

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

SAMSUNG ELECTRONICS CO., LTD.,

Petitioner,

vs.

Nos. IPR2022-00062
IPR2022-00064

NETLIST, INC.,

Patent Owner.

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REMOTE VIDEO DEPOSITION OF  
EXPERT ROBERT J. MURPHY

October 27, 2022

9:29 a.m.

Susan F. Magee, RPR, CCRR, CLR, CSR No. 11661

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Thursday, October 27, 2022

9:29 a.m.

THE VIDEOGRAPHER: Good morning. We are on the record at 9:29 a.m. on October 27, 2022. This begins the videoconference deposition of Robert Murphy taken in the matter of Samsung Electronics Co., Ltd., vs. Netlist Inc. concerning Cases IPR2022-00062 and IPR2022-00064.

My name is Mike Cooper. The court reporter is Susan Magee, and we represent Esquire Deposition Solutions.

Would all counsel present please introduce yourselves and whom you represent.

MR. CHANDLER: Good morning. This is Ted Chandler from the law firm of Baker Botts LLP on behalf of the Petitioner Samsung Electronics Co., Limited, and with me is my colleague Ferenc Pazandi from our San Francisco office.

MR. ROE: And this is Scott Roe from Gibson, Dunn & Crutcher on behalf of the Patent Owner Netlist, Inc. and the witness.

And before we get started, Ted, your screen is frozen on our end. We're doing this remotely.

THE VIDEOGRAPHER: He's moving okay for me.

1 I'm not sure about the court reporter.

2 MR. CHANDLER: I don't plan to present  
3 anything on my screen. I'm moving on my screen, so  
4 I'm willing to move forward if you are. If -- do you  
5 want to go off the --

6 MR. ROE: Yeah, absolutely. Just wanted to  
7 let you know that there's that technical issue on my  
8 end if it became an issue, but please proceed.

9  
10 ROBERT J. MURPHY,  
11 having been administered an oath, was examined and  
12 testified as follows:

13  
14 EXAMINATION BY MR. CHANDLER

15  
16 Q. Please state your name for the record.

17 A. Robert J. Murphy.

18 Q. What do you do for a living, Mr. Murphy?

19 A. I presently am -- I have two things I'm  
20 doing presently. I'm the vice president of  
21 engineering at a company called IC Manage that makes  
22 software, and it's software that does basically  
23 revision control for semiconductor chips. And I will  
24 say with -- inside that, one of our customers is  
25 Samsung. I've had this job for slightly over a year

1 and a half, and I have -- since I started the case  
2 before I got that job, I notified the company that I  
3 had this ongoing case, and what we've done is  
4 segmented the pieces out. I don't have any  
5 interaction with Samsung. Everybody else at IC  
6 Manage takes care of, like, the applications  
7 engineers who interact with Samsung in that matter.

8 So I do that, and then I also have my own  
9 consulting firm, Firenza LLC which I've had for --  
10 basically since 19-- roughly 1998, and in that I  
11 have designed intellectual property that is  
12 subsections of integrated circuits for other people.

13 And then along the way, I got involved in  
14 doing legal work for people with respect to patents  
15 in the semiconductor arena.

16 Q. Could I ask you to do us a favor which is,  
17 if you use a word that's not in the normal English  
18 dictionary, could you spell it out? You'll have an  
19 opportunity later after the end of the deposition to  
20 correct the transcript, but it can be more efficient  
21 if you remember just to spell it out at the moment.

22 So I think you used the word "Firenza." How  
23 do you spell that?

24 A. Oh, I'm -- I'm sorry. F-i-r-e-n-z-a, and  
25 it's an LLC.

1 Q. Mr. Murphy, were you retained by Netlist to  
2 provide opinions related to Netlist's '218 patent?

3 A. Yes.

4 Q. Were you retained by Netlist to provide  
5 opinions related to Netlist's '595 patent?

6 A. Yes.

7 Q. What is your home address?

8 A. My home address is 72 Fairview,  
9 F-a-i-r-v-i-e-w, one word, Plaza, Los Gatos, two  
10 words, L-o-s G-a-t-o-s, California 95030.

11 Q. And if somebody wanted to reach you in the  
12 future by telephone, what will be a good telephone  
13 number to call?

14 A. (408) 396-6098.

15 Q. And if somebody wanted to reach you in the  
16 future by e-mail, what would be a good e-mail address  
17 to use?

18 A. murf@firenza-llc.com. That's  
19 m-u-r-f-@-f-i-r-e-n-z-a-llc.com.

20 Q. Given that this is a remote deposition,  
21 meaning that we're not in the same physical room  
22 together, there are a few questions that I need to  
23 ask starting with, where are you physically located  
24 right now during this deposition?

25 A. So I'm physically located in the Gibson Dunn

1 building in Palo Alto. I'm sorry. I don't know the  
2 exact address here. Maybe my counsel can provide the  
3 address if you need that.

4 Q. And who else, if anyone, is in the room with  
5 you right now?

6 A. Just Counsel Scott Roe.

7 Q. Anyone else?

8 A. No.

9 Q. Given that I cannot see the room that you  
10 are in, will you please let us know if somebody  
11 enters the room that you're in at any time before  
12 this deposition ends?

13 A. I will.

14 Q. Mr. Murphy, did you bring anything with you  
15 to your deposition today?

16 A. I did not.

17 Q. And I see some binders of printed documents  
18 in front of you. Could you just generally describe  
19 what those are? For example, are those simply --

20 MR. ROE: I will represent on the record,  
21 Ted, you had asked that we print some materials in  
22 advance of the deposition here, and the materials  
23 that you had requested are on the table there in the  
24 binders. And there are some additional materials  
25 that -- you had asked of us for everything to be

1 printed. Those are at the end of the table here off  
2 the screen. If we need to get to those, I'll provide  
3 the witness those copies as well.

4 BY MR. CHANDLER:

5 Q. And Mr. Murphy, are you aware of anything in  
6 front of you that I have not seen before? So for  
7 example, anything that was not an exhibit or a paper  
8 that was filed in these IPRs?

9 MR. ROE: That was not an exhibit? Ted,  
10 lacks foundation. He hasn't even looked at the  
11 binders yet, so that's -- I think that question lacks  
12 foundation. I'll represent to you that in the  
13 binders are the papers from the IPR and exhibits.

14 BY MR. CHANDLER:

15 Q. And what I'm getting at is, nothing else; is  
16 that fair?

17 A. The only other thing is I brought my own  
18 copies of these materials which are at the far end of  
19 the table and that, as far as I understand, I am not  
20 allowed to use for this. So that's why the binders  
21 are here for me. They're all clean copies.

22 Q. Okay. That's what I'm really getting at is  
23 if you're just working off of clean copies or if  
24 there's any materials that are annotated or other  
25 things that I haven't seen before.

1 MR. ROE: And since we're in a remote  
2 setting here, Ted, I'll represent to you that they  
3 are at the far end of the conference room. If you  
4 want me to move them into an office that's fine too,  
5 but they're not accessible to the witness during the  
6 deposition.

7 BY MR. CHANDLER:

8 Q. And Mr. Murphy, is there anything on the  
9 computer screen right now besides the video feed and  
10 possibly the exhibits for this case?

11 A. Well, there's -- there are two screens here.  
12 One is the screen you see me on. The other is the  
13 screen I see the frozen image of one of the  
14 lawyers -- I don't know who it is we've talked  
15 about -- whose video seems to be frozen. He's on the  
16 second screen and still is not moving.

17 Q. So during your deposition today we will take  
18 breaks. But I want to remind you that during those  
19 breaks you should not consult with your counsel about  
20 the substance of your testimony.

21 Do you understand that?

22 A. I do understand that.

23 Q. And during your deposition I would ask that  
24 you not look things up on the Internet or do other  
25 things on a computer or on your phone that we cannot

1 see on the camera.

2 Do you understand?

3 A. I understand that.

4 Q. And you also understand that during your  
5 deposition you should not be e-mailing or texting  
6 other people?

7 A. I understand that.

8 Q. Do you have any questions for me about the  
9 procedure for today's deposition?

10 A. At this point no, I don't have any  
11 questions. I have been deposed before. So if you  
12 generally follow the standard arrangement, I'm -- I'm  
13 well aware of what that is.

14 Q. What did Netlist ask you to do in this  
15 matter?

16 A. Netlist --

17 MR. ROE: And I'll caution the witness not  
18 to reveal the substance of any privileged  
19 communications you've had with attorneys.

20 THE WITNESS: Okay.

21 So Netlist asked me to consider the '218  
22 patent and the '595 patent -- I'm sure it's okay to  
23 reference them in that way. They're listed other --  
24 in other places in the matter -- and to develop my  
25 opinions with respect to whether the patents were

1 supported by provisional and whether -- and whether I  
2 could get to an opinion that would define what my  
3 thinking is about the petition generated by Samsung.

4 BY MR. CHANDLER:

5 Q. Did anybody help you with your work, or did  
6 you work alone?

7 A. No. The attorneys from Gibson helped with  
8 respect to discussions and helped with some of the  
9 wording. So no, I did not work alone.

10 Q. Other than the attorneys at the Gibson Dunn  
11 law firm, was there anyone else that you worked with  
12 in preparing your opinions in this matter?

13 A. No.

14 Q. In preparation for this deposition today,  
15 did you have an opportunity to meet with Netlist  
16 lawyers to prepare?

17 A. Yes, I did.

18 Q. And --

19 MR. ROE: Just objection. Vague as to  
20 "Netlist lawyers" and who you're referring to.

21 BY MR. CHANDLER:

22 Q. Who attended that meeting?

23 A. Those meetings were just myself and Mr. Roe.

24 Q. And when did those meetings take place?

25 A. They took place this week Monday, Tuesday

1 and Wednesday.

2 Q. And approximately how long did you spend  
3 preparing for today's deposition?

4 MR. ROE: Objection. Vague.

5 THE WITNESS: I would say I was here at the  
6 office in Palo Alto for a total of 26 hours or so  
7 between the three days.

8 BY MR. CHANDLER:

9 Q. And did you also prepare for the deposition  
10 today on your own time, not meeting with other  
11 people?

12 A. Yes, I did.

13 Q. And how long approximately did you prepare  
14 on your own time in preparation for today's  
15 deposition?

16 A. Oh, I don't have a good accounting of that.  
17 At least not here today. I would have to check my --  
18 my records at home in my office. But it was  
19 generally a half a day to three-quarters of a day on  
20 various Saturdays and Sundays in preparation to, you  
21 know, refresh my memory about the matter. And what  
22 the cumulative title -- total is, I'm not able to say  
23 from my memory today.

24 Q. What documents did you review to refresh  
25 your memory in preparation for today's deposition?

1           A. I mostly reviewed my reports and any  
2 exhibits that are in my reports. I also read some of  
3 Dr. Alpert's testimony and read Dr. Alpert's report  
4 and reread certainly the '218 patent and the '595  
5 patent, the Hazelzet patent, the Buchmann patent and  
6 the various JEDEC exhibits at a minimum.

7           Q. And for clarity, Mr. Murphy, I don't know if  
8 you were saying Albert with a "b" or Alpert with a  
9 "p," but I believe his last name is Alpert with a  
10 "p"?

11          A. I was trying to say Alpert with a "p."

12          Q. Have you been deposed before?

13          A. I have.

14          Q. Approximately how many times?

15          A. I would say between 15 and 20.

16          Q. Have you been called as an expert witness  
17 before?

18          A. Yes, I have.

19          Q. And approximately how many times?

20          A. I guess I don't really know the answer to  
21 that. I don't really -- I don't really know the  
22 answer to that. I've been in court multiple times,  
23 and I would have to assume that I would have been  
24 qualified to be the expert witness to be allowed to  
25 testify in court, but I don't know if that's true or

1 not.

2 Q. Approximately how many times have you  
3 testified in court as an expert before?

4 A. My guesstimate would be maybe nine or ten.

5 Q. In any of the previous cases where you  
6 appeared as an expert witness, has a judge ever  
7 stricken any parts of your expert report or excluded  
8 any opinions that you had offered?

9 MR. ROE: Objection. Vague. Lacks  
10 foundation. Calls for speculation.

11 THE WITNESS: No, not to my recollection.

12 BY MR. CHANDLER:

13 Q. When did you start your work for Netlist in  
14 this matter?

15 MR. ROE: Objection. Vague.

16 THE WITNESS: Sorry. I don't remember  
17 exactly when I started this work. As you -- as you  
18 may know for cases, they very often start, last a  
19 long time, and experts get talked to or consulted  
20 with very sporadically, so I can't remember exactly  
21 when I started working on this.

22 BY MR. CHANDLER:

23 Q. So to help you, the IPR petition in each of  
24 these matters was filed in the fall of 2021. Does  
25 that help you to refresh your recollection as to

1 approximately when you may have started your work for  
2 Netlist in this matter?

3 MR. ROE: Objection. Vague.

4 THE WITNESS: Well, my perception is  
5 definitely inside of 2021. The part I had difficulty  
6 with is I can't -- I can't get it -- I couldn't get  
7 it down to a particular day or week or even months  
8 for that point of view, but I do remember it being in  
9 2021. But I didn't think that was a good enough  
10 answer as to what you were looking for.

11 BY MR. CHANDLER:

12 Q. Do you have access to your declaration  
13 marked as Exhibit 2027 in IPR2022-00062, which is --

14 A. I believe --

15 Q. -- the expert declaration related to the  
16 '218 patent?

17 A. Yes. I believe it's in the binder here.

18 Q. Is your expert declaration marked as  
19 Exhibit 2027 in IPR2022-00062 complete as far as you  
20 know, meaning does it provide a complete statement of  
21 all the opinions you plan to express in this matter,  
22 along with the basis and the reasons for your  
23 opinions?

24 A. Yes. As far as I believe right now, my  
25 declaration is complete. Unless some new information

1 is made known to me, I don't perceive that I would  
2 add anything else to this, but that depends upon what  
3 changes in the case.

4 Q. Is your expert declaration marked as  
5 Exhibit 2027 in IPR2022-00062 accurate, meaning it  
6 does not have any mistakes as far as you know?

7 MR. ROE: Objection. Vague.

8 THE WITNESS: As far as I know, it doesn't  
9 have any mistakes.

10 BY MR. CHANDLER:

11 Q. And then if you could turn to your other  
12 declaration, I'll ask the similar questions. So go  
13 ahead and let me know when you've got the other  
14 declaration in front of you. This is Exhibit 2027 in  
15 IPR2022-00064 for the '595 patent.

16 A. I have it.

17 Q. Is your expert declaration marked as  
18 Exhibit 2027 in IPR2022-00064 complete, meaning does  
19 it provide a complete statement of all the opinions  
20 you expect to express in this matter, along with the  
21 basis and the reasons for those opinions?

22 A. Yes. As far as I'm aware as of this date,  
23 this is the -- my complete declaration.

24 Q. Is your expert declaration marked as  
25 Exhibit 2027 in IPR2022-00064 accurate, meaning it

1 does not have any mistakes as far as you know?

2 MR. ROE: Objection. Form. Vague.

3 THE WITNESS: Yes. As far as I know, it  
4 does not have any mistakes.

5 BY MR. CHANDLER:

6 Q. Do you have any present plans to correct or  
7 supplement either of your expert declarations marked  
8 as Exhibit 2027?

9 A. I'm not --

10 MR. ROE: Objection. Mischaracterizes the  
11 record.

12 THE WITNESS: I'm not aware of any plans to  
13 add to or change any part of my declaration as of  
14 right now.

15 Q. Do you understand that you are testifying in  
16 this deposition with respect to both IPR2022-00062  
17 and IPR2022-00064?

18 THE WITNESS: Yes. That's my understanding.

19 BY MR. CHANDLER:

20 Q. And would it be fair to say that many of the  
21 exhibits in IPR2022-00062 are the same as in  
22 IPR2022-00064? Do you -- do you recall that?

23 MR. ROE: Objection. Vague.

24 THE WITNESS: Well, your question,  
25 Counselor, started with is it better to say. Better

1 than what, may I ask?

2 BY MR. CHANDLER:

3 Q. I apologize. I said "is it fair," not is it  
4 better. Is it fair? Is it fair to say?

5 A. Yes. I would say it's fair to say that.

6 Q. So for simplicity, during this deposition,  
7 when I refer to an exhibit number, I will be  
8 referring to the same exhibit number in both IPRs.

9 Is that understood?

10 A. I -- to tell you the truth, I haven't  
11 checked that they're marked the same way. But if  
12 you -- if you -- if you provide that as information  
13 to me, that's what I will accept.

14 Q. And that's what I'm trying to represent to  
15 you is that, other than your declaration, pretty much  
16 all of the exhibits are the same in the IPRs, and so  
17 I'll just use the exhibit number without specifying  
18 which IPR the exhibit's in because it's the same  
19 exhibit in both IPRs.

20 Is that understood?

21 A. That -- I understand, and that's acceptable  
22 to me.

23 Q. Now, you have two declarations, both marked  
24 as Exhibit 2027. And is it fair to say that your two  
25 declarations have a lot of overlap, but they're not

1 identical?

2 MR. ROE: Objection. Vague.

3 THE WITNESS: Yes. That is -- that's fair  
4 to say. So in light of what we just talked about  
5 with respect to the exhibits, since both of the  
6 declarations are labeled as 2027, when you talk about  
7 the declarations, will you describe them to me  
8 differently than the exhibit number?

9 BY MR. CHANDLER:

10 Q. Yes.

11 A. Thank you.

12 Q. And then do you have in front of you what  
13 was previously marked as Exhibit 1078, which is a  
14 redline comparing your two declarations marked as  
15 Exhibit 2027?

16 A. I do not, but I believe counsel is finding  
17 it at the end of the table.

18 MR. CHANDLER: Just let me know when you  
19 have it.

20 (Reporter clarification.)

21 MR. ROE: I'm sorry. Did you say 2027 or  
22 10- -- I'm sorry. Which document would you like me  
23 to hand to the witness, Ted?

24 MR. CHANDLER: The redline, which I think is  
25 1078.

1 MR. ROE: Oka. All right. And I'll object  
2 to Exhibit 1078 as -- on authenticity; foundation;  
3 relevance. And there's no -- there's no -- you know,  
4 for the record, this is a document presented to be a  
5 redline that was created by presumably counsel for  
6 Samsung, and so there's no ability for counsel -- for  
7 patent owner to determine the accurateness of that  
8 document.

9 BY MR. CHANDLER:

10 Q. So Mr. Murphy, I'll represent to you that  
11 Exhibit 1078 is a redline that was generated by a  
12 computer comparing your declaration marked as  
13 Exhibit 2027 in IPR2022-00064, to your declaration  
14 marked as Exhibit 2027 in IPR2022-00062.

15 Do you understand that representation?

16 A. I do understand that representation, and I  
17 will let you know that this is the very first time I  
18 have ever seen this document.

19 MR. CHANDLER: Okay.

20 MR. ROE: With that representation, I'll  
21 also object as on reliability concerns.

22 BY MR. CHANDLER:

23 Q. So given that your two expert depositions  
24 overlap in many instances, to expedite the deposition  
25 today, as a general matter, my questions will be

1 directed to both of your declarations at the same  
2 time whenever possible. And to help us, feel free to  
3 look at Exhibit 1078 to, you know, quickly determine  
4 whether the paragraph we're talking about is the same  
5 and the two expert declarations there is different.  
6 And obviously you can, you know, look at your two  
7 expert declarations to confirm, but that's only --  
8 the only reason for Exhibit 1078 is just as a tool  
9 that you and I can both use to try to get oriented  
10 more quickly.

11 Understood?

12 A. I understand. Can you tell me what the base  
13 information of 1078 is? Is the base '218 and then  
14 modified to include the '595 information? Or was it  
15 '595 and then modified to include the '218  
16 information?

17 Q. '218 was the base.

18 A. Thank you.

19 Q. All right. Do you have in front of you or  
20 nearby Exhibit 1001 in IPR2022-00062, which is U.S.  
21 Patent No. 9,858,218?

22 A. I do.

23 Q. During the deposition will it be okay to  
24 refer to that exhibit as the '218 patent?

25 A. Yes.

1 Q. Could you please turn to Exhibit 1001 in the  
2 other IPR2022-00064, which is U.S. Patent  
3 No. 10,474,595?

4 A. I have it.

5 Q. During the deposition would it be okay if we  
6 refer to this exhibit as the '595 patent?

7 A. Yes. That's acceptable.

8 Q. Could you please turn the Exhibit 1008,  
9 which is U.S. Provisional Application No. 61/186,799

10 A. I have it.

11 Q. During this deposition would it be okay if  
12 we referred to this exhibit as the "provisional  
13 application"?

14 A. Yes, that's acceptable.

15 Q. Could you turn to Exhibit 1014, which is  
16 U.S. Patent Publication No. 2008/0098277 to Hazelzet.

17 A. I have that.

18 Q. During this deposition, would it be okay if  
19 we refer to this exhibit as "Hazelzet"?

20 A. That's acceptable.

21 Q. Please turn to Exhibit 1015, which is a  
22 JEDEC ballot from the Committee JC-4B.4 with the Item  
23 No. 142.35, and the subject LR-DIMM DDR3 Memory  
24 Initialization Chapter Proposal.

25 A. I have that.

1 Q. During this deposition would be okay if we  
2 refer to this exhibit as the "JEDEC proposal"?

3 A. Yes.

4 Q. Please turn to Exhibit 1016, which is U.S.  
5 Patent No. 8,139,430 to Buchmann, et al.

6 A. I have it.

7 Q. During this deposition would it be okay if  
8 we refer to this exhibit as "Buchmann"?

9 A. Yes, that's acceptable.

10 Q. And could you please turn to Exhibit 1039,  
11 which is a presentation to JEDEC by Inphi, I-n-p-h-i,  
12 dated June 4th, 2009, with Item No. 142.35.

13 MR. ROE: Objection. Lacks foundation and  
14 to the extent it assumes facts in evidence as to the  
15 document itself and the characterization of it.

16 THE WITNESS: And you said this was the MB  
17 Initialization Sequence Item 142.35 dated 6-4-09 from  
18 Inphi?

19 BY MR. CHANDLER:

20 Q. Marked as Exhibit 1039.

21 A. Yes. I have that.

22 Q. Would it be okay if we refer to this exhibit  
23 as the "JEDEC presentation"?

24 A. Might be helpful if you tacked on Inphi  
25 there.

1 Q. Sure. So let's call it the "JEDEC  
2 presentation by Inphi."

3 A. That --

4 MR. ROE: Objection. Lacks foundation, and  
5 assumes facts not in the record.

6 THE WITNESS: That would be acceptable.

7 BY MR. CHANDLER:

8 Q. Have you read Netlist's '218 patent  
9 carefully?

10 A. Yes, I have.

11 Q. Do you believe that you understand Netlist's  
12 '218 patent?

13 A. Yes, I do.

14 Q. Do you believe you understand the claims at  
15 the end of the '218 patent?

16 MR. ROE: Objection. Vague.

17 THE WITNESS: Yes, I do.

18 BY MR. CHANDLER:

19 Q. Have you read Netlist's '595 patent  
20 carefully?

21 A. Yes, I have.

22 Q. Do you believe that you understand Netlist's  
23 '595 patent?

24 A. Yes, I do.

25 Q. Do you believe you understand the claims at

1 the end of the '595 patent?

