

UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE PATENT TRIAL AND APPEAL BOARD

META PLATFORMS, INC.,)
LG ELECTRONICS INC.,)
and SONY ELECTRONICS)
INC.,)
Petitioners,)
vs.) Case No. IPR2023-01127
JAWBONE INNOVATIONS,)
LLC,)
Patent Owner.)
_____)

REMOTE DEPOSITION OF
RICHARD M. STERN, Ph.D.
New York, New York
Tuesday, March 26, 2024

Reported By:
CATHI IRISH, RPR, CRR, CLVS

Page 2 1 2 3 4 5 6 7 8 March 26, 2024 9 10:07 a.m. 10 11 Remote deposition of RICHARD M. 12 STERN, Ph.D., with all participants 13 appearing via videoconference, before 14 Cathi Irish, a Registered Professional 15 Reporter, Certified Realtime Reporter, 16 and Notary Public of the State of 17 New York. 18 19 20 21 22 23 24 25	Page 4 1 2 RICHARD M. STERN, Ph.D., called as a 3 witness, having been duly sworn by a 4 Notary Public, was examined and 5 testified as follows: 6 EXAMINATION 7 BY MR. COWELL: 8 Q. Good morning, Dr. Stern. 9 A. Good morning. Good morning, 10 Attorney. 11 Q. Could you please state your name 12 for the record? 13 A. My full name is Richard Martin 14 Stern and then with a Junior on the end. 15 Q. And you've been deposed before; 16 is that correct? 17 A. Yes, I have. 18 Q. Approximately how many times? 19 A. Approximately a dozen times. 20 Q. I assume you're somewhat familiar 21 with the process but I'll go over a few 22 quick ground rules if that's all right. 23 A. Absolutely, thank you. 24 Q. Today I will be asking you 25 questions and you'll be answering them.
Page 3 1 2 A P P E A R A N C E S: 3 4 PAUL HASTINGS LLP 5 Attorneys for Petitioners 6 200 Park 7 New York, New York 10166 8 BY: GRACE WANG, ESQ. 9 10 FABRICANT LLP 11 Attorneys for Patent Owner 12 411 Theodore Fremd Avenue 13 Suite 206 South 14 Rye, New York 10580 15 BY: RICHARD COWELL, ESQ. 16 17 18 19 20 21 22 23 24 25	Page 5 1 STERN 2 Do you understand that? 3 A. Yes. 4 Q. If at any point one of my 5 questions is unclear to you, please ask me 6 to clarify and I'll do my best to clarify 7 or rephrase, but if you do answer the 8 question I will assume you understood 9 that. Is that fair? 10 A. Yes, it is. 11 Q. If at any time you need a break, 12 please let me know and I'll take a break 13 at the soonest convenient stopping point. 14 However, if there's a question pending, I 15 will ask that you answer that question 16 before we take a break, sound fair? 17 A. Yes. 18 Q. From time to time, as I'm sure 19 you're aware, your attorney may object to 20 some of my questions. However, unless she 21 instructs you not to answer them, you 22 still have to answer my questions. Do you 23 understand that? 24 A. Yes, I do. 25 Q. Are you -- are you on any

Page 6

1 STERN

2 medications today that would impair your

3 ability to give full and --

4 A. You're breaking up. I assumed

5 that you asked if I'm under medications

6 that would impair my ability to give full

7 and accurate testimony, but it dropped

8 off. In any case, the answer is no, I'm

9 under no medications.

10 Q. Okay. Is there any other reason

11 you can't give full and truthful testimony

12 today?

13 A. No, there is not.

14 Q. Okay. Are there any materials in

15 front of you where you're sitting right

16 now?

17 A. Yes. I have in front of me a

18 clean unmarked copy of my declaration and

19 also two other binders that I've been

20 provided with. One appears to have the

21 various exhibits associated with the

22 declaration and the other is a binder

23 labeled Papers, which seems to be the

24 various legal interactions between the

25 parties and the courts.

Page 7

1 STERN

2 Q. Are there any markings,

3 annotations or notes in any of the

4 materials in front of you?

5 A. No, there are not.

6 Q. Do you have any applications open

7 on your computer other than the Zoom link

8 right now?

9 A. I might. Let me close

10 everything. WebEx meetings came on. I'll

11 close that. And this is the one you

12 really don't want is Safari Web browser.

13 Messages application probably illegal.

14 And my mail, I'm killing that as well.

15 It's taking it awhile for it to die.

16 There we go. Okay. So at this point the

17 only application that's opened is Zoom.

18 Q. Okay. Is there anyone else in

19 the room with you right now?

20 A. No.

21 Q. Where are you?

22 A. I'm in the Paul Hastings law

23 offices in the MetLife Building in the

24 town of Manhattan, 45th and Park. I have

25 a beautiful view of the East River.

Page 8

1 STERN

2 Q. Okay. How did you prepare for

3 today's deposition?

4 A. Well, I had a couple of

5 conversations with Attorney Wang last week

6 totalling perhaps about five hours, and

7 yesterday I spent the whole day here

8 reviewing my declaration with a couple of

9 hours cut out for me to teach a class.

10 And then in the evening I spent a little

11 bit more time reviewing the declaration.

12 The declaration was written quite awhile

13 ago so I needed to refresh my memory about

14 what I had said and why I had said it.

15 Q. About how many hours in total did

16 you spend preparing for today's

17 deposition?

18 A. Well, we can take the five hours

19 last week, yesterday was maybe about seven

20 or eight hours, and then two more hours in

21 the evening, so maybe about 13, 14 hours.

22 Q. Where do you currently work, sir?

23 A. I'm a professor at Carnegie

24 Mellon University in Pittsburgh,

25 Pennsylvania.

Page 9

1 STERN

2 Q. And you mentioned you were

3 teaching a class yesterday. What are the

4 classes you're currently teaching?

5 A. Just one, it's entitled Digital

6 Signal Processing.

7 Q. What level class is that?

8 A. It's an interesting question. At

9 its inception in the early 1970s it was

10 considered a course appropriate for

11 graduate students. In the intervening 45

12 years or so, that material is now

13 considered more accessible. Most of the

14 students in the class are juniors, seniors

15 or entry level graduate students.

16 Q. And you understand today that we

17 are here for a deposition in regards to

18 IPR2023-01127; is that right?

19 A. The declaration that I have --

20 I'm sorry. The declaration that I have is

21 from the Amazon case, which I assume is

22 the same, but it's labeled IPR2023-00253.

23 My understanding is that Meta inherited

24 the IPR when Amazon settled with Jawbone,

25 LLC. I'm looking in the binder that I

Page 10 1 STERN 2 have -- looks like the Meta petition is 3 indeed labeled IPR2023-01127. 4 Q. And -- 5 A. To the best of my knowledge, the 6 declaration is the same. I have to rely 7 on Attorney Wang to confirm that. 8 Q. And just to maybe clear this up, 9 if you look at your declaration in the 10 bottom right-hand side, it should -- 11 A. It says the copy of the 12 declaration that I have in front of me is 13 labeled Meta Platforms Incorporated 14 Exhibit 1002. 15 Q. I think we're all on the same 16 page. Do you understand the proceeding is 17 about U.S. patent number 8,019,091; is 18 that right? 19 A. Yes. 20 Q. And in that proceeding, there are 21 five grounds of invalidity; is that right? 22 A. May I refer to the petition? 23 Q. Certainly. 24 A. (Witness perusing document.) 25 Yes, indeed. The petition cites	Page 12 1 STERN 2 at those opinions; is that right? 3 MS. WANG: Objection, form. 4 THE WITNESS: Yes. 5 BY MR. COWELL: 6 Q. Who hired you to work on this 7 proceeding? 8 A. I was originally retained by 9 Amazon sometime in the spring of 2022. I 10 worked on this proceeding and an 11 assortment of other related proceedings, 12 all in response to litigation instigated 13 by Jawbone from -- in varying degrees from 14 May or June 2022 through the end of the 15 summer 2023. At that point, my 16 understanding is that Amazon settled with 17 Jawbone and that ended my involvement with 18 Amazon for this particular case. It was 19 also my understanding that some other 20 companies, including at least Meta and 21 Sony, had used my declarations for their 22 litigation vis-à-vis Jawbone and so at 23 that point they engaged me. And this 24 discussion with Meta began in August but I 25 didn't do any real work on it until more
Page 11 1 STERN 2 five grounds for invalidity. 3 Q. Does that comport with your 4 understanding of the grounds for 5 invalidity you opined on in your 6 declaration? 7 A. Yes. 8 Q. And those five grounds of 9 invalidity are all obviousness based; is 10 that right? 11 A. Yes. 12 Q. And all five of those grounds are 13 based on some combination of at least some 14 of Ikeda, Puthuff, Alcivar, Sasaki and 15 Bartlett; is that right? 16 A. Ground 3 also includes Hussein, 17 ground C that is, but I think from that, 18 aside from that your recitation is 19 correct. 20 Q. And you've included all of your 21 obviousness opinions in your declaration; 22 is that right? 23 A. Yes. 24 Q. And your declaration cites all 25 the evidence on which you relied to arrive	Page 13 1 STERN 2 recently. 3 Q. When you say the discussion 4 began -- the discussion with Meta began in 5 August, were you retained by Meta at that 6 time? 7 A. I believe -- I can't confirm that 8 it was August but it was sometime late 9 summer, early fall I was retained by Meta. 10 Q. Have you conducted a prior art 11 search in connection with this proceeding? 12 A. That was part of the declaration, 13 yes. 14 Q. When did you do that prior art 15 search? 16 A. Well, the declaration emerged 17 from discussions that I had with the 18 attorneys at Amazon and the bulk of that 19 work would have taken place in the spring, 20 the summer, perhaps the fall of 2022. 21 That's a long enough time ago that my 22 memory is not that clear, especially since 23 there was no real activity for an extended 24 period of time. 25 Q. How much time did you spend on

Page 14 1 STERN 2 that prior art search? 3 A. On the prior art search per se, I 4 don't really know. It was -- there were 5 multiple patents involved. I didn't pay a 6 great deal of attention to which patent I 7 was spending how much time on and so I 8 can't give you a useful answer for that 9 question, I'm sorry. 10 Q. Do you consider your prior art 11 search to be a thorough search? 12 MS. WANG: Objection, form. 13 THE WITNESS: No, not really. I 14 was really looking for art that would 15 either anticipate or render obvious 16 the claims in the '091 patent and once 17 we identified some sources of prior 18 art, I felt that was sufficient so I 19 stopped looking. 20 BY MR. COWELL: 21 Q. Did you yourself locate the Ikeda 22 reference? 23 A. That reference was initially 24 identified by someone, I'm not sure who, 25 the legal team that was representing	Page 16 1 STERN 2 A. No, I did not, although I was a 3 participant in the -- in a national 4 conference at which that paper was 5 presented. 6 Q. Is it fair to say your prior art 7 search did not locate any of the six 8 references that form the basis for the 9 grounds in your declaration? 10 A. That is correct. 11 Q. Did you yourself formulate the 12 grounds set forth in your declaration? 13 A. Like everything else, the 14 declaration emerged after an extended 15 series of discussions between the legal 16 team at Amazon and myself. We discussed 17 many combinations of the prior art that's 18 addressed in this declaration and other 19 things that we rejected and chose the -- 20 chose the combinations that are detailed 21 in the declaration from those discussions. 22 There were other alternatives that were 23 discussed and discarded because we felt 24 that the various references in the 25 declaration provided a stronger series of,
Page 15 1 STERN 2 Amazon in the initial litigations. 3 Q. Did you yourself locate the 4 Puthuff reference? 5 A. No, I did not. 6 Q. Who did? 7 A. Somebody from the Amazon legal 8 team. 9 Q. Did you yourself locate the 10 Alcivar reference? 11 A. No, I did not. Also that was 12 provided by somebody or identified by 13 somebody on the Amazon legal team. 14 Q. Did you yourself locate the 15 Sasaki reference? 16 A. No, I did not. That was also 17 identified by someone on the Amazon legal 18 team. 19 Q. Did you yourself locate the 20 Bartlett reference? 21 A. No, I did not. That was also 22 located by somebody on the Amazon legal 23 team. 24 Q. Did you yourself locate the 25 Hussein reference?	Page 17 1 STERN 2 were basically better combinations of 3 evidence. 4 Q. Are you yourself aware of any 5 references that anticipate any claim of 6 the '091 patent? 7 A. That anticipate any claim? 8 Q. Yes. 9 A. I haven't looked carefully in 10 that regard but for -- some of the 11 dependent claims are very specific and 12 there are many references. For example, 13 the two claims that deal with sub-band 14 processing, S-U-B-B-A-N-D, and sometimes 15 people like to put hyphens between the two 16 b's, sub-band processing. So there are 17 hundreds, if not thousands of papers that 18 disclose the sub-band processing, but for 19 the independent claims I'm not aware of 20 anything that anticipates the entire 21 claim. 22 Q. Do you understand that in order 23 to anticipate a dependant claim, a 24 reference would have to include all the 25 limitations of the independent claim on

