended up in the declaration. I'm pretty sure they
17 didn't.

18 Q. Can you share with me why they didn't end up in
19 your declaration.

20 MR. DAS: Objection, asked and answered.

21 THE WITNESS: As I mentioned, I felt -- I
22 feel -- the reason would be that the documents that I
23 included -- the references I included in my declaration
24 seemed like the most -- the most succinct ways of making
25 the points that I wanted to make about the state of

1 knowledge at the time, and the other documents would
2 merely have been reiterating that.

3 BY MR. CRAIN:

4 Q. Do you recall if part of your efforts, whether
5 you considered any arguments of either invalidity or
6 unpatentability of the '542 patent claims; specifically,
7 Claims 5 and 13? Let me jump out of that. When I
8 reference Claims 5 and 13 of the '542 patent, do you
9 understand what I'm talking about?

10 A. I think so. I don't -- yes.

11 (Exhibit 2 marked for identification.)

12 BY MR. CRAIN:

13 Q. Dr. Ellis, you have what has been marked as
14 Exhibit 2. Would you please take a moment to review the
15 document and let me know when you're ready for a
16 question.

17 A. Yes. Yeah.

18 Q. Dr. Ellis, would you please identify what has
19 been marked as Exhibit 2.

20 A. This is what we're calling the '542 patent.

21 Q. A moment ago, I was referencing Claims 5 and 13.
22 If you would turn to them if you're able to, please.

23 A. Yes.

24 Q. Can you locate what's known as Claim 5 of the
25 '542 patent?

1 A. Yes.

2 Q. Where do you find it?

3 A. It's on the top of column eight on page seven.

4 Q. Are you able to find what's known as Claim 13?

5 A. Yes.

6 Q. Where do you find it?

7 A. It's on the top of column nine on page eight.

8 Q. Thank you.

9 So just for reference --

10 A. And on column ten as well.

11 Q. Sorry about that.

12 A. Yes.

13 Q. So, for reference, when I speak of Claims 5 and
14 13 of the '542 patent, I will be referring to those very
15 claims that you just identified. Is that okay?

16 A. Yes.

17 Q. With respect to your efforts in preparing your
18 declaration, did you consider any arguments of
19 invalidity or unpatentability of the '542 patent,
20 Claims 5 and 13, that are not referenced in your
21 declaration?

22 MR. DAS: Objection, form.

23 THE WITNESS: I don't -- that's not an easy
24 question for me to answer, because although I have some
25 understanding of what you mean by invalidity or

1 unpatentability, those are not the concepts that I
2 usually use. Right?

3 BY MR. CRAIN:

4 Q. Okay. What concepts are you more familiar with?

5 A. The -- the kinds of things I'm looking for are
6 whether there is -- whether the techniques described in
7 the patent have been described elsewhere.

8 Q. Can you remember, as a part of your efforts in
9 preparing your declaration, any other documents
10 elsewhere that described what's disclosed in Claims 5 or
11 13 that you did not speak about in your declaration?

12 A. I wouldn't say -- I wouldn't say that there
13 weren't any, but I don't have any distinct recollection.
14 So the question was, are there -- were there other
15 documents that I reviewed that are relevant to -- that
16 describe these same ideas that I didn't mention in my
17 declaration? And I think there probably were, but
18 unfortunately, I can't recall any details of them.
19 Because it didn't -- it didn't seem important -- you
20 know, once we have -- once I have a nice document that,
21 you know, discloses, for instance -- describes the idea
22 of using voltage and current to calculate impedance,
23 then if I find another document that talks about it,
24 it's like okay, but I've already -- we've already got a
25 document that documents this, so this one is not that

1 interesting to me anymore.

2 Q. So, in your declaration, there are documents
3 that discuss the calculation of impedance using voltage
4 and current?

5 A. There is certainly one document.

6 Q. Do you recall the name of the document?

7 A. It's the Tsurushima document is what I'm
8 thinking of.

9 Q. Is that the only one you can recall?

10 A. Well, there is also the Gittleman paper, which
11 can be understood to be dealing with that same idea; but
12 like I say, it's more explicitly stated in the
13 Tsurushima paper, so that's the one that I mostly think
14 about.

15 Q. Okay. Any others, other than the Tsurushima
16 paper and the Gittleman paper, that you can recall?

17 A. It definitely is related to the matter discussed
18 in Porambo. Porambo doesn't explicitly talk about
19 voltage and current, but they are talking about the
20 impedance of the load -- of the power amplifier load.
21 Porambo doesn't talk about the combination of voltage
22 and current.

23 Q. Does not?

24 A. Does not.

25 Q. Do you have anywhere --

1 A. Actually, no, I take that back. I mean, you
2 know, Porambo talks about voltage and it talks about
3 something that is -- I understand to be related to
4 current. So Porambo does not explicitly discuss taking
5 the ratio of those values to calculate impedance.
6 That's what I meant to say.

7 Q. We'll certainly have opportunity, I'm sure,
8 today to talk about Porambo. But I at least want to
9 understand what you mean here. I think you had
10 initially said that Porambo does not talk about the
11 combination of voltage and current, but then I think
12 you've now clarified that --

13 A. Yes.

14 Q. -- that it talks about voltage, and I think you
15 said something along the lines of what I understand.

16 A. Yes.

17 Q. Do you know what you're referring to? Is that
18 meaning -- let me ask you another question. So
19 understanding what I'm trying to get to --

20 A. I don't understand what you're trying to get to.

21 Q. You don't?

22 A. But carry on.

23 Q. Okay. What do you understand Porambo to talk
24 about related to current?

25 A. Porambo mentions a clip indication signal. It

1 doesn't say what that is. And I've been thinking about
2 what that is. And my guess is it's a current
3 limiting -- overcurrent sense condition in the power
4 amplifier output stage. I don't talk about this in my
5 declaration. This is something that has occurred to me
6 just, you know, in preparation for this deposition when
7 I was reviewing the document.

8 Q. Why didn't this occur to you when you prepared
9 your declaration?

10 A. That's a good question. It's just because it's
11 a strange way to describe it. It seems like a strange
12 way to describe it. That clipping, most often you think
13 of it as a voltage which then hits some upper threshold
14 and is held at that threshold. That's the way I think
15 about it. But then in preparing for this, I was trying
16 to think exactly what is going on in the Porambo system,
17 and that explanation didn't seem to make sense to me is
18 the best I could understand what that amplifier was
19 doing. And it just seemed like, oh, probably it's
20 actually looking at current limiting, because that's
21 more likely the kind of clipping that would be
22 implemented in that amplifier.

23 Q. Are you certain, as you testify today, that
24 Porambo is dealing with current in the manner that
25 you've just described?

1 A. No.

2 Q. What is the basis -- let me ask a better
3 question.

4 Why do you believe that you're not certain?

5 A. Why am I not certain? So what we're talking
6 about is my -- my inference that the signal referred to
7 as the clip indication or something like that in the
8 Porambo patent is related to the current. But it
9 doesn't -- but that's just an inference. That's me
10 trying to imagine what the circuit -- which, you know,
11 is not really the focus of the patent -- how that would
12 actually be implemented.

13 Q. Dr. Ellis, did you author your declaration?

14 A. Yes.

15 Q. Did anyone assist you in authoring your
16 declaration?

17 A. Yes.

18 Q. Who assisted you in authoring your declaration?

19 A. The process by which the declaration was
20 created?

21 Q. Sure.

22 A. Without getting into issues of privilege --

23 MR. DAS: I would hope so.

24 THE WITNESS: -- was that I had discussed

25 with -- I had discussions with the attorneys --

1 BY MR. CRAIN:

2 Q. Sure.

3 A. -- about the references and the points that
4 needed to be made. They provided me with a draft of the
5 document, the shape of the document that was appropriate
6 for this process. Right? Because without -- I haven't
7 ever written a declaration for a patent board before.
8 Then I went through and inserted my actual -- you know,
9 my beliefs and statements. And then I sent it back.
10 And it's possible -- I think there was another --
11 possibly a round of like copy editing or something. So
12 maybe -- and then I reviewed the final version. I don't
13 recall any substantial changes.

14 Q. This -- I believe you called it a first draft.
15 Did you reference a first draft?

16 A. I'm calling it an outline. Right? Because the
17 point is the document has various sort of pro forma --
18 various sections, such as, you know, my statements about
19 my understanding of the legal concepts and things like
20 that. And then, you know, okay, first we're going to
21 overview the patent, provide a sort of summary of the
22 references, and then go through each of the claims or
23 whatever -- the claims that I'm making statements about,
24 and then the particular form of those statements.
25 Right? And those are things that I needed help in

1 forming them in the right way that, okay, this is -- the
2 way it's appropriate to make the statement is either,
3 you know, that these items have been disclosed or that
4 they would have been obvious in view of various prior
5 references. So those kinds of things, I needed the
6 framework to set those up.

7 Q. Maybe the syntax or the phraseology?

8 A. Yes. There are some terms of art that would
9 not -- that I would not have written without that input.

10 Q. I believe, if I understand what you said
11 earlier, was that they, your attorneys, provided you a
12 draft.

13 A. You say draft and I'm saying outline, but I --

14 Q. That's what I want to correct. Because you did
15 say draft earlier. I want to make sure that that's what
16 you're now saying is an outline or if it was two
17 separate things.

18 A. So what is the difference?

19 Q. So I'm asking you -- let me go back and read
20 this. That way, we'll make sure we're talking about the
21 same thing.

22 Okay. If I understand it correctly, you stated,
23 "They provided me with a draft of the document, the
24 shape of the document that was appropriate for this
25 process." Could you speak about that draft and what

1 that was.

2 MR. DAS: Objection, asked and answered.

3 THE WITNESS: I believe I've answered this
4 before. Do you want me to say it again?

5 BY MR. CRAIN:

6 Q. Well, with respect to -- you also mentioned an
7 outline.

8 A. I'm not distinguishing those two things.

9 Q. So the draft that was provided to you was an
10 outline.

11 A. Yes.

12 Q. That's all. I wasn't sure if they were two --

13 A. No, you made me think like -- because I'm not
14 sure if there is some technical weight to these terms
15 which I'm not aware of. That's all.

16 Q. Let's see if we can start from the top.

17 A. Sure.

18 Q. Your attorneys provided you an outline that
19 ultimately led to the creation of your declaration.

20 A. That's right. The outline was a -- was based on
21 the discussions that we had. Right? So it was -- it
22 covered -- you know, it was basically including the
23 points that I wanted to make, which I had developed up
24 to that point.

25 Q. Was the outline in the basic form of what we see

1 your declaration now?

2 MR. DAS: Objection to form.

3 BY MR. CRAIN:

4 Q. Do you understand?

5 A. No, I'm not sure what you're asking. It was --
6 it had -- you know, it had sections. Right? It had
7 like many -- it had the subsections and section
8 headings, that kind of thing. And some content. And,
9 you know, the basic sentences that go in between.

10 Q. Yeah, that's what I'm trying to figure out. I
11 mean, was there some content in this draft that we see
12 in the declaration?

13 A. The declaration, if you -- yeah, they -- if you
14 saw them side by side, it would be clear that the
15 declaration was a descendent of that draft.

16 Q. Okay. Did you type the draft?

17 A. Yes. I mean -- so as -- I've described the
18 process. Right? There was an initial document, based
19 on our discussions, which was prepared for me -- sorry.

20 Q. For you? Prepared for you, did you say?

21 A. Which was given to me.

22 Q. Okay.

23 A. As a word processing file. I then typed my
24 changes and extensions and elaborations.

25 Q. Do you recall how substantial your changes and

1 elaborations were to the draft that you were provided?

2 MR. DAS: Objection, lacks foundation.

3 THE WITNESS: As I recall, I spent several hours
4 typing my input into the document, into the declaration,
5 which may give you some idea.

6 BY MR. CRAIN:

7 Q. Sure. I'm a little confused on one point, so
8 please bear with me. Did you type the draft -- the
9 initial draft?

10 A. No.

11 Q. So a draft was provided to you, you typed in
12 additional content. And I think you may have said
13 earlier that there were some additional back and forths.

14 A. Yes. It's possible. I don't recall exactly.

15 Q. According to your understanding of your draft --
16 I'm happy to get it for you if that would be helpful --
17 do you believe that more of the content in the draft was
18 typed by you or not by you?

19 MR. DAS: Objection to form. Objection, lacks
20 foundation.

21 BY MR. CRAIN:

22 Q. Can you answer?

23 A. I don't really recall. It doesn't seem
24 important. If there were -- the parts that I didn't
25 retype, the reason I would not have -- you know, that I

1 might have taken the text in the original draft was
2 because it correctly reflected what I had intended to
3 put in through discussions with my -- through the
4 discussions.

5 Q. Sure. I understand that. I don't think that
6 you're representing any part of your declaration is not
7 your opinion. Correct?

8 A. Right. Of course.

9 Q. It's all your opinion.

10 A. Yes.

11 Q. I'm just trying to understand who typed the
12 entire document.

13 A. Yeah. So -- but for me, it's not that
14 interesting, because the -- you know, the process of
15 providing the draft is hopefully to -- well, as I
16 understood it, to make sure that the draft has the form
17 that's expected for this particular technical process,
18 the legal process. But obviously, my involvement was
19 then to carefully go through the entire draft, making
20 all the changes and input that I felt necessary to be
21 comfortable that it was fully describing my position.
22 And my point being that's actually not -- it's not such
23 a big time save. It takes as long to read through it as
24 it would to type it -- to read through it and make
25 corrections as it would to type it from scratch.

1 Q. So you probably should have started out from
2 scratch typing? Is that what you suggest?

3 A. Well, I think the point is more of the form of
4 the document. Right? As I discussed. The different
5 sections and the -- some of the particular legal
6 technical wording of how to describe exactly what is
7 being discussed in the particular paragraph.

8 Q. Are you able to speak to the amount of time of
9 the 20 hours that you spent from your initial
10 involvement leading up to your declaration was spent on
11 the actual creation of the document?

12 MR. DAS: Objection, lacks foundation.

13 THE WITNESS: You know, the 20 hours is an
14 interesting number. Firstly, as I said, I'm not sure if
15 that's really the number. Secondly, even if that's the
16 number that I invoiced, I'm not -- there is -- we
17 shouldn't assume that that number is completely accurate
18 and the amount of time I spent. My --

19 BY MR. CRAIN:

20 Q. Go on.

21 A. My -- the style of work that I prefer is not,
22 oh, okay, now I'm going to spend two hours doing this.
23 As we've discussed, part of my involvement here is I
24 find these questions interesting. I'm interested in
25 knowing more about, you know, the development of ideas

1 and things like that. So probably if I billed 20 hours,
2 I don't recall exactly, but I think we probably had
3 discussed what would be an appropriate amount to bill.
4 And it's possible that I spent more time than that
5 involved in this project.

6 Q. Are you suggesting that you spent time on this
7 project that you did not bill for?

8 A. That's what I'm talking about. But the problem
9 is it's -- because of my particular work habits, it's
10 difficult to say, well, exactly when were you working on
11 this; when were you just following your own curiosity.

12 Q. Are you suggesting that you were giving your
13 time away for free for the project in any instance?

14 MR. DAS: Objection, form.

15 THE WITNESS: I'm not trying to suggest that.

16 BY MR. CRAIN:

17 Q. Okay. I'm just trying to understand what you
18 mean then.

19 A. The reason I raise it is just that it's -- to
20 help you understand that it may be difficult for me to
21 be precise about how to break down that time into
22 different activities.

23 Q. Are you backing away from the 20 hours, though?

24 A. No. I don't know. I mean, I think -- as far as
25 I -- this is obviously something that I have

1 documentation for. But my best recollection is the 20
2 hours is what I invoiced for.

3 Q. I appreciate that, Dr. Ellis. I don't have that
4 documentation, so I would ask for your best recollection.

5 A. Right. Right.

6 Q. I believe 20 hours is your best recollection?

7 A. That's correct.

8 Q. Was that 20 hours spent just for your efforts on
9 the '542 patent or for one or more other patents that
10 you may be serving as an expert on?

11 A. It's for the '542 patent and the '544 patent.

12 Q. Right. Because you are -- we'll be talking
13 tomorrow, I believe, about the '544 patent.

14 A. That's correct.

15 Q. So patent No. 5,652,544. Is that correct?

16 A. I don't know. But certainly the final three
17 digits are '544.

18 Q. You know the way I remember it? It's only two
19 off of the other one.

20 A. Okay. 5,652,544.

21 Q. So if I understand you correctly, when we were
22 talking about the first invoice that really began from
23 when you first got involved in this issue between -- let
24 me start again.

25 If I understand correctly, the 20 hours that

1 you've been referring to relates back to when you were
2 first engaged by QSC, up until the time you issued a
3 declaration for both the '542 and the '544 patents.
4 Correct?

5 A. That's correct.

6 Q. Thank you for that clarification.

7 A. Thank you for remembering that. It seems
8 important.

9 Q. Are you able to identify by name, the attorneys
10 that assisted you with your declaration?

11 MR. DAS: Objection, form.

12 THE WITNESS: I know who I communicated with,
13 yes.

14 BY MR. CRAIN:

15 Q. Who did you communicate with?

16 A. Mr. Tullett. There was some -- Mr. Das was
17 involved a couple of times, but primarily I was
18 communicating with Mr. Tullett.

19 Q. Did you communicate with anyone perhaps at
20 Columbia or anyone else other than attorneys with
21 respect to the preparation of your declaration?

22 A. I don't think so.

23 Q. I didn't ask that -- that wasn't a really good
24 question. Let's see if we can try it this way: Was
25 there anyone else that may have assisted in the creation

1 of the document that is your declaration other than
2 yourself and one or more of the attorneys --

3 MR. DAS: Objection to form.

4 BY MR. CRAIN:

5 Q. -- of QSC?

6 A. How could that be? I mean -- you mean -- not to
7 my knowledge.

8 Q. Well, for example, maybe did you have an
9 assistant in your office prepare --

10 A. Oh, no.

11 Q. -- doing typing for you?

12 A. (Witness shakes head).

13 Q. Did you have a graduate assistant or some
14 student maybe provide some assistance?

15 A. No.

16 MR. DAS: Objection, form. Objection, compound.

17 BY MR. CRAIN:

18 Q. Okay. That's what I was trying to understand.

19 A. Sorry.

20 Q. Sorry for --

21 A. That's fine.

22 Q. I think you stated this earlier. Let's just
23 make sure I'm clear on this. You adopt all of the
24 content in your declaration as your opinion, if I
25 understand you correctly. Isn't that right?

1 MR. DAS: Objection, form.

2 THE WITNESS: It's my declaration, yes. That's
3 what I'm saying, yes.

4 BY MR. CRAIN:

5 Q. That's the setup question.

6 A. Yes.

7 Q. The follow-up question is, is there any part of
8 your declaration that you do not adopt today as the
9 nature of your opinion?

10 MR. DAS: Objection, form.

11 THE WITNESS: No. Not that I can think of. You
12 know, I don't have the declaration in front of me, but
13 I'm not going to go through it line by line right now.
14 But there is certainly nothing weighing on my
15 conscience.

16 BY MR. CRAIN:

17 Q. I think you reviewed your declaration for the
18 past two days.

19 A. That's right.

20 Q. I can give it to you. But I'm asking you at
21 somewhat of a general level, if you're able to recall --
22 I understand you to say there is not any part of your
23 opinion that you do not adopt today.

24 MR. DAS: Objection to form.

25 THE WITNESS: Let me just think about that for a

1 second. I stand by the declaration.

2 BY MR. CRAIN:

3 Q. Thank you.

4 So I'm sure that probably means, then, there is
5 no part of your declaration that you believe, at least
6 today, that should be changed?

7 A. Why would I want to change it?

8 Q. I don't know. Is there any reason why your
9 declaration should be changed today?

10 A. No. Well, as we discussed, I feel that I have a
11 deeper understanding of Porambo. In particular, this
12 issue of the current -- the clipping possibly being
13 related to current. And if I had thought of that before
14 making the declaration, I might have wanted to try and
15 make that argument, because I feel like it actually
16 strengthens the relevance.

17 Q. Does that, in any way, make your declaration
18 incomplete?

19 A. I don't think so.

20 Q. Does that, in any way, make your declaration
21 inaccurate?

22 A. No.

23 Q. Dr. Ellis, when did you finish your
24 undergraduate degree?

25 A. I believe it was 1987.

1 Q. Where did you earn that degree from?

2 A. Cambridge University in England.

3 Q. What degree did you obtain?

4 A. A B.A., Bachelor of Arts, honors, in
5 electrical -- in engineering.

6 Q. You said 1987?

7 A. As I recall.

8 Q. Prior to pursuing the degree at Cambridge, did
9 you have any specialized training before that related to
10 electrical engineering?

11 A. Yes.

12 Q. What training was that?

13 A. As was certainly common in England at the time,
14 I took a year off between finishing secondary school and
15 starting university. During that year, I worked for
16 British Telecom, the telecommunications company, and
17 that -- they had a special management trainee scheme
18 that I was part of, which involved something like -- so
19 some kind of small version of actual classes. There was
20 a group of, I think, 15 of us. We spent that year in a
21 mixture of visiting different British Telecom facilities
22 and at a residential training college they had, where we
23 were given a series of courses, which I don't recall
24 very well, but I think would certainly -- certainly
25 included electronics -- some electronics topics. Prior

1 to that, when I was actually still in high school --

2 Q. Let me interrupt you. I want to ask one
3 question, then I want you to go to that. What year was
4 that, that you did that year at British Telecom?

5 A. I think that was 1983.

6 Q. Please go on.

7 A. Prior to that, I was -- electronics was a hobby
8 for me when I was in school -- when I was in secondary
9 school. And I was training myself to do electronics by
10 reading magazines. There is different magazines that
11 were available mainly aimed at hobbyists.

12 Q. Do you remember either the magazines or the
13 subject matter of the magazines?

14 A. I do. So I remember I was very fond of Wireless
15 World, which is a very, very long-established magazine.
16 I don't know if it still exists. But it was kind of
17 nice, because it has a mixture of both practical things
18 and more theoretical articles. It sort of amazes me now
19 to think back, because it was like, oh, I was already
20 reading technical papers.

21 Then there was another magazine called Elektor,
22 with a K, which I believe was published in Germany, that
23 was in English, that also had circuits and discussions
24 of how to build things.

25 Q. Approximately what year or years do you recall

1 reviewing Elektor and Wireless World?

2 A. Let's say -- so I don't recall exactly, but
3 probably 1981 through 1983.

4 Q. During your time at Cambridge when you sought
5 and obtained your B.A. degree in -- was it electrical
6 engineering or electronics engineering?

7 A. It was engineering. Would you like me to
8 explain?

9 Q. Yes. That would be helpful. Thank you.

10 A. At that time, the degree was engineering, but
11 you would have a final year specialization. My final
12 year of specialization was electrical and information
13 sciences.

14 Q. So leading up to that last year, may you also
15 have done say mechanical engineering?

16 A. That's correct.

17 Q. Chemical engineering maybe?

18 A. No. I never did any chemical engineering.

19 Q. Is it fair to say that it was a general type of
20 engineering training with a year conclusion focused on
21 the topic that you chose or pursued?

22 A. Yes. As I recall, that's how it is. As I
23 recall, in contrast to the normal experience at American
24 universities, there was very little choice involved in
25 the classes, and that it was basically the same range of

1 classes that everybody took until their final year.

2 Q. During any of your time at Cambridge, do you
3 recall being involved in power amplifiers?

4 MR. DAS: Objection, form.

5 THE WITNESS: It's hard for me to recall. What
6 I recall is before going to college, as a hobby --
7 hobbyist, I built several power amplifiers, and then --
8 when I was still in secondary school. And I imagine
9 it's quite possible that I continued some of that when I
10 was in college.

11 BY MR. CRAIN:

12 Q. What type of amplifiers did you build?

13 A. Again, I don't recall that well, but I'm
14 remembering one particular audio power amplifier that I
15 built. And I built it from a kit.

16 Q. And what did you do with it?

17 A. I used it to play music. I connected it to my
18 record player.

19 Q. Where did you get the kit?

20 A. I bought -- again, I'm somewhat synthesizing
21 rather fragmentary memories, but I remember visiting
22 hobby electronics shops which were on the Edgeware Road
23 in London. I was not living in London. I would go up
24 to London. One of the things I would do on my day trips
25 would be to travel out to Edgeware Road to go to the

1 electronics stores where you could buy components. I
2 think -- it wasn't -- I don't remember. Yes, I think it
3 was probably a complete kit, with all the components;
4 although in other situations, I would have perhaps
5 seen -- read an article in one of the magazines that
6 described something, and then gone and bought the
7 individual components to put it together. That's how
8 these things typically worked.

9 Q. Do you still have the power amplifier that you
10 built from the kit?

11 A. Sadly, no. I have no idea where it is.

12 Q. Do you have any of the amplifiers that you may
13 have built during this time that you're referring back
14 to?

15 A. No.

16 Q. What were some of the other uses for the
17 amplifiers that you built, if you can recall?

18 A. You know, I was -- I was mostly interested in
19 sound. So I think the only -- certainly the only power
20 amplifiers I ever built were for driving speakers,
21 driving loudspeakers.

22 Q. Did the kit that you purchased to build the
23 power amplifier for driving the loudspeaker that you can
24 recall have all of the components necessary to do that,
25 as best you can recall?

1 A. I think, no. I think there were certain things,
2 like the power supply, that maybe you had to provide
3 separately.

4 Q. How many power amplifiers do you recall building
5 during this time?

6 MR. DAS: Objection, form.

7 THE WITNESS: As I've mentioned, this is, you
8 know -- this is not something I've thought about very
9 much.

10 BY MR. CRAIN:

11 Q. I understand.

12 A. I can remember one specific amplifier.
13 Although, as the nature of these things, it's -- that
14 one specific amplifier could involve -- the process of
15 creating it could take -- it's not like an afternoon's
16 job. It would be something that maybe I would do once
17 and then possibly go back and modify later. So it could
18 extend over months.