2 MR. ROE: Objection. Form.

3 THE WITNESS: Yes, I do.

4 BY MR. CHANDLER:

5 Q. Have you carefully read the provisional  
6 application marked as Exhibit 1008?

7 A. Yes, I have.

8 Q. Do you believe that you understand the  
9 provisional application marked as Exhibit 1008?

10 A. Yes, I do.

11 Q. Have you carefully read Hazelzet marked as  
12 Exhibit 1014?

13 A. Yes, I have.

14 Q. Do you believe that you understand Hazelzet  
15 marked as Exhibit 1014?

16 A. Yes, I do.

17 Q. Have you carefully read the JEDEC proposal  
18 marked as Exhibit 1015?

19 A. Yes, I have.

20 Q. Do you believe that you understand the JEDEC  
21 proposal marked as Exhibit 1015?

22 A. Yes, I do.

23 Q. Have you carefully read Buchmann marked as  
24 Exhibit 1016?

25 A. Yes, I have.

1 Q. Do you believe that you understand Buchmann  
2 marked as Exhibit 1016?

3 A. Yes, I do.

4 Q. Have you carefully read the JEDEC  
5 presentation by Inphi marked as Exhibit 1039?

6 MR. ROE: Same objections as to the  
7 characterization of the document marked as  
8 Exhibit 1039.

9 THE WITNESS: Yes, I have.

10 BY MR. CHANDLER:

11 Q. I'm wondering if we should come up with a  
12 label that's not going to offend anyone with respect  
13 to Exhibit 1039. Is there a short --

14 MR. ROE: How about "Exhibit 1039," Counsel?

15 MR. CHANDLER: Well, it's hard to remember  
16 numbers.

17 BY MR. CHANDLER:

18 Q. Mr. Murphy, is there another way that you  
19 think we might want to refer to exhibit --

20 A. May I suggest the "Inphi presentation"?

21 Q. How about the "Inphi presentation to JEDEC"?

22 A. Yes.

23 Q. All right. Have you carefully read the  
24 Inphi presentation to JEDEC marked as Exhibit 1039?

25 A. Yes, I have.

1 Q. Do you believe that you understand the Inphi  
2 presentation to JEDEC marked as Exhibit 1039?

3 MR. ROE: Same objections. To the extent it  
4 characterizes the document, it lacks foundation and  
5 assumes facts in evidence -- not in evidence.

6 THE WITNESS: Yes, I do.

7 MR. ROE: Counsel, if you want to give me a  
8 standing objection to Exhibit 1039 as the way you're  
9 characterizing it, that's fine. Otherwise, I can  
10 continue to make the objection as to the  
11 characterization of the document that it lacks  
12 foundation and assumes facts not in evidence.

13 MR. CHANDLER: Would the label "JEDEC  
14 presentation" be acceptable to everyone?

15 MR. ROE: "Exhibit 1039" is acceptable to  
16 me, Counsel.

17 BY MR. CHANDLER:

18 Q. Mr. Murphy, would "JEDEC presentation," is  
19 something that you can remember as . . .

20 A. Yes.

21 Q. Please turn to your expert declaration  
22 marked as Exhibit 2027, and go to paragraph 15 which  
23 is the same in both declarations, and let me know.

24 A. So you said Exhibit 2027 for which I'm using  
25 my copy of the '2- -- sorry, the '218, and

1 paragraph 15?

2 Q. Yes.

3 A. And according to your Exhibit 1078, I don't  
4 see any redlines in that paragraph at all.

5 So I have those.

6 Q. Is it your understanding "that claims are  
7 construed from the perspective of a hypothetical  
8 person of ordinary skill in the art at the time of  
9 the claimed invention"?

10 A. Yes.

11 Q. Is it your understanding that "claims should  
12 be given their ordinary and accustomed meaning as  
13 understood by one of ordinary skill in the art"?

14 (Reporter clarification.)

15 BY MR. CHANDLER:

16 Q. Is it your understanding that "claims should  
17 be given their ordinary and accustomed meaning as  
18 understood by one of ordinary skill in the art"?

19 MR. ROE: Objection to the extent it  
20 mischaracterizes the declaration. Calls for a legal  
21 conclusion.

22 THE WITNESS: Yes, in view of the patent and  
23 its file history.

24 BY MR. CHANDLER:

25 Q. Please turn to paragraph 24 of your expert

1 declaration marked as Exhibit 2027, which I believe  
2 is the same in both, and let me know when you're  
3 there.

4 A. I'm there.

5 Q. In your expert declarations, you opined that  
6 the priority date of the '218 and '595 patents is  
7 June 12th, 2009; correct?

8 MR. ROE: Objection. Vague.  
9 Mischaracterizes the declaration.

10 THE WITNESS: Yes. I believe the date  
11 stated in my report is June the 12th, 2009.

12 BY MR. CHANDLER:

13 Q. During our deposition today, unless stated  
14 otherwise, can you please answer my questions from  
15 the perspective of a person of ordinary skill in the  
16 art as of June 12th, 2009?

17 A. I will do my best to do that.

18 MR. ROE: Objection. Lacks foundation.

19 BY MR. CHANDLER:

20 Q. And can you also answer my questions in a  
21 way that is consistent with what you believe is the  
22 ordinary and accustomed meaning of words to a person  
23 of ordinary skill in the art as of June 12, 2009?

24 A. Yes, I believe I can do that.

25 Q. Could you turn to your CV?

1 MR. ROE: Objection. Lacks foundation.

2 BY MR. CHANDLER:

3 Q. Could you turn to your CV which, in  
4 Exhibit 2027 for the IPR2022-00062, starts on  
5 page 116. Let me know when you're there.

6 And in the other exhibit it starts on  
7 page 120.

8 A. I'm there.

9 Q. Does this page and the next three pages list  
10 all of your prior expert matters in which you were  
11 either deposed or testified at trial?

12 A. I believe it does, yes.

13 Q. Are you aware of any matters that are not  
14 listed?

15 A. Sitting here today, no, I'm -- I cannot  
16 think of a matter not listed.

17 Q. Before this case, had you ever done any work  
18 for Netlist?

19 A. Yes, I believe I have.

20 Q. When did you first do any work for Netlist?

21 MR. ROE: Objection. Vague.

22 THE WITNESS: I'm sorry. I cannot remember.  
23 I remember at least doing something in 2018, I  
24 believe. Actually, if you look at Page No. 3 of my  
25 CV, one up from the bottom there is an ITC case that

1 I worked on that at least started in the year 2017  
2 which I did work for Netlist.

3 BY MR. CHANDLER:

4 Q. Do you believe that was the first work that  
5 you did for Netlist?

6 A. To tell you the truth, I cannot remember.  
7 I'd have to -- I'd have to -- I'd have to do some  
8 research to figure that out.

9 Q. Outside of expert consulting and litigation,  
10 do you believe that you would have ever done any work  
11 for Netlist in the past?

12 A. I have not ever done any work for Netlist  
13 outside of -- outside of litigation.

14 Q. And your CV by my count lists four matters  
15 that you provided expert opinions to Netlist on in  
16 2017 and 2018.

17 As far as you know, is your CV complete and  
18 accurate with respect to the matters for which you  
19 have provided expert opinions to Netlist?

20 A. To the best of my ability sitting here  
21 today, I believe it is complete, yes, and accurate.

22 Q. Approximately how many hours have you spent  
23 working as an expert in the two IPRs that are the  
24 subject of today's deposition?

25 A. I don't really have a running count of how

1 many total hours I have spent. I generally only deal  
2 with that when I -- when I do a billing, and then I  
3 don't keep a cumulative record.

4 Q. Do you have any estimate?

5 MR. ROE: Objection. Calls for speculation.

6 THE WITNESS: Yeah. I really don't at this  
7 point, no.

8 BY MR. CHANDLER:

9 Q. Currently how much are you charging Netlist  
10 for your expert work?

11 A. My rate is \$700 per hour.

12 Q. And how many other expert engagements do you  
13 currently have besides the work for Netlist?

14 A. Zero.

15 Q. So to be clear, the two Netlist IPRs that  
16 are the subject of today's deposition is the only  
17 expert work you're doing currently?

18 A. Correct.

19 Q. And do you have an estimate of how much you  
20 have charged Netlist in total in calendar year 2022  
21 to date?

22 A. I do not.

23 Q. How would you go about finding that  
24 information?

25 A. I would go back to my records in my office,

1 look at -- first I'd look at billings that I had  
2 provided to Netlist, and then I would look at the  
3 record of my time spent from my last billing until  
4 today, and then do a summation of all those numbers.

5 Q. And do you bill for your time at the end of  
6 each month?

7 A. I try to, but generally I don't.

8 Q. Can you explain that a little bit more?

9 A. Well, the -- my consulting work for this  
10 legal matter isn't the only thing that I do, and I'm  
11 quite busy at my other -- my other job. And I know  
12 that it is part of the agreement that Netlist and I  
13 have made in the letter they sent to me that they  
14 want me to bill every month, but often I don't -- I  
15 don't get to it.

16 Q. Before you were first engaged by Netlist  
17 around 2017, did you know the named inventor on the  
18 '218 and '595 patents identified as Hyun Lee, H-y-u-n  
19 Lee?

20 MR. ROE: Objection. Form. Assumes facts  
21 not in evidence. Mischaracterizes prior testimony.

22 THE WITNESS: No. Before then I did not  
23 know Mr. Lee, and since then I have not met nor  
24 talked to Mr. Lee.

25

1 BY MR. CHANDLER:

2 Q. When was the first time that you had heard  
3 of the named inventor Hyun Lee?

4 A. Probably when I would have read a patent  
5 that he had been the author of.

6 Q. As part of one of your expert engagements  
7 for Netlist?

8 A. Yes. There would have been no other -- I  
9 would have had no other interaction or to see his  
10 name otherwise.

11 Q. As has part of your work for Netlist on this  
12 matter, did you personally talk to anyone else?

13 A. Well, I have personally talked to a few  
14 different lawyers at Gibson, but I cannot recall -- I  
15 cannot recall at this point in time if I have talked  
16 to anybody else. There is the possibility that I  
17 might have met someone from Netlist earlier if they  
18 and I were at an ITC meeting, but I really -- I  
19 cannot remember.

20 Q. Other than the attorneys at Gibson Dunn, is  
21 there anyone else that you recall talking to as part  
22 of your work on the two IPRs that are the subject of  
23 today's deposition?

24 A. No. There's no one else that I've talked to  
25 relative to the matter here at hand today.

1 Q. And do you recall the names of the attorneys  
2 at Gibson Dunn that you spoke to as part of your work  
3 in this matter?

4 A. Sorry. I can remember Charlie. Don't  
5 remember his last name. Sorry.

6 And I think there was one other, one other  
7 attorney there that worked or at least I talked to.  
8 But no, in general most of my -- most of my dealings  
9 are with Mr. Roe.

10 Q. Did the attorneys at Gibson Dunn provide you  
11 with any facts that you took into consideration in  
12 forming your expert opinions?

13 MR. ROE: Objection. Vague.

14 THE WITNESS: Well, I --

15 MR. ROE: I'll caution the witness to not  
16 reveal the substance of any privileged communications  
17 with any counsel, but you can answer that question if  
18 you understand it.

19 THE WITNESS: So I guess facts would be a  
20 pretty broad subject. Certainly I received patents  
21 from -- you know, the patents in the matter from the  
22 attorneys at Gibson Dunn. Do you consider those to  
23 be facts?

24 BY MR. CHANDLER:

25 Q. Yes.

1           A. They're documents. They're -- they should  
2 be factual.

3                 So I received those. I received a copy of  
4 the petition.

5                 MR. ROE: And just aside, I'm going to  
6 caution the witness not to reveal the substance of  
7 any privileged communications unless counsel here  
8 sets the foundation under the Federal Rules of Civil  
9 Procedure.

10 BY MR. CHANDLER:

11           Q. And to be clear, I'm asking about facts or  
12 documents that you relied upon in forming your expert  
13 opinions.

14           A. Well, with respect to forming my expert  
15 opinion, all of the things that I relied upon are in  
16 my declaration. And some of those things -- some of  
17 those factual things, like the patents and the  
18 petition, I received those documents from Gibson  
19 Dunn.

20                 Other things that are in my declaration are  
21 things that I found on the Internet to support  
22 opinions I had about the matters at hand.

23           Q. And --

24           A. They're all listed -- sorry. They're all  
25 listed in my declaration.

1 Q. Do you recall what documents you found? So  
2 if you look at your list of exhibits in your  
3 declaration, are you able to identify which documents  
4 you found?

5 MR. ROE: Counsel, are you referring to page  
6 romanette iv which says "List of Appendices and  
7 Exhibits," and it has one appendix? I'm just --  
8 going off on a tangent here if you are assuming  
9 something that may not be true, if there some sort of  
10 a list that you're referring to that isn't in  
11 Exhibit 2027.

12 MR. CHANDLER: In the patent owner response  
13 there's a list of exhibits, and that document was  
14 filed August 15th, 2022, Paper 31.

15 THE WITNESS: I'm sorry. What exhibit  
16 number is that?

17 MR. CHANDLER: It's a paper. It's Paper 31.

18 THE WITNESS: Oh.

19 MR. ROE: And I'll hand that to the witness,  
20 Counsel. That's not in his binders.

21 Here's another binder for you. It should be  
22 listed in there.

23 THE WITNESS: Thank you.

24 BY MR. CHANDLER:

25 Q. So for example, romanette vii and viii,

1 there's an exhibit list.

2 MR. ROE: Are we looking at the '218 or the  
3 '595, Counsel, for the record?

4 MR. CHANDLER: Well, whichever one you're  
5 looking at, let me know.

6 THE WITNESS: So I am looking at -- so I am  
7 looking at '218.

8 BY MR. CHANDLER:

9 Q. Okay.

10 A. Paper -- oh, yeah. They're both labeled the  
11 same, so yes. '218, Paper 31.

12 Q. And do you recognize which exhibits are  
13 exhibits that you found and included?

14 A. So for example --

15 MR. ROE: Objection. Calls for speculation.

16 THE WITNESS: -- as stated in my  
17 supplemental declaration, Exhibit 2006, 2017, 2028.

18 To the best of my ability sitting here  
19 today, those are the ones that I'm pretty sure that I  
20 found. There might be something else here, but I  
21 cannot remember exactly. Let's see. So yeah.  
22 That's the best I can do.

23 For example, Exhibit 2016 is something that  
24 I know the attorneys at Gibson Dunn and I had talked  
25 about, fully buffered DIMMs, but I cannot remember

1 whether I pulled that document or they pulled the  
2 document and gave it to me. That's an example of one  
3 that I'm not sure about.

4 Most of the other things that are on this  
5 exhibit list are things that came to me, I believe,  
6 via Gibson Dunn.

7 BY MR. CHANDLER:

8 Q. With respect to the three exhibits you  
9 identified that you located, Exhibit 2006, 2017 and  
10 2028, were those exhibits you were familiar with  
11 before being engaged by Netlist for the two IPRs that  
12 are the subject of today's deposition, or are those  
13 exhibits that you went out and found as part of your  
14 work for this matter?

15 MR. ROE: Objection. Form.

16 THE WITNESS: They were exhibits that I went  
17 out and found as part of my work for this matter.

18 MR. CHANDLER: Okay. We've been going for  
19 about an hour, so why don't we take our first break  
20 for the morning. We can go off the record. But  
21 before you run away, after we're off the record,  
22 maybe just pause for a minute. We can see if the  
23 court reporter has any quick spellings that she'd  
24 like us to help her with.

25 THE VIDEOGRAPHER: Going off the record at

1 10:32 a.m.

2 (Recess taken from 10:32 a.m. to 10:48 a.m.)

3 THE VIDEOGRAPHER: Going back on the record  
4 at 10:48 a.m.

5 BY MR. CHANDLER:

6 Q. Mr. Murphy, during the break did you discuss  
7 the substance of your testimony with anyone?

8 A. No.

9 Q. And are there any corrections or  
10 clarifications you would like to make to any of your  
11 testimony earlier today?

12 A. Not at this time.

13 Q. Could you pull up the provisional  
14 application marked as Exhibit 1008, and go to page  
15 22, and let me know when you're there.

16 A. I'm there.

17 Q. Do you see that the provisional application  
18 marked as Exhibit 1008 refers to an acronym JEDEC,  
19 J-E-D-E-C?

20 A. In paragraph 2, for example?

21 Q. Yes.

22 A. Yes, I see that.

23 Q. What is JEDEC?

24 MR. ROE: Objection. Vague.

25 THE WITNESS: My understanding is that JEDEC

1 is a standard settings group that was started by the  
2 memory manufacturers, in addition to various  
3 manufacturing companies, to create standards for  
4 devices and memory chips -- well, not just memory but  
5 chips and boards so that people could manufacture  
6 them and have a common spec that they would meet so  
7 that other manufacturers could be guaranteed a --  
8 various number of sources to supply these complicated  
9 products to them.

10 BY MR. CHANDLER:

11 Q. And what do you personally know about JEDEC?

12 MR. ROE: Objection. Vague.

13 THE WITNESS: Well, personally I know what I  
14 just told you. And then I know that, over my work  
15 history, we would see various specifications -- final  
16 specifications come out of JEDEC. And if they were  
17 related to a part you were working on, then you paid  
18 quite a bit of interest in them to make sure that  
19 your parts met a JEDEC spec. And that was one of the  
20 things that the manufacturers of those chips  
21 considered when they designed the chips because it  
22 enabled them to get out and advertise to people that  
23 would use the chips that those particular chips they  
24 were making met the, quote/unquote, JEDEC standard.

25

1 BY MR. CHANDLER:

2 Q. And did you personally work with JEDEC  
3 standards or consult JEDEC standards as part of your  
4 work?

5 A. I had seen JEDEC final standards as part of  
6 my work, yes.

7 Q. Could you explain that a little bit more?

8 A. Well, as I said, for example, JEDEC has  
9 specs for various chip parts, for various board  
10 parts. The largest area that I would have had  
11 exposure to this would have been in my work in static  
12 RAMs, SRAMs. And at the time I worked for National  
13 Semiconductor, and we were a competitor to Intel, and  
14 we were trying to make integrated circuits that would  
15 be pin-for-pin compatible, which means you could take  
16 an Intel part out of a particular design that  
17 somebody did and then replace it with one of the  
18 National Semiconductor parts. And, of course, we  
19 tried to convince people to do this by having a  
20 better pricing point.

21 And the JEDEC spec allowed us to, for  
22 instance, do testing to make sure that our products  
23 met the same JEDEC spec that Intel looked to, and  
24 then we also would do testing to show to ourselves  
25 the differences between the Intel part, for example,

1 and then a National Semiconductor part, which would  
2 help us understand where we did things better than  
3 Intel did and/or where Intel had done better than us  
4 so that we could analyze whether that made a  
5 difference to the customers we were trying to sell  
6 to, or sometimes we were able to make a judgment that  
7 most of the customers we saw weren't really  
8 interested in a particular spec or Intel's  
9 performance to that spec, and so we adjusted our --  
10 our workload appropriately.

11 Q. In your opinion would a person of ordinary  
12 skill in the art have known about JEDEC?

13 MR. ROE: Objection. Vague.

14 And also -- sorry.

15 Counsel, this is a problem when you start  
16 giving different names to exhibit numbers. So to the  
17 extent you're referring to something -- to a  
18 particular exhibit, then there's an objection --  
19 there's an objection to form to that too.

20 MR. CHANDLER: And to be clear, when I say  
21 "JEDEC" without anything else, I'm referring to the  
22 standard setting organization that you just  
23 mentioned.

24 Understood?

25 MR. ROE: You -- counsel, you also referred

1 to Exhibit 1015 as JEDEC and asked us to refer to  
2 that in the deposition. So I --

3 MR. CHANDLER: No.

4 MR. ROE: I'll have to give an objection to  
5 any questions just about the word "JEDEC." I'm not  
6 trying to be difficult with you, Counsel, but this is  
7 the problem when you start giving different names to  
8 exhibits.

9 MR. CHANDLER: To be clear, that was --  
10 Exhibit 1015 we agreed was the JEDEC proposal.

11 BY MR. CHANDLER:

12 Q. Mr. Murphy, do you understand the  
13 distinction between JEDEC and the JEDEC proposal  
14 marked as Exhibit 1015?

15 A. I do. And I will state that the answer that  
16 I have just given about the use of "JEDEC" in the --  
17 paragraph 2 of the provisional is -- my answer was  
18 related to the JEDEC organization because it talks  
19 about the recent proposal in JEDEC.

20 So I -- I would see, in that language, the  
21 proposal as being something different than the  
22 organization.

23 Q. So would a person of ordinary skill in the  
24 art have known about JEDEC, the organization?

25 A. As the person of ordinary skill in the art

1 as defined in this matter, I think the best answer  
2 that I could say would be maybe because there are  
3 certain -- there are certain differences and  
4 experience that certain type of people have versus  
5 others. They may have -- for instance, they may have  
6 not heard of JEDEC; they may have heard of JEDEC;  
7 they may have a very cursory understanding of JEDEC  
8 as an organization-setting standard. But given the  
9 POSITA that's described in this matter, I'm not  
10 positive that they would have all known of JEDEC for  
11 sure.

12 Q. In forming your opinions in this matter, did  
13 you believe a person of ordinary skill in the art  
14 would have known about JEDEC, the organization?

15 A. In forming my opinion in this matter, I used  
16 the opinion that JEDEC would have been known to one  
17 of ordinary skill in the art, yes.

18 Q. And you believe that's the correct opinion?

19 A. I think for this matter it is, yes.

20 Q. How would you describe what a person of  
21 ordinary skill in the art would have known about  
22 JEDEC the organization?

23 MR. ROE: Objection. Vague.

24 THE WITNESS: Well, I think I just spoke to  
25 most of that question. You may recall that the

1 person of ordinary skill in the art that's been set  
2 forth in this matter has multiple different what's  
3 called in arenas that they have done work in or have  
4 experience in. I think some of those arenas, those  
5 people at best would have just a cursory knowledge of  
6 what JEDEC the organization is.

7 Others who have very specific experience,  
8 then I would expect their JEDEC organizational  
9 knowledge to be deeper, depending upon the actual  
10 jobs they've done.

11 BY MR. CHANDLER:

12 Q. I'm a little confused because normally we  
13 think of the hypothetical person of ordinary skill in  
14 the art as a single person, and it sounded to me like  
15 your last answer was suggesting that there might be  
16 different people of ordinary skill in the art. So  
17 I'm just trying to understand what the foundation was  
18 for your opinions when you were forming your opinions  
19 as to what a person of ordinary skill in the art  
20 would know.

21 A. So --

22 MR. ROE: Objection. Form. There's no  
23 question pending.

24 BY MR. CHANDLER:

25 Q. So in forming your opinions, Mr. Murphy,

1 what did you believe a person of ordinary skill in  
2 the art would have known about JEDEC the  
3 organization?

4 MR. ROE: Objection. Vague.

5 THE WITNESS: I think that a person of  
6 ordinary skill in the art at a minimum would have  
7 known that JEDEC creates standards that other people  
8 can use to build their parts to and then, for a  
9 different group of people, to use those parts to make  
10 other products.

11 BY MR. CHANDLER:

12 Q. Anything else?

13 MR. ROE: Same objection.

14 THE WITNESS: At this point, no, I don't  
15 think I have anything else to add to that. Maybe --  
16 maybe later something will come up in my mind.

17 BY MR. CHANDLER:

18 Q. In your opinion would a person of ordinary  
19 skill in the art have known about the JEDEC standards  
20 relevant to memory modules and memory devices?

21 A. Yes. With respect to my opinion in this  
22 matter that is -- that is what I believe we're  
23 discussing in this matter.

24 Q. In your opinion would a person of ordinary  
25 skill in the art have known about the presentations

1 and proposals to JEDEC relevant to memory modules and  
2 memory devices?

3 MR. ROE: Objection. Vague. Lacks  
4 foundation. Calls for speculation.

5 THE WITNESS: Yes. In this matter I believe  
6 a person of ordinary skill in the art would know  
7 those things.

8 BY MR. CHANDLER:

9 Q. In your opinion would a person of ordinary  
10 skill in the art have been able to get a copy of the  
11 presentations and proposals to JEDEC relevant to  
12 memory modules and memory devices such as the recent  
13 proposal to JEDEC about load-reduced DIMMs referenced  
14 in the provisional application?