Page 18 1 STERN 2 which that claim depends? 3 A. I must have been informed about 4 that, clearly was not thinking about that 5 when I just gave you the previous answer 6 because what I was addressing was only the 7 content of the dependent claims. So 8 you're right, I correct my previous answer 9 in that regard. 10 Q. So just to be clear then, are you 11 aware of any reference that anticipates 12 any claim of the '091 patent? 13 A. No. 14 Q. Let's talk about the Ikeda 15 reference. 16 A. Okay. 17 Q. Are you familiar with that 18 reference? 19 A. Yes, I am. 20 Q. Have you ever seen the Ikeda 21 reference before you worked on this case? 22 A. No, I had not. 23 Q. Would you agree with me that 24 Ikeda does not disclose a non-acoustic 25 sensor?	Page 20 1 STERN 2 A. Because you're not measuring the 3 voice activity directly. 4 Q. Is it okay if we refer to a voice 5 activity detector as a VAD, V-A-D? 6 A. Yes, that's a common acronym. 7 Q. I'm not sure if you fully 8 answered my question as to whether -- let 9 me start over. Strike that. 10 In your opinion does Ikeda 11 disclose a VAD? 12 A. It discloses -- it discloses 13 circuitry that provides similar 14 functionality to a VAD but it's not a VAD 15 itself. 16 Q. And that circuitry is boxes 10 17 and 11; is that right? 18 A. That's right. 19 Q. And Ikeda works purely on 20 acoustic input; is that correct? 21 A. Yes, that is correct. The only 22 inputs to the invention as disclosed by 23 Ikeda are the two microphones labeled XA 24 and XB in Figure 1. 25 Q. Ikeda discusses what it calls
Page 19 1 STERN 2 A. The only inputs to the Ikeda 3 reference are the two microphones so in 4 that sense, that is correct. 5 Q. Do you have the Ikeda reference 6 in front of you? 7 A. I do. May I have a look at it? 8 Q. Yes, please. 9 A. Okay, I have the Ikeda reference 10 here. 11 Q. Now, turn to Figure 1. 12 A. Yes. 13 Q. Do you consider boxes 10 and 11 14 of Figure 1 to be a voice activity 15 detector? 16 A. Boxes 10 and 11 estimate signal 17 noise ratios in the input. In the Ikeda 18 reference those are used to estimate voice 19 activity when the signal to noise is high 20 in input XA and load and input XB that can 21 be used for voice activity detection, but 22 in a sense it's an indirect way of 23 detecting voice activity. 24 Q. And why do you consider it an 25 indirect way of detecting voice activity?	Page 21 1 STERN 2 conventional noise cancellers. Do you 3 recall that? 4 A. I don't remember that term. It 5 seems plausible. 6 Q. I'll just direct you to column 3, 7 line 32 as one example. 8 A. You're talking about conventional 9 noise cancellers? 10 Q. Yes, just -- 11 A. Yeah -- 12 Q. You said -- I'll restate my 13 question. 14 Does Ikeda discuss conventional 15 noise cancellers? 16 A. I apologize. I misheard the 17 initial question. I heard conventional as 18 inventional and I was trying to figure out 19 what an inventional noise canceller might 20 be. 21 Q. Does Ikeda discuss what it calls 22 conventional noise cancellers? 23 A. Yes, it does. 24 Q. Would you agree with me that 25 Ikeda discloses one issue with a

Page 22 1 STERN 2 conventional noise canceller is to be -- 3 sorry, let me strike that. I messed up my 4 own question. 5 Do you agree with me that Ikeda 6 discloses a need for a noise canceller 7 that can update its adaptive filters 8 without receiving a command from the 9 outside? 10 A. And where do you point to in the 11 text of the '824 patent that discloses 12 that? 13 Q. Well, first I want to note your 14 impression of Ikeda. 15 A. Well, my impression of Ikeda is 16 that it has a very clever algorithm for 17 cancelling noise based on the inputs of 18 two acoustical sensors. It estimates the 19 parameters associated with the pair of 20 transfer functions and in order for it to 21 function properly, it must be able to 22 estimate some of those parameters when the 23 signal going -- when the desired signal is 24 absent and it must estimate another set of 25 those parameters when the desired signal	Page 24 1 STERN 2 outside. Ikeda proposes a solution in 3 which the -- an estimate of voice activity 4 detection is developed without additional 5 sources, but there's no representation 6 that that's the only way of doing that and 7 again, in certainly very high noise 8 environments that SNR estimation is 9 difficult. 10 Q. Let's take a look at column 3 of 11 Ikeda, right at line 46. 12 A. Uh-huh. 13 Q. Just read that first sentence to 14 yourself. 15 A. Oh, yeah, I've seen it. However, 16 it is in many cases difficult to command 17 the adaptive filters to perform learning 18 from the outside in accordance with the 19 level of the desired signal and that of 20 the noise signal depending on the 21 situation in which the noise canceller is 22 located. 23 So my parsing of that sentence is 24 that sometimes it's difficult, sometimes 25 it's feasible and sometimes it's demanded.
Page 23 1 STERN 2 is present and there's relatively little 3 or no noise present. As Ikeda describes 4 it, the operation of the device is 5 dependent on being able to accomplish 6 that. However, having said that, there 7 are many ways of determining whether the 8 voicing activity is present or not, as 9 published papers on that topic by myself, 10 some of which are cited somewhat. 11 So there are many ways of doing 12 that and Ikeda describes one of them. It 13 doesn't make any representation that I'm 14 aware of saying to be complete in that 15 regard. 16 Q. Would you agree with me that 17 Ikeda discloses that it is in many cases 18 difficult to command adaptive filters from 19 learning from the outside? 20 A. I wouldn't take that at face 21 value. Adaptive filters are very 22 effective in many, many applications. The 23 noise cancelling headphones you use on 24 airplanes do a very good job of adaptive 25 learning with information from the	Page 25 1 STERN 2 Q. And if we turn to the first 3 sentence under the Summary of Invention. 4 A. Yes. 5 Q. Ikeda there is telling us that an 6 object of the present invention is to 7 provide a noise canceller capable of 8 achieving a sufficient noise cancelling 9 ability and reducing signal distortion 10 even when adequate learning sections 11 cannot be indicated from the outside. 12 Do you see that? 13 A. I do. 14 Q. Do you agree with what Ikeda is 15 saying there? 16 A. Ikeda is simply stating the 17 object of the invention and I can't 18 reasonably disagree with the stated 19 objective, objective of the invention. 20 The only thing that I'm saying is that 21 sometimes this is a good solution and 22 sometimes it's not. 23 Q. If you turn to column 9. 24 A. Yes. 25 Q. Starting right at line 16 there's

Page 26 1 STERN 2 a sentence, the noise canceller therefore 3 issues -- ensures, excuse me -- rapid 4 convergence and allows a minimum of signal 5 distortion to occur without resorting to a 6 command customarily input from the outside 7 for commanding the learning operation of 8 filters. 9 Do you see that? 10 A. I do. 11 Q. And so here's Ikeda is summing up 12 its invention as not needing to resort to 13 a command from the outside; is that right? 14 A. Not needing is not the same as 15 never needing and what Ikeda teaches is a 16 way of -- the screen is just dropping down 17 in front of me -- is that a response to 18 anything -- I'm sorry, I did not answer 19 the question. Would you mind repeating 20 it? 21 Q. I said so here Ikeda is summing 22 up its invention as a system that doesn't 23 need to resort to a command from the 24 outside; is that right? 25 A. Right. And what I'm saying here,	Page 28 1 STERN 2 in your opinion, does Ikeda express that 3 there's a need for accuracy when 4 determining periods of speech and 5 nonspeech? 6 A. Yes, this algorithm depends on 7 being able to identify at least some 8 intervals when speech is absent and some 9 intervals when speech is present and noise 10 is largely absent. 11 Q. As we discussed earlier, that's 12 one of the problems that Ikeda is seeking 13 to solve with its system; is that right? 14 A. That's correct, yes. 15 Q. I want to talk for a minute, I'll 16 turn to Puthuff. 17 A. Okay. 18 Q. I'm perhaps butchering the 19 pronunciation but you know what I'm 20 talking about, Dr. Stern? 21 A. Yes, all of these pronunciations 22 are up for grabs. 23 Q. Have you ever seen Puthuff before 24 you started working on this case? 25 A. No, I had not.
Page 27 1 STERN 2 as I have said, is just -- that's the 3 invention. There's no assertion that 4 that's the solution that you would always 5 want to adopt under all circumstances and 6 it's appropriate for some things and not 7 for others. I've done a lot of work in 8 signal-to-noise ratio estimation, and what 9 the '824 patent does not address at all is 10 the difficulty of accomplishing SNR 11 estimation under all circumstances without 12 a prior knowledge of the environment and 13 nature of the signals and other things. 14 Q. But I think we agree Ikeda's 15 invention, just looking at Ikeda itself, 16 what Ikeda purports to invent is a system 17 that doesn't need a command from the 18 outside; is that right? 19 A. Yes, that's indeed the objective, 20 as you pointed out, and it accomplishes 21 that objective and that's a system that 22 provides useful functionality in some 23 circumstances but not in all 24 circumstances. 25 Q. And one of the other problems --	Page 29 1 STERN 2 Q. And you'd agree with me Puthuff 3 is describing an audio pickup system; is 4 that right? 5 A. As the abstract of the Puthuff 6 reference describes, Puthuff describes a 7 pickup system that utilizes both sound 8 pressure disturbances sensed by 9 microphone, so that would be your audio 10 pickup system, but in addition, bone 11 conduction sensed by vibration sensors 12 such as an accelerometer, velocity sensor, 13 displacement sensor and so forth and so 14 on. 15 So what Puthuff actually 16 discloses is a combination of sensors that 17 get used under different circumstances. 18 Q. And the aim of Puthuff is to 19 generate a signal that approximates the 20 user's speech; is that right? 21 A. No. Well, excuse me a second. 22 I'm just reviewing the Puthuff 23 reference. 24 (Witness perusing document.) 25 Can you repeat the question,

Page 30 1 STERN 2 please? 3 Q. Sure. The aim of Puthuff is to 4 generate a signal that approximates the 5 user's speech; is that right? 6 A. Yes, the aim of Puthuff is to 7 generate a signal that approximates the 8 speech under a wide range of acoustic 9 conditions using a combination of sensors. 10 Q. Right. And so do you agree with 11 me, if you just look at the front cover of 12 Puthuff, the figure there is a faithful 13 reproduction of the system? 14 A. You're looking at the figure 15 which I assume is Figure 10 from the 16 title? 17 Q. Yes, the figure right on the 18 first page. It corresponds to Figure 1 19 actually. 20 A. Right. Yeah, I'm looking at the 21 first page. What we're saying is two 22 input sources, the PD microphone and the 23 one labeled accelerometer, and the rest of 24 the circuitry describes a mixture, a 25 linear combination of those two inputs	Page 32 1 STERN 2 Q. And would you agree with me that 3 Puthuff -- let me start over. 4 If you look at that figure right 5 on 1, number 40 is the output signal; 6 right? 7 A. That's correct. 8 Q. And as we discussed earlier, that 9 output signal should approximate the 10 user's voice; is that right? 11 A. That's the objective, yes. 12 Q. And signal 40 is generated by 13 summoning the processed signals from the 14 microphone and the accelerator -- 15 accelerometer, excuse me. 16 A. Right, rather than summing, I 17 would say that it's a weighted 18 combination. Summing implies that the 19 weights are equal. 20 Q. Fair enough. So let me state it 21 better then. 22 Signal 40 is a combination of the 23 signals for the microphone and the 24 vibration sensor; is that right? 25 A. That's correct.
Page 31 1 STERN 2 with the combination coefficients. In 3 other words, the description of which 4 input you pay more attention to determined 5 by the inspection of thresholding 6 mechanisms. 7 Q. Okay. So you mentioned -- let me 8 just strike that. 9 Puthuff uses one microphone; is 10 that right? 11 A. Puthuff uses one microphone and a 12 second sensor, a second sensor for bone 13 conduction and that second sensor is 14 listed in plurality of devices and 15 technologies that could be used to achieve 16 that. 17 Q. I was just asking about the 18 microphone by itself. Puthuff uses one 19 microphone; is that right? 20 A. There's only one signal 21 microphone in the Puthuff invention, I 22 agree. 23 Q. And Puthuff also uses a vibration 24 sensor; is that right? 25 A. That's correct.	Page 33 1 STERN 2 Q. The way Puthuff works is 3 depending on the conditions in the pickup 4 room, it gives -- increases the gain to 5 the microphone or increases the gain to 6 the vibration sensor; is that right? 7 A. That's correct. 8 MR. COWELL: Why don't we take a 9 five-minute break. 10 (Recess taken from 10:51 a.m. to 11 10:59 a.m.) 12 BY MR. COWELL: 13 Q. Dr. Stern, welcome back from the 14 break. 15 A. Thank you. 16 Q. I'd like to know, I would like to 17 talk about your proposed combinations of 18 Ikeda plus Puthuff. 19 A. Okay. 20 Q. Now you propose actually two 21 different combinations of Ikeda and 22 Puthuff; is that right? 23 A. That's correct. 24 Q. And so the first one I think you 25 say -- I'm just looking at paragraph 89,