19 Q. We kind of got off on this because I was asking
20 you about did you do any design or testing of
21 amplifiers --

22 A. Yes.

23 Q. -- during your time at Cambridge. I think you
24 said no. But would you please clarify that.

25 A. I don't recall doing any design or testing of

1 amplifiers when I was at Cambridge. Let me just think
2 about it for a second.

3 As I've described, this -- my building an
4 amplifier from a kit is not designing an amplifier.
5 Although building an amplifier from a kit does involve
6 testing an amplifier, but not in a particularly rigorous
7 way.

8 While I was at Cambridge -- it's interesting --
9 while I was at Cambridge, my emphasis -- my intellectual
10 emphasis had already shifted towards signal processing
11 rather than electronics -- rather than, you know, the
12 amplifier electronics.

13 Q. I recall having similar kits like that, at least
14 it sounds similar.

15 A. Yes.

16 Q. I want to say that there were some instructions
17 in the ones I had.

18 A. Yeah.

19 Q. Was that the case with the one you recall?

20 A. So I think that reminds me. So, definitely,
21 that was not the only one I built. I started as an
22 electronics hobbyist probably when I was ten or eleven.
23 And I remember having actual Radio Shack kits, which may
24 be similar to the ones you're thinking about. By the
25 time I was in high school or secondary school, I sort of

1 moved beyond that and it was much more -- it was -- like
2 I've described this idea of you have these magazines
3 that publish these articles, but then you're assumed to
4 be able to go out and find the components on your own.
5 So it's a little less -- it's a little -- there is some
6 more independence involved in the construction.

7 Q. Dr. Ellis, what did you do after you obtained
8 your degree from Cambridge?

9 A. The first job I had on graduating from Cambridge
10 was working in what was called a management consultancy
11 called Metapraxis. My job was -- involved a number of
12 different things, but mostly it was writing software.

13 Q. What was the name of the company?

14 A. Metapraxis, M-E-T-A-P-R-A-X-I-S.

15 Q. I don't believe that company is listed in your
16 CV; is it?

17 A. It might not be.

18 Q. Do you recall what the software that you were
19 involved in writing was designed to do?

20 A. Yes. The company was -- they called -- they
21 styled themselves as an executive information systems
22 company. The business was providing information systems
23 to senior executives in large companies. And what we
24 did was we would write software that would process the
25 low-level accounting information from their operations,

1 and produce graphical representations that would allow
2 them to investigate what was happening to get a better
3 understanding of what the company was -- how things were
4 going in that company. So one of the things I would do
5 would be to write those kinds of software that would
6 take data streams and produce graphical representations.

7 MR. DAS: Dr. Ellis, I'm going to interrupt for
8 a second. I don't want to cut off the flow. But be
9 careful not to get into confidential information about
10 any of your past employers, because that's not something
11 that would be covered in this deposition.

12 THE WITNESS: Okay.

13 MR. DAS: Just be careful.

14 BY MR. CRAIN:

15 Q. So when were you employed with Metapraxix?

16 A. I worked for them for two years, I think from
17 like summer of '87 through the summer of '89.

18 Q. Was any of your work at Metapraxix -- did it
19 involve audio signal processing?

20 A. No.

21 Q. Were you pursuing a master's degree at the same
22 time you were working at Metapraxix?

23 A. No.

24 Q. So we've established after Cambridge, you worked
25 at Metapraxix. When did you leave Metapraxix?

1 A. I think in August of 1989.

2 Q. What did you do next?

3 A. Then I moved to the U.S., moved to Cambridge,
4 Massachusetts, and started as a graduate student at MIT.

5 Q. That was in '89?

6 A. Yes.

7 Q. Did you have a focus or concentration of your
8 study at MIT?

9 A. When I went to MIT, it was specifically to join
10 a group under a particular professor. The group was
11 called the Experimental Music Studio. So my -- and this
12 was following on from my interest -- you know, my
13 intellectual interest in sound and audio. So I was
14 focusing on -- on processing of sound -- processing and
15 analysis of sound and audio signals.

16 Q. Did you actually join the group called the
17 Experimental Music Studio at MIT?

18 A. Yes.

19 Q. Did you stay associated with that group during
20 your time pursuing your master's degree?

21 A. Yes. So let me explain. As a graduate student,
22 I worked with a particular professor. This is the
23 normal -- the normal pattern. As a graduate student,
24 you'll work with a specific professor. I worked with a
25 single professor, Professor Barry Vercoe, during my

1 entire time at MIT. When I joined his group, he had
2 several other graduate students. His group was called
3 the Experimental Music Studio. The name of the group
4 changed, possibly more than once, but the nature of the
5 group did not change very much.

6 Q. What did the name change to?

7 A. The name that I remember -- the second name that
8 I remember is the Machine Listening Group.

9 Q. So the name changed, but the purpose didn't?

10 A. Well, I think the name change reflects some
11 change in emphasis, that Professor Vercoe was actually a
12 professor of music, I think, a professor in the music
13 department, or certainly had an appointment, and had
14 done a lot of work on using signal processing to create
15 music sounds. But during the time I was there, the
16 focus moved more generally to sound processing, not
17 specifically limited to music.

18 Q. Why was Machine Listening Group a more accurate
19 name than -- I think the initial name was like
20 Experimental Music Group?

21 A. Experimental Music Studio.

22 Q. I'm sorry. Studio.

23 A. That's right. Because I think it was -- I agree
24 that it was a more accurate name, and it was because for
25 my own work, what I was doing, which was representative

1 of the kind of work being done in the group, I was
2 looking at taking sound -- recorded sound signals, but
3 not particularly music signals, and I was specifically
4 trying to develop algorithms to separate out the
5 different sound sources that might be present in those
6 signals, which it seems like -- machine listening seems
7 like a nice way to describe that.

8 Q. Is there a general reason or purpose for why one
9 would want to use a machine for listening to sound in
10 the nature of -- the manner in which you did it?

11 A. Obviously, we had a number of motivations and
12 arguments we would use to justify the work we were
13 doing. For instance, enhancement of noisy signals. So
14 that if you have some speech mixed with noise, it may be
15 difficult for a listener to understand the speech. If I
16 could build a system that could separate the speech and
17 the noise signals, then I could play the listener simply
18 the speech, and it would improve their understanding,
19 their intelligibility. Those are the kinds of
20 motivations.

21 Q. When did you earn your master's degree from MIT?

22 A. I believe it was in 1992.

23 Q. What did you do after you earned your master's
24 degree?

25 A. I continued into the Ph.D. program.

1 Q. Was that at MIT as well?

2 A. Yes. In the same group.

3 Q. So that would have been 1992 as well?

4 A. Yes.

5 Q. Did your study or emphasis as a student seeking
6 a Ph.D. stay the same as it had been with respect to
7 your master's degree?

8 A. There certainly wasn't any discontinuity just
9 because I finished my master's thesis. The graduate
10 program was very much a continuation, a single thread.

11 Q. With respect to your study at MIT, whether
12 for -- in pursuit of your master's degree or your
13 Ph.D. -- which by the way, when did you earn your Ph.D.
14 degree?

15 A. I earned the Ph.D. in 1996.

16 (Exhibit 3 marked for identification.)

17 BY MR. CRAIN:

18 Q. Dr. Ellis, I'm going to hand you Exhibit 3,
19 please. Would you take a minute to review Exhibit 3.

20 A. Okay.

21 Q. Dr. Ellis, are you able to identify what appears
22 to be Exhibit 3?

23 A. Yes.

24 Q. What is it?

25 A. This is my master's thesis from MIT.

1 Q. I see what appears to be the title, "A
2 Perceptual Representation of Audio." Is that correct?

3 A. That's right.

4 Q. Are you able to give me at least a summary of
5 what the thesis pertains to?

6 MR. DAS: Objection, form.

7 You can answer.

8 THE WITNESS: Sure. I, you know -- I do not
9 feel like, wow, I know exactly what the boundaries of
10 this work were. Shall I look at it so I can give you a
11 better answer?

12 BY MR. CRAIN:

13 Q. Feel free. I'm not trying to test you on it.

14 A. I know.

15 So, as best I can recall, from looking at the
16 table of contents, this is specifically about a way of
17 taking a sound signal and breaking it up into a set of
18 short-duration sinusoidal components which try to
19 completely account for all the important information in
20 the signal, which would be useful in the kind of mixture
21 of signal situations I described earlier.

22 Q. During your time in pursuit of your master's
23 degree, leading up to 1992, did your study involve
24 software design?

25 MR. DAS: Objection, form.

1 THE WITNESS: So the nature of the work in this
2 thesis is -- certainly involves a lot of software. I
3 don't recall taking any classes in software design, but
4 it's fair to say that what I was -- some of the stuff
5 that I was learning at that point would involve issues
6 relating to software design.

7 BY MR. CRAIN:

8 Q. Thank you for answering that. That question, I
9 think -- I'm not sure it got to where we wanted to go,
10 but I think you helped me there. So thank you for that.

11 Based on that response, I think I understand you
12 to say that you did or at least were writing software
13 with respect to your research and study during this time
14 period when you pursued your master's degree.

15 A. Yes.

16 Q. Were you also involved in hardware design during
17 that same time?

18 A. It certainly wasn't my emphasis, but this was --
19 it's relevant -- what's relevant here is this was the
20 time that I was first exposed to digital signal
21 processing chips. Because in the group at the time, my
22 professor, Professor Vercoe, was very interested in DSP
23 chips and using them for music -- for music audio. And
24 I don't recall the exact platform we were using, whether
25 it was something that was designed in-house. I think it

1 was. I think there was actually some in-house design of
2 the electronics, but that was not something that I was
3 directly involved in. I was not directly involved in
4 the electronics. I was certainly involved in some of
5 the programming of the DSP.

6 Q. Are you able to give us a specific time as
7 possible of when you were first exposed, as you said, to
8 digital signal processing chips?

9 A. Digital signal processing chips? As far as I
10 recall, it would have been immediately on my arrival at
11 MIT in 1989 -- in September 1989. As I recall, my
12 office mate was the one who was building a particular
13 DSP system, using a DSP chip.

14 Q. I think you've already kind of insinuated or
15 shared with me that you're not intimately familiar today
16 with maybe your master's thesis.

17 A. The point I was trying to make was that the
18 master's thesis, the work was very much -- I continued
19 in the same style of work to do my Ph.D. So the part
20 that I was unsure about is exactly where the boundary
21 was, how far did I get when I wrote this versus what I
22 did subsequently, which was sort of along the same lines.

23 Q. Do you recall if your work and study leading up
24 to your master's thesis involved the use of DSPs?

25 MR. DAS: Objection, form.

1 THE WITNESS: I'm sorry. The question was --
2 so -- as I've just stated, during the period of time
3 leading up to my master's degree at MIT, I was -- I was
4 involved in one or more projects that involved using a
5 DSP chip. The material described in the master's
6 thesis, I don't think has any reference to that. But
7 this was not a complete description of everything I was
8 doing at MIT in those years.

9 BY MR. CRAIN:

10 Q. I don't have a master's degree, so I can't say
11 that I have the experience that you have or maybe some
12 of the others at the table have. So when you pursue a
13 master's degree, is there -- the thesis, is that the
14 culmination of your area of emphasis during that time or
15 no?

16 A. So it's interesting. I now teach at the
17 university where we train a lot of master's students,
18 and there is no master's thesis, at Columbia University.
19 I would say that it's -- MIT is not unique in having a
20 master's thesis, but there is a variety of practices.
21 To get the master's degree, writing a thesis and having
22 it be accepted was a requirement, but it wasn't the only
23 requirement. You also had to do a certain number of
24 courses, and probably achieve some minimum grade point
25 average in those courses.

1 MR. CRAIN: Okay. That's helpful. Thank you.

2 MR. DAS: Henry, we've been going about an hour
3 and 15 minutes.

4 MR. CRAIN: This is actually a great time to
5 take a break. Good call there, KM. We'll go off the
6 record.

7 THE VIDEOGRAPHER: This is the end of Media
8 No. 2 in deposition of Dr. Daniel Ellis. The time is
9 12:09 p.m. We are now off the record.

10 (Lunch recess taken from 12:09 to 1:07.)

11 THE VIDEOGRAPHER: This is the beginning of
12 Media No. 3 in the deposition of Dr. Daniel Ellis. The
13 time is 1:07 p.m. We're back on the record.

14 MR. CRAIN: Thank you.

15 BY MR. CRAIN:

16 Q. Dr. Ellis, as we're coming off of our lunchtime
17 break, is there any testimony that we've talked about
18 that you've given earlier today that you would like to
19 go back and revisit and possibly change or correct?

20 A. No.

21 Q. Did you have a chance to consult with your
22 attorneys during the break?

23 MR. DAS: Objection, vague.

24 BY MR. CRAIN:

25 Q. Did you consult with QSC's counsel during the

1 break?

2 A. What do you mean by "consult"?

3 Q. Did you talk with your attorneys?

4 A. Yes.

5 Q. Did you consult or confer with QSC's counsel
6 during the break regarding the substance of the
7 testimony that you've already given?

8 A. No.

9 Q. Did you consult or confer with your attorneys,
10 Mr. Das or Mr. Tullett, regarding the substance of any
11 testimony anticipated to be given?

12 A. No.

13 MR. DAS: Mostly we talked about the world cup.

14 MR. CRAIN: So what's the final?

15 MR. DAS: So we're in. The U.S. is in.

16 BY MR. CRAIN:

17 Q. During the break, did counsel for QSC, in any
18 way, suggest to you the manner in which questions should
19 be answered?

20 A. They said -- yes.

21 Q. The answer to my question is yes?

22 A. Yes.

23 Q. What did they say?

24 A. Mr. Das noted that we were making fairly slow
25 progress and he encouraged me to not -- not pause so

1 long and make additional statements after pausing.

2 Q. What else?

3 A. That's all I can recall.

4 Q. But none of that discussion pertained to any
5 specific testimony that had been given earlier?

6 A. That's right.

7 Q. I believe we were talking before the break about
8 your time as a master's student and then subsequently in
9 pursuit of your Ph.D. Do you recall?

10 A. Yes.

11 Q. I don't know if I asked you. You may have a
12 better memory than I. But did you do any design or
13 testing of amplifiers during your time in pursuit of
14 your master's degree?

15 MR. DAS: Objection, form. Objection, asked and
16 answered.

17 THE WITNESS: I don't think so. I don't recall.
18 BY MR. CRAIN:

19 Q. What about in pursuit of your Ph.D.? Did you do
20 any design or testing work on power amplifiers?

21 A. It wasn't a substantial part of my work. My
22 work was focused on signal processing.

23 Q. I think you've used that term, signal
24 processing, a couple times today. I just want to be
25 sure I understand what you're talking about. Would you

1 describe that to me so that we have a common
2 understanding.

3 A. Signal processing is the field of engineering
4 that involves taking a signal, which is typically
5 information carried on some continuously varying value,
6 and then performing various operations on it to extract
7 other information or to change it into some form that's
8 more useful for some other purpose.

9 Q. I believe you said you earned your Ph.D. in
10 1996.

11 A. Yes.

12 Q. You shared with me the name of a company. Was
13 it Meta --

14 A. Metapraxix.

15 Q. Metapraxix. Subsequent to employment by
16 Metapraxix, and, of course, the pursuit of your degrees
17 as well, what was the next job or employment that you
18 had after Metapraxix, not including any educational
19 activities?

20 A. Okay. The only thing that's coming to mind is
21 the internships I did whilst I was at MIT, which was the
22 one -- the first one I can think of was work I did for
23 Aware, Inc.

24 Q. I believe, according to your CV, you started
25 around 1991. Does that sound about right?

1 A. Sounds about right.

2 Q. What was your role at Aware, Inc.?

3 A. Aware, Inc., was working on audio compression
4 algorithms, such as -- this was the time that MPEG audio
5 was being developed. I was involved in designing and
6 implementing versions of that algorithm and extensions,
7 algorithms of that kind.

8 Q. How were those algorithms being implemented?

9 A. As I recall, most of the work was done writing
10 programs in C language under a UNIX environment. I do
11 remember specifically that there was some additional
12 work where I was implementing algorithms to run in
13 machine code, on a 68040 processor. That's all I
14 recall.

15 Q. Do you recall doing any design or testing work
16 on power amplifiers during your time at Aware, Inc.?

17 A. No.

18 Q. Then, if I remember correctly, I think you left
19 Aware around 1993. Does that sound right?

20 A. So I wasn't a full-time employee by then. It
21 was an internship that I did during breaks from school.
22 I think the final break during which I worked for them
23 was like the December of '93 break, something like that.

24 MR. CRAIN: This is not meant to be a memory
25 test. So I will be glad to give you your CV if that

1 will be helpful to you. Because I think that's from
2 where this information was gleaned.

3 THE WITNESS: Sure.

4 (Exhibit 4 marked for identification.)

5 BY MR. CRAIN:

6 Q. Dr. Ellis, handing you what has been marked as
7 Exhibit 4. Would you please take a moment to review it
8 and identify it if you're able.

9 A. This is my full academic CV from very recently,
10 as published on my website.

11 Q. Is Exhibit 4 an accurate representation of your
12 CV, as best you can tell?

13 A. Yes. Oh, wait. 2013. So it's like a year out
14 of date. But yes.

15 Q. What would be different about your current CV --

16 A. Oh, just -- there is a few other things I've
17 added, like more classes I've taught, more papers that
18 I've published. But the current CV would be almost
19 entirely a superset of what's currently here.

20 Q. Got you.

21 So understanding we were talking about your time
22 at Aware, I think you may have characterized that as
23 part-time employment.

24 A. That's right.

25 Q. Why did you end your association with Aware?

1 A. They stopped working in that particular line of
2 area. The project to work on MPEG audio, they stopped
3 doing.

4 Q. After you concluded your association with Aware,
5 what was the next employment that you can recall having
6 had?

7 A. I did another -- I did another internship while
8 I was a graduate student, which was the summer of 1994
9 that I spent at Interval Research.

10 Q. Now, do you consider your time at Aware as an
11 internship?

12 A. Yes. There may be some technical reason why I
13 didn't list it this way. Because it was kind of --
14 unintentionally, it was more like a single short stretch
15 of time, where this was several things. I think they
16 called me technical staff. That's why it says that
17 here.

18 Q. Were you compensated by Aware during your time
19 there?

20 A. Yes.

21 Q. Did you earn any credit hours at MIT due to your
22 association at Aware?

23 A. I don't think so.

24 Q. All right. Then we move to Interval Research
25 Corporation. I believe it says June to August of 1994.

1 A. That's right.

2 Q. What was your role as an intern at the Interval
3 Research Corporation?

4 A. It was a nice opportunity. They actually took
5 on a bunch of students for these summer internships and
6 they essentially let them do what they wanted to do. I
7 was working directly for some of the more senior
8 researchers there, but I was told, "Look, whatever
9 you're working on, you can carry on doing your research
10 in that area." So, at the time, I was following on the
11 work for my master's thesis, on using auditory models
12 and trying to make them more practical for analyzing
13 sound. That's what I was continuing to develop.

14 Q. Was that more software-based work?

15 A. Yes. Let me just think for a second. There was
16 a lot of -- there was a very wide range of projects
17 going on at Aware, and there was a level of
18 involvement -- they tried to encourage everyone to be
19 interested. They would have presentations.

20 The guy I was working for was also working on a
21 project that was -- included a hardware component
22 that -- he was, you know, building the sensing -- the
23 microphone sensing system. I may have had some
24 involvement in that as well.

25 Q. That was back at Aware, though. Right?

1 A. Sorry. That was at Interval.

2 Q. Oh. I think you did say Aware. That's why I
3 misunderstood.

4 A. Sorry.

5 Q. So you may have had some involvement with a
6 microphone hardware component?

7 A. That's right.

8 Q. At Interval.

9 A. At Interval, yes.

10 Q. For about a two- to three-month stretch in 1994?

11 A. Right.

12 Q. Why did you end your association with Interval
13 Research?

14 A. It was a summer internship.

15 Q. Now, I think -- I guess, overlaying all this,
16 from 1989 through 1996, there were periods of time, I
17 guess, that you were a research assistant at MIT.
18 Correct?

19 A. Right. So I was a graduate student. And as a
20 graduate student, I was being supported. I was being
21 paid a stipend and my fees were being paid in my role as
22 a research -- an appointed research assistant.

23 Q. Jumping back to Interval Research Corporation
24 for a minute, were you compensated by Interval Research?

25 A. Yes.

1 Q. As a research assistant during your time at MIT
2 in the Media Lab Perceptual Computing Group -- I don't
3 know how you call that --

4 A. That's interesting, yes. As I said earlier, I
5 was in the Machine Listening Group. Perceptual
6 computing was like an area within the media lab. I used
7 that term there just because it's got some name
8 recognition.

9 Q. Got you. I suspect that over the course of 1989
10 through 1996, maybe your responsibilities changed during
11 that time.

12 A. Yes.

13 Q. Are you able to speak about them generally at
14 least?

15 A. Sure. So I was doing -- you know, I was doing
16 my primary academic research job, working towards the
17 material that was published in my papers and in my
18 thesis. I was also involved in a variety of other
19 projects to do with different things going on around the
20 lab. For instance, I was responsible, for some period,
21 for managing the computer systems and managing -- you
22 know, dealing with various changes in different
23 equipment that we would obtain.

24 There was a studio there. There was a studio
25 facility within the media lab, at least part of the time

1 there. I would have helped -- one of the things about
2 the media lab was we did a lot of demonstrations for
3 sponsors. So a big part of being a graduate student
4 there was making these demonstrations happen and go off
5 smoothly.

6 So one thing we had was a system where someone
7 would play a violin, and the computer would produce
8 accompaniment in realtime and keeping in time with the
9 performer. One of my jobs was to make that system work.
10 And I mention this, because that system also involved
11 some sound reproduction equipment; that is, amplifiers
12 and speakers.

13 Q. Did you design those amplifiers and speakers?

14 A. No.

15 Q. Were they just off-the-shelf type components?

16 A. They were certainly -- the core components were
17 off the shelf. Then it's a question of wiring it
18 together.

19 Q. But you didn't do that?

20 A. Oh, I would have been involved in putting
21 together the whole system, yes. But -- yeah.

22 Q. Did you build the system?

23 A. It depends what you mean by "build." I didn't
24 solder the components together, but I did connect the
25 components together, the larger components, to make the

1 entire system.

2 Q. I'm just trying to understand. I mean, are you
3 connecting an amp to a speaker or are you connecting
4 internal parts of an amplifier?

5 A. I'm not connecting internal parts of an
6 amplifier.

7 Q. So you're connecting discrete components that
8 was part of a sound reproduction system?

9 A. Yes.

10 Q. During your time from 1989 to 1996, did you have
11 occasion to design or test audio amplifiers?

12 A. I would not say that I designed any. I think
13 some of the things I did would count as testing them.

14 Q. What are some of those things that you would
15 consider as testing of audio amplifiers?

16 A. So in the system I've just -- in the
17 responsibility I've just mentioned, where I'm putting
18 together a system for a live demo, you want to make sure
19 that everything is working; and when things are not
20 working, diagnosing where problems are. Most likely,
21 that would be things like, you know, an amplifier that
22 was faulty in some way.

23 Q. So is that more like a sound check type test?

24 A. It's a little bit more than that. Right?

25 Because it's like -- you would start off with a sound

1 check; but if there is a problem, then it's not like,
2 okay, we're done. It's more like, okay, now we have to
3 figure out what happened and rectify it.

4 Q. Right. Do you remember the brands of power
5 amplifiers you dealt with?

6 A. I remember one, which was a Harman Kardon.

7 Q. What was the occasion or reason for you to end
8 your association at MIT as a research assistant?

9 A. When I finished -- when I graduated with my
10 Ph.D., that's when I ended that relationship.

11 Q. Obviously, I see what follows that. But would
12 you share with us what you did next.

13 A. Yes. Then I went to work at the International
14 Computer Science Institute in Berkeley, California,
15 which is affiliated with the University of California at
16 Berkeley, the electrical engineering and computer
17 science department there. I initially went as a
18 post-doc. After two years as a post-doc, I stayed
19 there; but you can't be a post-doc for that long, so my
20 title was changed to senior research scientist.

21 Q. During the entire time -- or if you want to
22 break it up, I'll leave it to you -- could you describe
23 your involvement and activities.

24 A. So, primarily, my job again was to be doing
25 research and to be writing academic papers and

1 developing knowledge, which was mainly related to speech
2 recognition, signal processing aspects, dealing with
3 speech recognition in noisy conditions. There was --
4 yeah, there was some hardware involved with that.

5 Q. What was the hardware design work?

6 A. There were a couple things. One was a
7 specialized computational device that was built within
8 the group while I was there. I was not the primary
9 architect, but I was somewhat involved in the design and
10 then the use and maintenance of that system.

11 Another thing that I was involved in while I was
12 there was a system for making recordings. We did a
13 project where we made recordings of people talking in
14 conference rooms. That was a fairly complicated
15 multichannel recording system. And I was actually
16 involved in designing the microphone preamplifier
17 components of that, because we couldn't find an
18 off-the-shelf solution.

19 Q. So it sounds like the answer may be in the
20 affirmative with respect to this question: During your
21 time at ICSI, did you have occasion to design or test
22 audio amplifiers?

23 A. Yes.

24 Q. What were those occasions?

25 A. As I just described, I think that's probably the

1 only occasion; but in the process of building the
2 specialized recording system, I was involved in the
3 design and manufacture and testing of these microphone
4 amplifiers.