15 MR. ROE: Objection. Lacks foundation.  
16 Calls for speculation.

17 THE WITNESS: Yeah.

18 MR. ROE: Vague.

19 THE WITNESS: I believe I have opined on  
20 whether they could get those things, and I believe  
21 whether JEDEC documents as such were public  
22 information is a different issue in this matter, one  
23 that I've not been asked to opine on.

24 In general my experience is that one of  
25 ordinary skill in the art is generally not able on

1 their own to get anything that isn't a final  
2 specification for a particular product or board like  
3 a DIMM from JEDEC until it's completed done.

4 BY MR. CHANDLER:

5 Q. So it would be fair to say that, in your  
6 opinion, a person of ordinary skill would not have  
7 been able to get a copy of the recent proposal in  
8 JEDEC for load-reduced DIMM referenced on page 22 of  
9 Exhibit 1008, the provisional application?

10 MR. ROE: Object. Objection. Form. Calls  
11 for speculation. Lacks foundation. Incomplete  
12 hypothetical. Outside the scope.

13 THE WITNESS: Well, I think with respect to  
14 have a person of ordinary skill actually have been  
15 able to get a copy of that proposal from JEDEC, my  
16 personal belief is one that they probably would not  
17 have been able to, but that doesn't necessarily mean  
18 that they wouldn't have already been aware of the  
19 material that's being discussed in that proposal at  
20 various JEDEC meetings.

21 BY MR. CHANDLER:

22 Q. So could you explain that a little bit more  
23 to me because, if I'm hearing what you're saying,  
24 you're suggesting that a person of ordinary skill in  
25 the art would not have a copy of proposals to JEDEC,

1 but they would know about the contents of JEDEC  
2 proposals, and I'm just trying to understand what  
3 you're saying. So could you explain it a little bit  
4 more, please.

5 MR. ROE: Objection to the extent the  
6 question mischaracterizes the prior testimony.

7 THE WITNESS: Well, the -- part that I'm  
8 trying to explain is that, even though -- I didn't --  
9 I don't believe the JEDEC proposals are public  
10 information. The -- that doesn't -- that doesn't  
11 mean that one of ordinary skill in the art wouldn't  
12 have been able to hear about them, be it  
13 word-of-mouth or from somebody who happened to be  
14 working in a company that was part of their JEDEC,  
15 like their JEDEC representative.

16 And as is true in many industries, as things  
17 change from one generation to the next, people start  
18 talking about, well, you know, what will the next  
19 generation look like? What kind of things will it  
20 have?

21 And as specifically in this case, not only  
22 were device manufacturers talking about these types  
23 of proposals, companies that were going to use the  
24 parts to make their products were talking about the  
25 proposals.

1           So it's -- it's my belief one of ordinary  
2 skill in the art would have understood the issues  
3 that were described in those proposals but not  
4 necessarily have been able to get an actual copy of  
5 the proposal or, for instance, a ballot measure.

6           (Reporter clarification.)

7 BY MR. CHANDLER:

8           Q. In your opinion would a person of ordinary  
9 skill in the art have known about the contents of  
10 presentations and proposals to JEDEC relevant to  
11 memory modules and memory devices, for example, by a  
12 word-of-mouth in the industry even if they did not  
13 have copies of those presentations and proposals to  
14 JEDEC?

15           MR. ROE: Objection. Lacks foundation.  
16 Incomplete hypothetical. Calls for speculation.  
17 Outside the scope.

18           THE WITNESS: Yes, I believe that that would  
19 have been the case, and that is so reflected in my  
20 declaration.

21 BY MR. CHANDLER:

22           Q. And specifically with respect to the JEDEC  
23 proposals and presentations for LR-DIMM, you believe  
24 that a person of ordinary skill in the art would have  
25 been familiar with the contents of the proposals and

1 presentation to JEDEC about LR-DIMM regardless of  
2 whether they actually had a copy of those proposals  
3 and presentations?

4 MR. ROE: Objection. Vague. Calls for  
5 speculation. Incomplete hypothetical.

6 THE WITNESS: I believe I just answered  
7 that, and it is stated in my declaration as  
8 effectively a basis for my opinion that one of  
9 ordinary skill in the art would understand about the  
10 content that was available in the JEDEC proposals  
11 independent of how they got that information.

12 MR. ROE: Pause for a second.

13 Can the court reporter hear me? Because not  
14 all of my objections are getting onto the realtime.

15 THE REPORTER: If you could speak up a  
16 little bit. The very last objection, did I -- could  
17 you please repeat it?

18 MR. ROE: Sure. There was also "incomplete  
19 hypothetical." It's happened a couple of times. I  
20 didn't want to interrupt counsel, but if we're trying  
21 to make a complete record here, I want to make sure  
22 you can hear me given that we're doing this in a  
23 remote setting, and I can't see you.

24 THE REPORTER: Yes, thank you. If you can  
25 please speak up when you make your objections. You

1 tend -- it tends to trail off a little bit near the  
2 end.

3 MR. ROE: I'll do my best.

4 THE REPORTER: Thank you.

5 BY MR. CHANDLER:

6 Q. For clarity, Mr. Murphy, let me ask the last  
7 question again, and then pause so your counsel can  
8 object, and then pause before you answer the  
9 question.

10 Understood?

11 A. Yes.

12 Q. In your opinion would a person of ordinary  
13 skill in the art have known about the contents of  
14 presentations and proposals to JEDEC relevant to  
15 LR-DIMM memory modules, for example, by word-of-mouth  
16 in the industry even if they did not have copies of  
17 those presentations and proposals to JEDEC?

18 MR. ROE: Objection. Lacks foundation.  
19 Incomplete hypothetical. Calls for speculation.  
20 Form.

21 THE WITNESS: As I said previously, yes, I  
22 believe they would. And this -- this is the basis  
23 for my opinion set forth in my declaration. And if  
24 you need more clarification, I'm pretty sure this is  
25 all covered in my declaration.

1 BY MR. CHANDLER:

2 Q. In your opinion if a person of ordinary  
3 skill in the art was interested in memory modules,  
4 would they have been able to participate in JEDEC  
5 meetings involving proposals and presentations  
6 relevant to memory modules?

7 MR. ROE: Objection. Outside the scope.  
8 Calls for speculation. Lack of foundation.

9 THE WITNESS: Yeah. I don't think I have  
10 provided an opinion on that. And if I were to think  
11 about it, I'd probably have to think about it and do  
12 some research to decide whether or not a person of  
13 ordinary skill in the art could participate in a  
14 JEDEC, let's say, validate procedure or specification  
15 review. So I don't think I can answer that here  
16 today.

17 BY MR. CHANDLER:

18 Q. In your opinion if a person of ordinary  
19 skill in the art was interested in memory modules,  
20 would they have been able to join the JEDEC committee  
21 that receives proposals and presentations relevant to  
22 memory modules?

23 MR. ROE: Objection. Outside the scope.  
24 Calls for speculation. Lack of foundation.  
25 Incomplete hypothetical.

1 THE WITNESS: So as I just said, this is not  
2 something I've opined on. I am not aware of what the  
3 specific requirements were to allow someone to join  
4 JEDEC in the years that we're discussing, so I don't  
5 think I can answer that here.

6 BY MR. CHANDLER:

7 Q. In your opinion would a person of ordinary  
8 skill in the art have known about the JEDEC standard  
9 for DDR memory devices?

10 MR. ROE: Objection. Vague.

11 THE WITNESS: So I guess the first  
12 clarification I would ask is which DDR memory devices  
13 are you referring to?

14 BY MR. CHANDLER:

15 Q. I'm going to ask you three questions, and  
16 I'll start with the first generation which I believe  
17 is referred to as DDR.

18 But is there a different way that you refer  
19 to that first generation of DDR memory devices?

20 A. No, there's not. But the way the question  
21 was phrased, I didn't know whether to answer relative  
22 to DDR, DDR2 or DDR3.

23 Q. In your opinion would a person of ordinary  
24 skill in the art have known about the JEDEC standard  
25 for the first generation of DDR memory devices?

1 MR. ROE: Objection. Outside the scope.  
2 Calls for speculation. Lack of foundation.

3 THE WITNESS: Even though I've not been  
4 asked to opine on that particular matter, I believe  
5 one of ordinary skill would have been aware of the  
6 first generation of DDR specifications, yes.

7 BY MR. CHANDLER:

8 Q. In your opinion would a person of ordinary  
9 skill in the art have known about the JEDEC standard  
10 for DDR2 memory devices?

11 MR. ROE: Objection. Same objections.  
12 Form.

13 THE WITNESS: And my answer is also the  
14 same. I've not been asked to opine on that, but I  
15 would say generally one of ordinary skill in the art  
16 at the time would have been aware of a DDR2  
17 specification from JEDEC.

18 BY MR. CHANDLER:

19 Q. In your opinion would a person of ordinary  
20 skill in the art have known about JEDEC standard for  
21 DDR3 memory devices?

22 MR. ROE: Incomplete hypothetical.  
23 Objection. Form.

24 THE WITNESS: Again, I've not been asked to  
25 opine on that. So I would say in general, one of

1 ordinary skill in the art would be aware at the time,  
2 so around 2009 would have been aware of a DDR3  
3 specification from JEDEC.

4 BY MR. CHANDLER:

5 Q. In your opinion would a person of ordinary  
6 skill in the art have known about DDR3 LR-DIMM memory  
7 modules?

8 A. I believe at the time of this matter in  
9 roughly 2009 that one of ordinary skill in the art  
10 would have known about a DDR3 LR-DIMM memory module.

11 Q. In your opinion would a person of ordinary  
12 skill in the art have known about FBDIMM memory  
13 modules?

14 A. A person of ordinary skill in the art is  
15 defined in this matter. And at the time of 2009, I  
16 believe they would have been aware of an FBDIMM  
17 specification, especially because FBDIMM information  
18 was available five years earlier or roughly in 2004.

19 Q. In your opinion would a person of ordinary  
20 skill in the art have known about RDIMM memory  
21 modules?

22 A. Once again, in terms of the time frame of  
23 this matter, 2009, I would -- I would agree that a  
24 person of ordinary skill in the art have known about  
25 an RDIMM memory module.

1 Q. In your opinion would a person of ordinary  
2 skill in the art have known about the proposed JEDEC  
3 standards for DDR3 LR-DIMM memory modules?

4 A. As I have stated in my report -- in my  
5 declaration, sorry -- it is -- it is something that I  
6 agree to that one of ordinary skill in the art would  
7 have known about a DDR3 LR-DIMM module.

8 Q. And would they have known about the  
9 proposals within JEDEC concerning standards for the  
10 DDR3 LR-DIMM memory module?

11 MR. ROE: Objection. Vague. Incomplete  
12 hypothetical. Asked and answered.

13 THE WITNESS: With respect to the JEDEC  
14 standards, It's my belief that the -- that one of  
15 ordinary skill in the art, as I've stated in my  
16 declaration, would have understand [sic] the content  
17 of those proposals, even though they may not have  
18 been specifically in JEDEC or on the committee.

19 BY MR. CHANDLER:

20 Q. How would you explain to a layperson the key  
21 differences between an RDIMM, an FBDIMM and a DDR3  
22 LR-DIMM memory module?

23 MR. ROE: Objection. Vague. Compound.

24 THE WITNESS: Well, I think the -- I think  
25 the biggest first point I would explain to someone

1 who was a layperson is that they -- these DIMMs all  
2 have very different architectures with respect to how  
3 they are built, and therefore different signaling  
4 conventions, for example, about how they -- the  
5 modules are run. The -- in each of those three  
6 cases, the solutions that they try to solve can be  
7 very different. In fact, most often they are very  
8 different. And then those modules have all settled  
9 on different architectures to try and -- to try and  
10 achieve the kind of performance power, cost, form  
11 factor that they had set up for themselves as a  
12 particular goal.

13 So that would be -- that would be the first  
14 thing that I would talk to people about, the fact  
15 that the architectures are very different.

16 The second thing I would talk to people  
17 about is the fact that they -- that they -- that they  
18 handle potentially different speeds, they cover  
19 different speed areas and potentially different  
20 capacities, and so oftentimes modules get -- modules  
21 get refined, understanding what the target product is  
22 and what kind of metrics they want to meet to get to  
23 the goals that they've chosen for themselves.

24 MR. CHANDLER: At this time I'd like to  
25 introduce a new exhibit, and so maybe we should go

1 off the record briefly so I can transmit it to  
2 everyone, and then we can get back on when you have  
3 the exhibit in front of you, okay?

4 MR. ROE: Okay. We can go off the record.

5 THE VIDEOGRAPHER: Going off the record at  
6 11:22 a.m.

7 (Recess taken from 11:22 a.m. to 11:39 a.m.)

8 THE VIDEOGRAPHER: Start of Video File  
9 No. 2. We're back on the record at 11:39 a.m.

10 (Exhibit 1079, 5/8/17 Netlist Technology  
11 Tutorial for IPR2022-00062 and IPR2022-00064,  
12 CDX-200.1-CDX200.11, marked for identification.)

13 BY MR. CHANDLER:

14 Q. Mr. Murphy, I've marked as Exhibit 1079 in  
15 both IPR2022-00062 and IPR2022-00064 the same  
16 document which is titled "Netlist Technology  
17 Tutorial."

18 Do you have Exhibit 1079 in front of you?

19 MR. ROE: And I'm going to object to the  
20 exhibit as late and untimely, on relevance,  
21 authenticity, hearsay, foundation, reliability,  
22 prejudice. I guess foundation.

23 Did you get all those? For the court  
24 reporter.

25 THE REPORTER: I did. Thank you.

1 BY MR. CHANDLER:

2 Q. Mr. Murphy, do you have Exhibit 1079 in  
3 front of you?

4 A. I do.

5 Q. Have you --

6 MR. ROE: And it's outside the scope of the  
7 testimony.

8 BY MR. CHANDLER:

9 Q. Mr. Murphy, have you seen Exhibit 1079  
10 before?

11 A. I cannot remember.

12 Q. Exhibit 1079 is Netlist Technology Tutorial  
13 in one of the cases where you were one of Netlist's  
14 expert witnesses; correct?

15 A. As I just said, I cannot remember. The  
16 documents are from 2017, so five years ago. It may  
17 very well be. I just cannot remember.

18 Q. Would it refresh your recollection to look  
19 at your CV to confirm that you were retained by  
20 Netlist as an expert witness Investigation  
21 No. 337-TA-1023 as shown on the cover of  
22 Exhibit 1079?

23 MR. ROE: Objection. Outside the scope.

24 THE WITNESS: Yes. It shows in my CV that I  
25 was an expert witness in that matter.

1 BY MR. CHANDLER:

2 Q. And can you briefly summarize for us what  
3 you opined on as an expert in that other matter where  
4 Netlist has engaged you as an expert. What was the  
5 general subject matter?

6 MR. ROE: Objection. Relevance. Outside  
7 the scope.

8 THE WITNESS: I'm sorry. I don't -- I don't  
9 remember. I mean, it was a patent matter, and it had  
10 to do with DIMMs, I believe.

11 But you're asking me to what I testified  
12 five years ago. I -- sorry. My memory is not that  
13 great.

14 BY MR. CHANDLER:

15 Q. Did you help create Exhibit 1079?

16 MR. ROE: Objection. Outside the scope.

17 THE WITNESS: I don't really know whether I  
18 did or not. I might have.

19 BY MR. CHANDLER:

20 Q. Could you please turn to page 2 of  
21 Exhibit 1079, and let me know when you're there.

22 A. And so I can use the exhibit ending in --  
23 from IPR ending in -62, as these are identical? I  
24 can just stick with the one?

25 Q. Correct. It's an identical exhibit in both

1 IPRs. The only difference is the stamp with the case  
2 number is IPR2022-00062 in one copy, and then in the  
3 other copy it has a stamp of IPR2022-00064; but  
4 otherwise it's the identical document.

5 Understood?

6 A. Great.

7 MR. ROE: And so the record's clear, of  
8 course my objections to Exhibit 1079 was in both IPR  
9 proceedings. The questions are outside the scope.

10 BY MR. CHANDLER:

11 Q. So Mr. Murphy, do you have page 2 of  
12 Exhibit 1079 in front of you?

13 A. I have page 2, yes.

14 Q. Does page 2 of Exhibit 1079 show a picture  
15 of a DIMM, which is to say Dual in-Line Memory  
16 Module?

17 A. Yes, I believe it does.

18 Q. Could you please turn to page 3 of  
19 Exhibit 1079, and let me know when you're there.

20 A. I have page 3.

21 Q. Does page 3 of Exhibit 1079 also show a  
22 picture of a DIMM memory module at the bottom of the  
23 page?

24 MR. ROE: Objection. Outside the scope.  
25 Lacks foundation. Authenticity.

1 THE WITNESS: Yes, I believe that's a DIMM.

2 BY MR. CHANDLER:

3 Q. Do you agree that SDRAM memory devices  
4 emerged in the 1990s and have been standardized by  
5 JEDEC?

6 MR. ROE: Objection. Outside the scope.

7 THE WITNESS: Generally I would say that's  
8 correct, although I don't know the date for certain.

9 BY MR. CHANDLER:

10 Q. Do you agree that SDRAM memory devices have  
11 evolved in several generations, including DDR, DDR2  
12 and DDR3?

13 MR. ROE: Objection. Outside the scope.  
14 Relevance.

15 THE WITNESS: I do. That matches exactly  
16 what's on this page.

17 BY MR. CHANDLER:

18 Q. And does that match your understanding?

19 A. Yes, it does.

20 Q. And do you believe that matches what a  
21 person of ordinary skill in the art would have  
22 understood?

23 MR. ROE: Objection. Outside the scope.

24 THE WITNESS: Generally I would say yes.

25

1 BY MR. CHANDLER:

2 Q. Please turn to page 4 of Exhibit 1079, and  
3 let me know when you're there.

4 A. I'm there.

5 Q. Do you agree that SDRAM memory devices  
6 contain several sections called "banks"?

7 MR. ROE: Objection. Outside the scope.

8 THE WITNESS: I do.

9 BY MR. CHANDLER:

10 Q. Do you agree that each bank within an SDRAM  
11 memory device consists of rows and columns of memory?

12 MR. ROE: Objection. Outside the scope.

13 THE WITNESS: I do.

14 BY MR. CHANDLER:

15 Q. And please turn to page 5 of Exhibit 1079,  
16 and let me know when you're there.

17 A. I'm there.

18 Q. Do you agree that "a rank is a set of DRAMs  
19 that are written to or read from together"?

20 MR. ROE: Objection. Outside the scope.

21 Calls for a legal conclusion.

22 THE WITNESS: I do.

23 BY MR. CHANDLER:

24 Q. Do you agree that DQ is an acronym that is  
25 commonly used to refer to a data line?

1 MR. ROE: Objection. Relevance.

2 THE WITNESS: Yes. I agree that DQ is an  
3 acronym that refers to a data line.

4 BY MR. CHANDLER:

5 Q. And I have a question now that nobody's ever  
6 been able to answer for me, so I'd be grateful if you  
7 can tell me the answer.

8 Do you know why it's called DQ?

9 MR. ROE: Objection. Outside the scope. It  
10 lacks foundation.

11 THE WITNESS: I think -- believe the history  
12 is that -- and this is a very deep recollection --  
13 that outputs on Bipolar RAMs used to be called Q. I  
14 don't know why. And then at -- somewhere along the  
15 line it got modified a little a bit to DQ, but I  
16 really -- I really don't have -- I don't have an  
17 exact -- an exact knowledge of that.

18 BY MR. CHANDLER:

19 Q. In the memory module drawn on page 5 of  
20 Exhibit 1079, is it fair to say that's illustrating  
21 that 64 bits would be read from the module or written  
22 to the module at a time?

23 MR. ROE: Objection. Outside the scope.  
24 Lacks foundation. Calls for an incomplete  
25 hypothetical.

1           Also, Counsel, I -- my pagination on the  
2 document you sent me appears to be different than the  
3 pagination indicated in the document itself, meaning,  
4 the cover page is something called CDX-200.1 and then  
5 your pagination is page 1, which would be consistent;  
6 but then on page 2 in my version it's CDX-200.3, and  
7 then yours is a page 2.

8           Is this a complete document? Can you make a  
9 representation on the record? Or is this an excerpt  
10 from some other document? I need to preserve my  
11 objections here, and I want to make sure it's not a  
12 printing problem or something else since we're doing  
13 this remotely.

14           MR. CHANDLER: Well, I can tell you this,  
15 that the page numbers we're using are on the bottom  
16 after Exhibit 1079, and there are ten pages, 1  
17 through 10.

18           And as to your question as to whether the  
19 original tutorial was sequentially numbered or  
20 whether it had gaps, that's not a question that I can  
21 answer.

22           MR. ROE: So object to this document as  
23 being incomplete and best evidence as well. That  
24 refers to both Exhibits 1079 in both proceedings.  
25

1 BY MR. CHANDLER:

2 Q. So Mr. Murphy, on page 5 in Exhibit 1079, do  
3 you agree the memory module that's drawn there would  
4 read or write 64 bits at a time?

5 MR. ROE: Objection. Outside the scope.  
6 Lacks foundation.

7 THE WITNESS: Yes, I agree that that's the  
8 case.

9 BY MR. CHANDLER:

10 Q. Could you please turn to page 6 of  
11 Exhibit 1079 and let me know when you're there.

12 A. I'm there.

13 Q. Do you agree that the acronym "DQS" refers  
14 to the data strobe signal?

15 MR. ROE: Objection. Outside the scope.  
16 Lacks foundation.

17 THE WITNESS: Yes, I agree that's what DQS  
18 stands for.

19 BY MR. CHANDLER:

20 Q. Do you agree that the DQS data strobe clocks  
21 the DQ data signal into and out of the DRAM memory  
22 device?

23 MR. ROE: Objection. Outside the scope.  
24 Mischaracterizes the document.

25 THE WITNESS: Yes, I agree that that's the

1 case.

2 BY MR. CHANDLER:

3 Q. Can you please turn to page 7 of  
4 Exhibit 1079 and let me know when you're there.

5 A. I'm there.

6 Q. Do you agree that page 7 of Exhibit 1079  
7 illustrates an unbuffered DIMM also known as a UDIMM?

8 MR. ROE: Objection. Outside the scope.  
9 Assumes facts in evidence. Lack of foundation.

10 THE WITNESS: Yes, I agree that that's what  
11 that slide shows.

12 BY MR. CHANDLER:

13 Q. In your opinion did a person of ordinary  
14 skill in the art know about UDIMM memory modules?

15 MR. ROE: Objection. Outside the scope.

16 THE WITNESS: With respect to the time frame  
17 that we're talking about for this patent in this  
18 matter?

19 BY MR. CHANDLER:

20 Q. Yes.

21 MR. ROE: Same objections.

22 THE WITNESS: Yes.

23 BY MR. CHANDLER:

24 Q. Using page 7 of Exhibit 1079, how would you  
25 explain to a layperson what a UDIMM is?

1 MR. ROE: Objection. Outside the scope.  
2 Relevance.

3 THE WITNESS: So a UDIMM is an Unbuffered  
4 DIMM, and that terminology refers to the fact that  
5 the Address, Command and Clock signals coming from  
6 the memory controller coming on to the DIMM via the  
7 edge connectors and edge pins go directly to the  
8 DRAMs, and this is also true of the DQ and DQS  
9 signals coming from the memory controller through the  
10 edge connections and the edge pins. Those signals  
11 also go directly to DRAMs No. 1 through 8.

12 BY MR. CHANDLER:

13 Q. And you referred to edge connectors and edge  
14 pins. Where would those be located on the  
15 representation of the memory module that's shown in  
16 Exhibit 1079?