Page 34 1 STERN 2 88 and 89 and thereafter of your 3 declaration, if you want to follow along 4 with me. 5 A. Thank you. I'm going there right 6 now. 7 Q. Are you there? 8 A. I am, thank you. 9 Q. So the first combination is using 10 Puthuff's vibration sensor as a VAD; is 11 that right? 12 A. Let's see. In place of or in 13 addition to so the first one is the 14 substitution, replacement, yes. 15 Q. So if we look at paragraph 88, 16 you have (a) and (b) there, those are the 17 two combinations you propose? 18 A. That's correct. 19 Q. Okay. So let's talk about the 20 first one, in place of. 21 A. Um-hum. 22 Q. So in your combination that 23 you're proposing here, you would take 24 Puthuff's accelerometer number 30 from 25 Figure 1 of Puthuff and put that in place	Page 36 1 STERN 2 their coefficients. 3 Q. You would need to make more 4 alterations to Ikeda, is that right, 5 rather than just dropping in the 6 accelerometer? 7 MS. WANG: Objection, form. 8 THE WITNESS: No, the way it is 9 right now, boxes 10 and 11 are there, 10 they take inputs from microphones A 11 and B, XA and XB, and control the 12 adaptation of the adaptive filters. 13 The sensor for Puthuff would do 14 exactly the same thing. You replace 15 boxes 10 and 11, eliminate the inputs 16 from XA and XB, at least in the 17 replacement mode, and then have the 18 signal, the voice activity detector 19 signal go to the adaptive filter in 20 exactly the same way the figure 21 specifies. So no additional 22 modifications, just a straight up 23 replacement. 24 BY MR. COWELL: 25 Q. So let's talk about the second
Page 35 1 STERN 2 of boxes 10 and 11 of Ikeda; is that 3 right? 4 A. That's correct. 5 Q. Would you make any other 6 alterations to Ikeda? 7 A. Well, looking at Figure 1 of 8 Ikeda, the signals μ 1 and μ 2, which of 9 course are step size parameter signals, 10 but really the objective of that part is 11 to determine when the coefficients of the 12 adaptive filters W1 and W2 are permitted 13 to adapt and when they are not permitted 14 to adapt. Generally the first adaptive 15 filter number 3 should adapt when there's 16 no speech present and some noise present. 17 And ideally the second coefficient, second 18 adaptive filter labeled 6 would adapt when 19 there is speech present and little or no 20 noise present. So the -- there's not an 21 explicit spot in the figure for that, but 22 the signal coming from the accelerometer 23 in Figure 1 of Puthuff would basically 24 control whether, you know, whether or when 25 the adaptive filters W1 and W2 update	Page 37 1 STERN 2 combination you begin discussing in 3 paragraph 96 of your report. 4 A. Right. 5 Q. And for this one, the second 6 combination, you would take Puthuff's 7 entire circuit as shown in Figure 1 of 8 Puthuff and drop it right essentially 9 where the letters XA and Z show in Figure 10 1 of Ikeda; is that right? 11 A. Give me one second. 12 (Witness perusing document.) 13 Can you repeat the question, 14 please? 15 Q. Sure. For the second 16 combination, you propose taking Puthuff's 17 circuit as shown in Figure 1 and dropping 18 it into Ikeda Figure 1 essentially where 19 the letters XA and Z appear, basically 20 where that's pointing; is that right? 21 A. Looks like as described, we 22 replace the PD microphone channel. The 23 output would be used as the output of the 24 microphone 20. So yeah, the PD microphone 25 would be replaced by the signal XA from

Page 38 1 STERN 2 the first microphone in the Ikeda 3 reference and then everything would 4 proceed as before. 5 Q. So the entire body of Figure 1 6 would be incorporated into Ikeda; is that 7 right? 8 MS. WANG: Objection, form. 9 THE WITNESS: Minus the PD 10 microphone, obviously. 11 BY MR. COWELL: 12 Q. The entire body of Puthuff Figure 13 1 minus the PD microphone would be 14 incorporated into Figure 1 of Ikeda; do I 15 now have it right? 16 MS. WANG: Objection, form. 17 THE WITNESS: Yes, that's 18 correct. 19 BY MR. COWELL: 20 Q. So then what we'd have on the 21 Ikeda side is we would have the signal 40 22 coming into box 8 and then also box 10, 23 the signal-to-noise power ratio estimator; 24 right? 25 A. The output of -- yes, that would	Page 40 1 STERN 2 noises; is that right? 3 A. Yeah, there's a good summary in 4 the background, column 1, lines 13 to 20. 5 Q. So Alcivar tells us the problem 6 is particularly acute with the diver's 7 breathing, noises and gas flow noises; 8 right? 9 A. Yes. 10 Q. Now Alcivar doesn't detect a 11 signal-to-noise ratio; is that right? 12 A. No, it uses, as I put it, a 13 different kind of sensor to detect the 14 voicing activity. Remember, the major 15 object of all of these devices is to 16 provide an accurate indication of voicing 17 activity rather than necessarily 18 signal-to-noise ratio. The 19 signal-to-noise ratio is just merely a 20 means to the end as proposed by Ikeda. 21 Q. And a different kind of sensor 22 that Alcivar uses is a tissue conduction 23 microphone; is that right? 24 A. Yes. I'm trying to confirm the 25 sensor as proposed in the claims disclose
Page 39 1 STERN 2 be correct. 3 Q. Now, I'd like to turn our 4 discussion to Alcivar. 5 A. Alcivar, yes. 6 Q. Alcivar, is that the right 7 pronunciation? 8 A. Yes. 9 Q. Have you ever seen Alcivar before 10 you started working on this case? 11 A. No, I did not. 12 Q. Just out of curiosity, how do you 13 know the proper pronunciation of Alcivar? 14 A. Many years of Spanish, (speaking 15 Spanish). 16 Q. Fair enough. He's from Ecuador 17 so I see your point. 18 So you would agree with me 19 Alcivar is directed to a voice operated 20 switch to be used for divers; correct? 21 A. Yes. 22 Q. And the objective of Alcivar is 23 to avoid a situation where a transmit 24 switch is activated by breathing noises 25 that the diver makes and other similar	Page 41 1 STERN 2 a separate tissue conduction -- I'm sorry, 3 in claim 1, a separate tissue conduction 4 microphone and associate meets, so yes, a 5 tissue conductor microphone. 6 Q. And Alcivar provides instructions 7 on where you have to place the tissue 8 conduction microphone; is that right? 9 A. I'm just reviewing the claims 10 here. 11 (Witness perusing document.) 12 We can see that in column 5 of 13 the '789 patent, in the first complete 14 paragraph, it's stated the tissue 15 conduction for microphone 54 should be in 16 good contact with the diver's neck tissue. 17 I'm being a little careful because if we 18 look at the -- if we look at the figure on 19 the front which is -- on the front of the 20 patent doesn't appear to be either of the 21 labeled figures, but there's disclosed a 22 bone conduction headphone and a throat 23 microphone. As described in column 5, the 24 throat microphone should be on the throat 25 presumably in close contact with the

Page 42 1 STERN 2 larynx. 3 Q. It needs to be in that close 4 contact with the larynx so that it can 5 properly pick up the vibration of the 6 vocal cords; is that right? 7 A. Yes, it's noted in that same 8 paragraph in column 5 that the actual 9 specific position varies from person to 10 person but generally remain constant for 11 that individual. 12 Q. Right, but that wasn't my 13 question. My question is that the reason 14 the throat microphone should be in close 15 contact with the larynx is so that it can 16 accurately pick up the vibration of the 17 vocal cords; is that right? 18 A. That's correct. 19 Q. And, in fact, Alcivar tells us 20 that it should be isolated from other 21 noises, it being the throat microphone; is 22 that right? 23 A. Because of the nature of the 24 throat microphone, it will primarily pick 25 up the vibrations emanating from the	Page 44 1 STERN 2 BY MR. COWELL: 3 Q. Are you saying that the sound 4 absorbing material serves no purpose? 5 A. No, the sound absorbing material 6 absorbs sound. What I'm saying is that in 7 that application the sound absorbing 8 material is already there as a natural 9 part of the suit that the diver is 10 wearing. 11 Q. Right. And in the last sentence 12 of that paragraph, Alcivar tells us that 13 otherwise, a simple holder is used to 14 maintain the microphone in place and to 15 provide acoustical isolation from the 16 water. 17 Do you see that? 18 A. I do. 19 Q. So Alcivar wants acoustical 20 isolation from the water; is that correct? 21 A. Yeah, but you're going to get 22 that to a good degree from just simply the 23 mere fact that the sensor disclosed is a 24 vibration sensor. In all of these 25 implementations you want to exploit any
Page 43 1 STERN 2 larynx. The patent also discloses the use 3 of additional circuitry, including 4 bandpass filters, to reject to the extent 5 possible extraneous noise sources and 6 other frequencies, but because of the fact 7 that the throat microphone is primarily a 8 vibration, the mechanical vibration sensor 9 as opposed to an acoustic sensor like a 10 microphone, it will primarily respond to 11 the vibrations inside the throat. 12 Q. If we look at Alcivar column 5, 13 lines 21 to 31, Alcivar is telling us that 14 the throat microphone needs to be isolated 15 from waterborne noises by a layer of sound 16 absorbing material; correct? 17 MS. WANG: Objection, 18 mischaracterizes the document. 19 THE WITNESS: Well, the throat 20 microphone is isolated by a layer of 21 sound absorbing material and that 22 emerges from the physical properties 23 of the suit that the divers are 24 wearing. 25 ///	Page 45 1 STERN 2 additional opportunities that you have to 3 improve the performance, especially if 4 it's at no marginal cost. If the device 5 that you have to maintain the mechanical 6 position of the throat microphone near the 7 larynx, which you do need, also provides 8 some additional isolation from the 9 mechanical motion of the water outside, 10 which it normally would, that's just a 11 bonus. 12 Q. I see. Now in your opinion, 13 Alcivar discloses a VAD; is that right? 14 A. Yes. 15 Q. And what is the VAD in Alcivar? 16 A. So the VAD in Alcivar is the -- 17 so it's first of all the detection of the 18 signal from the throat microphone and then 19 if you -- let's see. So there's an audio 20 detector. I'm looking now the first page 21 of the Alcivar patent at the diagram -- at 22 least in my copy it's not repeated 23 anywhere else in the patent and so it 24 doesn't have a number. 25 Q. May I direct you to Figure 1? I