5 Q. Let's talk about that. How do these microphone
6 amplifiers that you designed operate?

7 A. The recording device, the recording interface,
8 the multichannel recording interface, had a set of
9 line-level inputs, which is inputs of roughly a volt
10 amplitude. The microphones we were using, which were
11 say a headset mic., might generate a few -- less than a
12 millivolt of output. So you need an amplifier in
13 between to raise the level of the microphone output
14 signal to something that's suitable for the
15 analog-to-digital converter.

16 Q. Did this microphone -- did you use a DSP in this
17 application?

18 A. The microphone amplifier did not involve a DSP.
19 It was a purely analog device.

20 Q. Did you build multiple microphones having this
21 design?

22 A. We did. The reason that we -- the reason we
23 went for this is because we needed a bunch of them. So
24 we designed it once and then built, I think, like ten of
25 them.

1 Q. Were they ever commercially manufactured?

2 A. No.

3 Q. Why not?

4 A. Well, firstly, that wasn't our mission at all.
5 We weren't building it as an enterprise. It was just
6 because we needed it to complete our research.

7 Q. How long did it take you to build it?

8 A. The project probably took several months. I
9 definitely recall that we didn't get it right the first
10 time. We had to cycle it back. I was working -- there
11 was a full-time design engineer who was on staff I was
12 working with. So when I'm saying "we," that's who I'm
13 referring to.

14 Q. Of the four years that you were associated with
15 ICSI, were you compensated during that time?

16 A. Yes.

17 Q. Why did you ultimately leave ICSI in
18 August 2000?

19 A. I left to take up my position on the faculty of
20 Columbia, which seemed like a good career move.

21 Q. I'm sure. I understand from your CV that you
22 took the position of an assistant professor of
23 electrical engineering. Is that correct?

24 A. That's correct.

25 Q. What is an assistant professor of electrical

1 engineering at Columbia? What does that job entail?

2 MR. DAS: Objection to form. Objection,
3 compound.

4 MR. CRAIN: Okay. Let's start again.

5 THE WITNESS: Okay.

6 BY MR. CRAIN:

7 Q. Can you describe the responsibilities or duties
8 of an assistant professor as of the time that you were
9 there from 2000, 2005?

10 A. Sure. You have -- I mean, it's actually -- it's
11 a very -- it's not that well defined. But you have a
12 variety of roles. You're responsible for teaching
13 classes. You're responsible for developing your own
14 research program, which means both the intellectual work
15 of developing ideas, and also the fund-raising work of
16 writing grants and getting grants to fund your work.
17 You're responsible for supervising students, both your
18 own graduate students, and also the master's and
19 bachelor's students who are around. And you have some
20 level of responsibility for professional service, such
21 as serving as a reviewer for journals and publications
22 in your field, and also for helping with responsibilities
23 around the department, such as advising graduate
24 students -- advising undergraduate students and, you
25 know, running committees, things like that.

1 Q. It sounds like you stayed busy.

2 A. It's a busy job.

3 Q. I believe your title changed in 2005. Is that
4 correct?

5 A. Yes. That's my recollection.

6 Q. And your title became associate professor of
7 electrical engineering?

8 A. Yes. That's right.

9 Q. Are you still today --

10 A. No. Subsequent to this -- in January, I got
11 promoted to professor. January 2014.

12 Q. I'm sorry?

13 A. January 2014.

14 Q. Congratulations.

15 A. Thank you.

16 Q. What did you do as an associate professor of
17 electrical engineering from July 2005 to January 2014?

18 MR. DAS: Objection, form.

19 THE WITNESS: There is really little difference
20 between the responsibilities and role of an assistant
21 professor and an associate professor.

22 BY MR. CRAIN:

23 Q. Okay. Let's try it this way: What is the
24 difference between an assistant professor and an
25 associate professor?

1 MR. DAS: Objection, form.

2 THE WITNESS: In the normal progression of an
3 academic career, as you're moving towards tenure, there
4 are various milestones and one of them is being promoted
5 to associate professor. That involves the solicitation
6 of letters of assessment from various peers. So there
7 is really no difference between them except that the
8 associate professor has gone through the associate
9 review.

10 BY MR. CRAIN:

11 Q. Is there a compensation difference?

12 A. I would say no, although maybe technically,
13 there is, but it's so small that you wouldn't really
14 notice.

15 Q. Understood. Since you've become -- taken the
16 title of professor in January of 2014, do you do
17 anything that's different from your prior role as an
18 associate professor or your prior role to that as an
19 assistant professor?

20 MR. DAS: Objection, compound.

21 You can answer.

22 THE WITNESS: In the process of advancing -- you
23 know, becoming more senior within the department, my
24 balance of roles has shifted slightly. So now I do more
25 things which are involved in maintaining the health of

1 the department. Wherever possible, we try to allow and
2 my senior colleagues tried to allow me to focus on my
3 research primarily when I was still a junior assistant
4 professor.

5 BY MR. CRAIN:

6 Q. What do you mean when you speak about the health
7 of the department? I'm not sure I understand that.

8 A. For the past couple of years, I've been
9 responsible for leading the recruiting of new faculty.
10 So clearly, you know, one of the aspects of the health
11 of the department is that we should continue to have
12 high-quality, top-quality faculty, which involves
13 identifying and recruiting good junior talent to come
14 and join our department. So it's things like that.

15 Q. Now, you mentioned tenure. Do you have tenure
16 at Columbia?

17 A. Yes.

18 Q. When did you gain tenure?

19 A. As I recall, it was in early 2007.

20 Q. Is there another level or title beyond professor
21 that you may acquire?

22 A. You can have an endowed chair. So you would
23 then be the -- you know, the Joe Bloggs professor of
24 electrical engineering. Meaning that Joe Bloggs gave
25 the money to endow a chair, which is then an additional

1 honor beyond being a full professor.

2 Q. Is that currently your situation?

3 A. I do not have an endowed chair.

4 Q. Could you describe -- let me ask you this way:

5 During your time as an assistant professor of electrical
6 engineering at Columbia, were you involved in the design
7 and testing of audio amplifiers?

8 A. I did a lot of different things. I don't
9 recall -- I don't recall designing any audio amplifiers.
10 Similar to the roles I described at MIT, you know, I was
11 certainly involved in maintaining -- you know, in
12 putting together sound systems which would involve
13 amplifiers, but more at a modular level rather than
14 working inside of them -- inside of the boxes.

15 Q. Does this last response that you gave also apply
16 to your time as an associate professor at Columbia?

17 A. Yes. Hang on. Yes.

18 Q. Let me make sure we're clear. Do you recall any
19 time during your tenure as an associate professor of
20 electrical engineering at Columbia University where you
21 were involved in the design or testing of audio
22 amplifiers?

23 A. I'm hesitating because I -- in the past few
24 years, I have started doing more -- I've started doing
25 electronics work similar to the kind of thing I was

1 doing when I was in high school, but more as a hobby
2 activity rather than part of my professional
3 responsibilities.

4 Q. So I glean from that perhaps that there may be
5 some audio amplifiers that you've designed or tested
6 apart from your time as a professor of any capacity at
7 Columbia.

8 A. Yes.

9 Q. Can you speak to those, please.

10 A. So the hobby electronics that I'm now involved
11 in -- which, again, it's not easy to completely separate
12 from my professional work, given that I'm a professor of
13 electrical engineering -- but it's not -- it's not yet
14 fully connected to the work which is clearly my academic
15 work, which is my published papers. But that kind of
16 work involves putting together circuits from low-level
17 components to do various things, including driving a
18 speaker -- an amplifier driving a speaker.

19 Q. What is the purpose or application of these
20 circuits that you are designing or testing?

21 A. One of the things I'm doing in my teaching is I
22 teach a class on music signal processing. And one of
23 the directions I've taken within that is the use of
24 realtime music signal processing techniques, because I
25 found that for educational purposes, something that

1 happens in realtime -- that is, something that you
2 change it and immediately see and hear the results --
3 that's very useful for teaching. So the reason I've
4 gotten interested in driving a speaker is so I could
5 maybe build some kind of small device that would involve
6 audio output.

7 Q. This work that you're doing, is this something
8 that's current or is this sometime in the past?

9 A. This is current.

10 Q. Can you identify any particular time when you
11 began doing it?

12 A. It's like in the past two to three years.

13 Q. Fair enough. Real briefly, what is LabROSA?

14 A. LabROSA is my research group at Columbia.

15 Q. What does LabROSA do?

16 A. It's a set of graduate students and me. We
17 perform research on audio processing and recognition of
18 algorithms primarily.

19 Q. Is this related to machine listening?

20 A. Yes.

21 Q. How much of your time is involved in any way
22 with LabROSA?

23 A. Everything that I do in the -- you know, in
24 conducting my work at Columbia is arguably LabROSA.

25 Q. Is there any employment that we've not covered

1 that you'd like to share with us?

2 A. Why would I want to share it with you?

3 Q. Well, is there any that you haven't shared?

4 A. I've done some other consulting work which I
5 haven't -- which we haven't discussed, and I don't
6 believe it's on my CV.

7 Q. It's not on your CV?

8 A. I don't think so.

9 Q. Why is it not on your CV?

10 A. You know, the CV is mainly -- it's not -- it's
11 not something that would -- that I think people who
12 would be using my CV would be interested in. My CV, as
13 you see, it's very much focused on my academic
14 activities, my teaching, my publications. Generally
15 speaking, the consulting work that I've done is, by its
16 nature, kind of walled off from that. So it doesn't
17 really -- it's not very relevant.

18 Q. You mean like consulting in environments like
19 this?

20 A. Yes.

21 Q. Have you ever served as an expert witness
22 before?

23 A. Again, I'm not exactly sure what the boundaries
24 of that is. But I can think of one project I've done
25 before for an IP -- an intellectual property law firm.

1 Q. Can you speak to -- if there is any
2 confidentiality, I'm not trying to get into that -- but
3 can you speak about it at least from a high level?

4 A. It was a patent case. I was asked to review
5 some patents and come in and teach -- to help -- just to
6 talk about what the material was, to help the attorneys
7 involved understand what was going on.

8 Q. Do you happen to remember the patent numbers?

9 A. No.

10 Q. Do you remember the titles?

11 A. I don't know if I'm -- I have no recollection of
12 whether I'm able to -- whether I'm under any kind of
13 confidentiality. I can tell you it was to do with audio
14 compression algorithms.

15 Q. When was that?

16 A. Within the last five years. Probably about
17 three years ago. Maybe two or three years ago.

18 Q. What type of person were you educating?

19 A. Attorneys.

20 Q. That's what I thought.

21 A. Yeah.

22 Q. Did it have anything to do with amplifiers?

23 MR. DAS: Objection, form.

24 BY MR. CRAIN:

25 Q. Directly.

1 MR. DAS: Objection, form.

2 THE WITNESS: I'm trying to remember. What was
3 at issue was some kind of device that involved an
4 amplifier, but the stuff I was focusing on was not
5 specifically to do with the design of amplifiers.

6 BY MR. CRAIN:

7 Q. Based on any of your educational or work
8 experience of any kind or type or time, would you
9 describe for me what you believe to be your practical
10 experience in designing and testing electronic
11 amplifiers.

12 A. Most of my knowledge -- okay. The foundation of
13 my knowledge in amplifier design is from my
14 undergraduate electronics classes where this stuff is
15 covered. As I said, this is something that I consider
16 to be part of the basic core of every electrical
17 engineering degree -- electronics or electrical
18 engineering degree. Since then, I have various
19 practical experiences which have been -- which are
20 relevant, but that's what the core of it is.

21 Q. You've mentioned a couple of occasions to where
22 you either designed or constructed an audio amplifier.
23 I'd like to see if we can get the total universe of
24 those. Okay?

25 A. Um-hmm.

1 Q. If my memory serves me well -- and it may not --
2 I think you did that maybe during your teenage years,
3 from a kit, we talked about.

4 A. Yes.

5 Q. And I think you just recently, or a moment or
6 two ago, talked about maybe in the last couple or three
7 years, maybe as a side hobby.

8 A. Yes.

9 Q. Other than those two instances, can you think of
10 any other occasions where you were involved in design of
11 an audio amplifier?

12 A. Yes. As part of my undergraduate course work
13 would involve learning about and then practicals of
14 designing, and as far as I can recall, constructing
15 amplifiers such as the basic teaching of that material.

16 Q. Would this have been the class where the text
17 was The Art of Electronics?

18 A. That was -- when I was studying that material is
19 when I bought that book. That was not actually a
20 textbook, because in the Cambridge system, they didn't
21 really have textbooks. But that was the period when I
22 was interested in that stuff, yes.

23 Q. So you bought it yourself?

24 A. Yes.

25 Q. Have you ever designed a protection circuit for

1 a power amplifier?

2 A. No.

3 Q. And I believe, as part of your preparation for
4 this deposition, that you -- that was some of the
5 research that you did was in regard to audio amplifier
6 protection circuits. Is that correct?

7 A. That's right.

8 Q. Are you familiar with Class D amplifiers?

9 A. Yes.

10 Q. Can you describe for us any prior -- personal
11 experience that you've had with respect to Class D
12 amplifiers?

13 MR. DAS: Objection, form.

14 THE WITNESS: So I -- I don't recall when I
15 became aware of this concept, but at some point in the
16 last 20 years, the concept was -- I came across it. It
17 was a new idea. It was not something that was covered
18 when I was an undergraduate. So it was like this novel
19 idea in amplifier design, which I have no idea where I
20 learned about it, but somehow I learned about it; and,
21 you know, as with many things, looked it up, figured out
22 as much as was interesting to me about it. So that's my
23 first experience. So then it was like, okay, there is
24 this way of doing it. As part of the recent work in my
25 hobby electronics, one of the devices that I'm working

1 with is a Class D amplifier.

2 BY MR. CRAIN:

3 Q. Do you consider yourself today to be an expert
4 in Class D amplifiers?

5 A. I wouldn't say I was an expert in Class D
6 amplifiers, because I know those people. Right?
7 They're my colleagues in the department. So I certainly
8 would defer to them.

9 Q. Can you think of any -- let me start again.
10 Can you think of any power amplifiers that
11 you've had experience with, at any time, that were
12 Class D amplifiers?

13 MR. DAS: Objection, form. Objection, asked and
14 answered.

15 THE WITNESS: The example I just mentioned of
16 this device that I have recently purchased. It's a chip
17 that does Class D amplification.

18 BY MR. CRAIN:

19 Q. Where did you purchase it?

20 A. Adafruit.

21 Q. What did you do with it?

22 A. I hooked it up, saw that it worked. That's all
23 I've done with it so far.

24 Q. Are there any other Class D amplifiers that
25 you've worked with?

1 A. I haven't put my hands on them. That's not --
2 that's the -- there are -- yes, there are no other
3 Class D amplifiers that I can think of that I've worked
4 with in that kind of way.

5 Q. When you were speaking about some of your
6 colleagues at Columbia that deal with power amplifiers,
7 Class D power amplifiers, is that in the electrical
8 engineering department?

9 A. Yes.

10 Q. Is there a department at Columbia that is
11 focused on power amplifiers?

12 MR. DAS: Objection, form.

13 THE WITNESS: Electrical engineering is where
14 the work on power amplifiers is conducted.

15 BY MR. CRAIN:

16 Q. Are you familiar with a Class AB amplifier?

17 A. Yes.

18 Q. How is that different from a Class D amplifier?

19 A. Well, it's very different. It's the way that
20 the transistor -- they're very different devices --
21 they're very different circuit structures.

22 Q. What are the applications, according to your
23 understanding, for Class AB amplifiers?

24 A. As the letters suggest, Class AB is a
25 historically earlier amplifier design. So class A,

1 class B, Class AB amplifiers, are the kinds of
2 amplifiers that I learned about when I was in school,
3 and Class D are a more recent innovation.

4 Q. Do you have prior experiences, personal
5 experiences, with Class AB amplifiers?

6 MR. DAS: Objection, form.

7 THE WITNESS: Yes.

8 BY MR. CRAIN:

9 Q. You mentioned you learned about them in school.

10 A. Oh, sure.

11 Q. So an actual device that would be a Class AB
12 amplifier, could you describe some of your personal
13 involvement.

14 A. So I mentioned the amplifier I built when I was
15 in high school. That was a Class AB amplifier.

16 Q. Are there any others you can think of?

17 A. Of the other amplifiers I've worked with, I
18 wasn't working with them at a level of detail that I
19 would actually know particularly whether they were --
20 what particular output configuration they had, although,
21 most likely, they were Class AB.

22 Q. Are you familiar with a Class C amplifier?

23 A. No.

24 Q. I don't want to presume, but do you recall any
25 of your prior experience with power amplifiers to be of

1 the type of a Class C?

2 A. No, I don't.

3 Q. I didn't think so, but I wanted to make sure.

4 Are you able to describe to us the difference
5 between a Class C amplifier and a Class D amplifier?

6 A. I don't know what a Class C amplifier is.

7 Q. Maybe I'm mistaken. Is there such a thing as a
8 Class C amplifier?

9 A. I don't know.

10 Q. How is power level relevant to a power
11 amplifier?

12 MR. DAS: Objection, form.

13 THE WITNESS: What do you mean by "power level"?

14 BY MR. CRAIN:

15 Q. Let's try it this way: Could you explain for me
16 your understanding of amplifier power levels.

17 A. My first reaction is that that refers to the
18 amount of power that an amplifier can deliver.

19 Q. If the power amplifier is a low-power amplifier,
20 can you think of any applications for such an amplifier?

21 A. The distinction between the different power
22 levels is mainly one of scale. So if you're driving a
23 tiny speaker, maybe you need a lower-power amplifier.
24 If you're driving a medium-sized speaker, you need a
25 medium-power amplifier. If you're driving a large

1 speaker, you need a high-powered amplifier.

2 Q. Of the amplifiers that you mentioned earlier
3 that you had involvement with personally and maybe
4 designed, were they low power or high power?

5 A. The amplifier that I was talking about that I
6 built when I was in high school was a power amplifier
7 with an output of 100 watts, something like that. The
8 amplifiers I've worked with at various times in my
9 career -- you know, the actual off-the-shelf
10 amplifiers -- would be power amplifiers -- would be
11 probably high-power amplifiers. I don't know. The
12 amplifier that I mentioned most recently where I bought
13 the components from Adafruit, it's called a power
14 amplifier, although it's only like a four-watt power
15 amplifier. So that sounds like a low-power amplifier.

16 Q. It did to me, but I mean, I don't want to
17 presume.

18 A. But you can think of applications where you're
19 measuring the output in milliwatts. It's not really
20 about the number. It's about the purpose of the device
21 being to deliver power.

22 Q. I think there was one thing there I want to
23 circle back to. You mentioned that over the course of
24 your time, you've dealt with off-the-shelf amplifiers.

25 A. Yes.

1 Q. Can you remember any specific brands that you've
2 dealt with?

3 MR. DAS: Objection, asked and answered.

4 BY MR. CRAIN:

5 Q. You mentioned the Harman Kardon.

6 A. That's right.

7 Q. Any others?

8 A. I really -- oh, man. I don't remember. There
9 is definitely -- there is a Crown amplifier somewhere in
10 my past.

11 Q. Any others that you can pull out of your memory
12 banks?

13 A. No.

14 Q. Do you have any prior experiences with RF
15 amplifiers?

16 MR. DAS: Objection, form.

17 THE WITNESS: RF amplifier design is -- again,
18 it's part of the basic fundamentals of electronic
19 circuits that you learn as part of your undergraduate
20 electronic engineering degree. So I have some
21 experience and awareness of the issues from that. But I
22 have not worked in projects where I've had to design or
23 use RF amplifiers.

24 BY MR. CRAIN:

25 Q. So your understanding of RF amplifiers would be

1 based solely on your time as an undergrad at Cambridge?

2 A. I think so. I may have covered it a little bit
3 at MIT as well.

4 Q. So you've never had occasion to design or test
5 an RF amplifier?

6 A. I don't think so.

7 Q. Are you able to help me understand the
8 difference between an RF amplifier and an audio power
9 amplifier?

10 A. Yes. The difference is that RF stands for radio
11 frequency, which is much, much more rapid variations in
12 the voltages, et cetera, than an audio frequency
13 amplifier. There are various things that start to
14 become problems in radio frequency. Basically, the
15 electromagnetic coupling between different components
16 that you don't have to worry about at lower frequencies
17 such as audio frequency. You don't have to worry about
18 so much.

19 Q. Do you know if RF amplifiers can be any of these
20 classes of amplifiers we've previously discussed?

21 A. Certainly, in general, any kind of amplifier can
22 be used in any kind of application area. Given that
23 Class AB is the most popular amplifier design that would
24 be used for RF, I've never considered the possibility of
25 using Class D for RF. There would be some issues

1 because of the way the Class D exploits the fact that
2 there is a limited spectrum you're trying to deliver
3 information into. But I can imagine it being used.

4 Q. I'm sorry?

5 A. I can imagine a Class D amplifier being used for
6 RF.

7 Q. You can imagine it.

8 A. Yes.

9 Q. What would be the application that you can
10 imagine?

11 A. Oh. Because you want to amplify radio-frequency
12 signals, because you want to generate radio-frequency
13 signals at high power.

14 Q. Can you speak to any of the similarities that
15 you would expect to see between an amplifier -- a power
16 amplifier used in an audio application versus an
17 amplifier used in an RF application?

18 A. Sorry. Can I speak to similarities between
19 them?

20 Q. Yes.

21 A. They are doing the same thing. They're taking a
22 low-level input signal and supplying it to a load so
23 that it can be -- they're amplifying it faithfully and
24 lineally, then delivering it with significant power into
25 a load.

1 Q. Any other similarities you can think of?

2 A. That's pretty much all they do. So that's kind
3 of like everything.

4 Q. That's it?

5 Can you describe any differences that you can
6 think of between an RF amplifier and an audio power
7 amplifier?

8 A. As I said, the big difference is that in RF,
9 radio frequencies, you have very significant issues of
10 signals from one part of the circuit being parasitically
11 coupled to other parts of the circuit. Because they can
12 emit radio waves, just the circuit traces. In an
13 amplifier design, this can be very serious; because if
14 you have positive feedback, you can have an amplifier
15 that goes unstable.

16 Q. How easy would it be to take an amplifier
17 from -- an audio power amplifier and turn it into an RF
18 amplifier?

19 A. It would be very difficult. You would basically
20 have to replace all the components. The components
21 would not be suitable for operating those frequencies,
22 like the transistors.

23 Q. Would it likewise be difficult to take an
24 amplifier that's an RF amplifier and convert it into an
25 audio power amplifier?

1 A. No. It's much -- I mean, it's much easier -- so
2 an RF amplifier will have to generate signals over
3 megahertz or gigahertz. The audio amplifier is having
4 to generate signals over a bandwidth of a few kilohertz.
5 A few kilohertz is a proper subset of the gigahertz. So
6 its easy to imagine an RF amplifier that will also
7 amplify signals in the audio range.

8 Q. Can you think of any?

9 A. Can I think of any RF amplifiers that do that?

10 Q. Yes.

11 A. No. I don't -- I couldn't name an RF amplifier.

12 Q. Why not?

13 A. It's not -- it's not something I've ever had
14 cause to specify or -- I haven't ever purchased an RF
15 amplifier as a separate device.

16 Q. But are you otherwise aware of any RF amplifiers
17 that have been converted into audio power amplifiers?

18 A. It seems unlikely. Right? Because as I've
19 explained, there are big differences in the design
20 constraints. So if you had an amplifier that was able
21 to operate at radio-frequency ranges and then you used
22 it at audio frequency, it would just be a very
23 inefficient and wasteful use of the -- you know, of
24 those high-performance devices able to operate at radio
25 frequency, but you weren't using any of that capacity.

1 Q. Are you familiar with the term "saturation"?

2 A. Yes.

3 Q. Could you help me understand what that term
4 means as it pertains to RF amplifiers?

5 A. The idea is that at some level of power output,
6 the devices are no longer acting at their peak
7 efficiency.

8 Q. Does that mean that they're in saturation?

9 A. Yes. Well, that the amplifier is in saturation.
10 Saturation for an individual device has a different
11 meaning. Just, you know -- it's a more -- you could
12 point to individual devices and say this one is
13 saturated, which isn't necessarily a bad thing. But
14 when describing a whole amplifier, an amplifier going
15 into saturation means that it's -- you know, it's
16 outside the range where you would want it to perform.

17 Q. Do audio amplifiers go into saturation?

18 A. It's not normally referred to that way, but you
19 can -- there is an analogous condition, which is, again,
20 when the amplifier is trying to deliver more power than
21 it can usefully deliver.

22 Q. I think you still have Exhibit 3 -- I'm sorry.
23 I misspoke. Your CV. Exhibit 4.

24 A. Um-hmm.

25 Q. We did a word search for "amplifier" in your CV

1 and didn't find it.

2 A. Um-hmm.

3 Q. Can you give us any understanding of why that
4 may be?

5 A. My academic work has been focused on signal
6 processing.

7 Q. Does that mean not focused on amplifiers?

8 A. There are people in electrical engineering whose
9 main focus is on the design of amplifiers, and that's
10 not my work.

11 Q. So you're not one of the main people at Columbia
12 focused on amplifiers?

13 A. That's right.

14 Q. I also did a word search for "amp" just to make
15 sure we didn't miss maybe an abbreviation or something,
16 but I didn't see that either. So do you have any reason
17 or basis to disagree with that?

18 A. No.

19 Q. I just want to make sure. We could have been
20 mistaken.

21 A. Sure.

22 Q. I understand your CV does identify some patents
23 for which you are an inventor. Is that right?

24 A. That's correct.

25 Q. Do you know if any of those patents have been

1 issued?

2 A. I think some have. I know that some of them
3 have, yes.

4 Q. I did a search and had trouble finding them,
5 actually. Do you know any of the numbers?

6 A. No. You can search for -- I'm sure that Ellis,
7 Morgan and Hermansky. I think others. There is one
8 which was with me and Morgan which has been issued,
9 M-O-R-G-A-N; and there is one with me and Athineos which
10 I believe has been issued, A-T-H-I-N-E-O-S.