17 MR. ROE: Objection. Outside the scope.

18 THE WITNESS: So if we --

19 MR. ROE: Hold on.

20 THE WITNESS: Sorry.

21 MR. ROE. Objection. Form. Outside the  
22 scope. Assumes facts not in evidence. Lacks  
23 foundation.

24 THE WITNESS: Okay. So if we return back to  
25 Exhibit 1079, page 3 where we have a picture of a

1 DIMM, we can see specifically gold little vertical  
2 stripes at the bottom of the board. Those are all  
3 aligned on a single edge of the board. Those would  
4 be edge connect- -- those would -- that is literally  
5 the edge connector, and each one of those individual  
6 gold fingers, if you will, are the edge pins. That  
7 is how all of the electrical signals get into and out  
8 of a DIMM as shown here on this figure in this slide.

9           And then if we simply take -- keep that in  
10 mind, when we look back at Slide No. 7, even though  
11 the positioning of the RAMs and the number of RAMs do  
12 not actually totally match what we saw on page 3, the  
13 picture on page 3 of an actual device, the general  
14 nomenclature of these schematic diagrams are made to  
15 match in certain details the kinds of things that we  
16 see on the actual DIMM itself.

17           So for example, if we look at the memory  
18 controller which is the box at the bottom, we see  
19 along the top edge a multitude of circles that are  
20 filled in with color. And from the left they are --  
21 the -- the gold-colored ones are labeled DQ/DQS, and  
22 they came -- and those -- the signals from those gold  
23 circles come up, cross over what is the edge of the  
24 UDIMM, and then proceed to go directly to the DRAM.

25           And this is drawn this way to let people

1 understand that this is roughly how the signals get  
2 from the memory controller to the -- like, for  
3 instance, DRAM No. 1 through DRAM No. 8.

4 In addition to that, we see in the center of  
5 the memory controller a red dot. And if we follow  
6 that line up on to the UDIMM, it also goes through to  
7 the same edge connector, and we see it's labeled  
8 Address, Command and Clock. And we see that it is  
9 sent up through the center between the eight DRAMs,  
10 swings to the left, then comes down, and then, in  
11 succession, goes across to the right, hitting DRAM 1,  
12 2, 3, 4, 5, 6, 7, 8, and then having a termination  
13 resistor at the end of that electrical line. So  
14 this -- this picture helps one understand the general  
15 layout and connections of a UDIMM.

16 Does that answer your question?

17 BY MR. CHANDLER:

18 Q. I think so. So for clarity, the edge  
19 connections and pins would be along the bottom line  
20 of the rectangle labeled "UDIMM"?

21 MR. ROE: Objection. Outside the scope.  
22 Lacks foundation.

23 THE WITNESS: Yes. It's not only on the  
24 bottom line of the -- this UDIMM picture here. But  
25 if you refer back to picture -- the picture on

1 Slide 3, it's on the bottom of that actual UDIMM.  
2 And generally we call it the bottom because that's  
3 the piece that goes into the slot in the motherboard.  
4 And when the motherboard is sitting horizontally, the  
5 pins are pointed down, being the bottom, and there's  
6 no pins on the top; correct.

7 BY MR. CHANDLER:

8 Q. Could you please turn to page 8 of  
9 Exhibit 1079, and let me know when you're there.

10 A. I'm there.

11 Q. Do you agree that page 8 of Exhibit 1079  
12 illustrates a Registered DIMM also known as an RDIMM?

13 MR. ROE: Objection. Outside the scope.  
14 Lacks foundation.

15 THE WITNESS: Yes, I do. This picture  
16 represents schematically a Registered DIMM.

17 BY MR. CHANDLER:

18 Q. In your opinion did a person of ordinary  
19 skill in the art know about RDIMM memory modules?

20 A. Yes.

21 Q. And using this illustration on page 8 of  
22 Exhibit 1079, how would you explain to a layperson  
23 what an RDIMM is?

24 MR. ROE: Objection. Vague. Outside the  
25 scope.

1 THE WITNESS: So this slide is specifically  
2 titled "Evolution of DIMMs: JEDEC Registered"  
3 RDIMM -- oh, sorry. "JEDEC Registered DIMM (RDIMM)."

4 And so as I first talked about in the  
5 beginning, we can see -- one could see that the  
6 architectural structure of the DIMM is different here  
7 than a UDIMM. Certain aspects from the UDIMM have  
8 been kept unmodified, specifically the connections  
9 from the memory controller up to the DRAM 1 through  
10 DRAM 8 which are identified at the top line of memory  
11 controller by the gold circles and labeled inside the  
12 RDIMM as DQ/DQS. Those signals still, like the  
13 UDIMM, get sent from the memory controller and go  
14 directly to DRAMs Nos. 1 through 8.

15 However, what we see in the center of this  
16 DIMM is [sic] been changed from a UDIMM. In fact,  
17 the architecture is different. We again still see a  
18 red circle at the center top of the memory controller  
19 box. And of course, just as before, all of these  
20 signals are through the edge connection and the edge  
21 pins that we've previously talked about.

22 But in this -- in this depiction, we see  
23 that the lines labeled at the top of the RDIMM  
24 center, Address, Command and Clock, do not go  
25 directly to the DRAMs in question.

1           A couple of things have changed here. One  
2 is the fact that the lines run into the register  
3 directly, the box labeled "Register" which is a  
4 separate chip. And only after proceeding through  
5 that register do those Address, Command and Clock  
6 lines proceed up to get close to the top of the  
7 DRAMs, the closest two DRAMs being DRAM 4 and DRAM 5,  
8 again identified as with a red circle.

9           And then we see that those signals are  
10 electrically split both to the left and to the right.  
11 The left-hand side, the Address, Command and Clock  
12 signals, are servicing DRAM Nos. 1 through 4. And at  
13 the -- as the signal moves from the center point, it  
14 traverses through DRAM 4, then DRAM 3, then DRAM 2,  
15 then DRAM 1 and then hits a termination resistor.

16           On the right -- that's the left-hand side.  
17 And on the right-hand side we see that those signals,  
18 Address, Command and Clock, traverse from the center  
19 red dot through DRAM 5, DRAM 6, DRAM 7, DRAM 8, and  
20 then connect to a termination resistor on the far  
21 right.

22           So the architecture of the DIMM here has  
23 been specifically been modified. And besides having  
24 the signals that go through the register -- that's  
25 the Address, Command and Clock signals -- the other

1 thing that has changed is the physical layout of how  
2 those signals get to DRAMs 1, 2, 3, 4, 5, 6 and 7, 8.

3 You'll see, if you essentially do a  
4 comparison between this slide and the slide on page  
5 7, you could look at the UDIMM arrangement for those  
6 three signals -- Address, Command and Clock -- and  
7 see that they take a circuitous route up the center  
8 to the left down connecting through DRAM 1, 2, 3, 4,  
9 5, 6, 7, 8.

10 And since it's well known to a POSITA that  
11 electrical signals take time to propagate in a UDIMM,  
12 the DRAM would see the Address, Command and Clock  
13 signals before DRAM 1 would see those signals arrive  
14 before those signals arrive at DRAM 8.

15 So there would be eight -- eight transitions  
16 sitting on those signals, a transition there meaning  
17 a transition in the -- in the out- -- in the  
18 impedance of the line and -- which results from the  
19 connection of the DRAM onto those lines, any one of  
20 those DRAMs, whereas in slide 8, there is a less  
21 circuitous route for the Address, Command and Clock  
22 signals. They actually only traverse through four  
23 DRAMs which reduces the amount of reflections from  
24 either the left side or the right side compared to  
25 the UDIMM. And lowering the number of -- the number

1 and type of reflections due to loads enables one to  
2 move at a higher speed.

3 So two things really changed here.  
4 Address, Command and Clock signals only get to the  
5 DRAMs after they've been through the register, and  
6 also those signals are wired differently in a  
7 different physical configuration. The signals  
8 related to DQ and DQS have generally not changed.

9 MR. ROE: For the court reporter, you asked  
10 me to let you know if you missed objections. I'm  
11 trying my best. There was an "outside the scope"  
12 preceding the answer to that question that was missed  
13 on realtime.

14 THE REPORTER: Thank you.

15 BY MR. CHANDLER:

16 Q. Mr. Murphy, do you see the square in the  
17 middle of the RDIMM memory module on page 8 of  
18 Exhibit 1079 that's labeled "Register"?

19 A. I do.

20 Q. What does the register in an RDIMM do?

21 MR. ROE: Objection. Vague. Outside the  
22 scope possibly.

23 THE WITNESS: The register in the RDIMM  
24 receives the signals coming to it from the memory  
25 controller and then buffers those signals and sends

1    them out to all of the DRAMs.

2    BY MR. CHANDLER:

3           Q.   And how would you explain to a layperson  
4    what the benefit or the purpose of a register on an  
5    RDIMM is?

6           MR. ROE:  Objection.  Assumes facts not in  
7    evidence.  Lacks foundation.  Outside the scope.

8           THE WITNESS:  The benefit of a register  
9    is -- in this case is that it reduces the total  
10   amount of load that would be seen by the memory  
11   controller.  So for instance, if we contrast the  
12   image, the picture we have on page 8 versus the image  
13   we have on page 7, for example, if -- and page 7 is  
14   the UDIMM, if we look at the signals that come out of  
15   the memory controller in the center on the UDIMM  
16   page 7, we see that those signals are connected  
17   directly to all eight of the DRAMs, which means that  
18   the load of all eight of those DRAMs is present on  
19   the lines that come from the memory controller which  
20   means that the output driver of the memory controller  
21   has to drive all eight of those loads in a timely  
22   fashion, and meaning that the driver must be big  
23   enough.

24           The second problem with the UDIMM is that  
25   each of the DRAMs creates an impedance mismatch along

1 that line. And as you go down the line moving from  
2 left DRAM 1 to right DRAM 8, the waveform gets  
3 distorted based on the change in the impedance of the  
4 wire.

5 And the register in the case of the RDIMM on  
6 Slide 8, it only presents a much smaller and single  
7 load to the memory controller that is shown on  
8 page 8, and the drivers for those signals that are  
9 used in either the four DRAMs on the left 1 through 4  
10 or the four DRAMs on the right labeled 5 through 8,  
11 those electrical paths are run in parallel in a  
12 fashion that the goal would be to try and lower the  
13 amount of time that the UDIMM has for those signals,  
14 the transition time, and the transport time. And  
15 here as you can see -- and I've said before -- as we  
16 move to the left, we only see four DRAMs in a  
17 terminating resistor. And as we see to the right we  
18 only see four DRAMS in a terminating resistor all  
19 being driven by the register. So the register drives  
20 all of that load, not the memory controller.

21 BY MR. CHANDLER:

22 Q. And what's the benefit of having the memory  
23 module reduce the load that is seen by the system  
24 memory controller?

25 MR. ROE: Objection. Outside the scope.

1 Lacks foundation and assumes facts.

2 THE WITNESS: Well, the general benefit is  
3 that, since the load on any particular pin coming  
4 from -- sorry. Pin and signal on that pin coming  
5 from the memory controller -- in this case the  
6 Address, Command and the Clock signals -- they have  
7 lower -- lower loads that are presented to the memory  
8 controller which would enable someone to put, for  
9 example, multiple DIMMs in parallel and still have  
10 the memory controller see less load than if they had  
11 multiple DIMMs, multiple UDIMMs all being driven by  
12 the same memory controller.

13 BY MR. CHANDLER:

14 Q. And can you explain a little bit more to a  
15 layperson what load is and why lowering the load is  
16 beneficial?

17 MR. ROE: Objection. Form. Outside the  
18 scope.

19 THE WITNESS: Yeah. To a layperson I would  
20 tell them that load in electrical sense can very  
21 easily be thought of bucket size in a water sense.  
22 If you have a source for water, like the connection  
23 on the external part of the house that you could  
24 attach a hose to, and if you have a hose that is  
25 limited in size, if your bucket is -- let's say in

1 one case your bucket is an 8-ounce cup, and you  
2 have -- and the hose can go from completely off to  
3 completely on, and no other changes other than those,  
4 the fact that your load or your bucket size -- in  
5 this case an 8-ounce cup -- is small, that means that  
6 the hose, even with its limitations, is able to fill  
7 up the cup quickly. In this case the water drops  
8 would be representative of the electrons on  
9 electrical wire.

10 On the other hand if, let's say, the bucket,  
11 quote/unquote, at the end of the hose is not an  
12 8-ounce cup but a 55-gallon barrel, given that -- the  
13 fact that the hose is only so big, you've now  
14 increased the load significantly, and it will take  
15 much more time to fill that 55-gallon barrel with  
16 water than to fill the 8-ounce cup.

17 For an electrical system, load pretty much  
18 is very often dominated by capacitance, and to make  
19 the voltage on a capacitance change, we have to add  
20 or subtract electrons from the capacitance, and a  
21 capacitor is a very short-term storage element in  
22 electrical system.

23 So if I have very small capacitances and a  
24 large capable -- a large capability to deliver  
25 electrons, the signals get there very quickly. If I

1 have -- even if I have the same large capability to  
2 deliver electrons in the electrical system but the  
3 capacitance is now roughly 100 times bigger, this  
4 system moves in a very linear fashion. So whatever  
5 the time would be generally to fill up the small  
6 capacitor, to fill up the big capacitor it could be  
7 100 times slower.

8 And in that example, I'm specifically  
9 ignoring the resistance of the wires that carry the  
10 electrons.

11 BY MR. CHANDLER:

12 Q. So if I understand correctly, as a benefit  
13 of reducing electrical load, that it can permit the  
14 signaling on the memory module to be faster?

15 MR. ROE: Objection. Outside the scope.  
16 Mischaracterizes the testimony. Assumes facts not in  
17 evidence.

18 THE WITNESS: Yes. Generally when the load  
19 is lower, given that the source is fixed, the signal  
20 is able to get to the load in a quicker amount of  
21 time.

22 BY MR. CHANDLER:

23 Q. Could you please turn to page 9 of  
24 Exhibit 1079, and let me know when you're there.

25 A. I'm there.

1 Q. Do you agree that page 9 of Exhibit 1079  
2 illustrates a Fully Buffered DIMM also known as an  
3 FBDIMM?

4 MR. ROE: Objection. Outside the scope.  
5 Vague. Foundation.

6 THE WITNESS: Yes, I do.

7 BY MR. CHANDLER:

8 Q. In your opinion would a person of ordinary  
9 skill in the art have known about FBDIMM memory  
10 modules?

11 A. Yes. This is the one I spoke to earlier as  
12 having come roughly five years before the patent in  
13 question, so yes.

14 Q. Using page 9 of Exhibit 1079, how would you  
15 explain to a layperson what an FBDIMM is?

16 MR. ROE: Objection. Outside the scope.  
17 Vague.

18 THE WITNESS: So an FBDIMM is yet another  
19 example of a completely different architecture that  
20 tries to get increased performance and hopefully add  
21 the ability to keep that performance as you add  
22 capacity by buffering not only the Address, Command  
23 and Clock signals in the red dots but also the data  
24 and the data strobe signals labeled DQ/DQS in the  
25 yellow dots by putting the memory devices completely

1 on the opposite side of the Advanced Memory Buffer.

2 And so as you see here, the biggest -- the  
3 biggest change that you see here from the last one we  
4 looked at, the RDIMM, is that now instead of the  
5 memory controller driving the signals DQ/DQS directly  
6 to the DRAMs, they move the -- they move those  
7 signals from going from the memory controller  
8 directly to the DRAM to going from the memory  
9 controller directly to the Advanced Memory Buffer.

10 That's what AMB stands for.

11 And in the Advanced Memory Buffer, those  
12 signals get buffered up, meaning they are -- they  
13 have a -- the signals apply very small load to the  
14 memory controller, and yet we use multiple stages to  
15 enable a very large drive capability on the output of  
16 the Advanced Memory Buffer.

17 The other thing that you see is that the --  
18 is that those output signals -- actually input and  
19 output signals -- because the DQ lines are  
20 bidirectional -- DQS also -- unlike the RDIMM we saw,  
21 those lines all move through the Advanced Memory  
22 Buffer, and then they are distributed in the same  
23 sort of -- if you will, it's a "T" fashion. They  
24 come up in the center and then break left and right  
25 and go -- so the left side transitions to DRAM 4,

1 then DRAM 3, then DRAM 2 and then the termination  
2 resistor.

3 On the right-hand side the signals  
4 transition past DRAM 5, then DRAM 6, then DRAM 7,  
5 then DRAM 8, and then hits the termination resistor.

6 So this is an attempt to change the  
7 architecture once again and provide what people hope  
8 to be a good solution for increasing the speed that  
9 the DIMM would operate at and hopefully increasing  
10 the amount of capacity that a system might be able to  
11 have.

12 The one thing -- for example, the one thing  
13 that's different here with respect to the example on  
14 page 7 of the UDIMM is that now the signals that get  
15 to -- all of the signals now that get to the DRAMs in  
16 the FBDIMM actually arrive there slower than the  
17 example on page 7 in the UDIMM because the only thing  
18 preventing the signals from getting to the UDIMM  
19 DRAMs is the delay from the wires in that  
20 configuration and that architecture, whereas in the  
21 FBDIMM architecture, the -- all of the signals must  
22 move through the AMB, the Advanced Memory Buffer,  
23 which basically slows those signals down. The  
24 architecture tries to make up for that by being able  
25 to operate at a higher frequency, thereby making the

1 delay injected by the AMB less consequential.

2 BY MR. CHANDLER:

3 Q. And did you say that AMB stands for Advanced  
4 Memory Buffer?

5 A. Yes.

6 Q. Could you turn to page 10 of Exhibit 1079,  
7 and let me know when you're there.

8 A. I'm there.

9 Q. Do you agree that page 10 of Exhibit 1079  
10 illustrates a DDR3 LR-DIMM memory module?

11 MR. ROE: Objection. Outside the scope.  
12 Lacks foundation. Vague.

13 THE WITNESS: I believe it's probably --  
14 it's probably only from a very high conceptual point  
15 of view that to be true.

16 BY MR. CHANDLER:

17 Q. In your opinion did a person of ordinary  
18 skill in the art know about DDR3 LR-DIMM memory  
19 modules?

20 MR. ROE: Objection. Vague.

21 THE WITNESS: As I've testified already  
22 today, I believe -- I believe that they did. I  
23 don't -- I don't know that they would have perceived  
24 it in the fashion that's shown here on -- on Figure  
25 10.

1 BY MR. CHANDLER:

2 Q. Can you explain that a little more?

3 A. Yeah. The -- figure 10 is, in my parlance I  
4 would call it a 90,000-foot view. In reality I  
5 believe at least in some configurations that in an  
6 LR-DIMM, the buffers used to buffer DQ and DQS  
7 actually sit below each one of the DRAMs so that the  
8 path for the data comes straight up from the memory  
9 controller into a small buffer and then into the  
10 DRAM.

11 And here the impression I think one would  
12 receive is that all of the -- all of the DRAM input  
13 and output signals, so DQ/DQS, would move through a  
14 single box which is a combination of a register and a  
15 buffer, and that just -- that just to my mind goes to  
16 remind me of how much of a wiring nightmare that  
17 would be.

18 But it is certainly possible to do it this  
19 way. It's -- and it does list this as Generation 1,  
20 so -- but the -- the other part that is sort of well  
21 known is that the FBDIMM architecture with the  
22 Advanced Memory Buffer generally did not survive very  
23 long in the industry and whereas the LR-DIMM is very  
24 much a standard even until today.

25 And the two comparison images that we have

1 here might tend to make people think that they're  
2 identical, and I think generally today the  
3 distribution of the signals is a little bit different  
4 than this.

5           Nonetheless, an LR-DIMM has buffers on the  
6 data and buffers on the DQS and the Command and  
7 Address and Clock.

8           Q. In your opinion was it known to a person of  
9 ordinary skill in the art that the data buffers could  
10 be distributed along the bottom of the memory module  
11 as you were describing earlier in an LR-DIMM?

12           A. Yes, I believe it was.

13           Q. In your opinion was there also a version of  
14 DDR3 LR-DIMM that had a single buffer as shown on  
15 page 10 of Exhibit 1079 for all of the Command,  
16 Address, Clock and data signals?

17           MR. ROE: Objection. Outside the scope.  
18 Vague.

19           Let me just -- let me get my objections in.

20           Objection. Outside the scope. Vague.

21 Mischaracterizes prior testimony. Asked and  
22 answered.

23           THE WITNESS: My impression from reading  
24 this slide is that there is -- that there was one. I  
25 cannot remember exactly what it looked like or how

1 much of -- how much of an adjustment this slide has  
2 had to it to make it appealable for whatever Netlist  
3 wanted to do in this -- in this particular  
4 presentation.

5 MR. CHANDLER: All right. Why don't we take  
6 a break for lunch. Let's go off the record.

7 THE VIDEOGRAPHER: Going off the record at  
8 12:25 p.m.

9 (Luncheon recess taken from 12:25 p.m. to  
10 1:15 p.m.)

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1 A F T E R N O O N P R O C E E D I N G S :  
2

3 THE VIDEOGRAPHER: Going back on the record  
4 at 1:15 p.m.

5 BY MR. CHANDLER:

6 Q. Mr. Murphy, during the break did you discuss  
7 the substance of your testimony with anyone?

8 A. No.

9 Q. And do you have any corrections or  
10 clarifications to any of your earlier testimony  
11 today?

12 MR. ROE: Objection. Vague.

13 THE WITNESS: Not as of right now, no.

14 BY MR. CHANDLER:

15 Q. Could you pull up Exhibit 2007 and let me  
16 know when you have it.

17 MR. ROE: I think it's in the large binder  
18 there.

19 THE WITNESS: Okay. I have that.

20 BY MR. CHANDLER:

21 Q. And could you please turn to Figure 2 of  
22 Exhibit 2007, and then let me know when you're there.

23 A. I have Figure 2.

24 Q. Do you see on the left side of Figure 2 of  
25 Exhibit 2007 it says, "DIMM Types Supported in

1 Standard DIMM Connector"?

2 MR. ROE: Objection. Outside the scope.

3 Excuse me. Objection. Outside the scope.

4 THE WITNESS: Looks like the fourth row  
5 down.

6 BY MR. CHANDLER:

7 Q. Yes.

8 A. Yes, I do.

9 Q. What is a DIMM connector?

10 A. A DIMM connector is the receptacle that a  
11 DIMM is put into, like a slot.

12 Q. And what is your understanding of what is  
13 meant in Figure 2 of Exhibit 2007 by the phrase "DIMM  
14 Types Supported in Standard DIMM Connector"?

15 MR. ROE: Objection. Outside the scope.

16 THE WITNESS: So in general that would  
17 reference all of the different types of DIMMs that  
18 might be supported in the connector that was on a  
19 two-socket server as listed in the title.

20 BY MR. CHANDLER:

21 Q. Did RDIMM, UDIMM and LR-DIMM memory modules  
22 fit into the same slot on a computer?

23 MR. ROE: Objection. Outside the scope. It  
24 lacks foundation and incomplete hypothetical.

25 THE WITNESS: It -- it seems to -- this

1 table seems to give the impression that that was a  
2 case that's not something that I have specifically  
3 researched completely or opined on in my report in my  
4 declaration, I don't believe.

5 BY MR. CHANDLER:

6 Q. In your opinion would a person of ordinary  
7 skill in the art know whether or not RDIMM, UDIMM and  
8 LR-DIMM memory modules could fit into the same slot  
9 on a computer?

10 MR. ROE: Objection. Outside the scope.  
11 Lacks foundation. Incomplete hypothetical. Vague.

12 THE WITNESS: I'm sorry. I didn't hear the  
13 last part in that. Into the what?

14 BY MR. CHANDLER:

15 Q. In your opinion would a person of ordinary  
16 skill in the art know whether or not RDIMM, UDIMM and  
17 LR-DIMM memory modules could fit into the same slot  
18 on a computer?

19 MR. ROE: Objection. Outside the scope.  
20 Lacks foundation. Incomplete hypothetical. Vague.

21 THE WITNESS: Well, I haven't opined on that  
22 in my declaration, and I haven't done any research  
23 for it. Certainly this table seems to suggest that,  
24 but at this point today I couldn't -- I couldn't say.  
25 I couldn't answer that question.