Page 46 1 STERN 2 think it is the same. 3 A. I'm so stupid. Figure 1 is 4 rotated 90 degrees and do the same, yes, 5 thank you. So let's talk about Figure 1. 6 Figure 1, the signal from the throat 7 microphone goes through a bandpass filter, 8 then you see an audio detector and then 9 the Schmitt trigger. So basically what 10 the audio detector and the Schmitt trigger 11 circuit do are make a determination 12 whether the vibration activity detected by 13 the throat microphone is sufficiently 14 large, it will set off a single signal 15 that says yes, we have voicing activity so 16 that's what makes it a VAD. 17 Q. I was asking what components are 18 the VAD. 19 A. So again, I would refer to the 20 line of components beginning with the 21 throat microphone 54 leading up to -- 22 well, specifically including the Schmitt 23 trigger 68. I'm trying to figure out 24 whether it's 68 or 89, but it's 68, and 25 after that it's housekeeping about what	Page 48 1 STERN 2 what the coefficients of adaptive 3 filters W1 and W2 in Ikeda are 4 modified when the coefficients are 5 modified and when they're not. 6 BY MR. COWELL: 7 Q. So your proposal is to replace 8 boxes 10 and 11 of Figure 1 of Ikeda with 9 components 54, 56, 58, 60, 62 and 68 of 10 Figure 1 of Alcivar? 11 A. Yes, that's correct. 12 MS. WANG: Objection, 13 mischaracterizes the testimony. 14 THE WITNESS: I'm sorry. Also 15 possibly boxes 72 and 74. I need to 16 determine what 72 and 74 actually do. 17 BY MR. COWELL: 18 Q. And you don't know what 72 and 74 19 actually do at this point? 20 A. I wrote the declaration more than 21 a year ago. I would want to check again. 22 But the objective is to start with a 23 signal from the throat, end up with a 24 signal that indicates presence or absence 25 of voicing activity, which is, in fact, at
Page 47 1 STERN 2 they do with the signal. 3 Q. And just so we have a clear 4 record, the components of the VAD in 5 Alcivar are 54, 56, 58, 60, 62 and 68; is 6 that right? 7 A. Yeah, maybe 72 and 74, depending 8 on the application but that's the section. 9 Q. And when you combine Alcivar with 10 Ikeda, as you suggest in your declaration, 11 would you again take components 54, 56, 12 58, 60, 62 and 68 and put them into Ikeda 13 Figure 1? 14 MS. WANG: Objection, form. 15 THE WITNESS: I'm reviewing the 16 text in the declaration. 17 (Witness perusing document.) 18 So as I describe it in 19 approximately paragraphs 145 through 20 160, depending on how you want a count 21 of my declaration, the proposal is to 22 replace boxes 10 and 11 in Figure 1 of 23 Ikeda with the VAD that is thought by 24 Alcivar '789 patent, and have the 25 output of that directly go to control	Page 49 1 STERN 2 least what 54 through 68 accomplish, and 3 then use that to control when the 4 coefficients in W1 and W2 are modified or 5 when they are not. 6 Q. So what we end up with in your 7 combination is a system of Ikeda with the 8 two microphones just to start out; right? 9 We'll have those two microphones; correct? 10 A. That's correct. 11 Q. And those two microphones are in 12 close proximity to the user's mouth? 13 A. I'd have to review what Ikeda 14 says about that. I'm not sure it's really 15 specified. The expectation is that the 16 first microphone primarily is responsive 17 to the desired signal, the speech signal, 18 and the second microphone is primarily 19 responsive to the ambient noise, but I 20 would have to check the specification and 21 the claims in the patent to see what it 22 says about where they actually are. 23 Q. Maybe we can make it simple. 24 Would you agree with me the two Ikeda 25 microphones would be placed just as they

Page 50 1 STERN 2 are described being placed in Ikeda? 3 A. Yes, let's assume that the system 4 as described by Ikeda is followed, 5 including the locations of microphones, 6 simply replacing boxes 10 and 11 by the 7 voice activated detection that's 8 accomplished by the means disclosed by 9 Alcivar. 10 Q. So when we are adding the means 11 disclosed by Alcivar, now we have a throat 12 microphone that's in physical contact with 13 the user's throat; correct? 14 A. That's correct. 15 Q. And that would be connected by a 16 wire of some sort to the rest of the Ikeda 17 system; is that right? 18 A. Wouldn't necessarily have to be a 19 wire. It could be a Bluetooth connection. 20 This day and age could be almost anything. 21 Q. Well, at the time of the 22 invention, what would it be? 23 A. At the time of the invention it 24 probably would have been a wire. 25 Q. So now we've added an additional	Page 52 1 STERN 2 A. It could be a noisy restaurant, 3 it could be just stepping inside, it could 4 be inside a train station, there is an 5 airport, just talking to a cell phone on 6 the street. There's many, many, many use 7 cases. 8 MR. COWELL: I understand. 9 That's all my questions. I pass the 10 witness. 11 MS. WANG: Can we take a quick 12 break? 13 MR. COWELL: Sure. 14 MS. WANG: Let's go off the 15 record. 16 (Recess taken from 11:31 a.m. to 17 11:43 a.m.) 18 EXAMINATION 19 BY MS. WANG: 20 Q. Dr. Stern, do you recall your 21 testimony earlier today on the five 22 grounds in the petition and in your 23 declaration? 24 A. Yes. 25 Q. If I could direct your attention
Page 51 1 STERN 2 sensor to Ikeda; is that right? 3 A. That's correct. 4 Q. And what's the use case for this 5 Ikeda/Alcivar proposal? 6 MS. WANG: Objection to form. 7 THE WITNESS: The original use 8 case was for people diving but that 9 same apparatus has widespread 10 applicability. Throat microphones are 11 used for voicing in many applications 12 today that don't have anything to do 13 with diving. 14 BY MR. COWELL: 15 Q. And in your mind, what's the -- 16 what would someone use your Ikeda/Alcivar 17 combination for? 18 MS. WANG: Objection, asked and 19 answered. 20 THE WITNESS: For speaking into 21 microphones in noisy environments and 22 having the noise removed. 23 BY MR. COWELL: 24 Q. What's the noisy environment 25 you're thinking of?	Page 53 1 STERN 2 to your declaration at paragraph 212 and 3 take a moment to read that section or 4 these few sentences to yourself. And just 5 let me know when you're ready. 6 A. How far beyond 212 should I read? 7 Q. You can stop at 212, that's fine, 8 or read as much as you want. 9 A. (Witness perusing document.) 10 Okay. 11 Q. Do you understand this portion of 12 your declaration to be referring to any of 13 the above grounds, which are grounds 1 to 14 4, that include a challenge to any of 15 claims 11 to 20? 16 MR. COWELL: Objection to form. 17 THE WITNESS: I believe that 18 what's being stated here is simply 19 that although the disclosure for 20 obviousness is in the prior art 21 sources that I referenced, it also 22 would have been obvious that the 23 various capabilities could have been 24 implemented in other means using, for 25 example, a processor and a voicing

Page 54 1 STERN 2 sensor. 3 BY MS. WANG: 4 Q. Right. And so the -- would you 5 agree that the addition of ground 5 is to 6 include the use of a processor as 7 disclosed in Bartlett? 8 MR. COWELL: Objection to form. 9 THE WITNESS: I believe that's 10 what's stated, yes. 11 BY MS. WANG: 12 Q. And that would include the prior 13 art combinations that are included in the 14 above grounds, grounds 1 to 4 as well; 15 correct? 16 MR. COWELL: Objection to form. 17 THE WITNESS: Yes. 18 BY MS. WANG: 19 Q. So if we were to enumerate the 20 prior art combinations that are included 21 in ground 5 of your declaration, is it 22 your understanding that it would be any of 23 the prior art combinations relied on in 24 any of grounds 1 to 4 plus Bartlett? 25 MR. COWELL: Objection to form.	Page 56 1 STERN 2 Q. So is it your understanding that 3 Puthuff, based on at least this 4 disclosure, discloses a device that has 5 two conventional air pressure microphones? 6 A. Yes. 7 Q. Do you recall your testimony 8 earlier today that Ikeda discloses the 9 functionality of a VAD? 10 MR. COWELL: Objection to form. 11 THE WITNESS: Yes. 12 BY MS. WANG: 13 Q. Can you please explain how Ikeda 14 discloses the functionality of a VAD? 15 MR. COWELL: Objection to form. 16 THE WITNESS: The Ikeda reference 17 develops or estimates signal-to-noise 18 ratios of the signals going into the 19 two channels, the XA and the XB 20 microphones, and in circumstances in 21 which -- in circumstances in which the 22 signal-to-noise ratio received by 23 microphone XA is estimated to be high, 24 and the signal-to-noise ratio in 25 microphone XB is considered to be low,
Page 55 1 STERN 2 THE WITNESS: One second. 3 (Witness perusing document.) 4 Could you repeat the question, 5 please? 6 BY MS. WANG: 7 Q. If we were to enumerate the prior 8 art combinations included in ground 5, is 9 your understanding that it would be any of 10 the prior art combinations that are 11 referenced in grounds 1 to 4 plus the 12 Bartlett reference? 13 MR. COWELL: Objection to form. 14 THE WITNESS: Yes. 15 BY MS. WANG: 16 Q. Can we turn to the Puthuff 17 reference, please? And Dr. Stern, can I 18 direct your attention to page 4, the first 19 paragraph? 20 A. Yes. 21 Q. Starting at lines 4 to 7, do you 22 see that this portion of Puthuff that is 23 describing a device that has two 24 conventional air pressure microphones? 25 A. Yes, I see that.	Page 57 1 STERN 2 then you're more likely to have voice 3 activity during those periods of time. 4 During other time intervals in which 5 the signal-to-noise ratio estimated in 6 channel -- in microphone XA is low and 7 the signal-to-noise ratio estimated 8 for channel XB is high, you're likely 9 to have no voice activity during those 10 times. So the combinations of 11 signal-to-noise ratio estimators in 12 box 10, that information could be used 13 to indicate whether voice activity is 14 present or absent. 15 BY MS. WANG: 16 Q. Do you recall earlier today 17 discussing the portions of your 18 declaration that relate to the various 19 prior art combinations with Ikeda, and 20 specific I'm going to point you to a 21 couple of sections in your declaration 22 that you discussed with counsel, so for 23 the combination with Puthuff, this was at 24 paragraphs 88 to 98 of your declaration 25 and I'll give you a moment to turn to

Page 58 1 STERN 2 that. Do you recall that testimony? 3 A. Yes, I do. 4 Q. And do you also -- sorry, go 5 ahead. 6 A. Yes, I do. 7 Q. And do you also recall your 8 testimony relating to the prior art 9 combination of Ikeda with Alcivar at 10 paragraphs 148 to 154? 11 A. Yes. 12 Q. Do you also recall your testimony 13 or do you recall -- sorry, strike that. 14 Do you recall counsel pointing 15 you to various portions of Ikeda including 16 at column 3, line 46 to line 61? 17 MR. COWELL: Objection to form. 18 THE WITNESS: Yes, I do recall 19 that. 20 BY MS. WANG: 21 Q. Does this portion, so this is two 22 paragraphs of Ikeda; correct? 23 A. Yes, the one -- well, I'm looking 24 right now to one that's immediately before 25 the summary of the invention begins.	Page 60 1 STERN 2 perform learning from the outside in 3 accordance with the level of the 4 desired signal and that of the noise 5 signal, depending on the situation in 6 which the noise canceller is located. 7 With the conventional noise canceller, 8 sufficient noise cancelling ability 9 and sufficient distortion collection 10 characteristics are not achievable 11 unless adequate learning sections are 12 indicated to each adaptive filter 13 through the purpose. 14 So what was the question again? 15 BY MS. WANG: 16 Q. Does this portion of Ikeda at 17 column 3, lines 46 through 61, change your 18 opinion that it would be obvious to 19 combine Ikeda with the references relied 20 on in your declaration in the manner 21 discussed in your declaration? 22 MR. COWELL: Objection to form. 23 THE WITNESS: To me, it's still 24 obvious to seek outside sources for 25 the voice activity detection. And the
Page 59 1 STERN 2 Q. And Mr. Cowell also directed you 3 to the paragraph, the first paragraph 4 after the summary -- the first paragraph 5 within the summary of the invention 6 section? 7 A. That's correct, approximately 8 lines 46 through 61. 9 Q. Does this portion of Ikeda at 10 column 3, line 46 through 61, does this 11 portion of Ikeda change your opinion that 12 it would be obvious to combine Ikeda with 13 the references relied on in your 14 declaration in the manner discussed in 15 your declaration? 16 MR. COWELL: Objection to form. 17 THE WITNESS: Not really. As I 18 indicated previously, my reading of 19 those paragraphs is that it stated 20 that sometimes it's difficult to 21 command the adaptive filters -- I'm so 22 sorry, I'm just reading from the text 23 of the patent. The statement is 24 however, it is in many cases difficult 25 to command the adaptive filters to	Page 61 1 STERN 2 reason for that, although -- is that 3 although Ikeda motivates and describes 4 a means by which the voice activity 5 detection could be accomplished using 6 only the acoustic signals coming into 7 microphones XA and XB, I know from 8 personal experience and also from 9 what's not stated in the '824 patent 10 is that those estimates of SNR are 11 difficult to obtain, are not easily 12 obtained accurately in high noise 13 situations, which is exactly the use 14 case to which this invention would be 15 applied, and therefore, I would be 16 highly motivated to look at some other 17 way of getting the voice activity 18 signal more accurately than would be 19 obtained from estimates of 20 signal-to-noise ratios from the 21 acoustic signals from the two 22 microphones. So the paragraphs in 23 question here surrounding the 24 beginning of the summary of invention 25 do describe the reasons why Ikeda