11 Q. You believe these have been issued?

12 A. Yes.

13 Q. Because, I mean, you've got to do a search
14 either on applications that have been published or
15 patents.

16 A. Right.

17 Q. So these are patents for which you're an
18 inventor. Right?

19 A. Yes. I may be wrong. If you're not finding
20 them, then I maybe misunderstood.

21 Q. I easily could have made a mistake. I don't
22 doubt you. I just want to see what you have here.

23 A. Sure.

24 Q. Who is the other inventor or inventors.

25 A. So I'm saying there is one where I'm a

1 co-inventor with Nelson Morgan.

2 Q. M-O-R-G-A-N?

3 A. Yes.

4 Q. Are you two the only inventors?

5 A. I think Hynek Hermansky may also be an inventor
6 on that one.

7 Q. Let's try these two and see if we find it.

8 A. Hermansky, H-E-R-M-A-N-S-K-Y.

9 Q. Please spell that again.

10 A. H-E-R-M-A-N-S-K-Y.

11 Q. Hermansky. That didn't -- wait a minute. That
12 was a bad search. I got zero patents.

13 Now, I had 11 when I just did a search for you
14 and Morgan. One is a tire inflation system, one is a
15 titanium suboxide, drive axle, tire inflation connector,
16 pesticide, insecticide. I didn't find it. It may be
17 there. I think I did find one that didn't appear to be
18 listed on your CV.

19 A. I'm not finding -- where did I list it on my CV?

20 Q. They're there. I saw them.

21 A. Sure. I believe they're there as well. I'm
22 just interested in which ones --

23 Q. I thought it was toward the back maybe, but --

24 A. Yeah. As I explained, the CV is mainly
25 concerned about my academic activities. In that case,

1 the published papers are really what people care about.

2 Q. We're in Exhibit 1004. Oh, there it is.

3 A. Here we go.

4 Q. I think we found Patent No. 7,254,538 issued
5 back in 2007. Does that sound right?

6 A. Sounds good. I think it's one of -- it's
7 interesting that you bring this up. I mentioned the CV
8 is a year old. I seem to remember in the past year, I
9 actually went through and tried to put in the detail
10 here.

11 Q. Now, I think we did cover or discover -- and it
12 might just be a pending application, but it could be
13 issued -- does this sound familiar to you: method and
14 system for blind analysis of resource consumption?

15 A. Yes.

16 Q. What is that about?

17 A. It's about -- it's about measuring domestic
18 electrical power usage.

19 Q. So that's not about amplifiers?

20 A. No.

21 Q. Not about DSPs either; is it?

22 A. It's to do with DSPs. It's a follow-on of my
23 signal processing work. It's a secondary application of
24 the work I've done in audio.

25 Q. Did you find the list of patents there --

1 A. Yes.

2 Q. -- on page 18?

3 So the one I just mentioned is application
4 No. 13/634,568, for the record. Can you think of any
5 other patents that aren't listed in your CV -- that is,
6 Exhibit 4 -- or the one I just identified?

7 A. Yes.

8 Q. Are there any that pertain to amplifiers?

9 A. No.

10 Q. Do they pertain to digital signal processors?

11 A. Yes. Or digital signal processing, in general.

12 Q. Why would that not be on your CV?

13 A. Well, just oversight. I mean -- so one of them
14 relates to my consulting work or at least maybe -- I'm
15 thinking of at least one patent which is a result of my
16 consulting work, which, you know, for the reasons we've
17 discussed, I might not want to put on my CV, because I'm
18 not -- this is not about me being a consultant; this is
19 about me being an academic.

20 Q. I see. Who owns that patent that you're
21 referring to?

22 A. The Echo Nest.

23 Q. E-C-O N-E-S-T?

24 A. E-C-H-O N-E-S-T.

25 Q. Echo. I was thinking of eco like an

1 environment. I should have known it would have been the
2 other.

3 Can you think of any other patents that are
4 either published or issued for which you are an inventor
5 that we've not already talked about?

6 A. So to explain why there is some confusion here,
7 the process is that if I have an idea that I think might
8 be patentable, I contact the Columbia IP office, I file
9 an invention report with them. They then decide whether
10 to file a patent or -- you know, and then, how far to
11 prosecute it, how far to push it. I'm typically not
12 very involved in that. Occasionally, I get sent these
13 patent filings to review. I review them, but I don't
14 pay a lot of attention. So I'm not intimately aware of
15 the status of the various patents I may have filed --
16 that may have been filed with my name on it.

17 Q. We've talked pretty extensively today about your
18 prior experiences designing power amplifiers.

19 A. Yes.

20 Q. On a broad net just for a moment. Okay? So I'm
21 not asking you to speak about that. Let's put that
22 aside.

23 Can you tell me, though, what other types of
24 circuits, during any time in your education or work
25 history, that you've had occasion to design yourself.

1 A. The majority of my -- my academic work has been
2 at -- in signal processing and mostly concerned with
3 software implementations. The opportunities -- the
4 instances where I've worked with circuits have been, you
5 know, incidental. For instance, the situation where I
6 mentioned where we had to build the microphone preamp.

7 Q. Right.

8 A. So they haven't been part of my core
9 professional work.

10 As I mentioned, over the past two to three
11 years, I've gotten interested in electronics as a hobby
12 activity, and I've done a variety of different -- I've
13 built a large number of different circuits over that
14 time, but -- you know, they are more as -- it's
15 difficult to count them, because it's more like one
16 continuous thing that's constantly being changed.

17 Q. You mentioned a large number. How large is that
18 number?

19 A. That's what I'm saying, that you can't count
20 them. I've done a lot of trying things out with
21 electronics that doesn't really fit into the model of
22 like, okay, here is the device; design, build, test.
23 It's more like a continuous investigation.

24 Q. You mentioned a large number. So I'm trying to
25 get a sense of how you came to that.

1 A. Right. So I'm thinking about a large number,
2 because I'm thinking about my work bench at home covered
3 with all these breadboards with circuit devices on them.
4 I keep having to -- the idea of prototype and breadboard
5 is that you temporarily build a circuit on it, then you
6 can take it off and use it again. I keep on having to
7 buy new ones because I can't bear to take apart any of
8 the ones I've got. They kind of are not finished. I
9 haven't gone through transferring them to a permanent
10 board. So I probably have ten of those -- more than ten
11 of those breadboards laying around now.

12 Q. This is work that you've done as a hobby over
13 the last two, three, four years?

14 A. You know, I characterize it as a hobby because I
15 haven't written any technical publications on it, but
16 obviously, my hope is that as with my other work, it's
17 something that I enjoy doing; and if I can make it more
18 central to my professional work, then that would be a
19 good thing. I think there is a prospect for that. As I
20 mentioned, I'm using these signal processing circuits,
21 implementations, as part of my teaching. Signal
22 processing, in general. So that's how I see those
23 things ultimately coming together.

24 Q. Tell you what, I'm trying to get to a break
25 here, and we'll take a break. Just a few more

1 questions.

2 A. Okay.

3 Q. Have any of these circuits that you have created
4 on your bench at your home ever been manufactured?

5 A. No.

6 Q. Have you ever sold any of them?

7 A. No.

8 Q. Have you ever offered them for sale to anyone?

9 A. No.

10 Q. Did they all work?

11 MR. DAS: Objection, form.

12 THE WITNESS: That's not how -- that's not how
13 it goes. When you're developing -- designing and
14 developing a circuit, it doesn't work the first time.
15 That's the whole point is that you're investigating what
16 will and won't work.

17 BY MR. CRAIN:

18 Q. I understand. Thank you for clarifying that.

19 Any of these circuits you've ever designed, at
20 any point in time, have they ever involved non-volatile
21 memory?

22 A. Yes.

23 Q. Would you describe an instance or two.

24 A. Sure. So a lot of the work I've been doing
25 recently involves these embedded microcontrollers called

1 the ATmega, A-T-M-E-G-A, which includes non-volatile
2 memory.

3 Q. What type of non-volatile memory?

4 A. I believe it's flash memory.

5 Q. When was flash memory developed, according to
6 your understanding?

7 A. I don't know. But I think it -- certainly, I
8 would guess -- I mean, flash memory cards were certainly
9 available by 2000. So the technology must have been in
10 development for at least ten years before that, I would
11 imagine.

12 Q. What other non-volatile memory have you had
13 prior experience with?

14 A. I've worked with EPROMs and EEPROMs. In fact,
15 the ATmega includes an EEPROM, which is an electrically
16 erasable programmable read-only memory. Other numbers
17 of types of memory. I mean, the other kind of memory
18 would be conventional dynamic or static memory with
19 battery backup.

20 Q. You mentioned EPROM and EEPROM.

21 A. Yes.

22 Q. That you've worked with both of those.

23 A. Yes. So --

24 Q. Sorry?

25 A. Carry on.

1 Q. What is EPROM memory?

2 A. EPROM is erasable programmable read-only memory.
3 And most often, that's -- the erasing is done -- the
4 kind that I've worked with, you would put it under
5 ultraviolet light to erase the memory.

6 Q. It has to have a window on the chip; doesn't it?

7 A. Absolutely.

8 Q. Now, how is that different from EEPROM memory?

9 A. It's easier. You know, obviously, if we're
10 going to have to shine ultraviolet light on this thing,
11 the EPROM, to erase it, then that's a fairly cumbersome
12 process. Electrically erasable, you can put it in
13 circuit, and you can put a separate circuit to do the
14 programming, and there is no having to get physical
15 access to the device.

16 Q. Are you saying that you've got to have physical
17 access to the device for EPROM?

18 A. The term EPROM, as it says, it's just erasable
19 programmable read-only memory. So you could interpret
20 that as meaning -- as covering electrically erasable
21 programmable read-only memory.

22 Q. You're saying the term EPROM could include
23 EEPROM?

24 A. That's right.

25 Q. Is that how you understand it?

1 A. I'm not really sure. I think, yes -- I mean --
2 so it would be better if we called the other kind
3 UV EPROM, because then we would know exactly what we
4 were talking about.

5 Q. Have you ever designed any circuits with any
6 non-volatile memory that have been manufactured?

7 MR. DAS: Objection, form.

8 THE WITNESS: By "manufactured," you mean like
9 commercial manufacture where they're put into a
10 production line or something like that.

11 BY MR. CRAIN:

12 Q. I do mean commercial manufacturing.

13 A. No.

14 MR. CRAIN: Why don't we go off the record.

15 THE WITNESS: Okay.

16 THE VIDEOGRAPHER: This is the end of Media
17 No. 3 in the deposition of Dr. Daniel Ellis. The time
18 is 2:27 p.m. We are now off the record.

19 (Recess taken from 2:27 to 2:38.)

20 THE VIDEOGRAPHER: This is the beginning of
21 Media No. 4 in the deposition of Dr. Daniel Ellis. The
22 time is 2:38 p.m. We are back on the record.

23 BY MR. CRAIN:

24 Q. Dr. Ellis, is there any testimony from any point
25 before now that you'd like to go back and revisit or

1 change or correct?

2 A. No.

3 Q. Did you have an opportunity to talk with your
4 counsel during the break?

5 A. I had an opportunity to talk with them.

6 Q. Did you consult or confer with your counsel
7 regarding the substance of any testimony already given?

8 A. No.

9 Q. Did you consult or confer with your counsel
10 regarding the substance of any testimony that is
11 anticipated to be given?

12 A. No.

13 Q. During the break, did your counsel suggest to
14 you the manner in which a question should be answered?

15 A. No.

16 Q. Would you please pull Exhibit 2. Before you do,
17 I want to ask you one other question. A couple other
18 questions, actually. You've shared with me today that
19 you had some prior experience with Class AB amplifiers.

20 A. Yes.

21 Q. Do you consider yourself to be an expert in
22 the -- do you consider yourself to be an expert in
23 Class AB amplifiers?

24 MR. DAS: Objection, form.

25 THE WITNESS: You've asked this question in

1 several different forms a few times. So I want you to
2 understand, my colleagues are -- I know people in my
3 department whose job is circuit design, including
4 amplifier design. So compared to them, I'm not an
5 expert.

6 BY MR. CRAIN:

7 Q. Well, I think I had asked this in regard to
8 Class D. We can go back through the transcript. It
9 will tell me if I'm right or wrong. I wanted to circle
10 back on Class AB. But I want to clarify something from
11 your response. I'm not sure that answers my question,
12 so I want to ask it again.

13 Do you consider yourself to be an expert in
14 Class AB amplifiers, irrespective of any colleagues that
15 you have at Columbia?

16 A. I can't separate it. Right? It's like -- you
17 know, if there was a room where I was with a bunch of
18 people who have never studied electronics and I was the
19 only one there, and it's like, "Guys, we've got to fix a
20 Class AB amplifier together here," it's like, "Okay, let
21 me through, I'm the expert." But if you're saying,
22 "Okay, there is a student here who needs to know about
23 Class AB amplifiers," it's like, "You probably want to
24 go upstairs and talk to my colleague."

25 Q. So you're unable to tell me whether you consider

1 yourself to be an expert in Class AB amplifiers absent a
2 comparison to someone else with greater or lesser
3 knowledge?

4 A. That's what I'm saying.

5 Q. Let me ask you this:

6 A. I'm not accustomed to having to make that kind
7 of absolute determination. It's not part of my life
8 experience to have to say, okay, this is -- I am an
9 expert.

10 Q. Since you weren't familiar with Class C
11 amplifiers, this should be a pretty easy dialogue. Do
12 you consider yourself to be an expert in Class C
13 amplifiers?

14 A. No.

15 Q. Okay. So the comparison would be, with Class C
16 amplifiers, you indicate that you're not familiar with
17 that term.

18 A. That's right.

19 Q. So if Class C amplifiers happened to exist,
20 that's not an area of your expertise?

21 A. I don't know what the term means. Right? As
22 someone trained in electrical engineering, I'm pretty
23 sure that it's not going to be something that's very far
24 from what I understand. If I'm shown the circuit and
25 explained the basic principle, I think I could -- I

1 could give you some input pretty quickly. So it's more
2 like, because I don't know what it is, I can't really
3 describe -- I can't characterize my level of knowledge,
4 but I actually -- just because, you know, there is some
5 method of amplification that's within the realm of
6 electronics, yeah, it's going to be something that I can
7 make sense of.

8 Q. Are you able to tell us whether you consider
9 yourself to be an expert, based on either knowledge or
10 experience, with respect to RF amplifiers?

11 A. It's the same -- it's the same situation.

12 Q. What is the same situation? What do you mean?

13 A. There are plenty of people -- there are people I
14 know who would be -- who I would recommend ahead of me,
15 if you needed an expert in RF amplifiers. But if I'm
16 all you've got, then I'm not useless.

17 Q. How would you describe your level of awareness
18 of RF amplifiers?

19 A. I would say I'm generally aware of major trends.
20 Let's see. So here is -- my awareness of RF amplifiers
21 would be based on, you know, people giving talks in my
22 department. My department will include people giving
23 talks on RF amplifiers. I won't attend the talks, but
24 I'll read the abstracts.

25 Q. Do you have people in your department that you

1 would consider to be an expert in RF amplifiers?

2 A. Yes.

3 Q. I think you mentioned that you know people in
4 your department that you would consider to be an expert
5 in Class D amplifiers.

6 A. Yes. I don't -- you know, I don't know for
7 sure, you know, whether that's the current focus of
8 their research, but certainly, yeah.

9 Q. The same with AB amplifiers, Class AB, you know
10 people in your department that you would consider to be
11 experts in Class AB amplifiers.

12 A. That's right.

13 Q. Do you consider yourself to be an expert in
14 digital signal processors?

15 A. Yes. I consider myself to be an expert in
16 digital signal processing.

17 Q. What's the difference?

18 A. A digital signal processor is a device that is
19 used to implement digital signal processing.

20 Q. What do you consider yourself to be an expert
21 in?

22 A. So like I say, my primary expertise is digital
23 signal processing, which is the things you would do with
24 a digital signal processor. A digital signal processor
25 is -- you know, it's the -- it's the machine you use to

1 realize your digital signal processing application.

2 Q. All right. If you will take Exhibit 2, please.

3 A. Yes.

4 Q. Dr. Ellis, can you share with us your
5 understanding of what you believe the '542 patent shown
6 in Exhibit 2 to be about.

7 MR. DAS: Objection, form.

8 THE WITNESS: Can you be more specific.

9 BY MR. CRAIN:

10 Q. What's the point of clarity?

11 A. Well, there are a bunch of things that it
12 describes. Do you want me to try and give you like a
13 one-sentence description of what it's about?

14 Q. Well, are you able to give me an understanding,
15 at least at a high level, of what the '542 patent
16 represents to be about?

17 A. Yes.

18 Q. What is that?

19 A. Well, it might take a while. That's the thing.
20 Right?

21 Q. Okay.

22 A. So the patent is generally about a power
23 amplifier -- an audio power amplifier that includes a
24 DSP chip and some of the things you can do with that
25 setup. And in particular, it describes -- it focuses --

1 the claims in particular focus on the idea of the DSP
2 chip measuring and manipulating the performance
3 characteristics of the amplifier.

4 Q. You know what? You just actually reminded me of
5 something. Unless I tell you otherwise -- maybe we need
6 to -- but when I ask you questions about the '542
7 patent, predominantly I will be asking you about claims
8 as it pertains to Claims 5 and 13.

9 A. Okay.

10 Q. Now, if you feel the need to go beyond that,
11 that's fine. I'm happy to do that. But just so you
12 know where I'm coming from --

13 A. Okay.

14 Q. -- when I ask you these questions. So let's
15 start again. Because maybe that could help inform and
16 make us a little bit more streamlined.

17 A. Sure.

18 Q. What do you understand the '542 patent to be
19 about, at least with respect to Claims 5 and 13?

20 A. So, in general, the patent is about an audio
21 power amplifier that includes a digital signal
22 processing device, and Claim 5 is about how that device
23 has access to some measurement of the current and the
24 voltage being delivered to the load, and using those to
25 calculate the impedance of the load. Claim 13 is

1 similar except the current and voltage are used to
2 calculate the power -- hang on -- the power supply to
3 the load.

4 Q. Do you understand whether or not the '542 patent
5 is directed to audio amplifiers?

6 A. My impression from reading it is that it's
7 thinking about audio amplifiers. There is some mention
8 of loudspeakers as the loads in the description.

9 Q. Do you have any understanding of whether or not
10 the '542 patent, again, predominantly with respect to
11 Claims 5 and 13, are directed toward RF amplifiers?

12 A. That's kind of interesting, because Claims 5 and
13 13, I think, are pretty -- they try to remain neutral
14 about that. They don't say deliver to a speaker; they
15 just say to a load. So it's hard to say.

16 Q. Are you aware of whether the '542 patent, in any
17 page that's contained in Exhibit 2, mentions RF or radio
18 frequency?

19 A. I don't think it does.

20 Q. Are you aware of whether the '542 patent
21 references input audio signals?

22 A. I think it probably does.

23 Q. On column four, line 51, if you want to take a
24 look at that.

25 A. Yeah. Input audio signals. Yes.

1 Q. I think you had mentioned that it does reference
2 loudspeakers.

3 A. That's my recollection.

4 Q. Where do you see that? I'll tell you what. I'm
5 not going to ask you to go through the entire patent.
6 Do you see that in any of the figures?

7 A. Oh. Yes. On Figure 1, item 300 looks to me
8 like a loudspeaker. To be sure, we would have to check
9 the description of that -- discussion of that. But that
10 gives us an easy way to find it. 300? Maybe not. 300
11 is a network bus. Okay. It says Figure -- okay.
12 Figure 2. Oh, look, 300 appears twice on Figure 2.
13 Isn't that cute?

14 Q. Um-hmm. How about column five, line four or
15 five, whichever it is?

16 A. There you go. Yes. It mentions that the output
17 port is connected to a load such as a loudspeaker.

18 Q. Do you have any understanding, Dr. Ellis, of
19 what the '542 patent's improvement over the state of the
20 art at least claims to be?

21 A. Yes.

22 Q. What is your understanding?

23 A. Som again, we're talking primarily about
24 Claims 5 and 13.

25 Q. Correct.

1 A. My understanding is the claim is that it's an
2 amplifier that has a DSP, digital signal processor
3 incorporated in it, and that that DSP is receiving
4 information about the current and voltage being
5 delivered to the load. And then in five, it's using
6 that to calculate the impedance; and in 13, it's using
7 it to calculate the power, using those values.

8 Q. Based on your understanding, can you think of
9 any other amplifiers, prior to 1994, that include the
10 same features as you see in Claims 5 and 13?

11 A. The use of current and voltage to help control
12 the performance of the amplifier -- the use -- the
13 measurement of current and voltage of the output with an
14 amplifier is or would or has, for a long time, been a
15 standard part of amplifier design.

16 Q. Okay. My question was, are you aware of any
17 amplifiers, prior to 1994, that contain the features
18 claimed in Claims 5 or 13? Because I think it also
19 includes a DSP, and you didn't mention that in your
20 prior response.

21 A. That's right.

22 I can't think of any examples that include all
23 these features. That's kind of covered in my
24 declaration. The point was not that we have an exact
25 description of a system of this kind; it's more that

1 because -- it's the idea of having -- of sensing current
2 and voltage to detect when the amplifier is functioning
3 below optimal. To implement that functionality within a
4 DSP, once you have a DSP chip in the amplifier, is
5 obvious.

6 Q. So you're not aware, then, of any devices that
7 existed prior to 1994 containing all the features of
8 Claim 5 or all the features of Claim 13; are you?

9 A. You know, you're talking in a very technical
10 sense about features. Like I say, for me, the central
11 idea is the idea of using current and voltage, sensing
12 current and voltage, which is commonplace -- was
13 commonplace at the time.

14 Q. Is that a no, then? Because you're not able to
15 identify one; are you?

16 MR. DAS: Objection, asked and answered.

17 BY MR. CRAIN:

18 Q. Is that a no?

19 A. As I've said, amplifier sensing, current and
20 voltage, are commonplace.

21 Q. I understand that, Dr. Ellis. I understand the
22 points that you and QSC are making. But my question
23 pertains to something else. Are you or are you not
24 aware of any device that existed, prior to 1994, that
25 includes the features that you see in Claim 5?

1 MR. DAS: Objection, asked and answered.

2 BY MR. CRAIN:

3 Q. Yes or no.

4 MR. DAS: Objection, form.

5 THE WITNESS: (No response).

6 BY MR. CRAIN:

7 Q. Are you going to answer?

8 A. Do you want me to say the same thing again?

9 Q. If that's your response to a yes or no question,
10 sure.

11 Let me try it again. Because you've not
12 identified any device, you're not aware of any devices
13 that existed, prior to 1994, containing all the features
14 that you see in Claim 5; are you?

15 A. My familiarity with the essential elements of
16 Claim 5 are the use of sensing of voltage and current.
17 The detail that they are then being processed on a DSP,
18 to me, seems obvious.

19 Q. So what devices, according to your knowledge, if
20 you can name any, did that prior to 1994, as claimed --
21 as you see in Claim 5?

22 MR. DAS: Objection, form.

23 THE WITNESS: The amplifiers disclosed in
24 Gittleman and Tsurushima are both using current and
25 voltage inputs.

1 BY MR. CRAIN:

2 Q. Is it your contention then that the amplifiers
3 disclosed in either of Gittleman or Tsurushima include
4 all of the features that you read to be included in
5 Claim 5 or Claim 13?

6 MR. DAS: Objection, compound.

7 BY MR. CRAIN:

8 Q. Is that what you're testifying to?

9 A. My contention is that the -- what I see as the
10 essential idea here, the use of current and voltage, is
11 included in those amplifiers.

12 Q. Do those amplifiers include a DSP?

13 A. No.

14 Q. So again, are you able to identify any devices
15 that existed prior to 1994 that include the features
16 that you see in Claim 5?

17 MR. DAS: Objection, asked and answered.

18 THE WITNESS: I've answered that already.

19 BY MR. CRAIN:

20 Q. So you're not able to identify a device; are
21 you?

22 A. I've answered that already.

23 Q. How have you answered the question for the
24 identification of a device by telling me you think that
25 these features were in existence then? I'm asking you

1 for, okay, tell me what device that you're aware of. So
2 how is that an answer to that?

3 A. Because I've explained to you what my -- you
4 know, what my view of the matter is.

5 Q. By not identifying any device, according to your
6 knowledge, that fits the description of what you see in
7 Claim 5 or Claim 13?

8 MR. DAS: Objection, compound.

9 THE WITNESS: I've mentioned a couple of
10 amplifiers that include current and voltage sensing.

11 BY MR. CRAIN:

12 Q. So can we do this: Let's try it this way: Can
13 we agree that you've not identified a single device that
14 contains the features we see in Claim 5 or 13 that
15 existed prior to 1994?

16 A. As I've explained, my interpretation of the
17 features -- to me, what's important about them is the
18 use of current and voltage, and I've identified a couple
19 of amplifiers that use those.

20 (Exhibit 5 marked for identification.)

21 BY MR. CRAIN:

22 Q. I'll hand to you what has been marked as
23 Exhibit 5. Just take a moment to review it.

24 A. Okay.

25 Q. Let's go back to this last line of questioning.

1 One more question. In response to my question about
2 devices that may have been in existence that include the
3 features of Claim 5 and 13, I think the only thing
4 you've identified to me as potentially responsive to
5 that question was Gittleman and Tsurushima.

6 A. Yes.

7 Q. Am I mistaken there?

8 A. Those were the amplifiers that I mentioned.

9 Q. Why do you not -- why do you ignore the DSP
10 feature in Claim 5 or Claim 13 in referencing Tsurushima
11 and Gittleman?