1 BY MR. CHANDLER:

2 Q. Were UDIMM, RDIMM, FBDIMM and LR-DIMM the  
3 primary types of memory modules that existed for  
4 computer systems at that time, or do you recall other  
5 significant categories of memory modules that existed  
6 at that time?

7 MR. ROE: Objection. Vague.

8 THE WITNESS: Well, the one category that I  
9 don't see listed here in this time frame would be  
10 DIMMs that use Rambus parts.

11 (Reporter clarification.)

12 BY MR. CHANDLER:

13 Q. Mr. Murphy, did you say Rambus, R-a-m-b-u-s?  
14 The company Rambus?

15 A. Correct.

16 Q. And was there a name or a term that was used  
17 by persons of ordinary skill in the art for DIMMs  
18 made by Rambus?

19 A. Yes, but I can't seem to reach out and grab  
20 that. I don't remember right this second. The  
21 Rambus parts had a completely different architecture,  
22 so -- but I don't remember the pneumatic for it.

23 (Reporter clarification.)

24 BY MR. CHANDLER:

25 Q. So aside from UDIMM, RDIMM, FBDIMM, LR-DIMM

1 and the Rambus DIMM, do you recall any other  
2 significant categories of memory modules that existed  
3 at the time, or do you believe that those were the  
4 primary types of memory modules that existed for  
5 computer systems at the time?

6 MR. ROE: Objection. Vague. Outside the  
7 scope.

8 THE WITNESS: As I sit here today, I can't  
9 think of any others other than the Rambus ones.

10 BY MR. CHANDLER:

11 Q. In your opinion would a person of ordinary  
12 skill in the art have known about the tradeoffs  
13 between UDIMM, RDIMM, FBDIMM and LR-DIMM?

14 MR. ROE: Objection. Vague.

15 THE WITNESS: Generally speaking I believe  
16 they would. They -- they each have a different  
17 architecture, and those architectures lend themselves  
18 to certain performance metrics, and they definitely  
19 would -- one of ordinary skill in the art would have  
20 been at least aware of those differences, yes.

21 BY MR. CHANDLER:

22 Q. Could you turn to Exhibit 2017, and let me  
23 know when you're there.

24 A. I'm there.

25 Q. Could you turn to page 3 of Exhibit 2017,

1 please.

2 A. You said "3"; correct?

3 Q. Yes.

4 A. I'm there.

5 Q. Do you see at the bottom of page 3 of  
6 Exhibit 2017 there's a heading that says, quote, When  
7 load-reduced DIMMs (LR-DIMMs) are best?

8 A. I see that.

9 Q. In your opinion would a person of ordinary  
10 skill in the art have known that LR-DIMMs are better  
11 than RDIMMs when the goal is to have a very large  
12 quantity of memory?

13 MR. ROE: Objection. Outside the scope.

14 THE WITNESS: Well, I'll note that this is  
15 not something that I opined on. This document seems  
16 to say that LR-DIMMs are the way to go for very large  
17 quantities. One of the things that it also does note  
18 is that they are still quite costly, and I think the  
19 other part that is important to note here is the fact  
20 that large quantities was not necessarily the only  
21 goal for a memory system.

22 BY MR. CHANDLER:

23 Q. Could you turn to page 4 of Exhibit 2017,  
24 and look at the bottom, and let me know when you're  
25 there.

1 A. I'm there.

2 Q. In your opinion would a person of ordinary  
3 skill in the art have known that choosing LR-DIMMs  
4 and RDIMMs depends on what performance  
5 characteristics meets the needs of the application?

6 MR. ROE: Objection. Mischaracterizes the  
7 document or misstates the document.

8 THE WITNESS: Well, that's what this --  
9 that's what this document says here. But I will note  
10 that, in the sentence right after that, it also says,  
11 careful consideration of latency, speed and capacity  
12 as applied to your problem will show you the way to  
13 go.

14 So it wasn't -- it wasn't any one specific  
15 design choice, if you will. It was a combination of  
16 considering multiple design choices. But yes, one of  
17 ordinary skill in the art would have understood that.  
18 BY MR. CHANDLER:

19 Q. In your opinion would a person of ordinary  
20 skill in the art have chosen between an LR-DIMM and  
21 an RDIMM based on factors such as latency, speed and  
22 capacity?

23 MR. ROE: Objection. Outside the scope.  
24 Incomplete hypothetical. Vague.

25 THE WITNESS: I think that those certainly

1 would be -- would be part of the consideration. I  
2 think the things that were not mentioned in that  
3 question would have been cost and power. Those all  
4 would have been part of the design considerations  
5 considered.

6 BY MR. CHANDLER:

7 Q. In your opinion would a person of ordinary  
8 skill in the art have known about the tradeoffs with  
9 respect to latency, speed, capacity, cost and power  
10 when choosing between an LR-DIMM and an RDIMM?

11 MR. ROE: Objection. Vague.

12 THE WITNESS: Yes. I believe one of  
13 ordinary skill in the art would have known that those  
14 areas were all areas that need to be considered  
15 before making a choice.

16 BY MR. CHANDLER:

17 Q. Would a person of ordinary skill in the art  
18 have known about the tradeoffs between a memory  
19 module that buffers the data lines, such as an FBDIMM  
20 and an LR-DIMM; and a memory module that does not  
21 buffer the data lines, such as an RDIMM and a UDIMM?

22 MR. ROE: Objection. Vague. Assumes facts  
23 not in evidence. Foundation.

24 THE WITNESS: As we've talked about earlier  
25 today in the technical tutorial presentation that

1 we've discussed, I believe that a person of ordinary  
2 skill in the art would understand that those -- that  
3 those things are different amongst those  
4 architectures, and that they would make a difference  
5 to the various design considerations that people had  
6 to consider.

7 BY MR. CHANDLER:

8 Q. And would those design considerations  
9 include factors such as latency, speed, capacity,  
10 cost and power?

11 A. Yes, I believe they would.

12 Q. What were the known benefits at the time of  
13 having a Memory Buffer on an FBDIMM or an LR-DIMM for  
14 buffering the data lines?

15 MR. ROE: Objection. Outside the scope.  
16 Incomplete hypothetical. Assumes facts not in  
17 evidence.

18 THE WITNESS: Well, I think the -- in the --  
19 in the general sense, the known -- the known benefits  
20 would have been the reduction of load to the data  
21 lines themselves. That's what buffers generally  
22 provide.

23 BY MR. CHANDLER:

24 Q. And how would reducing load either help or  
25 hurt with respect to latency, speed, capacity, power

1 and cost?

2 A. Well, I think the one that is -- I think  
3 probably the one that's easiest to look at in that  
4 grouping is capacity because the lower capacitance on  
5 the data pins would allow one to put more DIMMs on a  
6 particular driver that exists in a memory controller.  
7 I think the ones that -- the ones that consider --  
8 that need much more consideration would be the  
9 latency, the speed and the power because the  
10 introduction of a data buffer changes those  
11 characteristics on a DIMM.

12 Q. In your opinion did a person of ordinary  
13 skill in the art understand the tradeoffs that would  
14 be created by including a Memory Buffer on the memory  
15 module --

16 MR. ROE: Objection.

17 BY MR. CHANDLER:

18 Q. -- for buffering the data lines?

19 MR. ROE: Objection. Vague.

20 THE WITNESS: I think one of ordinary skill  
21 in the art would truly understand that, if you took  
22 data lines that have no buffers as in the RDIMM and  
23 the UDIMMs and then added a buffer into all of those  
24 signal paths, there would be certainly issues with  
25 respect to speed of operation, with respect to --

1 with respect to the change in the architecture, the  
2 change in the latency and, depending upon the speeds,  
3 also the change in the reliability to do reads and  
4 writes.

5 BY MR. CHANDLER:

6 Q. In what situations would an LR-DIMM memory  
7 module be more advantageous than a memory module  
8 without a data buffer?

9 MR. ROE: Objection. Outside the scope.

10 Just a second.

11 Incomplete hypothetical and vague.

12 THE WITNESS: So I believe that the -- the  
13 biggest -- the biggest difference here would be that  
14 people understood that RDIMMs had shorter latencies.  
15 At the -- at the time of comparison they were -- you  
16 were able to run them at higher speeds, but that also  
17 comes about at a design choice of not having as much  
18 capacity as the LR-DIMMs. So I would say generally,  
19 if you needed something high speed, you would -- and  
20 somewhat lower cost, you would be interested more in  
21 RDIMMs than you would in LR-DIMMs. And if you need  
22 something that needed large capacity, you would pick  
23 the LR-DIMMs or anything that had a data buffer on  
24 it.

25 That being said, the data buffer on the DIMM

1 increases the latency, and so just putting the buffer  
2 on actually makes the performance go down. And  
3 unless you can raise the operating frequency high  
4 enough, you -- that's the only way to get that --  
5 that loss of speed back, so -- and that requires  
6 really that you expend more power to do it.

7 Q. And when you mentioned in your answer large  
8 capacity, are you referring to the total number of  
9 bits that can be stored on the memory module?

10 A. Yeah. That's -- that's certainly one way to  
11 consider it. I think another way to consider it  
12 would be total capacity also of the lines that you're  
13 driving as far as the data pins are concerned. So  
14 for instance, if you're just doing a comparison  
15 between, you know, an LR-DIMM with memory buffers --  
16 with data buffers on it versus an RDIMM with no data  
17 buffers on it, clearly the memory buffers are going  
18 to give you a lower load capacity than the RDIMM  
19 situation, and that lower load capacity would let you  
20 increase the total number of bits stored on the  
21 LR-DIMM compared to the RDIMM.

22 Q. And can you give a rough approximation of  
23 how many more bits could be stored on an LR-DIMM  
24 memory module compared to an RDIMM memory module? So  
25 for example, are we talking about twice the number of

1 bits on an LR-DIMM as compared to an RDIMM? Or four  
2 times? Or how would you characterize it?

3 MR. ROE: Objection. Outside the scope.  
4 Incomplete hypothetical. Vague.

5 THE WITNESS: At -- this point in time,  
6 since that wasn't something I was asked to opine on,  
7 I haven't researched it, so I wouldn't be able to  
8 give you an accurate answer, and I really want to  
9 research it before I did.

10 BY MR. CHANDLER:

11 Q. Do you believe it would be a multiple of the  
12 number of goods though, so at least twice as many?

13 MR. ROE: Objection. Outside the scope.  
14 Incomplete hypothetical.

15 THE WITNESS: I don't have the information  
16 here to answer that question.

17 BY MR. CHANDLER:

18 Q. Could you turn back to Exhibit 1079, the  
19 technology tutorial, and let me know when you have  
20 that in front of you.

21 A. I have it.

22 Q. Could you turn back to page 9 of  
23 Exhibit 1079 which is the page showing an FBDIMM, and  
24 let me know when you're there.

25 MR. ROE: Outside the scope and lack of

1 foundation.

2 THE WITNESS: So I'm there.

3 BY MR. CHANDLER:

4 Q. Did the JEDEC standards for FBDIMM memory  
5 modules provide for any type of training?

6 MR. ROE: Objection. Outside the scope.  
7 Vague. Calls for speculation.

8 THE WITNESS: I'm sorry. I wasn't ever  
9 asked to opine on anything with respect to the  
10 FBDIMMs, and I don't have that answer right off the  
11 top of my head today.

12 BY MR. CHANDLER:

13 Q. Before LR-DIMMs, was training something that  
14 a person of ordinary skill in the art knew was  
15 possible to do on a memory module?

16 MR. ROE: Objection. Vague.

17 THE WITNESS: My general concept of that is  
18 there probably was, but I haven't researched when  
19 that actually happened, so I couldn't say for sure,  
20 and that's -- here today that's the best answer I  
21 could give you.

22 BY MR. CHANDLER:

23 Q. Could you turn back to page 8 of  
24 Exhibit 1079 which is the page showing an RDIMM, and  
25 let me know when you're there.

1 Did the JEDEC standards for RDIMM memory  
2 modules provide for any type of training?

3 MR. ROE: Objection. Outside the scope.  
4 Vague.

5 THE WITNESS: Again, I wasn't asked to opine  
6 on that. I haven't gone back and reviewed any of the  
7 JEDEC RDIMM specifications.

8 BY MR. CHANDLER:

9 Q. Did the JEDEC standards for RDIMM memory  
10 modules provide for an initialization mode?

11 MR. ROE: Objection. Outside the scope.

12 THE WITNESS: Well, in general all of the  
13 memory used in computers for quite a while and quite  
14 a few years now have had an initialization sequence.  
15 For example, making sure that you could read and  
16 write data to the memories, making sure that what you  
17 wrote was actually what you read. So they -- and  
18 DRAMs especially, especially after the synchronous  
19 change, so from before -- before synchronous  
20 DRAMs until synchronous DRAMs, all of those DRAMs  
21 have initialization procedures in them because the  
22 DRAMs have functional differences that can be -- that  
23 can be very different from one another inside the  
24 part, meaning that the part will either let you  
25 function this way or this way, and those bits of

1 information telling the device what to be gets set in  
2 the initialization sequence.

3 BY MR. CHANDLER:

4 Q. So would it be fair to say that a person of  
5 ordinary skill in the art would know that RDIMM and  
6 FBDIMM and LR-DIMM memory modules would have an  
7 initialization mode?

8 MR. ROE: Objection. Vague.

9 THE WITNESS: Yes. Generally that's the  
10 case, yes.

11 BY MR. CHANDLER:

12 Q. As the speed of the DRAM memory increases,  
13 for example, from the DDR2 memory devices to the DDR3  
14 memory devices, would initialization become more  
15 important?

16 MR. ROE: Objection. Assumes facts not in  
17 evidence.

18 THE WITNESS: Well, once again, I haven't  
19 been asked to opine on that so I don't have an  
20 opinion here. But in general, I would say one of the  
21 things that generally occurred every time the DRAMs  
22 changed. So from SDRAM to DDR to DDR2 to DDR3, the  
23 features and functions inside those devices generally  
24 changed from generation to generation. And on the  
25 basis of just the fact that there were more features;

1 therefore, more things that potentially had to be  
2 initialized, I would say in general the answer to  
3 your question is yes because, now instead of  
4 potentially having five things to set up to get the  
5 part to work, maybe I had eight things to set up.  
6 And so the initialization sequences became more  
7 important at least in that fashion.

8 BY MR. CHANDLER:

9 Q. And would it be fair to say that it was  
10 known for memory modules, including LR-DIMM and  
11 FBDIMM and RDIMM, that, in addition to an  
12 initialization mode, there would be a normal mode of  
13 operation?

14 MR. ROE: Objection. Vague.

15 THE WITNESS: Yes. That was -- that was  
16 very well known to one of ordinary skill in the art  
17 that there was an initialization mode, and there was  
18 a normal mode. And until the initialization mode had  
19 completed successfully, the normal mode would not  
20 function correctly.

21 BY MR. CHANDLER:

22 Q. Could you turn to page 10 of Exhibit 1079  
23 which is the page showing DDR3 LR-DIMM, and let me  
24 know when you're there.

25 A. I'm there.

1 Q. What types of training existed for DDR3  
2 LR-DIMM memory modules?

3 MR. ROE: Objection. Vague.

4 THE WITNESS: Well, the types of training  
5 that I have identified in my declaration specifically  
6 relate to write training and read training.

7 BY MR. CHANDLER:

8 Q. Could you keep this page in front of you,  
9 and then also turn to page -- to Exhibit 1015, the  
10 JEDEC proposal. And let me know when you have both  
11 documents organized in front of you.

12 A. So I have 1015 available. What page would  
13 you like?

14 Q. Page 4.

15 A. I have it.

16 Q. Do you see on the top of page 4 of  
17 Exhibit 1015, the JEDEC proposal, there's an overview  
18 of the initialization of the Memory Buffer on a DDR3  
19 LR-DIMM?

20 A. I do.

21 Q. And for clarity, on page 10 of Exhibit 1079,  
22 where is the Memory Buffer that's referenced in  
23 Exhibit 1015?

24 MR. ROE: Objection. Outside the scope.  
25 Lacks foundation. Assumes facts not in evidence.

1 THE WITNESS: Well, as I said, in this  
2 90,000-foot view of the LR-DIMM shown on page 10, as  
3 drawn, all of the buffers exist inside the box that's  
4 labeled "Register/Buffer."

5 BY MR. CHANDLER:

6 Q. All right. Which trainings for a DDR3  
7 LR-DIMM involve the Memory Buffer?

8 MR. ROE: Objection. Vague. Lacks  
9 foundation. It's outside the scope to the extent the  
10 question refers to 1079.

11 THE WITNESS: So we --

12 THE REPORTER: I'm sorry. Do you mind  
13 repeating after, "Lacks foundation."

14 MR. ROE: Yes. It's outside the scope. It  
15 lacks foundation. And to the extent that question is  
16 referring to 1079 specifically, it lacks foundation.

17 I can't remember the other objections.

18 THE REPORTER: Thank you.

19 THE WITNESS: So would you like to repeat  
20 the question, please?

21 BY MR. CHANDLER:

22 Q. Which trainings for a DDR3 LR-DIMM memory  
23 module involve the Memory Buffer?

24 MR. ROE: Objection. Vague.

25 THE WITNESS: So if we look at Figure 1 and

1 we start at the top of that overview, we see a bubble  
2 labeled "Power-Up," another bubble labeled "SPD  
3 Readout."

4 A third bubble starts with "Host Interface,"  
5 the fourth bubble is labeled "MB Initialization," and  
6 the fifth RAM is -- the fifth bubble is labeled "DRAM  
7 initialization," and the sixth bubble is labeled  
8 "DRAM ZQ Calibration."

9 And the next element there is a box as  
10 opposed to a bubble, and it says "MB-DRAM Interface  
11 Training," and this is specifically talking about the  
12 signals that would go from the Memory Buffer that we  
13 see on page 10 specifically labeled  
14 "Register/Buffer," the signals that go from there out  
15 to the DRAMs themselves.

16 Proceeding down the Initialization Overview,  
17 the next bubble that we see is listed as "Host-MB  
18 Training," and that would reply to the signals that  
19 run between the memory controller, the host; and MB,  
20 the Memory Buffer, which on page 10 of Exhibit 1079  
21 is labeled "Register/Buffer."

22 So a combination of MB-DRAM interface  
23 training which handles the signals on one side of the  
24 buffer and then also the training of the other side  
25 of the buffer which the signals communicate to the

1 host with, Host-MB Training.

2 And just one other thing. The last bubble  
3 in the overview is the bubble labeled "Normal  
4 Operation," basically identifying that all of the  
5 elements before in this group of things need to be  
6 done and complete successfully before normal  
7 operation could be achieved.

8 Q. Does "Host Interface CA Clk-to-Cmd Training"  
9 involve the Memory Buffer?

10 MR. ROE: Objection. Outside the scope.

11 THE WITNESS: It's not possible to get that  
12 information from Exhibit 1079, page 10. And I will  
13 note, at the bottom that is one of the items that's  
14 starred, and at the bottom it says, This step is  
15 optional for a Memory Buffer but may be done by some  
16 platforms.

17 But you cannot derive that information from  
18 Exhibit 1079, page 10.

19 BY MR. CHANDLER:

20 Q. But I was -- to be clear, I was asking about  
21 Exhibit 1015, page 4, the JEDEC proposal. Do you  
22 have that page --

23 A. I -- yeah, I have that page in front of me,  
24 and I also have the page that you wanted me to  
25 compare it to, which is Exhibit 1079, page 10. And I

1 did that. I just did that comparison for you.

2 And the Host Interface CA Clk-to-Cmd

3 Training is not -- is not shown anywhere on -- is not  
4 shown anywhere on page 10 that you -- that you talked  
5 about, so I can't compare it to something that's not  
6 there.

7 Q. So what is Host Interface CA Clk-to-Cmd  
8 Training?

9 MR. ROE: Objection. Outside the scope.

10 THE WITNESS: So it is training basically  
11 that talks about the Command/Address/Clock and where  
12 that is turned into a -- turned into a specific  
13 command to get the timing done correctly.

14 BY MR. CHANDLER:

15 Q. And when you say "to get the timing done  
16 correctly," the timing between what and what?

17 A. Well, between the -- between the host  
18 interface and where the commands are decoded using  
19 the Clock and the CA. So that would -- that would  
20 more than likely happen in the Register/Buffer that's  
21 listed on Exhibit 1079, page 10, but it's not  
22 specifically stated there.

23 Q. Does Exhibit 1015, page 4, refer to the  
24 initialization of the Memory Buffer of a DDR3  
25 LR-DIMM?

1           A. Yes. I've talked about that at Bubble 1, 2,  
2   3 -- Bubble No. 4 has Memory Buffer initialization.

3           Q. And so would all of the bubbles on page 4 of  
4   Exhibit 1015 be performed with respect to the Memory  
5   Buffer of the DDR3 LR-DIMM?

6           MR. ROE: Objection. Outside the scope.  
7   Asked and answered. Vague.

8           (Reporter clarification.)

9           THE WITNESS: So the -- a certain number of  
10   the bubbles there are not related to the Memory  
11   Buffer per se. An example would be the "Power-Up"  
12   bubble, the "SPD Readout" bubble, the "DRAM  
13   Initialization" bubble, the "DRAM ZQ Calibration"  
14   bubble. Those -- those bubbles generally, at most  
15   the MB, might be involved in passing signals through  
16   from the memory controller to the DRAMs, for example,  
17   or from the -- to any of the other chips from the  
18   memory controller to any of the other chips that  
19   might be on the board.

20           But for instance, the Memory Buffer, it only  
21   holds -- or sorry. Passes through information, for  
22   example, for, like, the DRAM initialization or the  
23   DRAM ZQ calibration.

24   BY MR. CHANDLER:

25           Q. And do you see the asterisks with the

1 footnote that --

2 A. I do.

3 Q. -- "the Host Interface CA Clk-to-CMD  
4 Training"? Do you see that asterisk and footnote?

5 A. I do.

6 Q. And does that tell us that Host Interface CA  
7 Clk-to-CMD Training is an optional training for the  
8 Memory Buffer, abbreviated MB?

9 A. Yes, it does.

10 Q. Does the MB initialization step involve the  
11 Memory Buffer?

12 A. Well, MB stands for Memory Buffer; so I  
13 believe so, yes.

14 Q. So it would be fair to say that on page 4 of  
15 Exhibit 1015, the JEDEC proposal, that the  
16 initialization steps that directly implicate the  
17 Memory Buffer can include Host Interface CA  
18 Clk-to-CMD Training, MB Initialization, MB-DRAM  
19 Interface Training and Host-MB Training.

20 Is that a fair summary?

21 MR. ROE: Objection. Vague.  
22 Mischaracterizes the prior testimony.

23 Outside the scope.

24 THE REPORTER: I didn't hear it.

25 THE WITNESS: I would say only insofar as

1 the -- two of the ones you list, the host interface  
2 one and the Host-MB Training, which are both tagged  
3 as being optional, if they were actually needed for  
4 the platform in question.

5 THE REPORTER: And I didn't hear your last  
6 objection, Mr. Roe.

7 MR. ROE: Outside the scope.

8 THE REPORTER: Thank you.

9 BY MR. CHANDLER:

10 Q. On a DDR3 LR-DIMM, which of the trainings  
11 that involve the Memory Buffer require the edge  
12 connections to be active?

13 MR. ROE: Objection. Form.

14 THE WITNESS: Well, the only ones that  
15 require the edge connections to be active are the  
16 Host-MB Training, which is optional as shown here on  
17 Figure 1 of Exhibit 1015, page 4; and Host Interface  
18 CA Clk-to-CMD, Training, which is also shown as being  
19 active on the same figure.

20 And I'm sorry. Could you -- could I ask you  
21 to repeat? In that question you were asking about  
22 initialization or training?