Page 62 1 STERN 2 appears to have been motivated to have 3 added boxes 10 and 11 to the remaining 4 structure of the invention, but they 5 don't really -- the solution that's 6 proposed, in my opinion, is not 7 practical for many, many of the use 8 cases that are most likely to be the 9 object of the invention. 10 BY MS. WANG: 11 Q. And in your answer just now, you 12 refer to personal experience and you 13 stated that I, quote, I would be highly 14 motivated. Is it also your opinion that 15 the POSITA would have the same or similar 16 experience and have the same or similar 17 motivation? 18 MR. COWELL: Objection to form. 19 THE WITNESS: A person of 20 ordinary skill in the art who is 21 familiar with the role of literature 22 on adaptive filtering, noise levels, 23 on SNR, signal-to-noise ratio 24 determination, all of which had been 25 mined fairly heavily at the time of	Page 64 1 STERN 2 therefore, in my opinion, would not 3 diminish the obviousness with which a 4 person of ordinary skill in the art 5 would be motivated to seek outside 6 sources for that combination. 7 MS. WANG: I have no further 8 questions. 9 MR. COWELL: I have no questions. 10 THE REPORTER: Can I get your 11 orders, please? 12 MR. COWELL: I'll take a rough 13 and a three-day turnaround. 14 MS. WANG: I'll do the same. 15 Wait, I can do the slow track, that's 16 fine. I'll take a rough and the 17 normal. 18 19 20 21 (Continued on Next Page for Jurat.) 22 23 24 25
Page 63 1 STERN 2 the file date of the patent, would 3 have had the same concerns that I'm 4 describing here now. 5 BY MS. WANG: 6 Q. Earlier today, counsel also 7 directed you to in Ikeda column 9, line 14 8 to 18. Do you recall that? 9 A. Column 9, 14 to 18, yes. 10 Q. Does this portion of Ikeda change 11 your opinion that it would be obvious to a 12 POSITA to combine Ikeda with any of the 13 references relied on in your declaration 14 in the manner described in your 15 declaration? 16 MR. COWELL: Objection to form. 17 THE WITNESS: This portion of 18 Ikeda describes how blocks 10 and 11 19 in the '824 patent would accomplish 20 something or would attempt to 21 accomplish voice activity detection. 22 It really does not acknowledge the 23 difficulty in estimating 24 signal-to-noise ratios in the first 25 place in high noise environments and	Page 65 1 STERN 2 (Time noted: 12:03 p.m.) 3 4 RICHARD M. STERN, PH.D. 5 6 Subscribed and sworn to before me 7 this ____ day of _____, 2024. 8 9 _____ 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

1
2 *** ERRATA SHEET ***
3 NAME OF CASE: Meta Platforms vs. Jawbone
4 Innovations
5 DATE OF DEPOSITION: March 26, 2024
6 WITNESS: Richard M. Stern, Ph.D.
7
8 PAGE LINE FROM TO
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24

RICHARD M. STERN, PH.D.

Witness and sworn to before me
this ____ day of _____, 2024.

(Notary Public) My Commission Expires:

0	11:31 52:16	30 34:24	7
091 14:16 17:6 18:12	11:43 52:17	31 43:13	7 55:21
1	12:03 65:2	32 21:7	72 47:7 48:15 48:16,18
1 19:11,14 20:24 30:18 32:5 34:25 35:7,8,23 37:7 37:10,17,18 38:5,13,14 40:4 41:3 45:25 46:3,5,6 47:13,22 48:8 48:10 53:13 54:14,24 55:11	13 8:21 40:4 14 8:21 63:7,9 145 47:19 148 58:10 154 58:10 16 25:25 160 47:20 18 63:8,9 1970s 9:9	4	74 47:7 48:15 48:16,18 789 41:13 47:24
10 19:13,16 20:16 30:15 35:2 36:9,15 38:22 47:22 48:8 50:6 57:12 62:3 63:18 1002 10:14 10166 3:7 10580 3:14 10:07 2:9 10:51 33:10 10:59 33:11 11 19:13,16 20:17 35:2 36:9,15 47:22 48:8 50:6 53:15 62:3 63:18	2	4 53:14 54:14 54:24 55:11,18 55:21 67:4 40 32:5,12,22 38:21 411 3:12 45 9:11 45th 7:24 46 24:11 58:16 59:8,10 60:17	8
	2 35:8 20 37:24 40:4 53:15 200 3:6 2022 12:9,14 13:20 2023 12:15 2024 1:17 2:8 65:7 66:22 68:5,23 206 3:13 21 43:13 212 53:2,6,7 26 1:17 2:8 68:5 28th 66:22	5	8 38:22 8,019,091 10:17 824 22:11 27:9 61:9 63:19 88 34:2,15 57:24 89 33:25 34:2 46:24
	3	5 41:12,23 42:8 43:12 54:5,21 55:8 5027 66:23 52 67:5 54 41:15 46:21 47:5,11 48:9 49:2 56 47:5,11 48:9 58 47:5,12 48:9	9
	3 11:16 21:6 24:10 35:15 58:16 59:10 60:17	6	9 25:23 63:7,9 90 46:4 96 37:3 98 57:24
		6 35:18 60 47:5,12 48:9 61 58:16 59:8 59:10 60:17 62 47:5,12 48:9 68 46:23,24,24 47:5,12 48:9 49:2	a
			a.m. 2:9 33:10 33:11 52:16,17 ability 6:3,6 25:9 60:8 able 22:21 23:5 28:7 above 53:13 54:14 absence 48:24 absent 22:24 28:8,10 57:14

absolutely 4:23 absorbing 43:16,21 44:4 44:5,7 absorbs 44:6 abstract 29:5 accelerator 32:14 accelerometer 29:12 30:23 32:15 34:24 35:22 36:6 accessible 9:13 accomplish 23:5 49:2 63:19,21 accomplished 50:8 61:5 accomplishes 27:20 accomplishing 27:10 accordance 24:18 60:3 accuracy 28:3 accurate 6:7 40:16 accurately 42:16 61:12,18 achievable 60:10 achieve 31:15 achieving 25:8 acknowledge 63:22	acoustic 18:24 20:20 30:8 43:9 61:6,21 acoustical 22:18 44:15,19 acronym 20:6 action 66:18 activated 39:24 50:7 activity 13:23 19:14,19,21,23 19:25 20:3,5 23:8 24:3 36:18 40:14,17 46:12,15 48:25 57:3,9,13 60:25 61:4,17 63:21 actual 42:8 actually 29:15 30:19 33:20 48:16,19 49:22 acute 40:6 adapt 35:13,14 35:15,18 adaptation 36:12 adaptive 22:7 23:18,21,24 24:17 35:12,14 35:18,25 36:12 36:19 48:2 59:21,25 60:12 62:22	added 50:25 62:3 adding 50:10 addition 29:10 34:13 54:5 additional 24:4 36:21 43:3 45:2,8 50:25 address 27:9 addressed 16:18 addressing 18:6 adequate 25:10 60:11 adopt 27:5 age 50:20 ago 8:13 13:21 48:21 agree 18:23 21:24 22:5 23:16 25:14 27:14 29:2 30:10 31:22 32:2 39:18 49:24 54:5 ahead 58:5 aim 29:18 30:3 30:6 air 55:24 56:5 airplanes 23:24 airport 52:5 alcivar 11:14 15:10 39:4,5,6 39:9,13,19,22	40:5,10,22 41:6 42:19 43:12,13 44:12 44:19 45:13,15 45:16,21 47:5 47:9,24 48:10 50:9,11 51:5 51:16 58:9 algorithm 22:16 28:6 allows 26:4 alterations 35:6 36:4 alternatives 16:22 amazon 9:21 9:24 12:9,16 12:18 13:18 15:2,7,13,17,22 16:16 ambient 49:19 annotations 7:3 answer 5:7,15 5:21,22 6:8 14:8 18:5,8 26:18 62:11 answered 20:8 51:19 answering 4:25 anticipate 14:15 17:5,7 17:23 anticipates 17:20 18:11
--	---	---	--

apologize 21:16 apparatus 51:9 appeal 1:3 appear 37:19 41:20 appearing 2:13 appears 6:20 62:2 applicability 51:10 application 7:13,17 44:7 47:8 applications 7:6 23:22 51:11 applied 61:15 appropriate 9:10 27:6 approximate 32:9 approximately 4:18,19 47:19 59:7 approximates 29:19 30:4,7 arrive 11:25 art 13:10,14 14:2,3,10,14,18 16:6,17 53:20 54:13,20,23 55:8,10 57:19 58:8 62:20 64:4	aside 11:18 asked 6:5 51:18 asking 4:24 31:17 46:17 assertion 27:3 associate 41:4 associated 6:21 22:19 assortment 12:11 assume 4:20 5:8 9:21 30:15 50:3 assumed 6:4 attempt 63:20 attention 14:6 31:4 52:25 55:18 attorney 4:10 5:19 8:5 10:7 attorneys 3:5 3:11 13:18 audio 29:3,9 45:19 46:8,10 august 12:24 13:5,8 avenue 3:12 avoid 39:23 aware 5:19 17:4,19 18:11 23:14 awhile 7:15 8:12	b b 17:14,14 34:16 36:11 b's 17:16 back 33:13 background 40:4 band 17:13,16 17:18 bandpass 43:4 46:7 bartlett 11:15 15:20 54:7,24 55:12 based 11:9,13 22:17 56:3 basically 17:2 35:23 37:19 46:9 basis 16:8 beautiful 7:25 began 12:24 13:4,4 beginning 46:20 61:24 begins 58:25 believe 13:7 53:17 54:9 best 5:6 10:5 better 17:2 32:21 beyond 53:6 binder 6:22 9:25	binders 6:19 bit 8:11 blocks 63:18 blood 66:18 bluetooth 50:19 board 1:3 body 38:5,12 bone 29:10 31:12 41:22 bonus 45:11 bottom 10:10 box 38:22,22 57:12 boxes 19:13,16 20:16 35:2 36:9,15 47:22 48:8,15 50:6 62:3 break 5:11,12 5:16 33:9,14 52:12 breaking 6:4 breathing 39:24 40:7 browser 7:12 building 7:23 bulk 13:18 butchering 28:18 c c 3:2 11:17 66:2 66:2 called 4:2
---	---	--	--

calls 20:25 21:21 canceller 21:19 22:2,6 24:21 25:7 26:2 60:6 60:7 cancellers 21:2 21:9,15,22 cancelling 22:17 23:23 25:8 60:8 capabilities 53:23 capable 25:7 careful 41:17 carefully 17:9 carnegie 8:23 case 1:8 6:8 9:21 12:18 18:21 28:24 39:10 51:4,8 61:14 68:3 cases 23:17 24:16 52:7 59:24 62:8 cathi 1:22 2:14 66:7,24 cell 52:5 certainly 10:23 24:7 certified 2:15 66:8 certify 66:10,16 challenge 53:14	change 59:11 60:17 63:10 channel 37:22 57:6,8 channels 56:19 characteristics 60:10 check 48:21 49:20 chose 16:19,20 circuit 37:7,17 46:11 circuitry 20:13 20:16 30:24 43:3 circumstances 27:5,11,23,24 29:17 56:20,21 cited 23:10 cites 10:25 11:24 claim 17:5,7,21 17:23,25 18:2 18:12 41:3 claims 14:16 17:11,13,19 18:7 40:25 41:9 49:21 53:15 clarify 5:6,6 class 8:9 9:3,7 9:14 classes 9:4 clean 6:18	clear 10:8 13:22 18:10 47:3 clearly 18:4 clever 22:16 close 7:9,11 41:25 42:3,14 49:12 clvs 1:22 66:24 coefficient 35:17 coefficients 31:2 35:11 36:2 48:2,4 49:4 collection 60:9 column 21:6 24:10 25:23 40:4 41:12,23 42:8 43:12 58:16 59:10 60:17 63:7,9 combination 11:13 29:16 30:9,25 31:2 32:18,22 34:9 34:22 37:2,6 37:16 49:7 51:17 57:23 58:9 64:6 combinations 16:17,20 17:2 33:17,21 34:17 54:13,20,23 55:8,10 57:10	57:19 combine 47:9 59:12 60:19 63:12 coming 35:22 38:22 61:6 command 22:8 23:18 24:16 26:6,13,23 27:17 59:21,25 commanding 26:7 commission 68:25 common 20:6 companies 12:20 complete 23:14 41:13 components 46:17,20 47:4 47:11 48:9 comport 11:3 computer 7:7 concerns 63:3 conditions 30:9 33:3 conducted 13:10 conduction 29:11 31:13 40:22 41:2,3,8 41:15,22 conductor 41:5
---	---	---	---