12 A. Because I consider it obvious. Because that's
13 my position, that the idea of taking the established
14 process of measuring voltage and current and using it
15 to -- you know, using it as part of your amplifier -- to
16 go from using that in some analog circuit to using it
17 within a DSP is an obvious development, would have been
18 obvious to a person of ordinary skill.

19 Q. But you do agree with me that there is not a
20 single reference to DSP in Tsurushima?

21 A. I very much doubt there is a reference to DSP in
22 Tsurushima.

23 Q. Are you aware of any reference to a DSP in
24 Gittleman?

25 A. Both Gittleman and Tsurushima were published at

1 a time which was very early in the development of DSP.
2 So it would have been extremely surprising if they
3 mentioned it.

4 Q. Are you aware of any reference to DSP in
5 Gittleman?

6 A. As I just said, it was -- Gittleman is probably
7 before the time that DSP was even -- the term was
8 coined.

9 Q. So you're not aware of any reference to the term
10 "DSP" in the referenced Gittleman; are you?

11 A. Gittleman precedes the time that DSP was coined.

12 Q. That's all well and good. Is there a reference
13 to DSP in the document that is Gittleman?

14 MR. DAS: Objection, asked and answered multiple
15 times.

16 MR. CRAIN: Go ahead.

17 THE WITNESS: It would be very surprising if
18 there was a reference to DSP in Gittleman because of the
19 timing, because it precedes the development of the field.

20 BY MR. CRAIN:

21 Q. But that doesn't tell me whether there is or
22 isn't, according to your understanding. I understand
23 you might be surprised and your jaw might hit the floor.
24 Are you aware of a reference to DSP in Gittleman?

25 A. Gittleman precedes the development of DSP.

1 Q. So what does that have to do with the answer to
2 my question?

3 A. It would be surprising if Gittleman -- things
4 that don't exist at the time a paper is written can't be
5 referenced in that paper.

6 Q. So you're telling me then, DSPs didn't exist at
7 the time of Gittleman, so, therefore, there is not a
8 reference to DSP in Gittleman? Do I understand you
9 correctly?

10 A. It's not completely correct that they didn't
11 exist, but they were definitely in their infancy.

12 Q. If I give you the Gittleman document, do you
13 believe that you can find a reference to DSP in it?

14 A. I don't think so.

15 Q. Have you had an opportunity to review the
16 document that is Exhibit 5?

17 A. Yes.

18 Q. What is Exhibit 5, according to your
19 understanding?

20 A. It looks like it's my declaration.

21 Q. Would you please turn to paragraph 15 of
22 Exhibit 5. Before I ask a question, please take a
23 moment to read that paragraph.

24 A. Okay.

25 Q. Do you see the second sentence that begins, "In

1 my opinion, a person of ordinary skill in the art for
2 this '542 patent would have a master's degree in
3 electrical or electronics engineering and master's level
4 course work, along with practical experience designing
5 and testing electronic amplifiers"?

6 A. That's the sentence.

7 Q. Did I read it accurately?

8 A. Yes.

9 Q. Why do you believe, in your opinion, that a
10 person of ordinary skill in the art of the '542 patent
11 would possess a master's degree in electrical or
12 electronics engineering?

13 A. The subject of the patent is an electronic
14 amplifier. Someone who was working in that area --
15 someone who would be competent to understand what was
16 going on would be someone who was working in that area,
17 working in electronics design; and most often, the
18 background would have been a master's degree in
19 electrical engineering and some amount of practical
20 experience.

21 Q. Why not a Bachelor of Science degree?

22 A. Are you asking a Bachelor of Science degree in
23 electrical engineering or in some other subject?

24 Q. Thank you for the clarification. Why not a
25 Bachelor of Science degree in electrical or electronics

1 engineering?

2 A. Oh, it turns out that it's most common for
3 people who are going to work in the profession to get a
4 master's degree.

5 Q. What do you base that on?

6 A. I base that on my experience teaching in the
7 electrical engineering department.

8 Q. Was that the case in 1994?

9 A. I was not teaching electrical engineering in
10 1994. Was it the case that it was commonplace for
11 people to get a master's degree? I didn't have the same
12 perspective. I had -- my knowledge there is having been
13 a graduate student and knowing people who went to work
14 in industry who had master's degrees.

15 Q. Do you have any understanding of whether or not
16 it was most common for people who were going to work in
17 the profession in 1994 to get a master's degree?

18 MR. DAS: Objection, form.

19 THE WITNESS: Can you repeat the question.

20 BY MR. CRAIN:

21 Q. Do you have any understanding of whether or not
22 it was most common for people who were going to work in
23 the profession in 1994 to get a master's degree?

24 MR. DAS: Objection, form.

25 THE WITNESS: Do I have any understanding and

1 most common are a little bit vague. I can say that I
2 have knowledge that some people who went to work in the
3 profession have had a master's degree and I have -- you
4 know, I know in detail what the situation is currently.
5 So I can make an inference. So yes, I do have some idea.
6 BY MR. CRAIN:

7 Q. Are you saying that you know in detail what the
8 situation is currently, but you don't necessarily know
9 in detail what the situation would have been in 1994?

10 A. Because, you know, my experience as a professor
11 and working -- directly supervising master's students is
12 limited to my time at Columbia since 2000. I have, you
13 know, a particularly good understanding of the situation
14 there. My knowledge of the situation in 1994 is based
15 on a different kind of information, the people I knew
16 when I was at graduate school. So I -- I can't be -- so
17 if you're saying what proportion of people working
18 professionally have master's -- have a master's degree,
19 if I had to guess today, I would probably get it within
20 20 percent. And my confidence would maybe grow to 40
21 percent at that time, plus or minus.

22 Q. Well, going back to the statement in your
23 declaration in paragraph 15 in regard to your opinion
24 about the ordinary skill in the art, is that what a
25 person -- would a person of ordinary skill in the art in

1 the '542 patent in 1994 have been a person that had a
2 master's degree in electrical or electronics engineering
3 and master's level course work, along with practical
4 experience designing and testing electronic amplifiers?

5 A. Sorry. What was the question?

6 Q. Well, I'm trying to understand --

7 A. I understand what the definition is. What are
8 you asking me about it?

9 Q. Is your testimony that a person of ordinary
10 skill in the art as of 1994 would have had these
11 qualifications that we see in paragraph 15?

12 A. What I'm saying is that someone with those
13 qualifications would be someone I would consider a
14 person of ordinary skill in the art. Now, am I saying
15 that any individual who would have ordinary skill in the
16 art would have these qualifications? No. I'm not
17 trying to -- I'm not trying to come up with a
18 comprehensive definition. I'm trying to explain the
19 kind of person I'm talking about.

20 Q. What I was trying to do -- I was a little
21 confused about whether or not you considered this
22 requirement to be today or whether or not you considered
23 it to be at some other point in time.

24 A. I'm not -- it's not specific to a particular
25 time.

1 Q. So for all times, you believe that a person of
2 ordinary skill in the art, with respect to the '542
3 patent, would have a master's degree, in addition --
4 have a master's degree in electrical or electronics
5 engineering and master's level course work, along with
6 practical experience designing and testing electronic
7 amplifiers?

8 MR. DAS: Objection, mischaracterizes testimony.

9 MR. CRAIN: Object to form.

10 THE WITNESS: I'm sorry?

11 MR. CRAIN: No.

12 THE WITNESS: Okay. What I'm saying is that I'm
13 describing a hypothetical person with a certain level of
14 skills, certain level of training and experience, in
15 1994, in the early 1990s, and that that's the kind of
16 level -- that's what I'm referring to when I talk about
17 a person of ordinary skill. The reason I chose that
18 particular hypothetical person is because that is, in my
19 best estimate, the kind of person who would be involved
20 in this kind of work at that point.

21 BY MR. CRAIN:

22 Q. So a person in 1994, having a Bachelor of
23 Science in electrical or electronics engineering, would
24 not, in your opinion, be a person of ordinary skill in
25 the art of the '542 patent?

1 A. You know, I didn't say that, because it didn't
2 seem like it was important to put a lower bound on it.
3 It's like, okay, if we've got this level, we're good.

4 Q. Well, isn't that a lower bound? Isn't it the
5 floor?

6 A. Okay. No, I'm saying it's sufficient, but not
7 necessary. I'm not saying it's necessary. I'm not
8 describing what I consider to be necessary. Does it
9 really matter?

10 Q. Well, I'm trying to understand what you're
11 sharing with us. Do you believe it matters?

12 A. Well, no, I don't understand why you're -- we're
13 just trying to -- I'm going to obviously be talking
14 about obviousness. So it's like, well, obvious to who.
15 Okay, well, here is the kind of person I'm thinking
16 about it being obvious. Okay. You know, I can't --
17 it's impossible to describe someone specifically, but
18 here is an example of kind of someone with a certain
19 characterization of the kind of person. That's the kind
20 of person I'm thinking about.

21 Q. With respect to this notion of obviousness, then
22 would it therefore be obvious if someone didn't have
23 these levels of credentials?

24 MR. DAS: Objection, form.

25 BY MR. CRAIN:

1 Q. Is that what I understand you to say?

2 A. I'm sorry. If someone didn't have this
3 experience, it would not be obvious to them.

4 Q. I'm asking you. Is that what you're telling me?

5 A. That's what you're asking me. No, that's not
6 what I'm telling you. I'm saying that if someone does
7 have this, then that would be the situation where it's
8 like, okay, it's going to be obvious to them. There may
9 be other people to whom it is obvious. So now -- you
10 know, I didn't think about this at all. But you're
11 saying, well, let's say you only had a bachelor's degree
12 in electrical engineering. Would this not have been
13 obvious? For the majority of people who went on to get
14 a master's degree, I doubt that it was only by virtue of
15 their master's degree that they learned what was
16 obvious. However, certain people who get bachelor's
17 degrees maybe didn't get -- weren't that in touch with
18 what was going on in the course work, so they may -- I
19 can't really vouch for their ability to understand
20 things.

21 Q. Dr. Ellis, all I have is what you shared here.
22 So I'm trying to understand it.

23 A. Great.

24 Q. What do you see as the difference between a
25 master's degree and master's-level course work?

1 A. It's not a very important distinction. The
2 point -- I mean -- it's -- what I'm trying to say is
3 like, well, they have a master's degree. It's not the
4 holding of the degree that's important; it's the fact
5 they did the course work. So I could -- maybe I could
6 have just said someone who had performed master's degree
7 level course work. Although I guess if they hadn't got
8 the degree, that would possibly suggest that they didn't
9 do the course work -- they didn't get as much out of the
10 course work as somebody who successfully completed the
11 degree.

12 Q. Right. That's what I'm trying to understand.
13 If a person has a master's degree, don't they have to do
14 master's level course work, in most instances, to get
15 that degree?

16 A. I think that's a reasonable assumption. But, of
17 course, you could imagine some weird situation -- I
18 mean, you know, a master's degree, they could have, you
19 know -- I didn't say it was from -- you know, a
20 certification -- board certified master's degree. You
21 can make that whole -- you can make that argument about
22 like master's level course work, there is some, you
23 know, weird diploma mill college that claims to be
24 offering master's level course work, and we did that so
25 they have a fully experienced -- it doesn't seem that

1 important to me.

2 Q. I'm sorry. It doesn't seem what?

3 A. It doesn't seem that important to me.

4 Q. What doesn't seem as important to you?

5 A. It doesn't seem that important to me to be
6 really precise about describing the exact qualifications
7 of someone to whom I'm ascribing obviousness.

8 Q. Did you draft the sentence we're talking about?

9 A. You know, I don't recall, but --

10 Q. You seem to have a level of discomfort. I may
11 be misunderstanding you.

12 A. I'm not at all uncomfortable with it. I like
13 it. I mean, that's certainly -- that's my declaration.

14 Q. Okay. Then why did you also indicate that a
15 person of ordinary skill in the art, in your opinion,
16 would also have practical experience designing and
17 testing electronic amplifiers?

18 A. Because -- because if I met someone who had
19 worked in that area of designing and testing electronic
20 amplifiers, I would be very confident that they would
21 understand what was going on. So, you know, really, I
22 could have said someone with practical experience, but
23 then it's like, well, what do you mean? There is lots
24 of different kinds of practical experience. I'm saying
25 someone who has got a master's level education who has

1 then also been working as a design engineer. And that
2 just gives -- you see -- you understand the distinction
3 I'm making between an ability to just provide an
4 example, to provide a set of qualifications of a typical
5 example, and to provide an absolutely watertight
6 definition, saying okay, this person has to have all of
7 these things in order to be able -- for it to be
8 obvious, and if they don't have them, then there is no
9 way. That's not at all what I was trying to do.

10 Q. What do you mean when you state "electronic
11 amplifiers"?

12 A. Devices. Devices that function as amplifiers
13 made from electronics.

14 Q. So would that include any device which is
15 electronic and an amplifier?

16 A. Sure. I mean -- so no. I mean -- no. So you
17 could maybe find -- I don't know. This seems like a
18 really strange hypothetical situation. We're trying to
19 think of all these kind of weird variants. What I'm
20 trying to do is I'm trying to give an example -- I mean,
21 the point is, I could have said, oh, a person of ordinary
22 skill of the art is, you know, Joe Bloggs. It's like,
23 well, that's not very helpful. There is one guy you
24 think it would have been obvious to. That's not
25 really -- that's not very obvious. So I don't want to

1 say something that's too narrow. I want to say, here is
2 a kind of person. There are plenty of such people
3 around. There were plenty of such people around in 1994
4 or whatever. That's the kind of person I'm talking
5 about.

6 Q. That would have had practical experience
7 designing and testing any type of electronic amplifier?

8 A. I didn't say any type. Oh, you mean any type as
9 in one of any type rather than every type. So when you
10 say someone who has had experience designing any type of
11 electronic amplifier, that sounds like, wow, that's a
12 pretty broad range of experience you've got. But has
13 experience of designing and testing some type of
14 electronic amplifier, that's what I mean.

15 Q. Is there any specific type of electronic
16 amplifier, that you're aware of, that you would exclude?

17 A. I can't think of any.

18 Q. Go ahead.

19 A. I can't think of any.

20 Q. Are you familiar with servo drives?

21 A. I know -- I know of something called a servo.
22 I'm not actually sure what you mean by a servo drive.

23 Q. What do you understand a servo to be?

24 A. A servo is some kind of actuator that is a
25 device that you can control to move as part of a system

1 that you're using to control to move.

2 Q. Do you consider a servo to be an electronic
3 amplifier?

4 A. A servo -- well, the servo is the device at the
5 end that -- that moves. For instance, some kind of, you
6 know -- it could be like a solenoid. So a piece of
7 metal inside an electric cord that's being moved
8 backwards and forward. That's not the amplifier. It's
9 something that you deliver power into. So it would need
10 an amplifier to drive it.

11 Q. So the drive mechanism, the component of the
12 drive --

13 A. Oh. That's what you said, a servo drive?

14 Q. I said a servo drive, yes.

15 A. A servo driver sounds like an amplifier to me.

16 Q. So would you include that in the electronic
17 amplifiers category?

18 A. The circuitry, yes, would be essentially the
19 same.

20 Q. What do you mean by "practical experience"?
21 Could you describe that please.

22 A. I'm thinking of someone who has worked in a
23 company or works -- yeah, has been professionally
24 employed, producing, designing and building electronic
25 amplifiers.

1 Q. What do you mean by design and testing?

2 A. I just mean to sort of -- so if I had said
3 practical experience designing electronic amplifiers,
4 that would have been okay, but it's sort of like you
5 could imagine someone who was like designing these
6 things and having no idea if they actually did anything.
7 So the kind of person I'm thinking of is someone who is
8 actually involved in building these things, and that
9 would involve both designing them and then testing them
10 to see if they worked, and presumably, most often
11 revising the design in light of the results of the
12 testing.

13 Q. If I understand your testimony correctly, you
14 state, I am thinking of someone who is actually involved
15 in building these things. Are you referring to the
16 electronic amplifiers?

17 A. Yes.

18 Q. Are you thinking of any specific type or any
19 type of electronic amplifier?

20 A. I'm not thinking of any specific type of
21 electronic amplifier.

22 Q. So would that include a person that designs or
23 builds RF amplifiers?

24 A. Yes.

25 Q. Dr. Ellis, what experience do you feel like you

1 have that gives you the understanding of the
2 capabilities of a person of ordinary skill in the art?

3 A. It's kind of -- it's the essence of what we --
4 you know, what an electrical engineering training
5 education is about. That's kind of what we're aiming
6 at. We're aiming at producing students who have a
7 certain level of comfort -- competence and an ability to
8 go into industry if they choose to work as practicing
9 engineers. So that's -- you know, that's something that
10 we think about to some extent within our -- within the
11 electrical engineering department, what is it that we
12 want our students to know and to be able to do when they
13 leave our program.

14 Q. Do you consider yourself to be a person of
15 ordinary skill in the art with respect to the '542
16 patent?

17 A. I don't exactly fit this description that I've
18 given. Right? Because I don't -- I don't exactly fit
19 this description. I don't consider it necessary for me
20 to be this person to be able to know what I think is
21 obvious to such a person.

22 Q. Do you believe that you also do not fit this
23 description with respect to the understanding of a
24 person of ordinary skill in the art with respect to the
25 '542 patent as of 1994?

1 MR. DAS: Objection, form.

2 THE WITNESS: So me or the person or -- sorry.

3 BY MR. CRAIN:

4 Q. You.

5 A. So me, in 1994, would I consider myself a person
6 of ordinary skill in the art?

7 Q. Yes.

8 A. I've thought about this a bit. And that is --
9 you know, that's given me some insight, something I can
10 think about when I'm trying to understand this. Now, I
11 don't meet this definition. But like I say, the purpose
12 of the definition was to give an example so we can know
13 what we're talking about. It certainly wasn't meant to
14 be exclusive.

15 (Exhibit 6 marked for identification.)

16 BY MR. CRAIN:

17 Q. Dr. Ellis, you have what has been marked as
18 Exhibit 6. Would you please take a moment to review the
19 document marked as Exhibit 6.

20 A. Okay.

21 Q. Dr. Ellis, are you able to identify what appears
22 to be contained in Exhibit 6?

23 MR. DAS: Objection, form.

24 THE WITNESS: This appears to be the Petition
25 for Inter Partes Review.

1 BY MR. CRAIN:

2 Q. Does yours say "Corrected Petition"?

3 A. It does.

4 MR. CRAIN: KM, am I operating off the right
5 document? I want to make sure that there is no
6 understanding that this is not the right document.

7 MR. DAS: Right document for what?

8 MR. CRAIN: With respect to the Petition for
9 Inter Partes Review. We understand it to be QSC's
10 corrected Petition for Inter Partes Review. Do you have
11 any reason to disagree with that?

12 MR. DAS: This appears to be QSC's Corrected
13 Petition for Inter Partes Review.

14 MR. CRAIN: Well, we didn't use the original. I
15 think there was an issue --

16 MR. DAS: Oh, about service, I think.

17 MR. CRAIN: Right. I just want to make sure
18 we're all on the same page. Sorry about that.

19 THE WITNESS: Great.

20 BY MR. CRAIN:

21 Q. Do you recall whether or not you had opportunity
22 to review QSC's Petition for Inter Partes Review before
23 it was submitted with the United States Patent and
24 Trademark Office?

25 A. I don't recall. I have a feeling I did.

1 Q. Fair enough. Fair enough.

2 Would you turn to page 33. Do you see a chart
3 that begins on the bottom of page 33 and continues onto
4 page 34?

5 A. Yeah.

6 Q. Actually, it concludes, I believe, on the top of
7 page 35.

8 A. Right.

9 Q. Do you recall, at any time, ever seeing a chart
10 like this in your efforts with respect to this inter
11 partes review?

12 MR. DAS: Objection, form.

13 THE WITNESS: I've seen charts like this before.
14 I mentioned the consulting work that I did. It was for
15 a different patent. I saw a chart like this. I don't
16 remember whether I saw this in relation to this work or
17 not. Certainly I didn't study it in any depth.

18 BY MR. CRAIN:

19 Q. Let's see if you can walk through it.

20 A. Sure.

21 Q. If you feel uncomfortable about anything, please
22 let me know and we can talk about the specific documents
23 that are referenced.

24 A. Yeah.

25 Q. Are you familiar with the document that may be

1 known or referenced by the name Porambo?

2 A. Yes. I reference the document in my
3 declaration, which is the patent by Porambo.

4 Q. To make it easy on you --

5 A. Yeah.

6 (Exhibit 7 marked for identification.)

7 THE WITNESS: This is what I'm referring to.

8 This is what I understand by Porambo.

9 BY MR. CRAIN:

10 Q. Dr. Ellis, you have what's been handed to you as
11 Exhibit 7. When you're able, could you please identify
12 what you understand Exhibit 7 to be.

13 A. Exhibit 7 is the patent by Porambo that I
14 reference in my declaration.

15 Q. Is that Patent No. 5,450,624?

16 A. Yes.

17 Q. Have you read Porambo before?

18 A. Yes.

19 Q. Do you know how many times you may have read it?

20 A. I've looked at it a number of times. I probably
21 read the whole thing straight through a couple of times.

22 Q. Do you recall if you read through it again in
23 preparation for today's deposition that we talked about
24 earlier today, Tuesday or Wednesday?

25 A. Yes.

1 Q. Did you read through it completely?

2 A. I think so.

3 Q. Do you feel like you understand Porambo; that
4 is, Exhibit 7?

5 MR. DAS: Objection to form.

6 THE WITNESS: I feel like I understand what
7 the -- the idea that he was trying to describe -- the
8 ideas he was trying to describe.

9 BY MR. CRAIN:

10 Q. What do you understand the patent that is marked
11 as Exhibit 7 to be about?

12 A. That's interesting. So you asked me if I read
13 the whole thing. I don't think I read the claims. I
14 think when I was reading, I just read the description,
15 because that's the ideas, the materials covered. I
16 don't think I read through -- well, I looked at them. I
17 looked at them, but I didn't carefully read through all
18 the claims.

19 Q. That's fine. I'm not trying to trap you. I'm
20 just trying to understand what you did and what you
21 didn't --

22 A. I know. You asked me, so I wanted to --

23 Q. I know. Thank you for clarifying that.

24 A. Sorry.

25 Q. Let's go back. What is your understanding of

1 what Patent 5,450,624, what we're calling the Porambo
2 patent, to be about?

3 A. It's about a -- an approach to using the
4 existing DSP within an integrated audio playback and
5 amplification system in a car -- using that DSP as a way
6 of diagnosing possible faults within the speakers.

7 Q. Is it an oversimplification to say that Porambo
8 is about a diagnostic device in a car radio?

9 A. That's not inaccurate, but that, you know,
10 obviously, leaves out a lot of the detail.

11 Q. So it's a 50,000-foot view instead of a
12 30,000-foot view?

13 A. You know, for the purposes of this discussion,
14 I'd rather we -- the radio makes it sound like, oh, it's
15 just the radio, where, of course, this naturally
16 includes the power amplification portion.

17 Q. What is clipping?

18 MR. DAS: Objection, form, actually, now that I
19 think about it.

20 THE WITNESS: So in relation to electronics, and
21 particularly signals in electronics, the most common --
22 the most familiar form of clipping is when you try to
23 amplify a voltage that exceeds the voltage capabilities
24 of the system in which you're using it, so some absolute
25 limit on the values that can be represented. So instead

1 of carrying on, they stop at a level. And it looks as
2 if the picture that you wanted to see of this nice shape
3 has been clipped -- has been cut off at some level.

4 BY MR. CRAIN:

5 Q. Does Porambo relate to clipping at all,
6 according to your understanding?

7 A. Porambo uses the clipping signal from the
8 amplifier as part of his procedure.

9 Q. What is the nature -- I'm sorry. Were you done?

10 A. What he calls a clipping signal, which as far as
11 I understand, is not very precisely defined.

12 Q. What is the nature of the clipping feedback
13 signal in Porambo, according to your understanding?

14 A. Well --

15 MR. DAS: Objection, foundation.

16 You can answer.

17 THE WITNESS: Yeah. Porambo describes a system
18 where the power amplifier has some -- a diagnostic
19 clipping -- a single diagnostic output which indicates
20 when the amplifier is clipping, which in this case just
21 means that it's -- which I understand to mean it's
22 operating in a non- -- in a non-optimal fashion. It's
23 probably introducing a lot of distortion to the signal.

24 He describes -- I think he mentions the chip. I
25 did not look up the details of that chip to find out

1 exactly what that clipping output is meant to mean.

2 BY MR. CRAIN:

3 Q. You lost me there. What are you talking about?

4 A. Sorry. You're asking me what clipping means in
5 the context of this patent? Right?

6 Q. Well, I was asking -- yes. I think you
7 mentioned that Porambo at least relates to a clipping
8 signal.

9 A. Yes.

10 Q. So I'm just trying to understand the nature of
11 that clipping signal, according to your understanding.

12 A. Yeah. So he says the -- in column five, line
13 ten of the description, he says -- he references the
14 particular chip, the SGS-L109. And I assume that if we
15 looked up that chip, that chip actually has a clipping
16 output, a signal -- a pin, which is identified as the
17 clip output. I did not do that.

18 Q. Let's correlate this with your declaration. So
19 if you still have that handy. Exhibit 5, paragraph 24.
20 Thank you for bearing with me and jumping between these
21 documents. I think they all relate to each other. I
22 know it can be gangly. If you feel like I've lost you,
23 please stop me. If you'll look at paragraph 24.

24 A. Yeah.

25 Q. What do you mean when you talk about the control

1 signal intrinsic to the audio signal, itself?

2 A. So I describe that clipping is most commonly
3 understood to be when the voltage -- the voltages that
4 the amplifier is attempting to produce are so large that
5 it can't reach the outer extremes, and so it gets
6 clipped. Now, if you had an amplifier in that
7 condition, that's bad, because how do you distort it.
8 So you would want to control what was going on to avoid
9 that condition.