23 Q. Training.

24 A. And -- yeah. So my answer is -- stands as  
25 is.

1 Q. On a DDR3 LR-DIMM, which of the trainings  
2 that involve a Memory Buffer require the pins to be  
3 active?

4 MR. ROE: Objection. Form. Vague.

5 THE WITNESS: Well, the answer to that  
6 question relates to the fact that the pins -- I  
7 believe that the pins you're talking about are the  
8 pins of the edge connector, and my answer is the  
9 same.

10 BY MR. CHANDLER:

11 Q. So it's the Host-MB Training and the Host  
12 Interface CA Clk-to-CMD Training that require the  
13 edge connections to be active and the pins to be  
14 active? Is that a fair summary?

15 MR. ROE: Objection. Mischaracterizes prior  
16 testimony.

17 THE WITNESS: Yes, if they are required in  
18 the particular platform that's being dealt with.

19 BY MR. CHANDLER:

20 Q. On a DDR3 LR-DIMM, which of the trainings  
21 that involve the Memory Buffer do not require the  
22 edge connections or the pins to be active?

23 MR. ROE: Objection. Vague.

24 THE WITNESS: All of those trainings would  
25 be in the square box labeled "MB-DRAM Interface

1 Training."

2 BY MR. CHANDLER:

3 Q. Does the step of MB Initialization on a DDR3  
4 LR-DIMM require the edge connections and the pins to  
5 be active?

6 MR. ROE: Objection. Outside the scope.  
7 Vague.

8 THE WITNESS: In general this step is --  
9 involves communications from the memory controller to  
10 the Memory Buffer because generally memory buffers  
11 will support different types of DIMMs on the board or  
12 at different latencies, and so the MB Initialization  
13 is to set up the internal workings of the Memory  
14 Buffer. So those require communications through the  
15 edge connectors and the edge connector and the edge  
16 pins back to the memory controller.

17 MR. CHANDLER: All right. I want to mark an  
18 exhibit, so why don't we do what we did before. Take  
19 a quick break. I will, I guess, e-mail it to Scott  
20 and the court reporter, we'll get it printed, and  
21 then we'll reconvene after that.

22 THE VIDEOGRAPHER: Going off the record at  
23 2:05 p.m.

24 (Recess taken from 2:05 p.m. to 2:20 p.m.)

25 THE VIDEOGRAPHER: Start of Video File

1 No. 3. We're back on the record at 2:20 p.m.

2 MR. CHANDLER: So Mr. Murphy, I'd like to  
3 introduce a new exhibit which I'll mark as  
4 Exhibit 1080 in both IPR2022-00062 and IPR2022-00064.

5 (Exhibit 1080, Annotation of DDR3 LR-DIMM  
6 for IPR2022-00062 and IPR2022-00064, marked for  
7 identification.)

8 BY MR. CHANDLER:

9 Q. Do you have Exhibit 1080 in front of you?

10 MR. ROE: We will object to this document as  
11 late and untimely, authenticity, hearsay, foundation,  
12 undue prejudice.

13 THE WITNESS: I have them in front of me,  
14 yes.

15 BY MR. CHANDLER:

16 Q. Do you see that Exhibit 1080 includes a  
17 drawing of a DDR3 LR-DIMM like what we saw on  
18 Exhibit 1079 except that here in Exhibit 1080 some  
19 labels have been added that are highlighted in green,  
20 red and purple?

21 MR. ROE: Objection. Outside the scope.  
22 Lacks foundation.

23 THE WITNESS: I see that. And I assume that  
24 both of these are identical so that we can just deal  
25 with, like, the one marked ending in -62?

1 BY MR. CHANDLER:

2 Q. Correct.

3 A. Great.

4 Q. Do you see on the bottom right of  
5 Exhibit 1080 there's a label in purple that says  
6 "Edge Connections/Pins"?

7 A. I do.

8 Q. Does the horizontal purple line on  
9 Exhibit 1080 provide a reasonable approximation of  
10 where the edge connections and pins would be located  
11 on a DDR3 LR-DIMM memory module?

12 MR. ROE: Objection. Outside the scope.  
13 Vague. Lacks foundation. Mischaracterizes prior  
14 testimony.

15 THE WITNESS: As I've already testified  
16 today, I compared -- sorry -- page -- page 10 of  
17 Exhibit 1079 with page 3 of Exhibit 1079, both -- the  
18 IPR number ending in -62. And this purple line seems  
19 to coincide with what I described previously today.

20 BY MR. CHANDLER:

21 Q. And to be clear, what you described  
22 previously today with respect to the location of edge  
23 connections and pins?

24 A. Yes.

25 Q. Do you see in the upper right in

1 Exhibit 1080 there's a label in green?

2 MR. ROE: Objection. Outside the scope.

3 THE WITNESS: I see the label.

4 BY MR. CHANDLER:

5 Q. Would it be fair to say that on a DDR3  
6 LR-DIMM that MB-DRAM Interface Training does not  
7 require the edge connections and pins to be active as  
8 suggested by the label in green on Exhibit 1080?

9 MR. ROE: Let me digest that question.

10 Objection. Outside the scope. Vague.  
11 Lacks foundation.

12 THE WITNESS: I believe that that label  
13 is -- is poorly placed because of the fact that the  
14 person who did the graphic put that label on a  
15 horizontal line which goes between the eight DRAMs,  
16 yet the label says "MB-DRAM Interface Training,"  
17 which also includes the vertical line from the line  
18 that's presently highlighted in yellow down to the  
19 Register/Buffer which is, at a minimum, covered by  
20 another blue line.

21 BY MR. CHANDLER:

22 Q. But would it be fair to say that, on a DDR3  
23 LR-DIMM, that MB-DRAM Interface Training does not  
24 require the edge connections and pins to be active?

25 A. Yes, I believe that's the case.

1 Q. And that's because MB-DRAM Interface  
2 Training is between the buffer, which is illustrated  
3 in the square in the center, and the DRAM memory  
4 devices above the buffer.

5 Is that fair?

6 MR. ROE: Objection. Outside the scope to  
7 the extent this is directly directed to this image in  
8 1080 or in 1079. And assumes facts not in evidence,  
9 and mischaracterizes prior testimony.

10 THE WITNESS: I think -- I think that label,  
11 as I said, points to a line that goes across all of  
12 the DRAMs here and doesn't include the buffer, the  
13 line that would go down to the buffer for that  
14 training, but I agree that, to do that training in a  
15 DDR3 LRDRAM, you do not have to have the edge  
16 connections and -- or pins active.

17 BY MR. CHANDLER:

18 Q. I just want to understand a little bit  
19 better your concern about what the green arrow is  
20 pointing to.

21 Would it be fair to say that the orange  
22 circle indicating data lines would connect both  
23 horizontally to the DRAMs but also vertically down to  
24 the Memory Buffer?

25 MR. ROE: Objection. Mischaracterizes the

1 document. Assumes facts not in evidence. Outside  
2 the scope.

3 THE WITNESS: The example that we have in  
4 front of us has only a single -- a black line moving  
5 up from the Register/Buffer. And in the portion of  
6 that black line that then goes horizontal at the  
7 lower portion of the DRAMs, those, because of the  
8 yellow dot, would be recognized as the DQ/DQS lines  
9 based on the yellow dot just above the center of the  
10 Memory Controller whereas the lines that go left --  
11 the horizontal lines at the top of the DRAMs with the  
12 red dot represent the Command, Address and Clock  
13 lines distributed across the top of the DRAMs in this  
14 display.

15 And the appearance here is that the vertical  
16 line going from the Register/Buffer up to -- up to  
17 those two horizontal lines that I just discussed  
18 should have a combination of a red and a yellow dot  
19 on them because those lines in this depiction carry  
20 both the Command, Address and Clock lines and the  
21 DQ/DQS lines.

22 Is that clear?

23 BY MR. CHANDLER:

24 Q. I think so. And, you know, that's the  
25 reason that -- for the exhibit is to, you know, make

1 sure that we're both clear with each other.

2 So if I understand what you just said, would  
3 it be more clear or accurate if there was a second  
4 green arrow pointing to the red dot on the top  
5 horizontal line?

6 MR. ROE: Objection. Outside the scope.  
7 Lacks foundation.

8 THE WITNESS: Actually that wasn't -- I  
9 wasn't thinking of that at all. But the fact of the  
10 matter is that the -- that the training does in  
11 both -- does both involve the, for instance,  
12 Command, Address and Clock lines and the DQ/DQS  
13 lines.

14 I -- it just seems to me like you're trying  
15 to take a poor depiction and couch it as covering  
16 everything, and it's -- it's just a poor depiction.  
17 BY MR. CHANDLER:

18 Q. But explain again. What's the poor  
19 depiction with respect to MB-DRAM Interface Training?  
20 So I understand --

21 MR. ROE: Same objections.

22 BY MR. CHANDLER:

23 Q. -- your last comment was that I guess it  
24 includes both data lines and command lines, so both  
25 the orange dot and red dot horizontally.

1           Was there something else that you thought  
2 was --

3           A. Well, that --

4           Q. -- poorly depicted?

5           MR. ROE: So objection. Improper narrative.  
6 Mischaracterizes testimony and outside the scope.

7           THE WITNESS: So the poor depiction, I would  
8 say, is to do MB-DRAM Interface Training, which would  
9 include read and -- reads and writes, you not only  
10 have to have data on the data pins, you need to have  
11 addresses. You need to have the clock. You need to  
12 have a command, you know, saying you're doing that,  
13 those things. It looks like this only points to one  
14 of those.

15           Does that clarify it for you?

16 BY MR. CHANDLER:

17           Q. I think so. I'm just wondering, you know,  
18 working within the confines of what we have available  
19 to us here, would it be a better depiction if there  
20 was a second green arrow that went to the red dot to  
21 convey that the MB-DRAM Interface Training involves  
22 both data signals but also command signals?

23           MR. ROE: Objection. Outside the scope.  
24 Still lacks foundation.

25           THE WITNESS: So given --

1 THE REPORTER: I'm sorry. I --

2 THE WITNESS: So given that I looked at  
3 Exhibit --

4 THE REPORTER: I'm sorry. I only heard  
5 "outside the scope."

6 MR. ROE: Still lacks foundation.

7 THE REPORTER: Thank you.

8 THE WITNESS: So given that I looked at  
9 Exhibit 1079 which is the tutorial, page 10, it's  
10 very obvious to me that you clip this information on  
11 Exhibit 1080, page 1, and then added the labels that  
12 you wanted to add to it.

13 BY MR. CHANDLER:

14 Q. Correct.

15 A. Right? My -- my commentary here relates to  
16 the fact that I probably would not have labeled this  
17 in this fashion. And if your intent is to ask me  
18 whether the pins and the edge connections are active  
19 during MB-DRAM Training, Interface Training, I  
20 believe I've already answered that.

21 Q. Okay.

22 A. The part that I have said and tried to  
23 explain with respect to this depiction is that I  
24 think more than the DQ/DQS lines are involved in  
25 doing the MB-DRAM interface training, and this

1 seems -- this label seems to only point to the yellow  
2 dot up near the DRAMs.

3 Q. Okay. Do you see on the bottom left of  
4 Exhibit 1080 there's a label in red?

5 A. I do.

6 Q. Would it be fair to say that, on a DDR3  
7 LR-DIMM, that "Host-MB Training," "Host Interface CA  
8 Clk-to-Cmd Training," and "MB Initialization" each  
9 require the edge connections and pins to be active?

10 MR. ROE: Objection. Outside the scope.  
11 Compound. Asked and answered.

12 THE WITNESS: Yeah. As I've testified  
13 before, I believe that Host-MB Training, Host  
14 Interface CA Clk-to-Cmd Training and MB  
15 Initialization will all need the edge connections and  
16 pins to be active so that the signals can be brought  
17 from the Memory Controller to the box in this diagram  
18 labeled "Register/Buffer."

19 BY MR. CHANDLER:

20 Q. And do you believe that a person of ordinary  
21 skill in the art would have known that?

22 MR. ROE: Objection. Vague. Outside the  
23 scope. Compound. Lacks foundation.

24 THE WITNESS: Well, if they -- certainly  
25 we -- I've already testified that they would have

1 been aware of the -- at least the content in the  
2 JEDEC proposal which is Exhibit 1015. And since  
3 these items are all listed in 1015 and there's  
4 discussion about them, I believe that they would be  
5 aware.

6 MR. CHANDLER: All right. I have another  
7 exhibit, so could we take a quick break, and I'll  
8 send an e-mail.

9 MR. ROE: Let's go off the record.

10 THE VIDEOGRAPHER: Going off the record at  
11 2:35 p.m.

12 (Recess taken from 2:35 p.m. to 2:53 p.m.)

13 THE VIDEOGRAPHER: Going back on the record  
14 at 2:53 p.m.

15 MR. CHANDLER: I'd like to introduce a new  
16 exhibit which I'll mark as Exhibit 1081 in both  
17 IPR2022-00062 and IPR2022-00064.

18 (Exhibit 1081, Annotation of DR3 LR-DIMM for  
19 IPR2022-00062 and IPR2022-00064, marked for  
20 identification.)

21 BY MR. CHANDLER:

22 Q. Mr. Murphy, do you have Exhibit 1081 in  
23 front of you?

24 A. I do.

25 MR. ROE: And we will object to this exhibit

1 as late and untimely; irrelevant; unreliable; no  
2 foundation; outside the scope.

3 BY MR. CHANDLER:

4 Q. And similar to what we discussed just a  
5 moment ago, do you see that Exhibit 1081 includes a  
6 drawing of a DDR3 LR-DIMM like what we saw on page 10  
7 of Exhibit 1079, except in Exhibit 1081 some labels  
8 have been added that have been highlighted in green,  
9 red and purple?

10 MR. ROE: We also object to this document as  
11 hearsay as well and mischaracterizing testimony.

12 THE WITNESS: So I see the labels, yes.

13 BY MR. CHANDLER:

14 Q. And do you see on the upper right of  
15 Exhibit 1081 there's a label in green?

16 A. I do.

17 Q. Would it be fair to say that, on a DDR3  
18 LR-DIMM, that MB-DRAM Interface Training does not  
19 require the edge connections and pins to be active?

20 A. Yes. Based on the JEDEC proposal,  
21 Exhibit 1015, that would be the case.

22 Q. And do you believe that a person of ordinary  
23 skill in the art would have known that?

24 MR. ROE: Objection. Vague.

25 THE WITNESS: Yes, I believe that that is --

1 would have been knowledge to =- available to a person  
2 of ordinary skill in the art.

3 BY MR. CHANDLER:

4 Q. Do you see on the bottom right of  
5 Exhibit 1081 there's a label in purple that says  
6 "Edge Connection/Pins"?

7 A. Yes.

8 Q. Does the horizontal purple line on  
9 Exhibit 1081 provide a reasonable approximation of  
10 where the edge connections and pins would be located  
11 on a DDR3 LR-DIMM memory module?

12 MR. ROE: Objection. Outside the scope and  
13 asked and answered.

14 THE WITNESS: Yes, it does.

15 BY MR. CHANDLER:

16 Q. Do you see on the bottom left of  
17 Exhibit 1081 there's a label in red?

18 A. I do.

19 Q. And in your opinion would a person of  
20 ordinary skill in the art have known that, on a DDR3  
21 LR-DIMM memory module, that Host-MB Training, Host  
22 Interface CA Clk-to-CMD Training and MB  
23 Initialization each require the edge connections and  
24 pins to be active?

25 MR. ROE: Objection. Outside the scope.

1 Asked and answered.

2 THE WITNESS: Yes, I believe that's the  
3 case.

4 BY MR. CHANDLER:

5 Q. All right. You can put that exhibit down.  
6 You're welcome to look at it or refer to it. I mean,  
7 you don't have to put it too far way, but I'm going  
8 to ask you a different question, and I don't want to  
9 sort of confuse you by thinking that -- that you need  
10 to look at that exhibit to answer my next question.

11 Understood?

12 A. Yes.

13 Q. In your opinion would a person of ordinary  
14 skill in the art know that "MB" is a well-known  
15 acronym for Memory Buffer?

16 A. With respect to the subject matter we're  
17 talking about in this IPR, yes, they would.

18 Q. In your opinion would a person of ordinary  
19 skill in the art know that the MB on a DDR3 LR-DIMM  
20 refers to a Memory Buffer that buffers data, address  
21 and command signals?

22 A. Yes. Based on the information, they would  
23 have known via the word of mouth, et cetera, from the  
24 JEDEC proposal, Exhibit 1015.

25 Q. Would a person of ordinary skill in the art

1 have known that a DDR3 LR-DIMM has edge connections  
2 and pins for communicating data, address and command  
3 signals to a system memory controller?

4 MR. ROE: Objection. Vague. Compound and  
5 to the extent it calls for a legal conclusion.

6 THE WITNESS: Yes, I believe that would be  
7 the case in that many of those signals existed in  
8 prior art DDR RAMs previous to the DDR3.

9 BY MR. CHANDLER:

10 Q. In your opinion would a person of ordinary  
11 skill in the art know that an RDIMM memory module  
12 buffers address and command signals but not data  
13 signals?

14 MR. ROE: Objection. Vague.

15 THE WITNESS: Sorry.

16 (Reporter clarification.)

17 BY MR. CHANDLER:

18 Q. In your opinion would a person of ordinary  
19 skill in the art have known that an RDIMM memory  
20 module buffers address and command signals but not  
21 data signals?

22 MR. ROE: Objection. Lacks foundation.

23 THE WITNESS: In general I believe that to  
24 be true, especially based on the patent from  
25 Hazelzet.

1 BY MR. CHANDLER:

2 Q. In your opinion would a person of ordinary  
3 skill in the art have known how to train a memory  
4 buffer on a memory module such as an LR-DIMM?

5 MR. ROE: Objection. Lacks foundation.  
6 Incomplete hypothetical.

7 THE WITNESS: Well, I guess the first part  
8 of that I would answer by saying that, prior to them  
9 seeing the information, that would have been in the  
10 JEDEC proposal, Exhibit 1015, they would -- they  
11 would probably not know that information and --  
12 however, it -- it's true they would have known of  
13 training in general as there were multiple memory  
14 patents available that had training discussed in  
15 them.

16 So they would have known training from that  
17 background, but until they had seen or had  
18 communicated to them the JEDEC proposed -- proposal  
19 that we see in Exhibit 1015, I don't believe they  
20 would have been able to know the exact details of the  
21 training involved in an LR-DIMM -- DDR3 LR-DIMM.

22 BY MR. CHANDLER:

23 Q. At the time of the provisional application  
24 marked as Exhibit 1008, which is to say June 12th of  
25 2009, in your opinion would a person of ordinary

1 skill in the art have known how to train a Memory  
2 Buffer on an LR-DIMM?

3 MR. ROE: Objection. Vague. Incomplete  
4 hypothetical.

5 THE WITNESS: Well, I think that the only --  
6 the only information that we have concerning that  
7 with respect to that particular date would have been  
8 what isn't actually in the provisional which just  
9 talks to a recent JEDEC proposal. And so it's -- it  
10 certainly is -- presents an interesting question  
11 about whether the proposal for the LR-DIMM is the one  
12 that's talked about in the provisional. For our  
13 purposes here, that's -- that is what my declaration  
14 is based upon.

15 BY MR. CHANDLER:

16 Q. To be clear, in your opinion would a person  
17 of ordinary skill in the art at the time of the  
18 provisional application marked as Exhibit 1008 have  
19 known how to train a Memory Buffer on an LR-DIMM as  
20 indicated in the JEDEC proposal marked as  
21 Exhibit 1015?

22 MR. ROE: Objection. Vague. Incomplete  
23 hypothetical. Goes beyond the scope of the direct  
24 testimony. Compound.

25 THE WITNESS: With respect -- with respect

1 to the JEDEC proposal that's listed in the  
2 provisional Exhibit 1008, since it does not talk  
3 about which proposal it is talking about, and also as  
4 I previously testified, the -- a person of ordinary  
5 skill in the art would only know about this proposal  
6 from word-of-mouth through or interaction with other  
7 members potentially at their company that knew about  
8 the JEDEC proposal, that's the only way that I  
9 believe they would know a person of ordinary skill in  
10 the art would know that information.

11 BY MR. CHANDLER:

12 Q. In your opinion would a person of ordinary  
13 skill in the art at the time of the provisional  
14 application marked as Exhibit 1008 know how to train  
15 a Memory Buffer on an LR-DIMM using the steps that  
16 are listed on page 4 of Exhibit 1015, even if they  
17 did not have a copy of Exhibit 1015 at the time?

18 MR. ROE: Objection. Outside the scope.  
19 Incomplete hypothetical. It's compound. Asked and  
20 answered.

21 THE WITNESS: I think it's very hard to tell  
22 whether one of ordinary skill in the art, having  
23 never seen this specification and only communicated  
24 to via word-of-mouth or some other means of  
25 communication, it's hard to tell that they would

1 understand every exact limitation that's put into  
2 this -- or this proposed specification or the DDR3  
3 LR-DIMM Memory Buffer installation proposal.

4 BY MR. CHANDLER:

5 Q. Would it be fair to say that in your opinion  
6 it is unclear whether a person of ordinary skill in  
7 the art, at the time of the provisional application  
8 marked as Exhibit 1008, knew how to train the Memory  
9 Buffer on an LR-DIMM?

10 MR. ROE: Objection. Vague. Incomplete  
11 hypothetical. It's compound. Parts of it are  
12 outside the scope.

13 THE WITNESS: So with respect to your  
14 question, are we talking about a person of ordinary  
15 skill in the art who had this information  
16 communicated to them via word-of-mouth or that type  
17 of thing, or did they have the proposal given to them  
18 by somebody? How did they -- how did this person of  
19 ordinary skill in the art come upon this information?

20 BY MR. CHANDLER:

21 Q. I'm trying to understand your opinion on  
22 that question, and I guess I'm less interested in how  
23 they came to know it. I'm more interested in whether  
24 or not they did know it, but I do have some interest  
25 in how you believe they would have learned whatever

1 it is they knew.

2 But the first question, though, is, you  
3 know, what did the person of ordinary skill in the  
4 art know at the time of the provisional application  
5 marked as Exhibit 1008?

6 MR. ROE: Objection. Vague.

7 The witness: So as I have --

8 MR. ROE: Objection to form to the -- to  
9 that question, as to that question that's asked on  
10 the record.

11 THE WITNESS: So as I have noted in my  
12 declaration, it was -- known to a person of ordinary  
13 skill in the art that memory systems and employed  
14 Memory Buffer to buffer the data lines between a host  
15 and a memory module component such as DRAM were well  
16 known in the art at the time of the provisional, and  
17 the example I gave there was FBDIMMs.

18 So a POSITA would have understood and known  
19 that those systems that employed a Memory Buffer  
20 would hand off training conducted between a Memory  
21 Buffer, between the Memory Buffer and the DRAMs to  
22 the Memory Buffer, giving the host a reduced  
23 workload.

24 BY MR. CHANDLER:

25 Q. Okay.

1           A. Those issues were well known. All, for  
2 example, a POSITA would have to have known with  
3 respect to an LR-DIMM is that the memory output pins  
4 use data buffers in them that would have indicated to  
5 a POSITA that MB-DRAM training is critical to  
6 implement in those LR-DIMM initializations.

7           So the question in my mind still at hand is  
8 whether or not the person of ordinary skill in the  
9 art had seen the -- had seen the JEDEC proposal and  
10 was able to ascertain all of the information that it  
11 included within it.

12           The -- given that proposal, given that they  
13 had seen it or had been talked to about it, then they  
14 would have understood how that JEDEC proposal talks  
15 about dealing with MB training.

16           Q. I want to clarify your last statement.

17           So is it your opinion that a person of  
18 ordinary skill in the art would have known at the  
19 time of the provisional marked as Exhibit 1008 about  
20 how to train the Memory Buffer on an LR-DIMM as  
21 explained on page 4 of Exhibit 1015 even if the  
22 person of ordinary skill in the art did not have a  
23 copy of Exhibit 1015?