conference 16:4 confirm 10:7 13:7 40:24 connected 50:15 connection 13:11 50:19 consider 14:10 19:13,24 considered 9:10,13 56:25 constant 42:10 contact 41:16 41:25 42:4,15 50:12 content 18:7 continued 64:21 control 35:24 36:11 47:25 49:3 convenient 5:13 conventional 21:2,8,14,17,22 22:2 55:24 56:5 60:7 convergence 26:4 conversations 8:5 copy 6:18 10:11 45:22	cords 42:6,17 correct 4:16 11:19 16:10 18:8 19:4 20:20,21 28:14 31:25 32:7,25 33:7,23 34:18 35:4 38:18 39:2,20 42:18 43:16 44:20 48:11 49:9,10 50:13,14 51:3 54:15 58:22 59:7 corresponds 30:18 cost 45:4 counsel 57:22 58:14 63:6 count 47:20 county 66:5 couple 8:4,8 57:21 course 9:10 35:9 courts 6:25 cover 30:11 cowell 3:15 4:7 12:5 14:20 33:8,12 36:24 38:11,19 44:2 48:6,17 51:14 51:23 52:8,13 53:16 54:8,16 54:25 55:13	56:10,15 58:17 59:2,16 60:22 62:18 63:16 64:9,12 67:4 crr 1:22 66:24 curiosity 39:12 currently 8:22 9:4 customarily 26:6 cut 8:9 d d 17:14 20:5 67:2 date 63:2 68:5 day 8:7 50:20 64:13 65:7 66:22 68:23 deal 14:6 17:13 declaration 6:18,22 8:8,11 8:12 9:19,20 10:6,9,12 11:6 11:21,24 13:12 13:16 16:9,12 16:14,18,21,25 34:3 47:10,16 47:21 48:20 52:23 53:2,12 54:21 57:18,21 57:24 59:14,15 60:20,21 63:13 63:15 declarations 12:21	degree 44:22 degrees 12:13 46:4 demanded 24:25 dependant 17:23 dependent 17:11 18:7 23:5 depending 24:20 33:3 47:7,20 60:5 depends 18:2 28:6 deposed 4:15 deposition 1:14 2:11 8:3,17 9:17 66:12,14 68:5 describe 47:18 61:25 described 37:21 41:23 50:2,4 63:14 describes 23:3 23:12 29:6,6 30:24 61:3 63:18 describing 29:3 55:23 63:4 description 31:3 desired 22:23 22:25 24:19
--	---	---	--

49:17 60:4 detailed 16:20 detect 40:10,13 detected 46:12 detecting 19:23 19:25 detection 19:21 24:4 45:17 50:7 60:25 61:5 63:21 detector 19:15 20:5 36:18 45:20 46:8,10 determination 46:11 62:24 determine 35:11 48:16 determined 31:4 determining 23:7 28:4 developed 24:4 develops 56:17 device 23:4 45:4 55:23 56:4 devices 31:14 40:15 diagram 45:21 die 7:15 different 29:17 33:21 40:13,21 difficult 23:18 24:9,16,24 59:20,24 61:11	difficulty 27:10 63:23 digital 9:5 diminish 64:3 direct 21:6 45:25 52:25 55:18 directed 39:19 59:2 63:7 directly 20:3 47:25 disagree 25:18 discarded 16:23 disclose 17:18 18:24 20:11 40:25 disclosed 20:22 41:21 44:23 50:8,11 54:7 discloses 20:12 20:12 21:25 22:6,11 23:17 29:16 43:2 45:13 56:4,8 56:14 disclosure 53:19 56:4 discuss 21:14 21:21 discussed 16:16 16:23 28:11 32:8 57:22 59:14 60:21	discusses 20:25 discussing 37:2 57:17 discussion 12:24 13:3,4 39:4 discussions 13:17 16:15,21 displacement 29:13 distortion 25:9 26:5 60:9 disturbances 29:8 diver 39:25 44:9 diver's 40:6 41:16 divers 39:20 43:23 diving 51:8,13 document 10:24 29:24 37:12 41:11 43:18 47:17 53:9 55:3 doing 23:11 24:6 dozen 4:19 dr 4:8 28:20 33:13 52:20 55:17 drop 37:8 dropped 6:7	dropping 26:16 36:5 37:17 duly 4:3 66:13 e e 3:2,2 66:2,2 67:2 earlier 28:11 32:8 52:21 56:8 57:16 63:6 early 9:9 13:9 easily 61:11 east 7:25 ecuador 39:16 effective 23:22 eight 8:20 either 14:15 41:20 electronics 1:5 1:6 eliminate 36:15 emanating 42:25 emerged 13:16 16:14 emerges 43:22 ended 12:17 engaged 12:23 ensures 26:3 entire 17:20 37:7 38:5,12 entitled 9:5 entry 9:15 enumerate 54:19 55:7
---	--	--	---

environment 27:12 51:24 environments 24:8 51:21 63:25 equal 32:19 errata 68:2 especially 13:22 45:3 esq 3:8,15 essentially 37:8 37:18 estimate 19:16 19:18 22:22,24 24:3 estimated 56:23 57:5,7 estimates 22:18 56:17 61:10,19 estimating 63:23 estimation 24:8 27:8,11 estimator 38:23 estimators 57:11 evening 8:10,21 evidence 11:25 17:3 exactly 36:14 36:20 61:13 examination 4:6 52:18 67:3	examined 4:4 example 17:12 21:7 53:25 excuse 26:3 29:21 32:15 exhibit 10:14 exhibits 6:21 expectation 49:15 experience 61:8 62:12,16 expires 68:25 explain 56:13 explicit 35:21 exploit 44:25 express 28:2 extended 13:23 16:14 extent 43:4 extraneous 43:5 f f 66:2 fabricant 3:10 face 23:20 fact 42:19 43:6 44:23 48:25 fair 5:9,16 16:6 32:20 39:16 fairly 62:25 faithful 30:12 fall 13:9,20 familiar 4:20 18:17 62:21	far 53:6 feasible 24:25 felt 14:18 16:23 figure 19:11,14 20:24 21:18 30:12,14,15,17 30:18 32:4 34:25 35:7,21 35:23 36:20 37:7,9,17,18 38:5,12,14 41:18 45:25 46:3,5,6,23 47:13,22 48:8 48:10 figures 41:21 file 63:2 filter 35:15,18 36:19 46:7 60:12 filtering 62:22 filters 22:7 23:18,21 24:17 26:8 35:12,25 36:12 43:4 48:3 59:21,25 fine 53:7 64:16 first 22:13 24:13 25:2 30:18,21 33:24 34:9,13,20 35:14 38:2 41:13 45:17,20 49:16 55:18 59:3,4 63:24	five 8:6,18 10:21 11:2,8 11:12 33:9 52:21 flow 40:7 follow 34:3 followed 50:4 follows 4:5 form 12:3 14:12 16:8 36:7 38:8,16 47:14 51:6 53:16 54:8,16 54:25 55:13 56:10,15 58:17 59:16 60:22 62:18 63:16 formulate 16:11 forth 16:12 29:13 66:13 fremd 3:12 frequencies 43:6 front 6:15,17 7:4 10:12 19:6 26:17 30:11 41:19,19 full 4:13 6:3,6 6:11 fully 20:7 function 22:21 functionality 20:14 27:22 56:9,14
--	--	---	---

functions 22:20 further 64:7 66:16	ground 4:22 11:16,17 54:5 54:21 55:8	hum 34:21 hundreds 17:17	60:16,19 61:3 61:25 63:7,10 63:12,18
g	grounds 10:21 11:2,4,8,12 16:9,12 52:22 53:13,13 54:14 54:14,24 55:11	hussein 11:16 15:25 hyphens 17:15	ikeda's 27:14 illegal 7:13 immediately 58:24
gain 33:4,5 gas 40:7 generally 35:14 42:10 generate 29:19 30:4,7 generated 32:12 getting 61:17 give 6:3,6,11 14:8 37:11 57:25 given 66:15 gives 33:4 go 4:21 7:16 36:19 47:25 52:14 58:4 goes 46:7 going 22:23 34:5 44:21 56:18 57:20 good 4:8,9,9 23:24 25:21 40:3 41:16 44:22 grabs 28:22 grace 3:8 graduate 9:11 9:15 great 14:6	h hand 10:10 66:22 hastings 3:4 7:22 headphone 41:22 headphones 23:23 heard 21:17 heavily 62:25 hereinbefore 66:12 hereunto 66:21 high 19:19 24:7 56:23 57:8 61:12 63:25 highly 61:16 62:13 hired 12:6 holder 44:13 hours 8:6,9,15 8:18,20,20,21 housekeeping 46:25 huh 24:12	i ideally 35:17 identified 14:17,24 15:12 15:17 identify 28:7 ikeda 11:14 14:21 18:14,20 18:24 19:2,5,9 19:17 20:10,19 20:23,25 21:14 21:21,25 22:5 22:14,15 23:3 23:12,17 24:2 24:11 25:5,14 25:16 26:11,15 26:21 27:15,16 28:2,12 33:18 33:21 35:2,6,8 36:4 37:10,18 38:2,6,14,21 40:20 47:10,12 47:23 48:3,8 49:7,13,24 50:2,4,16 51:2 51:5,16 56:8 56:13,16 57:19 58:9,15,22 59:9,11,12	impaired 6:2,6 implementati... 44:25 implemented 53:24 implies 32:18 impression 22:14,15 improve 45:3 inception 9:9 include 17:24 53:14 54:6,12 included 11:20 54:13,20 55:8 includes 11:16 including 12:20 43:3 46:22 50:5 58:15 incorporated 10:13 38:6,14 increases 33:4 33:5 independent 17:19,25 indicate 57:13 indicated 25:11 59:18 60:12

indicates 48:24 indication 40:16 indirect 19:22 19:25 individual 42:11 information 23:25 57:12 informed 18:3 inherited 9:23 initial 15:2 21:17 initially 14:23 innovations 1:9 68:4 input 19:17,20 19:20 20:20 26:6 30:22 31:4 inputs 19:2 20:22 22:17 30:25 36:10,15 inside 43:11 52:3,4 inspection 31:5 instigated 12:12 instructions 41:6 instructs 5:21 interactions 6:24 interested 66:19	interesting 9:8 intervals 28:8,9 57:4 intervening 9:11 invalidity 10:21 11:2,5,9 invent 27:16 invention 20:22 25:3,6,17,19 26:12,22 27:3 27:15 31:21 50:22,23 58:25 59:5 61:14,24 62:4,9 inventional 21:18,19 involved 14:5 involvement 12:17 ipr 9:24 ipr2023-00253 9:22 ipr2023-01127 1:8 9:18 10:3 irish 1:22 2:14 66:7,24 isolated 42:20 43:14,20 isolation 44:15 44:20 45:8 issue 21:25 issues 26:3	j jawbone 1:9 9:24 12:13,17 12:22 68:3 job 23:24 june 12:14 junior 4:14 juniors 9:14 jurat 64:21 k killling 7:14 kind 40:13,21 know 5:12 14:4 28:19 33:16 35:24 39:13 48:18 53:5 61:7 knowledge 10:5 27:12 l labeled 6:23 9:22 10:3,13 20:23 30:23 35:18 41:21 large 46:14 largely 28:10 larynx 42:2,4 42:15 43:2 45:7 late 13:8 law 7:22 layer 43:15,20 leading 46:21	learning 23:19 23:25 24:17 25:10 26:7 60:2,11 legal 6:24 14:25 15:7,13 15:17,22 16:15 letters 37:9,19 level 9:7,15 24:19 60:3 levels 62:22 lg 1:5 likely 57:2,8 62:8 limitations 17:25 line 21:7 24:11 25:25 46:20 58:16,16 59:10 63:7 68:8 linear 30:25 lines 40:4 43:13 55:21 59:8 60:17 link 7:7 listed 31:14 literature 62:21 litigation 12:12 12:22 litigations 15:2 little 8:10 23:2 35:19 41:17 llc 1:9 9:25
---	---	---	--