10 The most natural thing to do is like -- well, if
11 we actually just allowed the signal to get smaller
12 globally, then we wouldn't have these bits that were
13 sticking out beyond our voltage rails or whatever, so we
14 could remove the clipping. So that's what I mean by
15 controlling the performance -- what I did say?
16 Modifying the performance -- wait. Yes. So the
17 operation -- there is clipping. The control system is
18 saying, okay, we've got to get out of this clipping
19 situation. What are we going to do? Oh, well, we can
20 scale back the input signal. Now, does that mean we've
21 got to have some separate control into the amplifier?
22 No. We're already feeding this input signal in. We're
23 simply going to -- we're going to implement the control
24 in that channel.

25 Q. I see. Do you still have Porambo handy?

1 A. Yeah.

2 Q. Do you have any understanding of whether or not
3 Porambo teaches a voltage or current detector?

4 A. Didn't I mention earlier that my interpretation
5 of Porambo has -- is a little more sophisticated when I
6 read my declaration. I think Porambo -- I mean, I don't
7 think I say this, but now I suspect that the clipping
8 signal corresponds to a current sensing situation, just
9 because -- we can discuss why if you like. Then he also
10 talks about measuring the level going into the amplifier,
11 which corresponds to a voltage situation. So yeah, you
12 could say that it does involve -- it does have some
13 involvement of both current and voltage sensing,
14 although it's not -- particularly, the current is not
15 described as current.

16 Q. Whether we agree or disagree, I'd like to know
17 exactly where you're referring to. So for our current
18 detector, can you refer me to any of the text or any of
19 the figures that you believe illustrates or demonstrates
20 a current detector.

21 A. Right. So what I'm thinking -- what I'm
22 suggesting, what I'm saying, is that I think the clip
23 signal is probably generated when the amplifier -- the
24 amplifier goes into a current limiting mode. Now, the
25 reason I would say this is because -- which is different

1 from the clipping -- the traditional interpretation of
2 clipping that I mentioned. The traditional
3 interpretation of clipping would be when the voltage
4 gets too high, it doesn't -- that's how you would think
5 of it.

6 So the strange thing about this is like, well,
7 in this figure, figure four of the Porambo patent, he
8 talks about the clipping threshold of the V-out, V
9 subscript out. And it's like well, if it's voltage
10 clipping, then -- an amplifier usually applies a fixed
11 and well-defined amount of voltage gain.

12 So if, let's say, this amplifier had a times ten
13 voltage gain, it had output voltage rails at ten volts.
14 An amplifier very conventionally is designed to deliver
15 a certain voltage, to be a low-impedance voltage source
16 of the output. So then it's like, well, if it's got a
17 time -- if it's got a gain of ten, it's got ten-volt
18 voltage rails, when you put one volt in, that's when
19 it's going to start clipping.

20 This picture says, oh, no, the actual input
21 voltage that generates a clip depends on the output
22 load. That doesn't make sense in terms of my
23 understanding of voltage clipping. However, if it was
24 looking at current clipping -- now, this is not an
25 unusual thing, but very often, an amplifier will have

1 some kind of circuit that will deploy, will limit the
2 amount of current that can be delivered through the
3 output, and that you could easily connect that -- you
4 know, you could have that coming out of a pin. So if it
5 was -- if the clipping signal indicated current
6 limiting, then this would make sense, that now the
7 current limiting is going to occur at some unpredictable
8 input voltage. It's the input voltage where the output
9 current, which depends on the load, is sufficiently
10 large that we're going to hit that current limit.

11 Q. Is there anything else in Porambo that suggests
12 to you a current detector?

13 A. That's my -- that's my interpretation of the
14 current detector in Porambo.

15 Q. Sure. I understand. I want to make sure. If I
16 understand you correctly, you're pointing me to your
17 understanding of Figure 4.

18 A. Right.

19 Q. So now I just want to make sure, is there
20 anything else that also leads you to that same
21 conclusion in Porambo?

22 A. I don't think so. I mean, leads me to the same
23 conclusion? It's not just Figure 4. Right? It's the
24 description of Figure 4, how we can interpret it, and my
25 basic electronics knowledge of what possible scenario

1 could result in that kind of figure being a useful way
2 of characterizing what's going on.

3 Q. So would you point me to any additional text
4 that you believe --

5 A. So there is Figure 4. And what is Figure 4
6 showing? You know, it's labeled, but obviously, you
7 have to read the text to understand exactly what it's
8 saying. Right? But it's saying based on the text -- do
9 you want me to -- wherever the text describes Figure 4,
10 which is -- I see a description in column five, around
11 line 20, 21 onwards. "If the clipping threshold
12 detected" -- sorry. I'm not going to read it out.

13 Q. What line are you on? Column five, line what?

14 A. Column five, line 24.

15 Q. Is it the sentence that begins, "If the clipping
16 threshold detected" --

17 A. Yes.

18 Q. So you believe that -- so it begins there. Do
19 you see an ending point? How far would you go?

20 A. I would go to line 51. So the rest of that
21 paragraph and then the next paragraph.

22 Q. Do you also believe that Porambo -- that is,
23 exhibit -- what exhibit is it? Is it five?

24 A. This one. Seven.

25 Q. Exhibit 7. Do you also believe that Porambo, in

1 Exhibit 7, teaches a DSP with an input port for
2 receiving detected current and voltage?

3 A. Let's see. I think -- you know, I think that
4 that you can regard -- there is this clipping input,
5 which you can regard as an input for detecting current;
6 and then there is this configuration that during the
7 operation, he switches the audio input to the DSP to
8 come from the output of the amplifier, which is tracking
9 the voltage that that amplifier will be delivering.

10 Q. Is that what you were showing in Figure 4?

11 A. No. That's different. So we're talking about
12 voltage now. Right?

13 Q. We're talking about voltage?

14 A. Yeah.

15 Q. Okay. Point me to where you're talking about
16 now.

17 A. The current sensor -- I know you asked me also
18 about voltage. So, in Figure 3, he has this feedback
19 link, 72, from the output. It's before the DAC, coming
20 back and going to the input to the DSP. It's the arc
21 marked 72.

22 Q. Seventy-two. Okay.

23 A. That's basically giving him a number -- giving
24 him a value which tells him the voltage that he would
25 expect at the output of the amplifier.

1 MR. DAS: Henry, I don't want to interrupt in
2 the middle of the line of questioning. But we've been
3 going an hour and 15 minutes. I'm just worried about
4 Dan more than anything else.

5 MR. CRAIN: Okay. Thank you.

6 I think we can finish up Porambo here in just a
7 second, just go for a few more minutes.

8 BY MR. CRAIN:

9 Q. Does feedback loop 74 in Figure 3 also relate
10 to --

11 A. Feedback loop 74, as I understand, is the
12 clipping detection. That would be the current sensing.
13 That's what I'm characterizing as current sensing.

14 Q. What type of signal is carried on feedback loop
15 74?

16 A. It's a binary signal.

17 Q. How is that representative of the current?

18 A. It's --

19 (Interruption.)

20 MR. CRAIN: Let's go off the record.

21 THE VIDEOGRAPHER: This is the end of Media
22 No. 4 in the deposition of Dr. Daniel Ellis. The time
23 is now 3:57 p.m. We are off the record.

24 (Recess taken from 3:57 to 4:10.)

25 THE VIDEOGRAPHER: This is the beginning of

1 Media No. 5 in the deposition of Dr. Daniel Ellis. The
2 time is 4:10 p.m. We are back on the record.

3 MR. CRAIN: Thank you.

4 BY MR. CRAIN:

5 Q. Dr. Ellis, we were talking before the last break
6 with respect to the Porambo reference.

7 A. Yes.

8 Q. Exhibit 7, I believe. Before I get back into
9 it, is there any of your testimony that we've covered at
10 any point prior to -- today that you would like to go
11 back and change, modify, or correct?

12 A. No.

13 MR. DAS: Objection, form.

14 BY MR. CRAIN:

15 Q. Did you have a chance to consult with QSC's
16 counsel during the break?

17 A. I had the chance.

18 Q. Did you consult or confer with QSC's counsel
19 regarding the substance of the testimony that you have
20 already given in this deposition?

21 A. No.

22 Q. Did you consult or confer with QSC's counsel
23 regarding the substance of the testimony that is
24 anticipated to be given?

25 A. No.

1 Q. During the break, Dr. Ellis, did QSC's counsel
2 suggest to you the manner in which any question should
3 be answered?

4 A. No.

5 Q. I think we were talking about feedback loop 74.

6 A. Yes.

7 Q. Do you recall talking about that?

8 A. Yes.

9 Q. Would you remind me what you understand feedback
10 loop 74 to be for.

11 A. It's the clip detect signal coming from the
12 power amplifier which indicates it's used to -- it's
13 provided to indicate the power amplifier is not doing
14 well, it's in trouble, and -- that's what it's for.

15 Q. Did you tell me earlier that the clip detection
16 signal in loop 74 relates to current?

17 A. So my current understanding of the system as
18 described makes me think it's most likely that it's
19 relating to, yeah, an overcurrent situation.

20 Q. Does the signal that would be communicated on
21 loop 74 indicate how much power is being delivered to
22 the load in Porambo?

23 A. You can infer something about the power that's
24 being delivered to the load, but it's not directly
25 describing that.

1 Q. Why is it not directly describing that?

2 A. All it's saying -- well, I don't know -- all
3 it's saying is that the amplifier is clipping. Most
4 likely, in situations -- well, because current alone
5 does not tell you what the power is going to be. You
6 have to know the current and the voltage. I don't know.
7 It's hard to say.

8 Q. What's hard to say?

9 A. It's hard to say whether you could say if you --
10 just looking at the clipping signal, whether you could
11 say something -- whether that would tell you what power
12 was being delivered to the load.

13 Q. Now, is the clipping signal that Porambo teaches
14 on loop 74 an analog or digital or binary signal?

15 A. It's a digital signal. It's a binary signal.

16 Q. A binary signal.

17 A. Which is a kind of digital signal.

18 Q. Would the binary signal that's communicated on
19 loop 74 communicate the measured value of current?

20 A. It tells you when the current is -- it's a very
21 coarse approximation -- a coarse quantization of the
22 measured current.

23 Q. How so?

24 A. Because when the current is small, it's zero.
25 When the current exceeds some threshold, it goes to one.

1 This is my understanding. This is my construction of
2 what it's doing.

3 Q. And I understand that. I think you had pointed
4 us to column five, around line ten. Right?

5 A. I don't recall. Yes.

6 Q. Starting at line ten to maybe line 14?

7 A. That's interesting. They actually specify that
8 it's the other way around.

9 Q. What's that?

10 A. That it goes low when -- to indicate that the
11 current -- the clipping situation has occurred. So it's
12 a coarse quantization of current, because if the current
13 is low, it's a value one. When the current exceeds some
14 threshold, it goes to value zero.

15 Q. Would you look at the sentence that begins on
16 line 14. If I understand it correctly, I believe when
17 it says, "The signal," that it's referring to the clip
18 detection signal; but if you disagree with me, please
19 correct me.

20 A. Um-hmm.

21 Q. But I believe it starts out on line 14 in column
22 five of the Porambo patent, where it says, "The signal
23 is introduced through an interrupt pin of a signal
24 limiter 31," and it goes on to give us a specific TI
25 chip.

1 A. Yes.

2 Q. It finishes that sentence, "which continuously
3 reduces the signal level introduced to the D-A converter
4 32 linearly. Do you see that?

5 A. Yes.

6 Q. Do you understand what that means?

7 A. I think so.

8 Q. Can you explain what you understand it to mean.

9 A. What it appears to say is that this clip signal
10 automatic -- is connected to part of the digital signal
11 processing chain; this particular chip, the TMS 57002.
12 And that's already been configured so that when that
13 input is detected, it directly starts reducing the
14 amplitude of the signal being fed to the amplifier.

15 Q. What is an interrupt pin?

16 A. It's a kind of pin you would put on a
17 microprocessor that causes the microprocessor -- it's a
18 way of taking an electrical signal that changes voltage,
19 and then it, as soon as possible, makes the
20 microprocessor execute particular instructions.

21 Q. Now, in that sentence that I just read to you,
22 where do you understand the interrupt pin to be?

23 A. On the 57002.

24 Q. Is that block 31, Figure 3?

25 A. Yes.

1 Q. Is the signal that's communicated on clip
2 detector loop 74 that's routed to the interrupt pin in
3 block 31 communicating the value of the current?

4 A. Yes.

5 Q. How is it doing that?

6 A. Because there is a threshold. If it's below --
7 if the current is below some threshold, it's one value.
8 If the current is above the threshold, it's the other
9 binary value.

10 Q. But it's not communicating the value of the
11 current; is it?

12 MR. DAS: Objection, asked and answered.

13 THE WITNESS: Yes, I would say it is
14 communicating the value of the current.

15 BY MR. CRAIN:

16 Q. At all times?

17 A. At all times, yes.

18 Q. So as long as the interrupt -- I'm sorry -- the
19 clip detection -- let me ask again.

20 As long as the clip detection signal is
21 communicated as a one -- say a high voltage --

22 A. Um-hmm.

23 Q. -- how does the DSP know what the value of the
24 current is?

25 A. Because the clip detection pin -- the clip

1 detection signal is -- it's at all times reporting
2 whether the current is in the range zero to some
3 threshold, in which case it outputs some value; or some
4 threshold and above, in which case it outputs the other
5 value.

6 Q. But it would never know the exact value.

7 A. You never know the exact value.

8 MR. DAS: Objection, asked and answered.

9 THE WITNESS: No digital representation
10 communicates the exact value.

11 BY MR. CRAIN:

12 Q. How would you calculate the load impedance or
13 the power based upon the clip detection signal?

14 MR. DAS: Objection, compound. Objection, form.

15 THE WITNESS: In a sense, that's what Porambo is
16 describing. So here is one way of doing it, which is
17 what Porambo describes. You drive the amplifier with
18 some level -- with some signal at a particular level.
19 You increase that level until -- which means that you
20 know the voltage coming out of the amplifier -- until
21 you get this clip signal. Then the minute you see that
22 clip signal -- which we can discuss how they can figure
23 that out -- the minute you see that clip signal, you
24 know that the current has passed that threshold. You
25 know the value of the current at that point. At that

1 time, you know both the voltage and the current being
2 delivered into the load, and you can calculate the ratio
3 to get the impedance of the load.

4 BY MR. CRAIN:

5 Q. Why would you ever want to calculate the
6 impedance of a load if you're going to preset the DSP or
7 the signal to change at a certain threshold? Aren't you
8 already going to know it?

9 A. This is what Porambo is about. It's about
10 detecting a situation where the load is different from
11 what you already know it to be, what you expect it to
12 be, because perhaps the wires are short-circuited or
13 perhaps the wires are an open circuit. If the wires are
14 short-circuited, the impedance is going to zero. If the
15 wires are open circuited, then the impedance is
16 approaching infinity.

17 Q. Are you representing that Porambo teaches that
18 the DSP calculates the impedance of the load?

19 A. That's really a question -- that's kind of a
20 difficult question to answer. I think that the behavior
21 of the system is very much about calculating -- you
22 know, finding -- observing the impedance of the load and
23 using that to decide what to do. However, I don't think
24 it calculates it to any great precision, because
25 basically they don't care about knowing whether it's

1 eight ohms or nine ohms. They're interested in knowing
2 is it less than one ohm, indicating short-circuit; is it
3 more than 100 ohms, indicating an open circuit. There
4 are three conditions, so there are two thresholds.
5 They're just interested in knowing where it lies on that
6 range.

7 Q. Are you aware that it teaches any calculation of
8 the impedance of the load?

9 A. That's implicit. Right? That if you're looking
10 at the voltage at which a particular current occurs,
11 that means you're talking about a particular impedance.

12 Q. Is the DSP calculating --

13 A. See on Figure 4 how the access here is Z load.
14 Z is the variable used for impedance. So this axis is
15 actually the impedance axis.

16 Q. Does the DSP perform this calculation?

17 A. Yes. The DSP is figuring out where we lie on
18 this curve.

19 Q. Does the DSP calculate a specific value for the
20 load?

21 A. I don't know.

22 Q. Why don't you know?

23 A. It's not described in Porambo. You could
24 imagine -- that would be one way of doing it. You could
25 imagine a more -- you know, a more cut-down way of doing

1 it where you didn't bother to calculate the precise
2 value; you just say, you know, is it above -- is it
3 above this threshold. You have some shortcut where you
4 can figure out which range it lies in. But certainly,
5 that's what he cares about is like knowing whether he's
6 in some range of value on this axis. Right? That's
7 what the picture is showing.

8 It's like, okay, we want to know if we're in
9 this range. If we're in this range, we're not going to
10 do anything. The picture shows the load axis divided
11 into three ranges, short-circuit, normal range, open
12 circuit, each of them corresponding to a particular
13 range of values for the Z load, the impedance of the
14 load. So the function of the system as described is to
15 decide which of those regions you're in, which one
16 natural way to do it would be to actually calculate the
17 value on this axis and then decide where it lay on that
18 axis.

19 Q. Is that what Porambo teaches you?

20 A. It doesn't say exactly how to do it, but
21 that's -- he -- that's the process that he's describing.
22 And it would be obvious to a person of ordinary skill
23 that that would be one way to do it. In fact, I mean,
24 that would be kind of like the most obvious way to do
25 it. To do it any other way would be kind of like a more

1 subtle way of doing it.

2 Q. Well, I'm still not clear how you calculate the
3 impedance if all you know about the current is a binary
4 value.

5 A. Because he's driving the voltage over a
6 continuous range and seeing at what point it causes the
7 current to hit that threshold voltage.

8 Q. But you never know the value of the current; do
9 you?

10 A. Well, you do. That's the thing. That if you've
11 got something -- you've got this one bit quantization of
12 the current and you've got something that you -- you've
13 got some situation where you can manipulate it. So
14 you're changing the characteristics of the system
15 incrementally. At the point at which that threshold
16 changes, that's the one time you have a very good
17 knowledge of what the current is. Because it's the --
18 you know that immediately before the current -- before
19 the value changed, it was below that threshold value.
20 Immediately afterwards, it was above the threshold
21 value. So now you've localized the current over a very
22 narrow range.

23 Q. Are you suggesting to us that Porambo teaches
24 the calculation of an impedance value or whether or not
25 the impedance is above or below a predetermined point?

1 MR. DAS: Objection, compound.

2 THE WITNESS: I would say that there is no
3 distinction there; that in order to decide whether
4 impedance is above or below some point, you have to have
5 the value.

6 BY MR. CRAIN:

7 Q. Does the clip detection signal communicate that
8 value?

9 A. Not on its own.

10 Q. Going back to column five, in about line 12,
11 what do you understand that SGS-L109 to represent?

12 A. It looks like the designation of an integrated
13 circuit which is -- yeah, it's the power amplifier
14 integrated circuit, I believe.

15 Q. So is it a correct understanding of that
16 statement that it's the power amplifier that sources the
17 clip detection signal?

18 A. Yes. The SGS-L109, I believe is the integrated
19 circuit that is including the power amplification
20 circuitry; and as a part of that circuitry, which, you
21 know, has probably been used in many different
22 situations, they included a clip output as a diagnostic
23 output so that the rest of the circuit could be
24 immediately alerted when the speaker or the load is
25 being driven into a distorted region.

1 (Exhibit 8 marked for identification.)

2 BY MR. CRAIN:

3 Q. Dr. Ellis, you have what has been marked as, I
4 believe, Exhibit 8. Would you please take a moment to
5 review it and let me know when you're ready.

6 A. Okay. I'm ready.

7 Q. What do you understand Exhibit 8 to be?

8 A. It's a patent application which I refer to as
9 Black in my declaration.

10 Q. Just so we're on the same page, when you say
11 Black, are you referring to the last name of the first
12 listed inventor?

13 A. Yes.

14 Q. Gregory R. Black?

15 A. Yes.

16 Q. I'm happy to refer to it as the Black reference
17 as well.

18 A. Great.

19 Q. Just so, again, we're clear, is this also
20 identified as QSC Audio Products Exhibit No. 1006 at the
21 bottom right-hand corner?

22 A. Yes.

23 Q. Have you read the Black reference before?

24 A. Yes.

25 Q. Do you believe you read it thoroughly?

1 MR. DAS: Objection, form.

2 THE WITNESS: I think -- I've been more
3 interested in particular parts of it. So there may be
4 parts that I haven't read as thoroughly as others, but
5 I've read the whole thing, yeah.

6 BY MR. CRAIN:

7 Q. Do you have any understanding of how many times
8 you may have read the Black reference?

9 A. I probably read the whole thing a couple of
10 times. No more than that. Say three or four times.

11 Q. Three or four times.

12 Do you recall if you had opportunity to read the
13 Black reference, in preparation for today's deposition,
14 earlier this week?

15 A. I did.

16 Q. Do you believe that you have any uncertainties
17 with respect to Black in similar fashion as you
18 expressed with regard to Porambo?

19 MR. DAS: Objection, form.

20 THE WITNESS: I'm not sure what you mean by the
21 uncertainties in regard to Porambo.

22 BY MR. CRAIN:

23 Q. I think -- well, did you not testify this
24 morning before the break that there were some maybe new
25 revelations about Porambo --

1 A. That's right.

2 Q. -- that perhaps you were still a little unclear
3 about?

4 A. Yes. So that's not uncertainty. That's
5 increased -- you know, that's more -- that's a greater
6 insight. I don't have anything like that on this,
7 unfortunately. I think that -- no, it's not
8 unfortunate.

9 Q. I was wondering what you meant by that.

10 A. It was exciting to suddenly -- to have
11 something -- it's like, oh, yeah, that makes more sense
12 now.

13 Q. What do you understand the Black reference to be
14 about?

15 MR. DAS: Objection, form.

16 THE WITNESS: It's about using -- it's about a
17 mechanism for rapidly -- you know, it's about
18 controlling the power output of an RF amplifier for use
19 in something like a cellular telephone, and it's
20 particularly concerned -- well, it motivates it by
21 talking about being able to rapidly modulate the power,
22 and as part of that, it's about making sure the
23 amplifier is in a particular -- maintains in a
24 particular level of performance and avoids saturation.

25 BY MR. CRAIN:

1 Q. Does the term TDMA mean anything to you?

2 A. Yes.

3 Q. What does it mean to you?

4 A. Time division multiple access. It's a format
5 for sharing radio-frequency bandwidth amongst multiple
6 users like cell phone users.

7 Q. Does the Black reference pertain to RF
8 amplifiers in TDMA communications systems?

9 A. That's the motivation, yes. That's the
10 background, as I understand it.

11 Q. Could you describe your own knowledge or
12 experience in the area of the Black reference.

13 MR. DAS: Objection, form.

14 MR. CRAIN: Let me ask that again.

15 BY MR. CRAIN:

16 Q. Could you describe your own experience or
17 knowledge with respect to RF amplifiers in TDMA
18 communication systems.

19 A. This patent, as I mentioned, has some parts
20 which are more interesting to me than others. The part
21 that's interesting is that it's using a DSP as part of
22 the amplifier management. Your question was, what's my
23 experience in relation to RF amplifiers in TDMA?

24 Q. Yes.

25 A. It's the general knowledge of how amplifiers

1 work. You know, there is a certain kernel of principals
2 and information which is common to all these transistor
3 amplifiers, which includes these ones.

4 Q. Do you have any prior specific experience in RF
5 amplifiers in TDMA communication systems?

6 MR. DAS: Objection, asked and answered.
7 Objection, form.

8 THE WITNESS: What I'm saying is my previous
9 experience is at the general level of how amplifiers
10 work.

11 BY MR. CRAIN:

12 Q. I was asking for any prior specific experience.
13 Do you have any?

14 A. Specific? So are you saying specific experience
15 of building or designing TDMA RF amplifiers? I've never
16 designed or built that particular kind of amplifier, but
17 I would understand and my general knowledge -- my core
18 electrical engineering knowledge of amplifiers spans
19 that kind of --

20 Q. I didn't ask you about that. I'm trying to get
21 one piece of information at a time. And that was in
22 direct relationship to any prior specific experience. I
23 understand if you believe that you have knowledge.
24 Okay?

25 A. Yes.

1 Q. You also mentioned, I think, something along the
2 lines -- I don't see it on the transcript now -- maybe
3 fast turn on or turn off. Was it something in that
4 regard?

5 A. Yes.

6 Q. What is your understanding about the Black
7 reference in regard to the --

8 A. You know, I would -- I'm hesitant to discuss
9 that, because that is not the part that I was focusing
10 on. But as I understand, the motivation is because of
11 the characteristics of TDMA where you have this --
12 you're sharing the spectrum by having the individual
13 transmitters turn on and off in rapid alternation. So
14 it's very important that each of the individual devices
15 has a set amount of time to use the spectrum and then it
16 lets the other devices use it. So you have to turn it
17 on and turn it off very quickly and very precisely,
18 because otherwise you're going to reduce the number of
19 different -- you're going to step on the other people
20 using the spectrum. So that's just a motivation for
21 having an amplifier that you can turn on and off very
22 quickly. And that's particularly important -- I mean,
23 it's interesting, because there are a couple of
24 motivations. One of them is to protect the amplifier,
25 but one of them is to allow very fast turn on and turn

1 off.

2 Q. So as not to interfere with other ones?

3 A. Exactly.

4 Q. I believe the patent mentions something along
5 the lines of like 577 microseconds.

6 A. That's right. I mean, I don't know if that's
7 right, but it's in the microsecond and nanosecond range.

8 Q. Do you remember earlier, we were talking about
9 low-power amplifiers and high-power amplifiers?

10 A. Yeah.

11 Q. Do you have any understanding of whether Black
12 is more inclined to be relating to high-power amplifiers
13 or low-power amplifiers?