24           A. Am I -- I think that's exactly the point  
25 that I'm trying to understand from you in that what I

1 said is that, if Memory Buffers included data  
2 buffering were known -- and they certainly were known  
3 in the industry -- then one of ordinary skill in the  
4 art would understand that, if you buffered the  
5 memory, then you would need to do MB-DRAM training.

6 It's very clear from looking at the JEDEC  
7 proposal that not every portion of an LR -- an  
8 LR-DIMM or DDR3 is taught in that -- what is it? A  
9 nine-page document, I believe. So it's -- it's quite  
10 an ask, I would say, for you to ask me if it's my  
11 opinion that the person of ordinary skill in the art  
12 in 2009 knew of all those details simply from the  
13 nine-page disclosure of the JEDEC proposal.

14 Q. I wasn't trying to ask about all the  
15 details. I was more focused on whether a person of  
16 ordinary would -- skill in the art would know how to  
17 train the Memory Buffer, and --

18 MR. ROE: Objection.

19 Sorry.

20 BY MR. CHANDLER:

21 Q. -- it's still a little unclear to me as to  
22 your opinion about whether or not the person of  
23 ordinary skill in the art, at the time of the  
24 provisional marked as Exhibit 1008, would know how to  
25 train the Memory Buffer on an LR-DIMM.

1 MR. ROE: Objection. Outside the scope.  
2 Vague, and it's an incomplete hypothetical.

3 THE WITNESS: So as far as the documents  
4 that the petitioner has put up with discussion of  
5 this matter is a single nine-page document called the  
6 JEDEC proposal which talks about a memory buffer to  
7 DRAM initialization, I don't know whether I would --  
8 I don't think I would call it a scheme, but let's  
9 just call it an overview.

10 The reason the issue for me with your  
11 question causing me to have difficulty is that  
12 that that nine-page disclosure does not tell one how  
13 to do memory training. It certainly tries to  
14 describe the order of certain pieces of it. For  
15 instance, if we examine that document and look inside  
16 it, we see that there's no discussion whatsoever  
17 about how write levelling is supposed to be  
18 accomplished. It just literally says that you should  
19 do write level. And the document also is roughly the  
20 same in content with respect to read enabling.

21 So if you're asking if one of ordinary skill  
22 in the art would know from just that document how to  
23 do those specific tasks which are part of MB-DRAM  
24 training, without any description of how they're  
25 supposed to be accomplished in the document, right,

1 then one of ordinary skill in the art would have to  
2 remember what they have seen in the prior art that  
3 they've seen somewhere else of which you included no  
4 other prior art in the petition.

5 And then, once they had understood what  
6 training was with respect to memory systems that --  
7 where the data was buffered, they would have to  
8 understand how those concepts get adjusted for the  
9 design that an LR -- a DDR3 LR-DIMM was.

10 And it's pretty clear to me that the -- the  
11 Document 1015 doesn't spell much of any of that out.  
12 And so I find it very hard to answer your question  
13 about whether one of ordinary skill in the art would  
14 know how to implement MB training from just that  
15 document at the time of provisional.

16 BY MR. CHANDLER:

17 Q. And to be clear, I'm not trying to limit the  
18 question to the nine pages of Exhibit 1015. I'm  
19 focused on what a person of ordinary skill in the art  
20 would know, whether it comes from Exhibit 1015 or  
21 whether it comes from another source. So let me just  
22 pause right there.

23 So I'll ask a question, but first am I clear  
24 about that, that I'm not trying to limit the  
25 questions I'm asking you to just 1015? I'm trying to

1 focus more on what a person of ordinary skill would  
2 know. Is that understood?

3 A. Yes, that's understood. The point I've been  
4 trying to make here is that you're asking for an  
5 opinion about what one of ordinary skill in the art  
6 would know from either word-of-mouth or hearsay or  
7 some sort of knowledge event that happened that here  
8 I am years later trying to figure out and the  
9 inclusion of the JEDEC Proposal Document 1015,  
10 Exhibit 1015.

11 Q. So would it --

12 A. And so in doing that, I'm trying to answer  
13 your question accurately, correctly, and in my own  
14 mind understand where the information, where would  
15 one of ordinary skill in the art have the information  
16 to answer the question that you asked.

17 Q. Would it be fair to say that in your opinion  
18 a person of ordinary skill in the art reading the  
19 provisional application marked as Exhibit 1008 would  
20 not know how to perform training of the Memory Buffer  
21 on an LR-DIMM?

22 MR. ROE: Objection. Outside the scope and  
23 vague.

24 THE WITNESS: Well, I think the answer to  
25 this is certainly -- is certainly wrapped around the

1 fact that clearly one of ordinary skill in the art  
2 understands data buffers used in other memory  
3 subsystems and understands that, you know, they have  
4 to be handled correctly.

5           The -- the proposal that's identified in the  
6 provisional is -- is one that talks about the fact  
7 that, you know, the initialization sequences of which  
8 the MB training -- MB-DRAM training is part of are  
9 going to be handed over from the MCH to the Memory  
10 Buffer.

11           And one of skill in the art at the time  
12 would have to have knowledge that, if you  
13 specifically tie that to the LR -- the LR-DIMM DDR3  
14 product -- or architecture, if you will, is a better  
15 word -- then they have that knowledge of what that  
16 architecture is, and they have to be able to get that  
17 somehow.

18           So if they have -- if they have seen that  
19 information and participated in some discussions with  
20 people or they got a copy of the proposal somehow,  
21 then -- then I think they would understand how the  
22 MB -- in general, they would understand how the  
23 MB-DRAM training works.

24           But like I said, if you look inside of the  
25 document, there is -- there are no details about how

1 you do a read or write training given in that  
2 particular JEDEC proposal.

3 BY MR. CHANDLER:

4 Q. In your opinion would a person of ordinary  
5 skill in the art know that training could be  
6 performed during the initialization of a memory  
7 module?

8 MR. ROE: Objection. Incomplete question or  
9 hypothetical.

10 THE WITNESS: I think in general one of  
11 ordinary skill in the art would understand that  
12 training can be done during the initialization. It  
13 can be one of the initialization sequences that can  
14 happen inside of the memory module.

15 BY MR. CHANDLER:

16 Q. In your opinion would a person of ordinary  
17 skill in the art know that training the Memory Buffer  
18 on an LR-DIMM would be needed to achieve optimal  
19 performance?

20 MR. ROE: Objection. Vague.

21 THE WITNESS: Well, as I've already answered  
22 if the -- if one of ordinary skill in the art knew  
23 that on an LR-DIMM data buffering was going to be  
24 part of the solution, then from other information  
25 that was available before the LR-DIMM, they would

1 know that that training would need to be performed to  
2 make -- to make that data buffering be viable and be  
3 optimal, yes.

4 BY MR. CHANDLER:

5 Q. And to be clear, I mean, an LR-DIMM has data  
6 buffering Memory Buffer; correct?

7 A. That's basically identified in the  
8 provisional, yes.

9 Q. And would that have been known before the  
10 provisional?

11 MR. ROE: Objection. Vague.

12 THE WITNESS: Yes. Before the provisional,  
13 data buffering was known in, for example, FBDIMMs in  
14 2004.

15 BY MR. CHANDLER:

16 Q. Was it known before the provisional marked  
17 as Exhibit 1008 that LR-DIMM memory modules had a  
18 Memory Buffer to buffer data signals?

19 A. I think that that -- the answer to that  
20 would be that one of ordinary skill would know that  
21 had they seen or received somehow the information  
22 from the JEDEC Proposal 1015 -- Exhibit 1015 we've  
23 been talking about.

24 Q. And in your opinion would a person of  
25 ordinary skill in the art have seen or received

1 somehow the information from the JEDEC proposal  
2 marked as Exhibit 1015 by the time of the provisional  
3 application marked as Exhibit 1008?

4 MR. ROE: Objection. Outside the scope.  
5 Unintelligible question.

6 THE WITNESS: I don't -- I don't see how you  
7 could draw an opinion about how a person of ordinary  
8 skill in the art would absolutely know this  
9 information. If they were involved in LR-DIMM --  
10 DDR3 LR-DIMMs in some fashion in internal discussions  
11 within their company or they had seen the JEDEC  
12 proposal Exhibit 1015 we're talking about, then I  
13 think -- then I think they would know that.

14 I think they would know that, if there was  
15 discussion about the fact that LR-DIMM using DDR3s  
16 intended to buffer the data pins from the knowledge  
17 that was already available in the art, that they  
18 would understand that methods were probably going to  
19 be needed to offset the -- offset the extra latency  
20 that those data buffers add to the situation and that  
21 the general solution to that would have been to  
22 increase the speed, and increasing the speed  
23 generally requires you to add training to the  
24 higher-speed signals to keep the right reliability at  
25 the right level.

1 BY MR. CHANDLER:

2 Q. In your opinion would a person of ordinary  
3 skill in the art, at the time of the provisional  
4 application marked as Exhibit 1008, have been  
5 interested in LR-DIMM memory modules?

6 MR. ROE: Objection. Vague.

7 THE WITNESS: I think that's -- that's a  
8 question that depends upon the individual person of  
9 ordinary skill in the art. For -- for example, we've  
10 talked about the fact that our DIMMs are able to  
11 achieve higher speeds in the time frame than LR-DIMMs  
12 were. And so if the person of ordinary skill in the  
13 art we're talking about was really doing systems,  
14 mostly focused on doing RDIMM work or systems that  
15 used RDIMMs to make their solution, then they may not  
16 have been very interested in LR-DIMM at all.

17 Certainly people who were interested in  
18 significantly increasing the capacity of a computer  
19 system, I think those people of ordinary skill in the  
20 art would have been much more interested in an  
21 LR-DIMM arrangement.

22 BY MR. CHANDLER:

23 Q. In your opinion at the time of the  
24 provisional application marked as Exhibit 1008, were  
25 there persons of ordinary skill in the art that were

1 interested in increasing the capacity of a memory  
2 module and thus interested in an LR-DIMM memory  
3 module?

4 MR. ROE: Objection. Outside the scope of  
5 the direct. Vague, Incomplete hypothetical question.

6 THE WITNESS: Yeah. I don't believe I've  
7 been asked to offer an opinion there, so I won't  
8 offer one today. I'd have to research that to get a  
9 good, accurate answer.

10 BY MR. CHANDLER:

11 Q. Well, I mean, that's all I'm trying to get  
12 at. So in your opinion you can't say whether a  
13 person of ordinary skill in the art reading the  
14 provisional application marked as Exhibit 1008 would  
15 have known anything about the LR-DIMM proposal,  
16 correct, because you don't know, in your opinion,  
17 whether that person had any interest in increasing  
18 the capacity.

19 Is that a fair summary?

20 MR. ROE: Objection. Mischaracterizes the  
21 testimony, and it's an improper narrative question,  
22 so form.

23 THE WITNESS: No, I don't believe that's how  
24 I testified previously. What I said is that there  
25 were -- I'm sure that there were persons that were

1 interested and aware of the information that's  
2 presented here in the provisional, and I would be  
3 remiss to say that that was every person of ordinary  
4 skill in the art in the industry at the time.

5           The industry is very broad. People get  
6 focused on certain things and not on other things.  
7 But it's -- I think that it's pretty clear that there  
8 would have been enough people of ordinary interest in  
9 the art who read the provisional and understand what  
10 it described.

11 BY MR. CHANDLER:

12           Q. And in your opinion those persons of  
13 ordinary skill in the art at the time of the  
14 provisional marked as Exhibit 1008, would they have  
15 understood how to train a Memory Buffer on an LR-DIMM  
16 memory module?

17           MR. ROE: Objection. It goes -- it's  
18 compound. Parts of it goes beyond the scope. It's  
19 an incomplete hypothetical. Vague.

20           THE WITNESS: Well, as I have said before,  
21 data buffers on memory modules or buffered data  
22 signals on memory modules had been in existence for  
23 years before the provisional. Certainly one of  
24 ordinary skill in the art understands -- understood  
25 that. They understood that those buffers created

1 latency. They lengthened the latency of the response  
2 of the DIMM, they also understood that that had  
3 created issues for making sure the performance was  
4 correct, and they certainly understood that, as they  
5 increased the speeds talking to those buffers like  
6 FBDIMMs, they had to make sure that the increase in  
7 speed would offset the fact that adding the data  
8 buffers would lengthen the latency.

9 Now, in addition to that, that really  
10 describes the fact that people knew about buffering  
11 data pins and the issues that they had and the -- I  
12 would say that the provisional sets out pretty  
13 succinctly that the information that was in a recent  
14 JEDEC proposal required that the MCH hand over the  
15 process of MB training -- I'm sorry, MB-DRAM training  
16 to the MB because it was inefficient in that the host  
17 was tied up in the proposal having to wait for the  
18 training to be accomplished.

19 So the fact that people knew about training  
20 before, they knew about data buffers before, even if  
21 they had not seen the specific JEDEC proposal, they  
22 would at least have understood that for -- well, in  
23 the provisional it's called LB DIMM, but it's been  
24 said as load-reduced DIMM, so LR-DIMM -- they would  
25 at least have understood that this initialization

1 sequence that was proposed was much more efficient in  
2 making the LR-DIMMs more usable to the system.

3 BY MR. CHANDLER:

4 Q. In your opinion would a -- would this person  
5 of ordinary skill in the art reading the provisional  
6 application marked as Exhibit 1008 know about  
7 additional training of the Memory Buffer of an  
8 LR-DIMM beyond MB-DRAM training?

9 MR. ROE: Objection. Lacks foundation.  
10 Vague question.

11 THE WITNESS: So when you say "additional  
12 training," can you narrow that down to me to what  
13 you're talking about?

14 BY MR. CHANDLER:

15 Q. In your opinion would the person of ordinary  
16 skill in the art reading the provisional application  
17 marked as Exhibit 1008 only know about MB-DRAM  
18 training of the Memory Buffer on an LR-DIMM? Or  
19 would that person know about other types of training  
20 of the Memory Buffer on an LR-DIMM?

21 A. Well, if you -- if you look at second  
22 paragraph on page 22 of Exhibit 1008 which is the  
23 provisional it succinctly states there, "In general,  
24 there's no method of handshaking between the MCH and  
25 a memory subsystem during initialization since the

1 MCH does not monitor the error out signal from the  
2 memory subsystem."

3           So clearly what's identified here is that  
4 the DIMM itself has initialization, and it is -- it  
5 is well known from previous memory systems that  
6 training can take place in any place where high-speed  
7 signal limitations require that, to improve or to  
8 guarantee certain reliability levels, that signals  
9 must be optimally timed to make sure that those data  
10 are captured reliably. So they would have known --  
11 they would have known that.

12           Q. Would a person of ordinary skill in the art  
13 at the time of the provisional application marked as  
14 Exhibit 1008 know how to configure the timing on a  
15 DDR3 LR-DIMM memory module so that the memory module  
16 would operate correctly?

17           MR. ROE: Objection. Outside the scope.  
18 Vague and incomplete.

19           THE WITNESS: Well, I don't believe I've  
20 offered an opinion about that, but a -- timing is an  
21 issue that any person of ordinary skill in the art  
22 has to understand to be able to use the devices at  
23 hand. It is -- it is true over many generations  
24 various timing considerations have changed. So from  
25 SDRAM to DDR to DDR2 to DDR3, even now DDR4 and DDR5,

1 the timing continues to change as the frequencies get  
2 higher and higher. So I think a person of ordinary  
3 skill in the art is well versed in the fact that  
4 timing considerations are paramount to making any  
5 memory subsystem work well -- work correctly.

6 BY MR. CHANDLER:

7 Q. In your opinion would a person of ordinary  
8 skill in the art at the time of the provisional  
9 application marked as Exhibit 1008 have known that  
10 LR-DIMM memory modules would not run at their full  
11 speed without having previously completed training of  
12 the Memory Buffer?

13 MR. ROE: Objection. Assumes facts not in  
14 evidence. Outside the scope.

15 THE WITNESS: I think one of ordinary skill  
16 in the art at the time of the provisional would have  
17 known that any memory subsystem that uses training is  
18 required to have that training set the timing  
19 optimally so that the part can achieve its highest  
20 performance and have its best reliability. And I  
21 don't think it matters whether it was LR-DIMMs or a  
22 different -- a different type of memory architecture.

23 BY MR. CHANDLER:

24 Q. So in other words, you think a person of  
25 ordinary skill in the art would know that to be true

1 for all memory modules with training?

2 MR. ROE: Objection. Vague. Lacks  
3 foundation.

4 THE WITNESS: Well, I think that, for memory  
5 subsystems that have very high-speed signals on  
6 them -- Buchmann is an example here. We haven't  
7 talked about Buchmann yet, but those signals run in  
8 the multiple gigahertz range.

9 If you do not have timing on them set  
10 correctly, they do not work very well at all. The  
11 system doesn't work very well at all. So -- and that  
12 was certainly around the time of this provisional,  
13 and that was -- that was known.

14 BY MR. CHANDLER:

15 Q. In your opinion would a person of ordinary  
16 skill in the art at the time of the provisional  
17 application marked as Exhibit 1008 know how to  
18 configure the timing for a read operation as part of  
19 the initialization of a -- DDR3 LR-DIMM memory  
20 modules so that the read operations work correctly?

21 MR. ROE: Objection. Outside the scope.

22 THE WITNESS: Well, this gets back to our  
23 discussion before. So from a historical point of  
24 view, clearly one of ordinary skill in the art  
25 understands what read timing is all about, and they

1 understand it inside of the scope of the particular  
2 architecture they are working with. At the time of  
3 provisional, an LR-DIMM was a new architecture still  
4 being proposed and talked about. And so they would  
5 have understood that, if the speed in the LR-DIMM  
6 modules were -- were being -- was being pushed up and  
7 the fact that the data buffers were being used, they  
8 would have understood that the timing issues would  
9 have been very difficult and probably require  
10 training, yes.

11 BY MR. CHANDLER:

12 Q. And would they know how to perform the  
13 training so that the memory module operated  
14 correctly?

15 MR. ROE: Objection. Outside the scope.

16 THE WITNESS: Well, I hadn't opined on that  
17 in my declaration. What I would talk to with respect  
18 to that is that I don't see -- I don't see any  
19 information available to one of ordinary skill in the  
20 art from the JEDEC proposal, Exhibit 1015. Certainly  
21 one of ordinary skill in the art at the time of the  
22 provisional would have understood that read timings  
23 and write timings to operate DDR2 and DDR3 parts on  
24 DIMMs were very critical and that you had to get them  
25 right.

1 I would expect that they would understand  
2 that, if there was a new proposed module coming out  
3 like LR-DIMM, that they -- that they would still have  
4 those types of timing issues with respect to reading  
5 and writing, that they had to be very careful to  
6 get -- to get them done correctly.

7 BY MR. CHANDLER:

8 Q. In your opinion would a person of ordinary  
9 skill in the art at the time of the provisional  
10 application marked as Exhibit 1008 know how to  
11 properly configure the timing of the data signals  
12 going through the Memory Buffer of an LR-DIMM as a  
13 part of the initialization sequence such that  
14 read-and-write operations would work correctly?

15 MR. ROE: Objection. Outside the scope.

16 THE WITNESS: Well, clearly at the time of  
17 the proposal, both DDR2 and DDR3 parts were  
18 available, and the timing considerations at the DRAM  
19 interface, meaning the actual DRAM chips, were very  
20 well known.

21 If, then, this ordinary person, a POSITA,  
22 had learned that data buffers had been put into place  
23 in the new modules, then they would have understood  
24 that the timing limitations that were set up on the  
25 actual chip pins would have to be understood. And

1 the interface through the data buffer would have to  
2 be maintained so that those timing situations would  
3 occur correctly throughout the module as a whole.

4 BY MR. CHANDLER:

5 Q. In your opinion would a person of ordinary  
6 skill in the art know how to perform read and write  
7 operations for DDR3 LR-DIMM memory modules?

8 MR. ROE: Objection. Outside the scope.  
9 The -- it's an incomplete hypothetical. Vague.

10 THE WITNESS: Certainly I had not opined on  
11 that. In general I would say that that really  
12 depends upon whether or not the person of ordinary  
13 skill in the art at the time of the provisional had  
14 seen information that would allow them to do that. I  
15 don't see that kind of information in the JEDEC  
16 proposal, Exhibit 1015. Just simply, you know, the  
17 detail just isn't there.

18 And so I -- I think it's -- I think it's one  
19 of those things that would depend upon, you know, how  
20 much -- how much of the information about what was in  
21 the whole JEDEC proposal for LR-DIMMs detailed out to  
22 them.

23 BY MR. CHANDLER:

24 Q. So it would be fair to say that, in your  
25 opinion, you cannot draw any conclusions based on the

1 provisional application marked as Exhibit 1008 as to  
2 whether or not a person of ordinary skill in the art  
3 could actually make an LR-DIMM that was usable with  
4 respect to being able to perform read-and-write  
5 operations after any training that might have taken  
6 place?

7 MR. ROE: Objection. Outside of this scope.  
8 It's clearly outside the scope if you're talking  
9 about -- we can go off the record, but this is well  
10 beyond the trial practice guidelines about the scope  
11 of testimony here if you're talking about enabling.

12 MR. CHANDLER: And Counsel, I'd like to  
13 remind you that, under the trial practice guide,  
14 speaking objections are strictly prohibited.

15 BY MR. CHANDLER:

16 Q. Mr. Murphy --

17 MR. ROE: I'm reminding you, Counsel, that  
18 the trial practice and trial guide remind you the  
19 scope of your examination, sir.

20 BY MR. CHANDLER:

21 Q. Mr. Murphy, do you understand the question?

22 A. I'd like you to repeat it, please.

23 Q. Would it be fair to say that, in your  
24 opinion, you cannot draw any conclusions based on the  
25 provisional application marked as Exhibit 1008 as to

1 whether or not a person of ordinary skill in the art  
2 could actually make an LR-DIMM that was usable with  
3 respect to being able to perform read-and-write  
4 operations after any training that might have taken  
5 place?

6 MR. ROE: Objection. Outside the scope.

7 THE WITNESS: I haven't been asked to opine  
8 on that. And sitting here today without research,  
9 there's no way I could answer that question  
10 accurately.

11 BY MR. CHANDLER:

12 Q. So would it be fair to say that in your  
13 opinion --

14 MR. ROE: Counsel, we asked to take a break.  
15 Are you not allowing the witness to take a break?

16 THE WITNESS: I think he just didn't hear.

17 I asked to take a break. Is that okay? Or  
18 do you have another question to --

19 MR. CHANDLER: I have another question, but  
20 why don't we take a break, a short break, and we'll  
21 pick it up again.

22 THE VIDEOGRAPHER: Going off the record at  
23 3:53 p.m.

24 (Recess taken from 3:53 p.m. to 4:10 p.m.)

25 THE VIDEOGRAPHER: Start of Video File

1 No. 4. We're back on the record at 4:10 p.m.

2 BY MR. CHANDLER:

3 Q. Mr. Murphy, would it be fair to say that you  
4 are not offering any opinion that a person of  
5 ordinary skill in the art reading the provisional  
6 application marked as Exhibit 1008 would actually be  
7 able to make and use an LR-DIMM memory module that  
8 would work for its intended purpose which includes  
9 performing read-and-write operations? Is that fair?

10 MR. ROE: Objection. Outside the scope.

11 THE WITNESS: Counselor, my opinions are  
12 all -- it's not in my declaration, I don't have  
13 opinion on any of it.

14 Can you reference me to a particular  
15 paragraph in my declaration that relates to this?

16 (Reporter clarification.)

17 THE WITNESS: Counselor, my opinions in this  
18 matter are listed in my declaration. All of my  
19 opinions are in this -- in this matter are in my  
20 declaration.

21 Do you have a particular paragraph in my  
22 declaration that you would like to understand that  
23 you don't understand now that is a question about my  
24 declaration?