llp 3:4,10 load 19:20 locate 14:21 15:3,9,14,19,24 16:7 located 15:22 24:22 60:6 locations 50:5 long 13:21 look 10:9 19:7 24:10 30:11 32:4 34:15 41:18,18 43:12 61:16 looked 17:9 looking 9:25 14:14,19 27:15 30:14,20 33:25 35:7 45:20 58:23 looks 10:2 37:21 lot 27:7 low 56:25 57:6	makes 39:25 46:16 manhattan 7:24 manner 59:14 60:20 63:14 march 1:17 2:8 66:22 68:5 marginal 45:4 markings 7:2 marriage 66:18 martin 4:13 material 9:12 43:16,21 44:4 44:5,8 materials 6:14 7:4 matter 66:20 means 40:20 50:8,10 53:24 61:4 measuring 20:2 mechanical 43:8 45:5,9 mechanisms 31:6 medications 6:2,5,9 meetings 7:10 meets 41:4 mellon 8:24 memory 8:13 13:22 mentioned 9:2 31:7	mere 44:23 merely 40:19 messages 7:13 messed 22:3 meta 1:5 9:23 10:2,13 12:20 12:24 13:4,5,9 68:3 metlife 7:23 microphone 29:9 30:22 31:9,11,18,19 31:21 32:14,23 33:5 37:22,24 37:24 38:2,10 38:13 40:23 41:4,5,8,15,23 41:24 42:14,21 42:24 43:7,10 43:14,20 44:14 45:6,18 46:7 46:13,21 49:16 49:18 50:12 56:23,25 57:6 microphones 19:3 20:23 36:10 49:8,9 49:11,25 50:5 51:10,21 55:24 56:5,20 61:7 61:22 mind 26:19 51:15 mined 62:25	minimum 26:4 minus 38:9,13 minute 28:15 33:9 mischaracteri... 43:18 48:13 misheard 21:16 mixture 30:24 mode 36:17 modifications 36:22 modified 48:4,5 49:4 moment 53:3 57:25 morning 4:8,9 4:9 motion 45:9 motivated 61:16 62:2,14 64:5 motivates 61:3 motivation 62:17 mouth 49:12 multiple 14:5
m			n
m 1:15 2:11 4:2 65:4 66:11 68:6,20 mail 7:14 maintain 44:14 45:5 major 40:14 make 23:13 35:5 36:3 46:11 49:23			n 3:2 17:14 67:2 name 4:11,13 68:3 nassau 66:5 national 16:3 natural 44:8

nature 27:13 42:23 near 45:6 necessarily 40:17 50:18 neck 41:16 need 5:11 22:6 26:23 27:17 28:3 36:3 45:7 48:15 needed 8:13 needing 26:12 26:14,15 needs 42:3 43:14 never 26:15 new 1:16,16 2:17 3:7,7,14 66:3,10 noise 19:17,19 21:2,9,15,19,22 22:2,6,17 23:3 23:23 24:7,20 24:21 25:7,8 26:2 27:8 28:9 35:16,20 38:23 40:11,18,19 43:5 49:19 51:22 56:17,22 56:24 57:5,7 57:11 60:4,6,7 60:8 61:12,20 62:22,23 63:24 63:25	noises 39:24 40:2,7,7 42:21 43:15 noisy 51:21,24 52:2 non 18:24 nonspeech 28:5 normal 64:17 normally 45:10 notary 2:16 4:4 66:9 68:25 note 22:13 noted 42:7 65:2 notes 7:3 number 10:17 32:5 34:24 35:15 45:24	obtain 61:11 obtained 61:12 61:19 obvious 14:15 53:22 59:12 60:18,24 63:11 obviously 38:10 obviousness 11:9,21 53:20 64:3 occur 26:5 office 1:2 offices 7:23 oh 24:15 okay 6:10,14 7:16,18 8:2 18:16 19:9 20:4 28:17 31:7 33:19 34:19 53:10 once 14:16 open 7:6 opened 7:17 operated 39:19 operation 23:4 26:7 opined 11:5 opinion 20:10 28:2 45:12 59:11 60:18 62:6,14 63:11 64:2 opinions 11:21 12:2	opportunities 45:2 opposed 43:9 order 17:22 22:20 orders 64:11 ordinary 62:20 64:4 original 51:7 originally 12:8 outcome 66:19 output 32:5,9 37:23,23 38:25 47:25 outside 22:9 23:19 24:2,18 25:11 26:6,13 26:24 27:18 45:9 60:2,24 64:5 own 22:4 owner 1:10 3:11
	o		p
	object 5:19 25:6,17 40:15 62:9 objection 12:3 14:12 36:7 38:8,16 43:17 47:14 48:12 51:6,18 53:16 54:8,16,25 55:13 56:10,15 58:17 59:16 60:22 62:18 63:16 objective 25:19 25:19 27:19,21 32:11 35:10 39:22 48:22		p 3:2,2 p.m. 65:2 page 10:16 30:18,21 45:20 55:18 64:21 67:3 68:8 pair 22:19 paper 16:4 papers 6:23 17:17 23:9

paragraph 33:25 34:15 37:3 41:14 42:8 44:12 53:2 55:19 59:3,3,4 paragraphs 47:19 57:24 58:10,22 59:19 61:22 parameter 35:9 parameters 22:19,22,25 park 3:6 7:24 parsing 24:23 part 13:12 35:10 44:9 participant 16:3 participants 2:12 particular 12:18 particularly 40:6 parties 6:25 66:17 pass 52:9 patent 1:2,3,10 3:11 10:17 14:6,16 17:6 18:12 22:11 27:9 41:13,20 43:2 45:21,23 47:24 49:21	59:23 61:9 63:2,19 patents 14:5 paul 3:4 7:22 pay 14:5 31:4 pd 30:22 37:22 37:24 38:9,13 pending 5:14 pennsylvania 8:25 people 17:15 51:8 perform 24:17 60:2 performance 45:3 period 13:24 periods 28:4 57:3 permitted 35:12,13 person 42:9,10 62:19 64:4 personal 61:8 62:12 perusing 10:24 29:24 37:12 41:11 47:17 53:9 55:3 petition 10:2 10:22,25 52:22 petitioners 1:7 3:5 ph.d. 1:15 2:12 4:2 65:4 66:11	68:6,20 phone 52:5 physical 43:22 50:12 pick 42:5,16,24 pickup 29:3,7 29:10 33:3 pittsburgh 8:24 place 13:19 34:12,20,25 41:7 44:14 63:25 placed 49:25 50:2 platforms 1:5 10:13 68:3 plausible 21:5 please 4:11 5:5 5:12 19:8 30:2 37:14 55:5,17 56:13 64:11 plurality 31:14 plus 33:18 54:24 55:11 point 5:4,13 7:16 12:15,23 22:10 39:17 48:19 57:20 pointed 27:20 pointing 37:20 58:14 portion 53:11 55:22 58:21 59:9,11 60:16 63:10,17	portions 57:17 58:15 posita 62:15 63:12 position 42:9 45:6 possible 43:5 possibly 48:15 power 38:23 practical 62:7 prepare 8:2 preparing 8:16 presence 48:24 present 23:2,3 23:8 25:6 28:9 35:16,16,19,20 57:14 presented 16:5 pressure 29:8 55:24 56:5 presumably 41:25 previous 18:5,8 previously 59:18 primarily 42:24 43:7,10 49:16,18 prior 13:10,14 14:2,3,10,17 16:6,17 27:12 53:20 54:12,20 54:23 55:7,10 57:19 58:8
--	--	--	---

probably 7:13 50:24 problem 40:5 problems 27:25 28:12 proceed 38:4 proceeding 10:16,20 12:7 12:10 13:11 proceedings 12:11 process 4:21 processed 32:13 processing 9:6 17:14,16,18 processor 53:25 54:6 professional 2:14 66:8 professor 8:23 pronunciation 28:19 39:7,13 pronunciations 28:21 proper 39:13 properly 22:21 42:5 properties 43:22 proposal 47:21 48:7 51:5 propose 33:20 34:17 37:16	proposed 33:17 40:20,25 62:6 proposes 24:2 proposing 34:23 provide 25:7 40:16 44:15 provided 6:20 15:12 16:25 provides 20:13 27:22 41:6 45:7 proximity 49:12 public 2:16 4:4 66:9 68:25 published 23:9 purely 20:19 purports 27:16 purpose 44:4 60:13 put 17:15 34:25 40:12 47:12 puthuff 11:14 15:4 28:16,23 29:2,5,6,15,18 29:22 30:3,6 30:12 31:9,11 31:18,21,23 32:3 33:2,18 33:22 34:25 35:23 36:13 37:8 38:12 55:16,22 56:3 57:23	puthuff's 34:10 34:24 37:6,16 q question 5:8,14 5:15 9:8 14:9 20:8 21:13,17 22:4 26:19 29:25 37:13 42:13,13 55:4 60:14 61:23 questions 4:25 5:5,20,22 52:9 64:8,9 quick 4:22 52:11 quite 8:12 quote 62:13 r r 3:2 66:2 range 30:8 rapid 26:3 rather 32:16 36:5 40:17 ratio 27:8 38:23 40:11,18 40:19 56:22,24 57:5,7,11 62:23 ratios 19:17 56:18 61:20 63:24 read 24:13 53:3 53:6,8	reading 59:18 59:22 ready 53:5 real 12:25 13:23 really 7:12 14:4 14:13,14 35:10 49:14 59:17 62:5 63:22 realtime 2:15 66:8 reason 6:10 42:13 61:2 reasonably 25:18 reasons 61:25 recall 21:3 52:20 56:7 57:16 58:2,7 58:12,13,14,18 63:8 received 56:22 receiving 22:8 recently 13:2 recess 33:10 52:16 recitation 11:18 record 4:12 47:4 52:15 66:14 reducing 25:9 refer 10:22 20:4 46:19 62:12
--	---	--	--

reference 14:22 14:23 15:4,10 15:15,20,25 17:24 18:11,15 18:18,21 19:3 19:5,9,18 29:6 29:23 38:3 55:12,17 56:16 referenced 53:21 55:11 references 16:8 16:24 17:5,12 59:13 60:19 63:13 referring 53:12 refresh 8:13 regard 17:10 18:9 23:15 regards 9:17 registered 2:14 66:7 reject 43:4 rejected 16:19 relate 57:18 related 12:11 66:17 relating 58:8 relatively 23:2 relied 11:25 54:23 59:13 60:19 63:13 rely 10:6 remain 42:10 remaining 62:3	remember 21:4 40:14 remote 1:14 2:11 removed 51:22 render 14:15 repeat 29:25 37:13 55:4 repeated 45:22 repeating 26:19 rephrase 5:7 replace 36:14 37:22 47:22 48:7 replaced 37:25 replacement 34:14 36:17,23 replacing 50:6 report 37:3 reported 1:21 reporter 2:15 2:15 64:10 66:8,9 representation 23:13 24:5 representing 14:25 reproduction 30:13 resort 26:12,23 resorting 26:5 respond 43:10 response 12:12 26:17	responsive 49:16,19 rest 30:23 50:16 restate 21:12 restaurant 52:2 retained 12:8 13:5,9 review 49:13 reviewing 8:8 8:11 29:22 41:9 47:15 richard 1:15 2:11 3:15 4:2 4:13 65:4 66:11 67:4 68:6,20 right 4:22 6:15 7:8,19 9:18 10:10,18,21 11:10,15,22 12:2 18:8 20:17,18 24:11 25:25 26:13,24 26:25 27:18 28:13 29:4,20 30:5,10,17,20 31:10,19,24 32:4,6,10,16,24 33:6,22 34:5 34:11 35:3 36:4,9 37:4,8 37:10,20 38:7 38:15,24 39:6 40:2,8,11,23	41:8 42:6,12 42:17,22 44:11 45:13 47:6 49:8 50:17 51:2 54:4 58:24 river 7:25 role 62:21 room 7:19 33:4 rotated 46:4 rough 64:12,16 rpr 1:22 66:24 rules 4:22 rye 3:14 s s 3:2 17:14 safari 7:12 sasaki 11:14 15:15 saying 23:14 25:15,20 26:25 30:21 44:3,6 says 10:11 46:15 49:14,22 schmitt 46:9,10 46:22 screen 26:16 se 14:3 search 13:11,15 14:2,3,11,11 16:7 second 29:21 31:12,12,13 35:17,17 36:25 37:5,11,15
---	---	--	--