14 A. So in terms of the absolute power, this is
15 probably in the order of -- it's probably less than one
16 watt. It's probably more than -- I don't really know.
17 But it's the kind of thing that you can supply with a
18 phone battery. Right? So it's not going to be many
19 watts. However, it's interesting that one of the things
20 they're talking about is the potential to damage the
21 actual amplifier. That means that they're delivering
22 enough power that's actually going to, you know,
23 potentially heat up the devices sufficiently to cause
24 them to break down, which is, you know, going to be at
25 hundreds of degrees. So there is some significant power

1 involved here.

2 Q. Do you know if the Black reference is pertaining
3 to an amplifier that may very well be in a mobile phone
4 handset?

5 A. That's my impression.

6 MR. DAS: Objection to form.

7 THE WITNESS: That's my impression. I'm sorry
8 that I'm not sufficiently on top of the actual wording
9 to immediately quote that, but that's my recollection.
10 Yes. It says that. Well, it's -- the background talks
11 about radio telephones. What year is this? This is --
12 '92. Yes. When a cell phone is still a strange idea.

13 BY MR. CRAIN:

14 Q. I think you may have mentioned that it may be
15 battery powered or you would at least maybe expect it to
16 be?

17 A. Yes.

18 Q. So the amplifier in the Black reference can be
19 powered on and powered off in rapid succession? Is that
20 what it's describing?

21 A. That's not really what it's -- well, that's not
22 the only thing it's describing. It's actually -- I
23 mean, that's the motivation, and that's -- you know,
24 that's one of the reasons they want to maintain this
25 amplifier outside of its saturation.

1 Q. Well, let me ask this: It may answer the
2 question. Is the amplifier in the TDMA communication
3 system being actuated on and off in rapid succession?

4 MR. DAS: Objection, form.

5 THE WITNESS: The description indicates that. I
6 don't see that -- I don't know how that's implemented in
7 the circuit. There is nothing in the circuit diagrams
8 that I see as being the thing that turns the amplifier
9 on and off. All I see is the modulation of the input
10 signal.

11 BY MR. CRAIN:

12 Q. Would you turn to -- it's native page three of
13 the document; page five, as QSC has marked it. The
14 paragraph that begins around line 17, "Saturation."

15 A. Yeah.

16 Q. Would you read that first sentence, please.

17 A. "Saturation of a power amplifier occurs when the
18 power amplifier cannot produce as much power as the
19 control circuitry demands."

20 Q. Feel free -- I'm sorry. I didn't mean for you
21 to read it out loud.

22 A. I'm sorry.

23 Q. That's perfectly fine.

24 Can you explain to me what you understand that
25 sentence to mean. If you need to read any more, feel

1 free.

2 A. I understand that to mean that it's when the --
3 that they're using saturation to describe a situation
4 where the power amplifier is being asked to deliver a
5 certain amount of power into the load, and is unable to
6 do that because it's too large, it's greater than the
7 amplifier can supply.

8 Q. Do you have any understanding why the saturation
9 occurs?

10 A. The normal expectation would be that it's
11 something like clipping where simply the voltage is --
12 the requested power output of the amplifier would exceed
13 the ability of the voltage that it can generate, or it
14 could be, again, somehow it can't generate enough
15 current into the load to produce the requested power.

16 Q. Why isn't it called clipping then?

17 A. I don't know. Most likely, just because this is
18 the way that that situation is described in these kinds
19 of circuits -- in radio-frequency circuits. But there
20 may be more to it.

21 It's not -- I mean, it's -- clipping is a very
22 specific kind of -- well, clipping has a narrow meaning
23 that I described originally when -- you know, the
24 voltage hits some maximum, then it's like the top gets
25 clipped off. But the term is also used more broadly to

1 indicate situations where due to finite resources, the
2 amplifier doesn't do what you want it anymore. So you
3 can't -- these words are sometimes used in slightly
4 vague ways.

5 Q. Are you indicating that saturation, as used in
6 page three, line 17, is in some way vague?

7 A. If they had used clipping, I wouldn't have been
8 surprised. I don't know exactly what -- which -- you
9 know, what they're talking about being saturated there.

10 Q. Are clipping and saturation synonymous?

11 A. I wouldn't say they're synonymous, but they very
12 often may refer to the same situation. There are a
13 range of situations where you could use them synonymously.

14 Q. Is clipping to audio as saturation is to RF
15 perhaps?

16 A. Like I say, I wouldn't be at all surprised to
17 hear people use the term "clipping" in response to any
18 kind of voltage amplifier. But I'm not familiar with
19 people using the term "saturation" to refer to audio
20 amplifiers, at least not in -- not in terms of the
21 output -- the output becoming distorted because it's
22 exceeded its design specifications.

23 Q. Do you understand whether or not Black teaches a
24 voltage or a current detector?

25 A. It describes a power detector.

1 Q. Where is that?

2 A. Oh. There is a thing in the figure called
3 detector 211. Let's see what he calls it. The detector
4 detects -- native page eight, line 11. "The detector
5 211 detects the power level."

6 Q. I think I found it. Page eight, line 11. It
7 says, "The detector 211 detects the power level of the
8 RF output signals and creates a power level signal 229,
9 the voltage of which is responsive to the amount of
10 power in the RF output signals." Is that what you're
11 referring to?

12 A. Yes.

13 Q. Is that a voltage detector?

14 A. I don't know.

15 Q. Is detector 211 a current detector?

16 A. It's detecting -- okay. So if you got down to
17 the circuit, most likely it's a wire that has some
18 voltage on it. It's interesting that he goes on to say
19 that the output is specifically a voltage. Because in
20 this situation where you're driving a known load, if
21 you -- a fixed load, because it's the antenna of the
22 device, not something you can change -- if you know
23 either the voltage or the current or any function that
24 is proportional to either of them, then you know the
25 power. So that's why he calls it a power detector. It

1 could be detecting the voltage, it could be detecting
2 the current. Most likely, it's detecting somehow the
3 electromagnetic field around the antenna. That's why
4 it's got a coupler. Which, you know, is ultimately
5 related to the voltage and the current going into the
6 load.

7 Q. Is that what Black is telling us?

8 A. He's not telling us. Right? He's just saying,
9 I have a detector that detects the power level going
10 into the load.

11 Q. It was interesting. You indicated that the load
12 is fixed, did you say?

13 A. Right. It's part of the design.

14 Q. Well, one of the claims, five or thirteen, is
15 concerned with the calculation of the impedance of the
16 load.

17 A. That's right.

18 Q. It sounds like in Black, that's already known.

19 A. Yes. I'm not claiming that Black discloses the
20 invention. I'm using it as an example of someone using
21 a DSP as part of an amplifier protection circuit to
22 indicate that that idea was not unfamiliar to people --
23 to electronic designers.

24 Q. I understand you to say that, "I'm using it as
25 an example of someone using a DSP as part of an

1 amplifier protection circuit" -- is that all?

2 A. Is that all I'm using it for?

3 Q. Yes.

4 A. I don't recall.

5 Q. Let's go back to the '542 patent and look at
6 Claim 5.

7 A. I'm using it as an example of someone using a
8 DSP as part of an amplifier protection circuit in
9 response to the measured per -- something measured from
10 the output of the amplifier.

11 Q. You were looking somewhere. Point me to where
12 you're looking at.

13 A. I'm looking at my characterization of Black.

14 Q. What page?

15 A. Page 17. Native page 13; QSC page 17.

16 Q. What specific sentence in there were you looking
17 at?

18 A. The first sentence is pretty good.

19 Q. Okay. Is there any other sentences that you
20 also believe are pretty good?

21 A. I think the first sentence says basically what I
22 just said.

23 Q. That this is an example of a DSP used to control
24 amplifier behavior in response to performance
25 characteristics measured from the output?

1 A. That's right. That sentence doesn't cover the
2 idea that it's actually using it to protect the
3 amplifier.

4 The final sentence, "to ensure that the power
5 amplifier 203 remains unsaturated," is also something
6 relevant. But the whole thing is relevant. That's why
7 I put it in there. Right?

8 Q. That's what I'm trying to understand, the exact
9 point of relevance, because I'm struggling with that a
10 little bit.

11 A. Sure.

12 Q. So thank you for your patience with me. I'm
13 trying to understand what you understand that it teaches
14 with respect to Claims 5 and 13.

15 A. Yes.

16 MR. DAS: Objection, form.

17 MR. CRAIN: It wasn't a question. It was a
18 headline to help him understand where we're going to go,
19 but whatever.

20 BY MR. CRAIN:

21 Q. Let's look at -- bear with me -- excuse my reach
22 here --

23 A. Sure.

24 Q. -- Exhibit 6.

25 A. Yes.

1 Q. Will you go back, please --

2 A. To the table?

3 Q. Yes. That table.

4 A. What page is it on?

5 Q. Pages 33, 34, and 35.

6 A. Yes.

7 Q. You see there is basically two columns there.

8 A. Yes.

9 Q. Are you familiar with this format where you have
10 two columns?

11 A. Yes.

12 Q. A claim being in one column, and then the prior
13 art as is shown there being in the other?

14 A. Yes.

15 Q. I don't see Black listed in the column that is
16 prior art, unless I may be overlooking it. Do you see
17 it?

18 A. I don't see it.

19 Q. If you turn back to page 31, do you see the
20 heading there, heading D, "Claim 5 is unpatentable"? Do
21 you see the heading?

22 A. Yes.

23 Q. But it does list Black there. Do you see that?

24 A. Yes.

25 Q. Just for kicks here, could you turn to your

1 opinion -- your declaration. Would you turn to native
2 page 24.

3 A. Yes.

4 Q. Do you see the heading under Roman numeral VII,
5 A1, "The subject matter of Claim 5" --

6 A. Yes.

7 Q. -- "would have been obvious in view of Porambo"?
8 Then we see Black again. Do you see that?

9 A. Yes.

10 Q. So in combination with your declaration that you
11 have there, and then going back to the QSC petition,
12 what does Black add that perhaps one of these other
13 references is not teaching?

14 A. That's a good question. Let me see.

15 Black adds the specific idea of looking at the
16 power of the output.

17 Q. Okay. Anything else you want to add?

18 A. I mean, it does various other things, but I
19 think they are also covered by some of the other
20 references. So I wasn't, you know -- let's say I could
21 have written this without referring to Black. I didn't
22 feel any obligation to use the absolute minimum number
23 of references in any situation here.

24 Q. That's why I want to make sure I understand.

25 A. Yeah.

1 Q. Is it your opinion that the Black reference is
2 required in combination with the Porambo reference, the
3 Gittleman reference, and the Tsurushima reference?

4 A. Is it? I don't know. It could be that it isn't
5 required.

6 Q. Can we understand that from either your
7 declaration or what you understand -- if you have any
8 understanding -- with regard to QSC's petition? If you
9 don't, that's fine.

10 A. Let's look at my declaration.

11 Q. Okay.

12 A. Because I'm much more comfortable with that.

13 I feel like Black is much more relevant to
14 Claim 13, which is specifically about calculating power.

15 Q. Before you go on, so does that mean it's less
16 relevant to Claim 5 -- that Black is less relevant to
17 Claim 5?

18 A. Let me look at it. Let me refresh my memory.

19 Q. Sure.

20 A. I'm referring to Black because it is a nice
21 example -- a very clear and unambiguous example of
22 measuring the output of the amplifier within a system
23 with a DSP. Now, as we've discussed, Porambo does that,
24 too, but -- and Porambo is possibly -- requires more
25 interpretation to -- you have to read a little more

1 closely to understand that's what's going on. So I like
2 this, because it's pretty clear what's going on.

3 Q. That the output power is being measured?

4 A. Yes.

5 Q. And is a value being communicated?

6 MR. DAS: Objection, form.

7 THE WITNESS: In this case, I am less clear
8 about the exact value. It's not a specific value in
9 terms of a voltage, some threshold voltage, as far as I
10 understand, because it's more about, you know, well,
11 given everything else that's going on with the
12 amplifier, when does it start saturating, which may
13 change over time. So it's more of a functionally
14 specific point.

15 BY MR. CRAIN:

16 Q. What do you mean by that?

17 A. So the situation -- I think the situation
18 here -- again, reading between the lines -- is that
19 we're talking about an amplifier when the system is
20 driven by battery. That means at different points in
21 the charge cycle, the voltage coming out of that battery
22 will vary. So then -- and presumably, that voltage is
23 maybe going straight into the amplifier. You want to
24 use as much of the voltage as is available to drive the
25 amplifier. But that condition may vary over time. Now,

1 what we want to know is not is the current of the
2 amplifier one milliamp; we want to know is the power of
3 the amplifier exceeding its ability to generate a low
4 distortion signal into the load. So that's the thing
5 that is being sensed.

6 Q. Does Black teach a voltage detector?

7 A. It's talking specifically -- it characterizes
8 the detector as a power detector.

9 Q. Does it teach -- does Black teach a current
10 detector?

11 A. As you know, power is the product of current and
12 voltage. So if you like, it teaches a combined current
13 and voltage detector.

14 Q. That's only because the load is known due to
15 this being an RF situation and not an audio situation.
16 Right?

17 MR. DAS: Objection, form.

18 THE WITNESS: Yes, it's a nice question. What
19 is it actually measuring? As I said, what it's probably
20 actually measuring is something related to the EM field,
21 electromagnetic field, around the antenna. I can't
22 really say exactly how that relates to the voltage and
23 the current. It's probably better to characterize it as
24 a power detector.

25 BY MR. CRAIN:

1 Q. And that detector -- power detector is detector
2 211; is it not?

3 A. Yes.

4 Q. And that detects -- I think you've already told
5 me. That creates power level signal 229. Correct?

6 A. Yes. That's what they say.

7 Q. And that power level signal 229 -- let me start
8 again.

9 The power level signal 229 is communicated to
10 saturation detection comparator 217. Is that correct?

11 A. Yes. That's not the only place it goes, but
12 that's, I think, the important place it goes for us.

13 Q. Doesn't Black disclose that the saturation
14 detection comparator 217 compares the detector output
15 signal 229 to the AOC voltage signal 231? Is that
16 correct?

17 A. It's a function of the AOC voltage. It's not
18 the exact voltage. There are some resistors in there.

19 Q. So then it is at least a function of the AOC
20 voltage signal 231. Is that correct?

21 A. That's correct, yes.

22 Q. Output signal 233 from comparator 217 is input
23 into DSP 223. Isn't that correct?

24 A. Yes.

25 Q. And continue on if you want to also look at

1 Figure 5, which is a functional block diagram of what's
2 going on, if I understand it correctly.

3 A. It's a flow chart of the algorithm.

4 Q. Yes.

5 So if I understand step 503 correctly, the DSP
6 checks the status of the saturation detection signal
7 233. Is that correct?

8 A. Yes.

9 Q. If it's logically high, that means that the
10 power amplifier 203 is saturated. Correct?

11 A. I think that's what it means.

12 Q. If it's logically low, that means that the power
13 amplifier 203 is not saturated.

14 A. Yes.

15 Q. Output signal 233 is a binary signal, then.

16 A. Yes.

17 Q. Output signal 233 does not communicate any
18 current value. Is that correct?

19 A. No.

20 Q. Why is it incorrect?

21 A. Because, you know, it's telling you that the
22 current value is the value that corresponds to the
23 amplifier going into saturation under the current
24 conditions -- under the prevailing conditions.

25 Q. If the current -- if the -- I'm sorry. I'll

1 start again.

2 If the output signal 233 is logically low, then
3 DSP 223 has no way of calculating or understanding the
4 current.

5 MR. DAS: Objection, compound.

6 THE WITNESS: So let's define it as the output
7 233 is indicating saturation present or absent. Now,
8 you were saying if the -- you were saying if that's in
9 one of those two -- so we're saying it's got two
10 possibilities. You're saying that under one of those
11 possibilities, the DSP has no knowledge of what the
12 current is. No, it knows the current is whichever it is
13 to indicate that the amplifier is operating in normal
14 operating or saturated operating.

15 BY MR. CRAIN:

16 Q. But it has no understanding a DSP could have of
17 the instantaneous value of the current; does it?

18 MR. DAS: Objection.

19 THE WITNESS: Yes. It knows whether it's -- it
20 knows that -- the only important thing that it would
21 ever derive from that current, which is whether it's
22 above or below the value that indicates saturation.

23 BY MR. CRAIN:

24 Q. But it doesn't know the precise value?

25 MR. DAS: Objection, asked and answered.

1 Objection, form.

2 THE WITNESS: I think that's -- the precise
3 value is not what it cares about. What it cares about
4 is whether the amplifier is in saturation.

5 BY MR. CRAIN:

6 Q. I hear you.

7 A. Yes.

8 Q. Isn't output signal 233 more analogous to a
9 flag --

10 MR. DAS: Objection, form.

11 BY MR. CRAIN:

12 Q. -- and not a value?

13 MR. DAS: Objection, form.

14 THE WITNESS: Remember the discussion we had
15 about Porambo?

16 BY MR. CRAIN:

17 Q. Perhaps not.

18 A. So those are two different perspectives on the
19 same piece of information. A binary value can be viewed
20 as a real value. It's either value zero or one. So it
21 can be viewed as a very coarse quantization of a
22 continuous value. A binary value can also be viewed as
23 a flag, indicating the truth or non-truth of some
24 situation. In this case, it's useful to interpret it
25 either way -- both ways.

1 Q. So you would at least agree with me then that
2 output signal 233 is a binary value.

3 A. As far as I can tell, yes, it's the output of a
4 comparator, which would normally be, you know, high or
5 low.

6 Q. If you'll turn back to your declaration,
7 paragraph 56.

8 A. Yes.

9 Q. The second sentence in that paragraph states,
10 "Any person skilled in the art would know that output
11 power in an amplifier can be determined from the product
12 of output voltage and output current." Do you see that?

13 A. Yes.

14 Q. Does Black disclose output voltage and output
15 current?

16 A. In Black, he is measuring a single value which
17 is directly indicative of the power.

18 Q. Which he can only do because he already knows
19 the impedance of the load?

20 A. In this case, my understanding is that that's
21 possible because he doesn't -- he's not -- he's not
22 designing for a varying load. I could be wrong. Like I
23 say, I'm not sure of the details of the detector. It
24 could be there is something more sophisticated going on
25 such that it actually -- it could be that the actual

1 inductance that's picking up the voltage going into the
2 detector somehow does actually vary with the power, not
3 just the output voltage, but also the actual power
4 that's being delivered into the load. Because that can
5 happen with antennas.

6 Q. Are you speculating to that or do you understand
7 that to be disclosed in Black?

8 A. Well, he's saying that it's a power detector,
9 which I don't -- he doesn't describe how it's
10 constructed. But if that's what he wants it to be,
11 which is what he needs it to be to make the whole thing
12 work, then I assume that he knows if it's useful.
13 Right? I mean, it's not -- if this thing was only like
14 sometimes accurate, then the whole circuit wouldn't
15 really do its job. So I assume it's accurate, by
16 whatever principle he's able to get an accurate power
17 value coming out of that detector.

18 I don't know if the load is fixed and if that's
19 why -- it could be that yes, he can do that because it
20 is a fixed load, so he just has to measure the voltage.
21 Although it's interesting that he doesn't just measure
22 the voltage. Right? So it's also possible that no, he
23 can't assume the impedance of the antenna is fixed,
24 because, you know, it might be an antenna you can pull
25 out or push in. So, in that case, maybe there is

1 something more sophisticated going on that allows it to
2 directly measure the correlative power.

3 Q. Directly measure the correlative power.

4 A. Yes.

5 Q. Does Black contain anything that gives you that
6 understanding?

7 A. He calls it a power detector.

8 Q. So you believe it's a power detector because he
9 either knows the impedance or there is something more --

10 A. I don't know.

11 Q. -- something more sophisticated going on.

12 A. Yes.

13 Q. Is it one of those two alternatives, according
14 to your opinion?

15 A. I think -- so the only thing I've excluded is
16 something less sophisticated going on. I suppose it
17 could be that.

18 Q. In your opinion, does Black disclose a voltage
19 detector?

20 A. The power detector is implicitly a detector of
21 the product of the voltage and current.

22 Q. Does the circuit diagram in Black -- where is
23 Black -- Figure 6 of Black, does that give you any
24 insight?

25 A. Oh, yes. I've looked at this. It's a

1 complicated circuit that I don't claim to fully
2 understand, but I believe I can identify what he's
3 talking about as the power sensor.

4 Q. No. 605(211)? Do you see at the bottom? Do you
5 see right there?

6 A. Sorry, what?

7 Q. Is that the detector?

8 A. Oh. Well, I'm talking -- I mean, I'm
9 particularly interested in the -- in --

10 Q. The actual component?

11 A. The part that's -- the part that's drawn inside
12 the coupler, 201. Because that's kind of where it's
13 getting the information from. That's this part, I
14 think -- I haven't looked closely, but I believe that's
15 part 607(201). Yes, that's right.

16 And that's interesting, because it shows there
17 is no electrical connection between them, but somehow,
18 they're near each other, which implies that the sensing
19 is done via electromagnetic induction.

20 Q. Do you consider what's shown in Figure 6, that
21 you were just referring to, to constitute a voltage
22 detector?

23 MR. DAS: Objection, form.

24 THE WITNESS: The part that I was just talking
25 about, the part in box 607(201) is, it would be weird to

1 call that a voltage detector. The entire thing that is
2 producing a voltage at the output, which is indicative
3 and we understand proportional to the total power being
4 emitted by the power amplifier, as I've said, I would
5 characterize as a detector of the product of the voltage
6 and current.

7 BY MR. CRAIN:

8 Q. Or a power detector?

9 A. That's right.

10 MR. CRAIN: How long have we been going?

11 THE VIDEOGRAPHER: Six hours and 16 minutes.

12 MR. CRAIN: I mean on this tape.

13 MR. DAS: An hour and five minutes.

14 MR. CRAIN: This is a good time for a break.
15 We're at a transition point.

16 THE VIDEOGRAPHER: We're off the record. The
17 time is 5:15 p.m.

18 (Recess taken from 5:15 to 5:29.)

19 (Exhibit 9 marked for identification.)

20 THE VIDEOGRAPHER: We're back on the record.
21 The time is 5:29 p.m.

22 BY MR. CRAIN:

23 Q. Dr. Ellis, you have what has been marked as
24 Exhibit 9. Would you take a moment to review it,
25 please.

1 A. Yep.

2 Q. What do you understand Exhibit 9 to be?

3 A. This is a patent describing a particular kind of
4 power amplifier. It's what I refer to as Tsurushima in
5 my declaration.

6 Q. Is Exhibit 9 also known as Patent No. 3,912,981?

7 A. Yes.

8 Q. Have you read Tsurushima before?

9 A. Yes.

10 Q. Do you believe that you understand the teachings
11 of Tsurushima?

12 A. I understand some of them.

13 Q. Are there some that you don't understand?

14 A. The patent deals with a particular kind of
15 output transistor which I -- I'm not particularly
16 familiar with. A lot of it is the detail of how to
17 drive these transistors of particular characteristics.
18 I didn't focus on trying to follow that too closely.

19 Q. What is a VI limiter?

20 A. A VI limiter sounds like something that would
21 limit the product of voltage and current.

22 Q. Do you know how a VI limiter works?

23 A. I would expect that you would -- any circuit
24 that you built whose role was to limit the product of
25 voltage and current, you would refer to as a VI limiter.

1 I don't think it refers to a single circuit or even a
2 single architecture.

3 Q. Does the Tsurushima patent that is Exhibit 9
4 pertain to a VI limiter?

5 A. Possibly. I don't recall if they describe it in
6 that way. The part that I was interested in was the
7 part where they characterize it as measuring the
8 impedance of the load.

9 Q. Where do you understand Tsurushima to teach that
10 it measures the impedance of the load?

11 A. Okay. Hang on.

12 So, for instance, column eight, the paragraph
13 starting at line 63, a transistor amplifier is provided
14 with a detecting circuit, 14, which functions to detect
15 the current and voltage of load ZL. That is the load
16 impedance.

17 Q. And this detection circuit 14, does it, in
18 detecting the current and voltage, output a measured
19 value of current and voltage?

20 A. Let me just see -- 14. Right. It doesn't --
21 the only thing it outputs is the trigger to suppress the
22 drive. I mean, this is the nature of transistor
23 circuits. We don't have the luxury of having a bunch of
24 individually well-identified voltages. It's like there
25 is a pretty tight space of things you can produce. So

1 you put together a circuit like this that does what you
2 want at the global scale somehow.

3 Q. When you say "somehow," does that mean that
4 you're not sure how?

5 A. No. That's kind of the nature of this kind of
6 style of circuit -- of circuit design. The work -- it's
7 like these little -- beautiful little creations, that
8 they integrate a lot of functionality into this very --
9 pretty sparse realization, and it does what you want.
10 And the whole art is doing something that is meaningful
11 that you started off with that you wanted, but doing it
12 with a very small number of calculations -- with a very
13 small number of elements and without necessarily having
14 to have explicit representations of everything that you
15 would -- if you're trying to explain what it was doing,
16 you would have -- you would refer to.

17 Q. So you mentioned detecting circuit 14. That
18 detects the current of the load?

19 A. So it has -- a part of it is involved in -- is
20 responsive to the current going into the load, and
21 another part of it is responsive to the voltage going
22 into the load.

23 Q. Look at column nine.

24 A. Um-hmm.

25 Q. Start at line 32. I see a statement there that

1 begins that paragraph. Do you see where it says, "The
2 detecting circuit 14..."?

3 A. Yeah.

4 Q. I'll go ahead and read it. "The detecting
5 circuit 14 is shown to be generally composed of a first
6 detecting circuit 14a for detecting the current of load
7 ZL." Do you understand what that means?