49:18 55:2 section 47:8 53:3 59:6 sections 25:10 57:21 60:11 see 25:12 26:9 34:12 39:17 41:12 44:17 45:12,19 46:8 49:21 55:22,25 seek 60:24 64:5 seeking 28:12 seems 6:23 21:5 seen 18:20 24:15 28:23 39:9 seniors 9:14 sense 19:4,22 sensed 29:8,11 sensor 18:25 29:12,13 31:12 31:12,13,24 32:24 33:6 34:10 36:13 40:13,21,25 43:8,9 44:23 44:24 51:2 54:2 sensors 22:18 29:11,16 30:9 sentence 24:13 24:23 25:3 26:2 44:11 sentences 53:4	separate 41:2,3 series 16:15,25 serves 44:4 set 16:12 22:24 46:14 66:13,22 settled 9:24 12:16 seven 8:19 sheet 68:2 show 37:9 shown 37:7,17 side 10:10 38:21 signal 9:6 19:16,19 22:23 22:23,25 24:19 24:20 25:9 26:4 27:8 29:19 30:4,7 31:20 32:5,9 32:12,22 35:22 36:18,19 37:25 38:21,23 40:11 40:18,19 45:18 46:6,14 47:2 48:23,24 49:17 49:17 56:17,22 56:24 57:5,7 57:11 60:4,5 61:18,20 62:23 63:24 signals 27:13 32:13,23 35:8 35:9 56:18 61:6,21	signature 66:23 similar 20:13 39:25 62:15,16 simple 44:13 49:23 simply 25:16 44:22 50:6 53:18 single 46:14 sir 8:22 sitting 6:15 situation 24:21 39:23 60:5 situations 61:13 six 16:7 size 35:9 skill 62:20 64:4 slow 64:15 snr 24:8 27:10 61:10 62:23 solution 24:2 25:21 27:4 62:5 solve 28:13 somebody 15:7 15:12,13,22 somewhat 4:20 23:10 sony 1:6 12:21 soonest 5:13 sorry 9:20 14:9 22:3 26:18 41:2 48:14 58:4,13 59:22	sort 50:16 sound 5:16 29:7 43:15,21 44:3,5,6,7 sources 14:17 24:5 30:22 43:5 53:21 60:24 64:6 south 3:13 spanish 39:14 39:15 speaking 39:14 51:20 specific 17:11 42:9 57:20 specifically 46:22 specification 49:20 specified 49:15 specifies 36:21 speech 28:4,8,9 29:20 30:5,8 35:16,19 49:17 spend 8:16 13:25 spending 14:7 spent 8:7,10 spot 35:21 spring 12:9 13:19 ss 66:4 start 20:9 32:3 48:22 49:8
---	---	---	--

started 28:24 39:10 starting 25:25 55:21 state 2:16 4:11 32:20 66:3,10 stated 25:18 41:14 53:18 54:10 59:19 61:9 62:13 statement 59:23 states 1:2 stating 25:16 station 52:4 step 35:9 stepping 52:3 stern 1:15 2:12 4:2,8,14 5:1 6:1 7:1 8:1 9:1 10:1 11:1 12:1 13:1 14:1 15:1 16:1 17:1 18:1 19:1 20:1 21:1 22:1 23:1 24:1 25:1 26:1 27:1 28:1,20 29:1 30:1 31:1 32:1 33:1,13 34:1 35:1 36:1 37:1 38:1 39:1 40:1 41:1 42:1 43:1 44:1 45:1 46:1 47:1 48:1 49:1 50:1 51:1 52:1	52:20 53:1 54:1 55:1,17 56:1 57:1 58:1 59:1 60:1 61:1 62:1 63:1 64:1 65:1,4 66:11 67:1,4 68:6,20 stop 53:7 stopped 14:19 stopping 5:13 straight 36:22 street 52:6 strike 20:9 22:3 31:8 58:13 stronger 16:25 structure 62:4 students 9:11 9:14,15 stupid 46:3 sub 17:13,16,18 subscribed 65:6 substitution 34:14 sufficient 14:18 25:8 60:8,9 sufficiently 46:13 suggest 47:10 suit 43:23 44:9 suite 3:13 summary 25:3 40:3 58:25 59:4,5 61:24	summer 12:15 13:9,20 summing 26:11 26:21 32:16,18 summoning 32:13 sure 5:18 14:24 20:7 30:3 37:15 49:14 52:13 surrounding 61:23 switch 39:20,24 sworn 4:3 65:6 66:13 68:22 system 26:22 27:16,21 28:13 29:3,7,10 30:13 49:7 50:3,17	talking 21:8 28:20 52:5 teach 8:9 teaches 26:15 teaching 9:3,4 team 14:25 15:8,13,18,23 16:16 technologies 31:15 telling 25:5 43:13 tells 40:5 42:19 44:12 term 21:4 testified 4:5 testimony 6:7 6:11 48:13 52:21 56:7 58:2,8,12 66:15 text 22:11 47:16 59:22 thank 4:23 33:15 34:5,8 46:5 theodore 3:12 thing 25:20 36:14 things 16:19 27:6,13 think 10:15 11:17 27:14 33:24 46:2
		t	
		t 66:2,2 take 5:12,16 8:18 23:20 24:10 33:8 34:23 36:10 37:6 47:11 52:11 53:3 64:12,16 taken 13:19 33:10 52:16 talk 18:14 28:15 33:17 34:19 36:25 46:5	

thinking 18:4 51:25 thorough 14:11 thought 47:23 thousands 17:17 three 64:13 thresholding 31:5 throat 41:22,24 41:24 42:14,21 42:24 43:7,11 43:14,19 45:6 45:18 46:6,13 46:21 48:23 50:11,13 51:10 time 5:11,18,18 8:11 13:6,21 13:24,25 14:7 50:21,23 57:3 57:4 62:25 65:2 times 4:18,19 57:10 tissue 40:22 41:2,3,5,7,14 41:16 title 30:16 today 4:24 6:2 6:12 9:16 51:12 52:21 56:8 57:16 63:6 today's 8:3,16	topic 23:9 total 8:15 totalling 8:6 town 7:24 track 64:15 trademark 1:2 train 52:4 transfer 22:20 transmit 39:23 trial 1:3 trigger 46:9,10 46:23 true 66:14 truthful 6:11 trying 21:18 40:24 46:23 tuesday 1:17 turn 19:11 25:2 25:23 28:16 39:3 55:16 57:25 turnaround 64:13 two 6:19 8:20 17:13,15 19:3 20:23 22:18 30:21,25 33:20 34:17 49:8,9 49:11,24 55:23 56:5,19 58:21 61:21	uh 24:12 um 34:21 unclear 5:5 under 6:5,9 25:3 27:5,11 29:17 30:8 understand 5:2 5:23 9:16 10:16 17:22 52:8 53:11 understanding 9:23 11:4 12:16,19 54:22 55:9 56:2 understood 5:8 united 1:2 university 8:24 unmarked 6:18 update 22:7 35:25 use 23:23 43:2 49:3 51:4,7,16 52:6 54:6 61:13 62:7 used 12:21 19:18,21 29:17 31:15 37:23 39:20 44:13 51:11 57:12 useful 14:8 27:22 user's 29:20 30:5 32:10 49:12 50:13	uses 31:9,11,18 31:23 40:12,22 using 30:9 34:9 53:24 61:5 utilizes 29:7
			v
			v 20:5 vad 20:5,11,14 20:14 34:10 45:13,15,16 46:16,18 47:4 47:23 56:9,14 value 23:21 varies 42:9 various 6:21,24 16:24 53:23 57:18 58:15 varying 12:13 velocity 29:12 vibration 29:11 31:23 32:24 33:6 34:10 42:5,16 43:8,8 44:24 46:12 vibrations 42:25 43:11 videoconfere... 2:13 view 7:25 vis 12:22,22 vocal 42:6,17 voice 19:14,18 19:21,23,25 20:3,4 24:3 32:10 36:18

39:19 50:7 57:2,9,13 60:25 61:4,17 63:21 voicing 23:8 40:14,16 46:15 48:25 51:11 53:25 vs 1:8 68:3	water 44:16,20 45:9 waterborne 43:15 way 19:22,25 24:6 26:16 33:2 36:8,20 61:17 66:19 ways 23:7,11 we've 50:25 wearing 43:24 44:10 web 7:12 webex 7:10 week 8:5,19 weighted 32:17 weights 32:19 welcome 33:13 whereof 66:21 wide 30:8 widespread 51:9 wire 50:16,19 50:24 witness 4:3 10:24 12:4 14:13 29:24 36:8 37:12 38:9,17 41:11 43:19 47:15,17 48:14 51:7,20 52:10 53:9,17 54:9,17 55:2,3 55:14 56:11,16 58:18 59:17	60:23 62:19 63:17 66:12,15 66:21 67:3 68:6,22 words 31:3 work 8:22 12:6 12:25 13:19 27:7 worked 12:10 18:21 working 28:24 39:10 works 20:19 33:2 written 8:12 wrote 48:20	years 9:12 39:14 yesterday 8:7 8:19 9:3 york 1:16,16 2:17 3:7,7,14 66:3,10
w			z
w1 35:12,25 48:3 49:4 w2 35:12,25 48:3 49:4 wait 64:15 wang 3:8 8:5 10:7 12:3 14:12 36:7 38:8,16 43:17 47:14 48:12 51:6,18 52:11 52:14,19 54:3 54:11,18 55:6 55:15 56:12 57:15 58:20 60:15 62:10 63:5 64:7,14 67:5 want 7:12 22:13 27:5 28:15 34:3 44:25 47:20 48:21 53:8 wants 44:19			z 37:9,19 zoom 7:7,17
			à
			à 12:22
		x	
		x 67:2 xa 19:20 20:23 36:11,16 37:9 37:19,25 56:19 56:23 57:6 61:7 xb 19:20 20:24 36:11,16 56:19 56:25 57:8 61:7	
		y	
		yeah 21:11 24:15 30:20 37:24 40:3 44:21 47:7 year 48:21	

Federal Rules of Civil Procedure

Rule 30

(e) Review By the Witness; Changes.

(1) Review; Statement of Changes. On request by the deponent or a party before the deposition is completed, the deponent must be allowed 30 days after being notified by the officer that the transcript or recording is available in which:

(A) to review the transcript or recording; and

(B) if there are changes in form or substance, to sign a statement listing the changes and the reasons for making them.

(2) Changes Indicated in the Officer's Certificate. The officer must note in the certificate prescribed by Rule 30(f)(1) whether a review was requested and, if so, must attach any changes the deponent makes during the 30-day period.

DISCLAIMER: THE FOREGOING FEDERAL PROCEDURE RULES ARE PROVIDED FOR INFORMATIONAL PURPOSES ONLY.

THE ABOVE RULES ARE CURRENT AS OF APRIL 1, 2019. PLEASE REFER TO THE APPLICABLE FEDERAL RULES OF CIVIL PROCEDURE FOR UP-TO-DATE INFORMATION.

VERITEXT LEGAL SOLUTIONS

COMPANY CERTIFICATE AND DISCLOSURE STATEMENT

Veritext Legal Solutions represents that the foregoing transcript is a true, correct and complete transcript of the colloquies, questions and answers as submitted by the court reporter. Veritext Legal Solutions further represents that the attached exhibits, if any, are true, correct and complete documents as submitted by the court reporter and/or attorneys in relation to this deposition and that the documents were processed in accordance with our litigation support and production standards.

Veritext Legal Solutions is committed to maintaining the confidentiality of client and witness information, in accordance with the regulations promulgated under the Health Insurance Portability and Accountability Act (HIPAA), as amended with respect to protected health information and the Gramm-Leach-Bliley Act, as amended, with respect to Personally Identifiable Information (PII). Physical transcripts and exhibits are managed under strict facility and personnel access controls. Electronic files of documents are stored in encrypted form and are transmitted in an encrypted

fashion to authenticated parties who are permitted to access the material. Our data is hosted in a Tier 4 SSAE 16 certified facility.

Veritext Legal Solutions complies with all federal and State regulations with respect to the provision of court reporting services, and maintains its neutrality and independence regardless of relationship or the financial outcome of any litigation. Veritext requires adherence to the foregoing professional and ethical standards from all of its subcontractors in their independent contractor agreements.

Inquiries about Veritext Legal Solutions' confidentiality and security policies and practices should be directed to Veritext's Client Services Associates indicated on the cover of this document or at www.veritext.com.