8 A. Yes.

9 Q. So if I understand Tsurushima correctly, as long
10 as the impedance of the load is greater than a
11 predetermined value -- if you want to refer to the
12 figure --

13 A. Yeah.

14 Q. I think it says transistors Q3a and Q3b are
15 turned off or non-conducted. Is that correct?

16 A. No. It's not that simple.

17 Q. Well, look at column nine, starting at line
18 eight.

19 A. Yeah. Column nine starting at line eight.

20 Q. When it refers to switching circuit 15.

21 A. Yes.

22 Q. Do you understand what switching circuit 15 is?

23 A. Yes.

24 Q. And if you look down --

25 A. The only part that I object to is you're saying

1 it's in response to the current. It's not just the
2 current. It's also -- it also considers the voltage.

3 Q. Okay. Well, let's read the exact sentence so
4 that there is no unclarity here.

5 A. Um-hmm.

6 Q. Line 17 begins, "So long as the impedance of
7 load ZL, as determined by circuit 14, is above a
8 predetermined value, transistors Q3a and Q3b are turned
9 off or non-conductive." Do you understand that?

10 A. Hang on. Sorry. Which line are we starting
11 from?

12 Q. Seventeen through 20.

13 A. Okay. That's right. Yes.

14 Q. It goes on to say, "with the result that the
15 signal at output terminal T2 of driving stage amplifier
16 11 is normally applied, as the input, to triode
17 characteristic field effect transistors F1a, F2a, F1b
18 and F2b of output stage amplifier 13 for further
19 amplifying thereby prior to being applied to output
20 terminal T3."

21 A. Yes.

22 Q. Long sentence. But do you follow that sentence?

23 A. Yes. Absolutely.

24 Q. Then the next sentence goes on to state,
25 "However, when the detected load impedance falls below

1 such predetermined value, circuit 14 causes transistors
2 Q3a and Q3b to be turned on or rendered conductive, as
3 hereinafter described, which the result that switching
4 circuit 15 is closed for shunting the signal from output
5 terminal T2 of driving stage 11 to output terminal T3 of
6 output stage 13."

7 MR. DAS: Objection, misrepresents that --

8 MR. CRAIN: I may have --

9 THE WITNESS: That's fine. It was a with that
10 became a which.

11 BY MR. CRAIN:

12 Q. Long day. I'll tell you what, let me start
13 again.

14 Although I may have misspoke with respect to
15 column nine, line 25 through about line 31, do you
16 understand what that means?

17 A. Yes.

18 Q. Would you describe it, according to your
19 understanding.

20 A. It's just saying that the function of this
21 protection circuit 14 is to activate this input
22 attenuation circuit 15. I'm putting more into it than
23 what it's saying. But it's talking about how, you know,
24 these transistors, Q3a and Q3b, are used to cut or to
25 attenuate the input to the amplifier, and in the

1 situation, the protection needs to be turned on, wants
2 to be turned on.

3 Q. It basically turns the signal off --

4 A. That's right.

5 Q. -- if the condition is detected?

6 A. It might not turn it off entirely, but it's
7 going to attenuate. It's basically -- it's not a
8 very -- it's not a gentle attenuation. It's pretty
9 severe.

10 Q. If I understand that text we're focusing on, the
11 result is that switch circuit 15 is closed for shunting
12 the signal at point T2?

13 A. Yes. Into the load. Right? T3. I mean,
14 that's the interesting thing. Right? It's kind of cute
15 that it's taking the drive to the power amplifier and
16 putting it straight into the load. So, in a sense, it's
17 still driving the load. But the preamplifier output
18 hasn't got the power output to drive a load, so it's
19 minimal. It's effectively shorting out the drive stage
20 with the load.

21 Q. So there is no measured current value provided
22 in Tsurushima; is there?

23 MR. DAS: Objection to form.

24 THE WITNESS: As I explained, circuit 14 -- what
25 do they call it -- the detecting circuit -- is a

1 rendition of a system that looks at both the value of
2 the current and the value of the voltage and decides
3 when to turn on the shunting, to cut off the input
4 signal.

5 BY MR. CRAIN:

6 Q. What decides?

7 A. The circuit decides. I mean, how do you
8 describe it? As a thing. As a box. It looks at the
9 output. It's got access to the characteristics
10 that refers to the current of the output. It's got
11 access to the voltage of the output. Over some range of
12 values, for some combination of those values, it has
13 this behavior.

14 Q. Isn't it preconfigured to behave in accordance
15 with a detected condition?

16 A. They characterize it as being something that's
17 going to -- it's not -- it's designed to react when
18 the -- when the amplifier needs protection. They
19 particularly mention the situation when the output load
20 is too low.

21 Q. So the circuit, as shown in Tsurushima, has to
22 be configured with components specific to act or react
23 to this predetermined condition. Is that correct?

24 MR. DAS: Objection, lacks foundation.

25 Objection, form.

1 THE WITNESS: You know, at a high level, the
2 point of the circuit is that when you have a -- connect
3 it to a load that's of a sufficiently low impedance, it
4 will turn -- it will stop the amplifier from trying to
5 deliver current -- trying to deliver power into that
6 impedance. That is a -- ultimately, it can either turn
7 the amplifier off or not. It can do that over a very
8 short -- over a short time scale. But there are -- it's
9 useful to understand that there are two states here when
10 the -- sorry, I was looking up the exact term -- that's
11 not the page -- when the switching circuit 15 is turned
12 on and when it's turned off.

13 BY MR. CRAIN:

14 Q. Would you describe for me how Tsurushima
15 monitors output voltage and current and then provides a
16 suitable value that could be input to a DSP for
17 calculation of output power.

18 A. So, as I've explained, the purpose of circuit 14
19 is to sort of fold the -- all of those steps into a
20 single circuit. So it has the -- it has a behavior
21 which you can characterize in response to the different
22 output current and voltage. And then when that's
23 something that you want to -- when it's a situation
24 where you want to protect the output drivers, it will
25 switch on circuit 15.

1 Q. That wasn't my question. How does Tsurushima
2 monitor the output voltage and current and then provide
3 a suitable value thereof that could be input into a DSP
4 for calculation of the output power?

5 A. Well, if you wanted to do that, you would
6 look -- you would try and -- you would take out some of
7 these interior voltages and feed them into the DSP.

8 Q. You would do what?

9 A. I mean, there are a bunch of different nodes
10 here. This is how a circuit diagram works. Right?
11 Each node, at any particular time, has a voltage that we
12 could measure. So you could take out some of those
13 voltages. You could take out one for the current and
14 another one for the output voltage.

15 Q. Is that suggested or taught in Tsurushima?

16 A. That's kind of how a circuit like this works.
17 Right? The particular configuration of circuit 14 is to
18 take those two different -- those two different
19 voltages, one proportional to the output voltage, one
20 proportional to the output current, and combine them in
21 such a way that when they indicate the impedance is low,
22 it's going to turn on the protection circuit.

23 Q. Right. And where are the analog values that
24 correspond to output voltage and output current made
25 available in Tsurushima so they could be applied to a

1 DSP?

2 A. Where are they made available?

3 Q. Yes.

4 A. Or were they made available?

5 Q. Where?

6 A. They're right there in the circuit.

7 Q. Specifically where?

8 A. So the output current is specifically the
9 voltage across R10a, for instance. There are a bunch --
10 there are four resistors.

11 Q. What figure are you looking at?

12 A. I'm looking at --

13 Q. Figure 6?

14 A. Figure 6. Figure 6? Yes.

15 Q. Start again, please.

16 A. So the output current is -- so you see R10a and
17 R9a. Let's look at the top half. Because it's a
18 largely symmetric circuit, so there is a top half and a
19 bottom half driving positive and negative cycles of the
20 output. In the top half, there are two output driver
21 transistors, F1a and F2a. They are basically working in
22 parallel. The output of those two go to the load
23 through R9a and R10a. The voltages developed across
24 those two resistors are basically -- we try and take the
25 maximum of them by wiring them together through the two

1 diodes, D4a and D4a prime, and the output at that point
2 is -- the voltage between that and point T3 indicates
3 the current that's going into the load.

4 The voltage going into the load is the voltage
5 at point T3 which is then input into the circuit
6 through -- well, it's connected directly to the emitter
7 of transistor Q4a.

8 Q. So if you were going to pull off these points,
9 would you even need detecting circuit 15 or switch
10 circuit -- detecting circuit 14 or switching circuit 15?

11 MR. DAS: Objection, form.

12 THE WITNESS: If you wanted to measure the
13 voltage and the current, you would not need switching
14 circuit 15. It's not involved. There are some
15 elements -- some elements of detecting circuit 14 are
16 related to conditioning those aspects of the circuit,
17 and some of them are related to performing the desired
18 calculation.

19 (Exhibit 10 marked for identification.)

20 BY MR. CRAIN:

21 Q. Let's go ahead and talk about this one. I'll
22 give you that. Would you please take a moment to review
23 Exhibit 10.

24 A. Yes, I have.

25 Q. Are you able to identify it?

1 A. Yes. This is the paper that I refer to as
2 Gittleman -- in my declaration earlier, I explained -- I
3 tried to spell Gittleman. I think I got it wrong. It's
4 actually G-I-T-T-L-E-M-A-N. It's a paper that was
5 presented at the 41st AES convention in 1971.

6 Q. Did you attend the 41st convention of AES in
7 1971?

8 A. No. Sadly, no.

9 Q. Does page one of Exhibit 10 go with the
10 remaining pages of Exhibit 10?

11 A. I believe so.

12 Q. Why do you believe so?

13 A. Because the titles are the same. One good
14 indication is that the title and the author are the same
15 on both. Let's see. And it's consistent with the style
16 of AES and other conference papers at the time which I'm
17 familiar with.

18 Q. Are you a member of AES?

19 A. I am.

20 Q. Do you attend AES conferences?

21 A. I have in the past.

22 Q. Are you aware of whether or not there is a date
23 on pages two through -- QSC pages two through 14? Let
24 me ask that again. That's not the last page.

25 Do you see any date with respect to Exhibit 10

1 on pages two through 16?

2 A. Well, those dates are the references. Yes.
3 Because he references -- on native page eight, he
4 references The Audio Cyclopedia, 1969; he references an
5 AES preprint from 1970; he references an AES Journal
6 paper from 1968.

7 Q. On page eight?

8 A. Yes. Native page eight.

9 Q. Do you see any other dates on any of the
10 remaining pages?

11 A. No. That's where I would expect to find the
12 dates. If I find a page that it doesn't have it --
13 often there is a date on the first page. This predates
14 the ability to produce papers in such a consistent
15 fashion. So then I often look at the references to
16 figure out, okay, what is the most recent thing he's
17 talking about. It's the nature of technical
18 publications that they're often likely to be talking
19 about a recent reference. So looking at the dates is
20 often a pretty good indication of when the paper was
21 written.

22 Q. Do you know if the document in Exhibit 10 was
23 published at the 41st convention on October 5 through 8,
24 1971?

25 A. I would be really surprised if that wasn't the

1 case. So the -- I don't know what the exact procedure
2 for -- that the papers went through, at this point, for
3 this particular conference. I see it's called a
4 preprint, and that it's presented, which, you know,
5 suggests -- currently, if -- when I give a paper at a
6 conference, the conference has a proceedings, which is a
7 published single volume which contains all the papers
8 presented at the conference. As I -- I don't know --
9 some other conferences, they don't have such -- quite
10 such a formal thing. You go to a conference, you make a
11 presentation -- in some other conferences, you can make
12 a presentation and you don't -- there is no formal paper
13 associated with it.

14 So I don't know exactly what the situation was
15 for the 41st AES convention, however -- I mean, the
16 cover sheet is -- this is the style of a publication
17 that AES has kind of adopted, that is something like --
18 that they've taken into their system and now they're
19 redistributing it as one of their products. This is --
20 so is this -- it's possible that someone made this up
21 and stuck it onto this paper. That's what it would look
22 like. But that would be a strange thing to do. It's
23 very easy to check, of course. Just go to the AES
24 website and look it up. My expectation would be that
25 you go there, you would find this paper and it's

1 presented. It's represented as being the paper that was
2 presented at that conference in 1971.

3 Q. Do you happen to know what a preprint is?

4 A. A preprint is generally used to refer to a
5 publication that has not yet been published.

6 Q. In the case of AES, do you know what is being
7 referred to here as a preprint?

8 A. No. Obviously, before -- a paper exists before
9 it's published. So every paper could potentially exist
10 as a preprint. The copy of the paper calling it a
11 preprint would continue to exist after it was published.
12 So it could be that when this -- when this paper was
13 produced, it was a preprint, and then it became
14 published and it became a published paper. Or it could
15 be that for whatever reason, the AES at that time
16 referred to these papers that were corresponding to
17 presentations made at conferences as preprints. It
18 could be something like they -- they were not peer
19 reviewed.

20 Q. Do you know if, in fact, the document contained
21 in Exhibit 10 was indeed published in the AES journal?

22 A. I don't think it was published in the journal,
23 because that would be a different -- that would look
24 different. It would say that it was an AES journal
25 paper, not a presentation -- a conference presentation.

1 Q. I don't think my question was clear. What I'm
2 asking is, do you happen to know if the content that is
3 included in Exhibit 10 was subsequently published in an
4 AES journal or not?

5 A. That's a nice question. I have a recollection
6 that there are two Gittleman papers. So one of them may
7 be this one and the other one may be the journal
8 publication, but I don't know beyond that.

9 Q. Have you read Gittleman before?

10 A. Yes.

11 Q. Do you understand Gittleman?

12 A. I understand --

13 MR. DAS: Objection, form.

14 THE WITNESS: Sorry. I understand a lot of it.

15 BY MR. CRAIN:

16 Q. But not necessarily all of it?

17 A. Not necessarily all of it.

18 Q. What does Gittleman teach to you that Tsurushima
19 does not?

20 MR. DAS: Objection, form.

21 THE WITNESS: So there are a couple of things
22 that are nice about Gittleman. One is that he provides
23 this helpful block-level overview of what the circuit is
24 doing, Figure 1 in the paper, which, you know, is a lot
25 easier to read than the actual low-level implementation

1 of several of the other figures. Also, he breaks
2 down -- he goes about explaining his circuit by drawing
3 these partial circuit diagrams, whereas in Tsurushima,
4 we just have the full and final circuit diagram.

5 So it's -- I mean, you know, the part that I'm
6 interested in is this protection circuit, which he's
7 particularly concerned about trying to be responsive to
8 the power in the output transistors. So he has a nice
9 presentation and description of that. It's a different
10 circuit to the one in Tsurushima. There may be some
11 things that are clearer in this presentation than in the
12 Tsurushima circuit.

13 BY MR. CRAIN:

14 Q. Are there any elements in Claim 5 or Claim 13 of
15 the '542 patent that you believe Gittleman discloses
16 that Tsurushima does not?

17 MR. DAS: Objection, compound.

18 THE WITNESS: The idea -- the motivation for me
19 referencing this was that it's -- I felt that it was
20 pretty clear that he's talking about trying to detect
21 the power at the amplifier output, which is responsive
22 to one of the two claims which talks about the
23 calculation of power. Whereas Tsurushima is explicit
24 about trying to be responsive to the load, the
25 impedance, which is relevant to the other of the two

1 claims, five and thirteen. Sorry, I can't remember
2 which is which.

3 BY MR. CRAIN:

4 Q. I believe, in your report, with respect to
5 Gittleman, on native page nine of your report -- I think
6 it's Exhibit 5 --

7 A. Yeah.

8 Q. The last sentence states, "Figure 1 of the
9 Gittleman paper" --

10 A. Yeah.

11 Q. -- "shown below illustrates the process of
12 monitoring output current and voltage in a feedback loop
13 to control amplifier gain."

14 A. Yes.

15 Q. Would you please illustrate for me in Figure 1
16 where that's occurring.

17 A. Yes. So Figure 1 from the Gittleman paper has a
18 box labeled, "Current and Voltage Sensors." That's what
19 I mean by saying it illustrates the process of
20 monitoring output of current and voltage. The output of
21 those current voltage sensors go towards the left,
22 whereas the general circuit goes toward the right.
23 That's what I mean by feedback. Then they go into this
24 dissipation limiting circuit which takes -- is inserted
25 between the output of the voltage amplifier circuit and

1 the input of the power output circuit. The dissipation
2 limiting circuit is used to attenuate the signal going
3 into the power output circuit.

4 Q. Would you turn to Figure 1 in the Gittleman
5 paper.

6 A. Yeah.

7 Q. Again, with respect to your statement that
8 Figure 1 of the Gittleman paper illustrates the process
9 of monitoring output current and voltage in a feedback
10 loop to control amplifier gain, would you circle the
11 component or box that you believe does that.

12 A. It illustrates the process of monitoring output
13 current and voltage in a feedback loop to control the
14 amplifier gain.

15 Q. May I see what you circled.

16 A. (Complies).

17 Q. Okay. I believe there is a green box circled in
18 the Gittleman paper or a box circled in the Gittleman
19 paper on native page four. I don't know if that was
20 added by QSC or if that was in the native document.

21 A. It's not in the native document. I don't know
22 what that is.

23 Q. So you didn't circle -- you didn't include that
24 box?

25 A. (Witness shakes head).

1 Q. If you would direct your attention to the
2 statement in that box. Does that speak to the issue
3 that you're speaking about with respect to monitoring
4 the output current voltage in the feedback loop to
5 control amplifier gain?

6 A. So the box is referring -- the paragraph is
7 referring to that circuit. It's also referring to the
8 temperature control circuit, which I didn't circle.

9 Q. Right.

10 A. It's referring to a few other things as well.
11 Because it's referring to the output transistors which I
12 didn't circle.

13 Q. Is there any particular sentence in there that
14 is relevant to what you did circle?

15 A. "The limiting circuit senses potentially unsafe
16 conditions of voltage, current and temperature, and
17 limits the dissipation of the output transistors to an
18 acceptable level without interrupting the output
19 signal."

20 Q. What are the output transistors?

21 A. There are several actual transistor circuits
22 presented in the paper, but in Figure 2, which is, I
23 think, his whole final circuit, they are -- the
24 right-most transistors -- let's see. I'm sorry. I'm
25 actually having difficulty reading this without glasses.

1 But it looks like it's -- yeah, it looks like it's Q15
2 and Q -- do you have a magnifying glass? Can I borrow
3 your glasses?

4 It's Q19 and Q15 on the positive cycle and Q20
5 and Q16 -- no, wait. Oh, man. Let's look at a
6 different one. Figure 4 is an easier one to look at.
7 It doesn't require glasses. It's only half the output
8 circuit. It's the positive half. But in this case, the
9 output transistor is Q1. Is that right? Yes, that's
10 right. It's just the single transistor, Q1.

11 Q. Look at Fig. 6. Can you identify it in Fig. 6?

12 A. In Figure 6, it is again Q1. Q1 and Q3. So
13 we've got both halves here.

14 Q. Turn back to native page three and the paragraph
15 under the heading "Dissipation Limiting Circuit."

16 A. Yeah.

17 Q. That first sentence is speaking about output
18 transistors; specifically, the output transistor
19 collector current.

20 A. Yes.

21 Q. With respect to Fig. 6, is that referring to
22 something other than Q1 and Q3?

23 A. That's what -- sorry, Fig. 6. That's an
24 interesting question. It's certainly referring to Q1.

25 Q. But not necessarily to Q3?

1 A. I'm not sure. It would be helpful if I had
2 actual values on the resistors. It's hard to tell
3 whether Q3 is going to be delivering as much current as
4 Q1 is. Q1 is very clearly the output transistor,
5 because it's directly connected to the positive voltage
6 rail; it goes through R1, which we can assume is a small
7 resistance; and then directly into the load. Q3 has
8 both R5, in a kind of symmetrical position; but also has
9 R3, which looks more like it's maybe operating at lower
10 currents.

11 Q. What do you understand the second sentence of
12 the paragraph back on native page three where it states,
13 "This is normally done" -- and it is referring to limit
14 the maximum output transistor collector current. The
15 sentence starts, "This is normally done by sensing the
16 output transistor collector current through a resistor
17 in series with the emitter, and limiting the base drive
18 when the current becomes excessive." What do you
19 understand that to mean?

20 A. So in reference to say -- I guess we should look
21 at -- I'm not sure what Figure 6 is. Let's look again
22 at Figure 4, because it's about the -- it has the
23 dissipation limiting circuit. So the output transistor
24 is Q1, with an R1 between the thing with the arrow,
25 which is the emitter, and the load, ZL. Let's just

1 check it on Figure 6. Figure 6 has the same kind of
2 configuration.

3 So they're saying that you sense the output
4 current by looking at the voltage across a resistor on
5 the emitter -- I'm sorry, that may not be the exact
6 words -- but that's what R1 is. R1 is carrying the
7 current from the transistor, the collector current,
8 which is the current going into the top of Q1. Then
9 most of it comes out the bottom through the emitter and
10 then goes out into the load through R1. R1 is a small
11 value, but because the voltage across the resistor is
12 proportional to the current going through it, you can
13 look at the voltage across that resistor and you can
14 then use that to determine the current going into the
15 load and going through the output transistor as well.

16 Q. On the top of native page four, doesn't that
17 indicate to us that Gittleman already knows the load?

18 A. That discussion is about the design of the
19 amplifier. So it's saying, okay, I'm going to design an
20 amplifier to deliver a particular current into a
21 particular load. So he's assuming that if the amplifier
22 is being used as intended, then yes, that's because you
23 specify the design load for that amplifier.

24 Q. So he already knows the load of the amplifier?

25 A. No.

1 Q. Let me start again. He either already knows or
2 is assuming the load.

3 MR. DAS: Objection, compound.

4 THE WITNESS: For the purpose of this design --
5 he's designing this amplifier. This is an early stage
6 of the design, but he's figuring out the specifications
7 of the amplifier for a given load. That would be the
8 normal process in designing an amplifier.

9 BY MR. CRAIN:

10 Q. Is there anything about Gittleman, according to
11 your understanding, that would suggest calculating the
12 impedance of the load?

13 A. The system is not only -- at the highest level,
14 he's trying to design an amplifier that's unconditionally
15 reliable. So there are a couple of things that -- there
16 are a couple of situations in which amplifiers can get
17 into trouble. One is when the -- just for whatever
18 reason, it's delivering so much power that the output
19 transistors dissipate power, get hot and burn out.
20 Another could be when the -- if the output was
21 short-circuited, the current through the output
22 transistors would instantaneously exceed the rated
23 maximum for that transistor. So he's explicitly trying
24 to be -- design a circuit that can accommodate both of
25 those situations. So when he's looking -- when he's

1 worried -- when he's thinking about a situation of
2 making it tolerant or short-circuit, that's talking
3 about implicitly calculating the impedance of the load.

4 Q. So you understand a situation of short-circuit
5 or overload to be implicit -- implicitly relating to the
6 calculation of the load?

7 A. I'm saying that when we say short-circuit, that
8 is saying that the actual impedance of the load is of a
9 very small value, less than one ohm.

10 MR. DAS: Counsel, we've now exceeded seven
11 hours.

12 MR. CRAIN: All right. That's fine. I think
13 we're at a good point anyway. I think we will tender
14 the witness.

15 MR. DAS: Okay. We'll take a break.

16 THE VIDEOGRAPHER: We're going off the record.
17 The time is 6:14 p.m.

18 (Recess taken from 6:14 to 6:43.)

19 THE VIDEOGRAPHER: This is the beginning of
20 Media No. 6 in the deposition of Dr. Daniel Ellis. The
21 time is 6:43 p.m. We are back on the record.

22 MR. DAS: At this time, we have no further
23 questions for this witness, but we reserve the right to
24 review and sign the transcript.

25 MR. CRAIN: Okay. I think we are concluded with

1 respect to --

2 MR. DAS: The '542 patent.

3 MR. CRAIN: The '542 patent.

4 THE VIDEOGRAPHER: This is the end of Media
5 No. 6 in the deposition of Dr. Daniel Ellis. The time
6 is 6:43 p.m. We are off the record.

7 (Deposition adjourned at 6:43 p.m.)

8 (Signature reserved.)

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1 S I G N A T U R E

2

3 I declare under penalty of perjury under the laws
4 of the State of Washington that I have read my within
5 deposition, and the same is true and accurate, save and
6 except for changes and/or corrections, if any, as
7 indicated by me on the CHANGE SHEET flyleaf page hereof.

8 Signed in _____, Washington,
9 this _____ day of _____ 20____.

10

11

12

13

DANIEL P.W. ELLIS, Ph.D.

14

Taken: Thursday, June 26, 2014

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24 Re: QSC Audio vs. Crest Audio
Cause No.: IPR2014-00129
25 Donald W. McKay, RMR, CRR, CCR

1 C E R T I F I C A T E

2

STATE OF WASHINGTON)
3) ss
COUNTY OF KING)

4

5 I, the undersigned Washington Certified Court
Reporter, hereby certify:

6

7 That the foregoing deposition upon oral examination
of the witness named herein was taken stenographically
before me and transcribed under my direction;

8

9 That the witness was duly sworn by me pursuant to
RCW 5.28.010 to testify truthfully;

10 That the transcript of the deposition is a full,
true and correct transcript to the best of my ability;

11

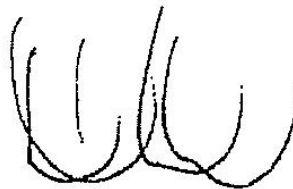
12 That I am neither an attorney for, nor a relative
or employee of any of the parties to the action or any
attorney or counsel employed by the parties hereto, nor
13 financially interested in its outcome.

14 I further certify that in accordance with CR 30(e),
the witness was given the opportunity to examine, read,
15 and sign the deposition, within 30 days upon its
completion and submission, unless waiver of signature was
16 indicated in the record.

17

18

19



20

Donald W. McKay, RMR, CRR
Washington Certified Court Reporter No. 3237
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