25

1 BY MR. CHANDLER:

2 Q. Yes. That's my question about your  
3 declarations. I don't see any paragraph or any  
4 suggestion that you have offered any opinion that a  
5 person of ordinary skill in the art reading the  
6 provisional application marked as Exhibit 1008 would  
7 actually be able to make and use an LR-DIMM memory  
8 module that would work for its intended purpose. Is  
9 that --

10 A. At this --

11 Q. -- fair?

12 MR. ROE: Objection. Improper narrative and  
13 outside the scope.

14 THE WITNESS: At this point in time I  
15 haven't been asked to offer an opinion with respect  
16 to those matters or that matter, and so I reserve my  
17 right to add an opinion at a later date.

18 BY MR. CHANDLER:

19 Q. And Mr. Murphy, you have not offered any  
20 opinion that a person of ordinary skill in the art  
21 reading the provisional application marked as  
22 Exhibit 1008 would actually be able to make and use a  
23 memory module as claimed in the '218 patent; correct?

24 MR. ROE: Objection. Outside the scope. If  
25 I understand that question correctly, it's outside

1 the scope.

2 THE WITNESS: Counselor, do you have a  
3 reference paragraph for me where this question is  
4 talked about or referred to in my declaration?

5 BY MR. CHANDLER:

6 Q. No. That's what I'm trying to confirm  
7 because I don't see any paragraph or any suggestion  
8 that you have offered any opinion that a person of  
9 ordinary skill in the art reading the provisional  
10 application marked as Exhibit 1008 would actually be  
11 able to make and use a memory module as claimed in  
12 the '218 patent; correct?

13 MR. ROE: Objection. Improper narrative.  
14 Outside the scope.

15 THE WITNESS: Counselor, all of my opinions  
16 are included in my declaration. As of this date they  
17 are as accurate as I believe they can be and up to  
18 date. If I'm asked at another time to make an  
19 opinion about the question you asked, I will do so  
20 then, and I reserve my right to do that at that time.

21 BY MR. CHANDLER:

22 Q. And to be clear, do you have any opinion on  
23 that right now?

24 A. My opinions, Counselor, are inside of my  
25 declaration.

1 Q. I'm trying to ask you a straightforward  
2 question, and you understand that I have the  
3 declaration and have read it, but I'm trying to ask  
4 you your opinion to make sure I'm not misconstruing  
5 anything.

6 Do you have any opinion as to whether a  
7 person of ordinary skill in the art reading the  
8 provisional application would actually be able to  
9 make and use a memory module as claimed in the '218  
10 patent?

11 MR. ROE: Objection to form. Improper  
12 narrative. Outside the scope.

13 THE WITNESS: Counselor, can you point me to  
14 a paragraph in my declaration that has any opinion  
15 like this in it?

16 BY MR. CHANDLER:

17 Q. No. As far as I know, it doesn't exist, but  
18 I want to give you the opportunity to correct the  
19 record if I'm incorrect.

20 A. My statement still stands as previously  
21 stated. My opinions in this matter to this date are  
22 all listed in my declaration. If at some time in the  
23 future I'm asked for other opinions, then I reserve  
24 the right to give those opinions at that time.

25 Q. Do you have any opinion as to whether a

1 person of ordinary skill in the art reading the  
2 provisional application marked as Exhibit 1008 would  
3 actually be able to make and use a memory module as  
4 claimed in the '595 patent?

5 MR. ROE: Objection. Outside the scope.  
6 And to the extent it calls for a legal conclusion and  
7 vague.

8 THE WITNESS: Counselor, can you point me to  
9 any paragraph in my declaration, Exhibit 2027 in  
10 IPR2022-00064, in which I expressed an opinion with  
11 regard to this question in any way, shape or form?

12 BY MR. CHANDLER:

13 Q. No. I don't see any opinion by you as to  
14 whether a person of ordinary skill in the art reading  
15 the provisional application marked as Exhibit 1008  
16 would actually be able to make and use a memory  
17 module as claimed in the '595 patent, but I want to  
18 ask you the question now to allow you to offer the  
19 opinion or point to the opinion if it exists and if  
20 you have it.

21 MR. ROE: Objection. Improper narrative.  
22 Form. Outside the scope.

23 THE WITNESS: Counselor, at this point in  
24 time all of my opinions with respect to this matter  
25 in the IPR of the '559 [sic] are included in my

1 declaration. If at some time I'm asked to provide  
2 additional opinions, then I will provide them at that  
3 time, and I reserve the right to do so.

4 (Reporter clarification.)

5 BY MR. CHANDLER:

6 Q. And Mr. Murphy, you understand that this --  
7 this is my time to ask you questions, so I'm not  
8 going to get another opportunity in the future to ask  
9 you your opinions. Now is the designated time for us  
10 to conduct this deposition. So I just want to be  
11 sure, give you the opportunity to express any opinion  
12 you have now with respect to whether or not a person  
13 of ordinary skill in the art reading the provisional  
14 application marked as Exhibit 1008 would be able to  
15 make and use a memory module as claimed in the '218  
16 patent or the '595 patent.

17 MR. ROE: Objection. Vague. Outside the  
18 scope.

19 THE WITNESS: Counselor, can you point me to  
20 a particular paragraph in my declaration that talks  
21 about either making or using an LR-DIMM with respect  
22 to the '595 patent in my declaration?

23 BY MR. CHANDLER:

24 Q. No. Again, that's the question we're trying  
25 to get clarity on is I don't see that you've offered

1 any opinion that a person of ordinary skill in the  
2 art reading the provisional application marked as  
3 Exhibit 1008 would be able to make and use a memory  
4 module that practices the claims of either the '218  
5 patent or the '595 patent. But if I've overlooked  
6 something, please let me know.

7 MR. ROE: Objection. Form. Improper  
8 narrative. Compound. Vague. Outside the scope.

9 THE WITNESS: As of this point in time  
10 today, Counselor, my opinions, all of my opinions on  
11 this matter, are included in my declaration. They  
12 are the opinions that I have been asked to offer.

13 BY MR. CHANDLER:

14 Q. And --

15 A. If at some point in the future I'm asked to  
16 offer other opinions, then I will feel free to do the  
17 research, put in the work and generate opinions on  
18 those things that I am asked to do, and I reserve the  
19 right to do that. My opinions are all in my  
20 declaration.

21 Q. And in preparation for the deposition today,  
22 you reviewed your declarations marked as  
23 Exhibit 2027; is that correct?

24 A. I did.

25 Q. Carefully?

1 A. Yes.

2 Q. And are you aware of any opinion on whether  
3 or not a person of ordinary skill in the art reading  
4 the provisional application marked as Exhibit 1008  
5 will be able to make and use a memory module that  
6 practices the claims of either the '218 patent or the  
7 '595 patent?

8 A. Counselor, as I've --

9 MR. ROE: Objection. Improper narrative.  
10 It's compound. It's vague. It's outside the scope.

11 THE WITNESS: Counselor, as I've already  
12 stated, my opinions as I've been asked to give them  
13 are in my declaration. I've stated to you before to  
14 the best of my knowledge that my declaration is  
15 accurate and up-to-date. As of today, those are my  
16 opinions, the ones that are in my declaration. If at  
17 a later date I'm asked to create more opinions, then  
18 I will do that, and I reserve the right to do that.

19 BY MR. CHANDLER:

20 Q. What is an open drain output?

21 MR. ROE: Objection. Incomplete  
22 hypothetical.

23 THE WITNESS: So are you asking with respect  
24 to, for example, a pin on an integrated circuit?

25

1 BY MR. CHANDLER:

2 Q. Is there a difference between an open drain  
3 output on a pin on an integrated circuit versus on a  
4 memory module?

5 MR. ROE: Objection. Vague.

6 THE WITNESS: So we are limiting ourselves  
7 to electronics.

8 BY MR. CHANDLER:

9 Q. Sure.

10 A. Okay. And you asked if there's a difference  
11 between an open drain output on a memory device and  
12 on a memory module. I don't believe that one of  
13 ordinary skill in the art would understand them to be  
14 different, no.

15 Q. And how would you explain to a layperson  
16 what an open drain output is?

17 MR. ROE: Objection. Lacks foundation.

18 THE WITNESS: An open drain output is a --  
19 usually a pin, whether on a DRAM or a memory module  
20 or some other piece of electronics in which generally  
21 speaking digital data is provided, and that data is  
22 provided actively only in one logical direction,  
23 meaning that we generally in electronics, especially  
24 digital electronics, use a voltage level to represent  
25 either a 0 or a 1.

1           In an open drain output which can be  
2 configured both in one fashion or its complementary  
3 fashion, the -- let's take, for example, the case  
4 where the active signal from the device pulls,  
5 meaning discharges the output pin to, in this case, a  
6 good example would be ground. There is no  
7 complementary device on that same pin within the  
8 device to pull that particular open drain output to a  
9 high. That device is specifically left out.

10           The idea here is that one is able to create  
11 what's called a wired-or configuration where if,  
12 let's say, end devices are connected together on  
13 their open drain outputs, so one pin designated as an  
14 open drain is connected to, let's say, seven other  
15 ICs, and then that wire has a pull-up resistor to a  
16 positive power supply like BDD, then any one of the  
17 eight integrated circuits that have an open drain  
18 connected to that wire would be able to pull that  
19 wire to a logical low, meaning close to ground  
20 independent of the action of any other of the  
21 integrated circuits connected to that wire.

22           And the action that this makes is that, any  
23 one of the integrated circuits that it has its open  
24 drain connected to that wire can pull the wire low,  
25 but none of them can pull the wire high, which means

1 that, if the open drain driver on each one of the  
2 integrated circuits is active, that that outside wire  
3 will be pulled to 0.

4 And that could happen from Integrated  
5 Circuit No. 1 doing it or Integrated Circuit No. 3  
6 doing it, or any one of the individual circuits or  
7 all of them in unison pulling that wire down to a low  
8 or -- a low voltage which would be a 0 digital piece  
9 of information.

10 On the other hand, when all of those  
11 integrated circuits with their open drains are  
12 inactive, there is no current going into the pin from  
13 the wire on the outside, and the pull-up resistor  
14 that's connected to the wire will make that wire go  
15 to a high voltage which would be representative of a  
16 1, which indicates that all of the integrated  
17 circuits that are connected to that wire with open  
18 drain outputs are presently inactive.

19 BY MR. CHANDLER:

20 Q. What is the benefit of using an open drain  
21 output?

22 MR. ROE: Objection. Vague. Lacks  
23 foundation. Assumes facts not in evidence. Outside  
24 the scope.

25 THE WITNESS: One of ordinary skill in the

1 art understands that the benefit of an open drain  
2 output is that this configuration of wired-or logic  
3 can be distributed across multiple chips, and the  
4 signals combine for multiple chips generating a  
5 single digital piece of information that is outside  
6 of all of those chips.

7 BY MR. CHANDLER:

8 Q. And in your opinion, did a person of  
9 ordinary skill in the art know what an open drain  
10 output was and what the benefit of an open drain  
11 output was?

12 A. I believe a person of --

13 MR. ROE: It's outside the scope.

14 THE WITNESS: I believe a person of ordinary  
15 skill in the art understands what an open drain  
16 output is and also understands what the benefits are  
17 and what the detriments are.

18 Q. What were common-use scenarios for an open  
19 drain output?

20 MR. ROE: Objection. Vague. Outside the  
21 scope.

22 THE WITNESS: So a common-use case is the  
23 use case that I just talked to you about where you're  
24 taking an individual logic signal from multiple chips  
25 and using the open drain outputs on each of those

1 chips to create an external signal line to those  
2 chips and then creating this wired-or logical-type  
3 gate.

4 BY MR. CHANDLER:

5 Q. So --

6 A. So --

7 MR. ROE: Hold on. He's not done, Counsel.

8 THE WITNESS: So that, as I explained, if  
9 any one of those chips pulled the signal down, the  
10 signal would stay low. If five of them pulled it  
11 down, the signal would stay low. The -- doesn't  
12 matter how many pulled down. The signal would stay  
13 low.

14 What is unique about the logical signal here  
15 is that, when all of them are inactive, the signal  
16 will go high because the pull-up resistor in this  
17 case allows current to flow into the wire and pull it  
18 to the high voltage, what I'm used to and people of  
19 ordinary skill in the art would say BCC or BDD.

20 It's also true that the opposite polarity of  
21 a wired-or can be designed, it's a design choice.  
22 And in those cases the active state of the individual  
23 chips is a state that tries to pull the external wire  
24 high and hold it there whether one is active -- one  
25 chip is active or three are active or seven are

1 active, and it's not until all of the chips and their  
2 respective open drain pins are inactive. Then in  
3 that situation, the external wire would be allowed to  
4 go to a low, logical level. And in this case, it  
5 would have a pull-down resistor on the wire to  
6 accomplish that.

7 BY MR. CHANDLER:

8 Q. Were there common examples of when an open  
9 drain output would be used on a memory module?

10 MR. ROE: Objection. Vague.

11 THE WITNESS: Well, if you think about  
12 the -- think about the example that I just gave you,  
13 you could use -- you could use an open drain wired-or  
14 logical technique to share logical signals between  
15 memory DIMMs if you wanted to. So for example,  
16 instead of having, let's say, a single memory DIMM  
17 with eight DRAMs on it, you had two memory DIMMs with  
18 eight DRAMs each on it. One could create a logical  
19 signaling system that would tell you a particular  
20 condition that would exist on not just one of the  
21 modules but on both of the modules.

22 So in that case, as we've discussed in the  
23 first portion of my answer where the system has a  
24 pull-up resistor, it would take all eight of the  
25 DRAMs on DIMM No. 1 to have their output -- their

1 open drain outputs inactive. And all of the eight  
2 DRAMs on Module No. 2, their output -- their open  
3 drain outputs would have to go inactive, and then the  
4 wire that would have been on Module 1 has to be  
5 connected to the wire on the Module 2, and then a  
6 pull-up resistor would be -- need to be connected to  
7 that to get a logical high out of that logic system.

8 The only time a logic high would occur in  
9 that case is when all 16 of the total DRAMs in that  
10 system had their open drain pins inactive.

11 BY MR. CHANDLER:

12 Q. I believe that you said a moment ago  
13 "wired-or"; is that correct?

14 A. Correct.

15 Q. And --

16 A. Correct.

17 Q. When you say "wired-or," do you mean the  
18 logical "or"?

19 A. Yes. The electrical engineering -- the  
20 electrical engineering term is w-i-r-e-d-o-r,  
21 wired-or. And it combines the two words: "or"  
22 meaning the logical function, and "wired" meaning the  
23 fact that the function is accomplished by having  
24 various open drain drivers connected to a particular  
25 wire.

1 Q. So if I understand you correctly, you're  
2 saying that an open drain output can create a  
3 wired-or between --

4 A. I am not.

5 Q. Okay. Well, then I misunderstood. So  
6 what's the relationship between the open drain output  
7 and this phrase "wired-or"?

8 A. An open drain output in and of itself is  
9 effectively never used alone. The reason it's never  
10 used alone is because, when it's active, in the case  
11 of a pull-down, it can only pull a signal to ground.

12 If you don't connect it to something else,  
13 it can never pull high because that portion of the  
14 gate in the driver is missing. We literally only put  
15 a pull-down on that driver. No pull-up.

16 So the -- a wired -- an open drain output in  
17 and of itself and only having itself is kind of  
18 useless. You can only ever output a low.

19 What the wiring part says is, oh. If I have  
20 two or more, I can wire them together, and then put  
21 on a passive pull-up resistor in this case to  
22 generate the high signal in that system. And then  
23 when I look at the two open drain pins that are  
24 connected to that wire, either one or the other can  
25 pull that wire down to ground, causing a logical 0.

1           When both of them are off, inactive or high  
2 Z (phonetic), the passive resistor on the wire pulls  
3 the wire to a high which is a logical 1. And in  
4 having that passive resistor, you are able to deliver  
5 both levels of logic in a two-level system. You can  
6 deliver a 0 whenever one or both of the open drains  
7 are active, or you can deliver a high when only both  
8 open drains are inactive.

9           Q. So if I understand correctly, a combination  
10 of an open drain output plus pull-up or pull-down  
11 resistor would result, as a functional matter, in a  
12 wired-or? Is that a fair summary?

13           A. Yes. That particular -- that particular  
14 logic would be, you know, something very simple. Is  
15 the light on in the room? If the light is on in the  
16 room and if the dog is in the room, then the -- a  
17 particular thing might happen. Sorry. Wrong logic.

18           If the light is on in the room or the dog is  
19 in the room, a particular thing might happen. That's  
20 the logic "or."

21           Q. In your opinion would a person of ordinary  
22 skill in the art have known that an open drain output  
23 in combination with a pull-up or pull-down resistor  
24 would result in a wired-or function?

25           MR. ROE: Objection. Vague. Outside the

1 scope.

2 THE WITNESS: Yes. One of ordinary skill in  
3 the art would have known this. It's probably 40  
4 years old.

5 BY MR. CHANDLER:

6 Q. Did a person of ordinary skill in the art  
7 know that an open drain output in combination with a  
8 pull-up or pull-down resistor could be used for a  
9 notification signal on a memory module?

10 MR. ROE: Objection. Vague. Incomplete  
11 hypothetical.

12 THE WITNESS: I guess I don't -- I don't  
13 really know exactly what the right way to phrase my  
14 answer to that is. Certainly one of ordinary skill  
15 in the art would have known how to create a wired-or  
16 logical gate which creates a logical signal. And I  
17 guess if one of ordinary skill in the art wanted to  
18 declare as a design choice that signal to be some  
19 sort of a notification signal, then I would say the  
20 answer to your question would be yes. Of course if  
21 the person of ordinary skill in the art did a design  
22 choice and declared that to be some other kind of  
23 signal, then it would not be a notification signal.  
24 Basically any signal can be put on a wired-or logical  
25 gate.

1 BY MR. CHANDLER:

2 Q. Are you aware of concrete examples of  
3 memory modules that used open drain outputs in  
4 combination with a pull-up or pull-down resistor?  
5 And if so, you know, what was the function that  
6 you're aware of?

7 MR. ROE: Objection. Vague.

8 THE WITNESS: I'd have to think for a  
9 second. Hold on.

10 So I'll reference you to Exhibit 2027 for  
11 the '218 patent, page 103 as an example, here at the  
12 top is a portion of Figure 4B that's annotated which  
13 identifies in Hazelzet an open drain signal that is  
14 used for the /ERROR (UE).

15 BY MR. CHANDLER:

16 Q. Can you turn to paragraph 101 of your  
17 declaration. In IPR2022-00062 which is the same as  
18 paragraph 110 in your declaration marked as  
19 Exhibit 2027 exhibit -- in IPR2022-00064, and let me  
20 know when you're there.

21 A. I'm sorry. Would you say the first  
22 paragraph again.

23 Q. 1001 [sic]. 101.

24 A. Paragraph 101 on page 56 of Exhibit 2027 in  
25 the '218?

1 Q. Correct. And if you want to look at the  
2 corresponding declaration? It's Exhibit 1- --  
3 paragraph 110. I think they're the same. Just let  
4 me know when you're ready and I'll ask the question.

5 A. Okay. I have checked your redline, and it  
6 appears based on that the two paragraphs are  
7 identical. And I'm ready.

8 Q. What is address mirroring?

9 A. Address mirroring is the technique to adjust  
10 the pin -- adjust the addresses that are connected to  
11 certain pins on the DRAM devices.

12 Q. In your opinion would a person of ordinary  
13 skill in the art have known about address mirroring?

14 A. At the time of provisional?

15 Q. Correct.

16 A. Yes, I believe they would have understood  
17 what address mirroring is.

18 Q. In your declaration you refer to a statement  
19 that the controller must have the capability to do  
20 address mirroring.

21 Do you see that?

22 A. In the same paragraph, yes.

23 Q. Is the controller that you're referring to  
24 in paragraph 101 of your expert declaration marked as  
25 Exhibit 2027 in the IPR2020-00062 or alternatively

1 paragraph 110 in Exhibit 2027 of IPR2022-00064, is  
2 that the system memory controller?

3 A. Yes. That paragraph specifically talks  
4 about this information coming from Hazelzet. And in  
5 Hazelzet, Item 19 on Figure 1 is the memory  
6 controller process.

7 Q. But in the previous sentence where you  
8 indicate that the controller must have the capability  
9 to do address mirroring, I'm trying to get clarity on  
10 are you referring to the system memory controller or  
11 to the controller on the memory module?

12 MR. ROE: Objection. Vague.

13 THE WITNESS: Which controller -- which  
14 memory module are you talking about and which  
15 controller? Please identify.

16 BY MR. CHANDLER:

17 Q. Well, I'm trying to ask you about what you  
18 wrote in paragraph 101 of Exhibit 2027 of the  
19 IPR2022-00062, which is the same as in paragraph 110  
20 of Exhibit 2027 of IPR2022-00064.

21 A. Okay. So --

22 MR. ROE: Hold on. Objection. It's vague  
23 as to the controller referenced in that paragraph.  
24 You have the -- the controller's referenced more than  
25 once, and you're not pointing -- he's asking you

1 what -- which one. I mean, you're not answering his  
2 question.

3 MR. CHANDLER: No. There's only one  
4 reference.

5 BY MR. CHANDLER:

6 Q. You say "the controller must have the  
7 capacity to do address mirroring."

8 Do you see that?

9 THE REPORTER: I'm sorry. Do you mind  
10 repeating the quote. I didn't hear it.

11 BY MR. CHANDLER:

12 Q. "The controller must have the capability to  
13 do address mirroring."

14 MR. ROE: Clarification, Counsel. The  
15 paragraph refers to -- well, I'll leave it at that.

16 THE WITNESS: Sorry. I have to find the  
17 right document.

18 So if in this paragraph we go back to the  
19 beginning, this paragraph starts, "As an initial  
20 matter, that same document that the Petition and  
21 Dr. Alpert cite for their conclusory positions (Ex.  
22 1036, LR-DIMM Design Specification) contradicts them,  
23 describing that "[a]s" designed -- or sorry. "As  
24 defined, the controller must have the capability to  
25 do address mirroring."

1           So that's Exhibit 1036 at page 5.

2   BY MR. CHANDLER:

3           Q.   And my -- and feel free to look at that  
4   exhibit if you want to or need to. My question to  
5   you is, is the controller that you're referring to  
6   the system memory controller or the controller that's  
7   on the memory module?

8           A.   Okay. So let's now read the sentence that  
9   comes after what I just left off at. "Hazelzet does  
10   not teach a controller with the capability to address  
11   mirroring, and neither the Petition nor Dr. Alpert  
12   contends that it does. Thus, even the document the  
13   Petition and Dr. Alpert cite for their generic  
14   assertions contradicts their positions."

15           So that means you have to go look at  
16   Hazelzet, which is Exhibit 1014. And in Hazelzet  
17   Figure 1, there is no controller on the DIMM labeled  
18   as Element 10 in Figure 1. The only controller  
19   labeled in this figure is the Memory Controller at  
20   the bottom labeled as Element 19.

21           So as I've talked about somewhat before,  
22   there are different architectures for different  
23   DIMMs. Hazelzet is a very different architecture  
24   than LR-DIMM, DDR3 LR-DIMM. Its controller was not  
25   on the DIMM. Its controller was on the motherboard.

1           And so when -- when Dr. Alpert referenced  
2 this section, right, he was doing it in a fashion  
3 that related to Hazelzet. And in the paragraph  
4 before starting at paragraph 100, I was simply  
5 responding to him that a POSITA would not simply swap  
6 out RDIMMs for LR-DIMMs and that the petition failed  
7 to demonstrate how the proposed combinations of  
8 either Hazelzet and JEDEC or Hazelzet and Buchmann  
9 could have done that, and there would have been no  
10 reasonable expectation of success there.

11           Further in that paragraph I say, "The  
12 Petitioner merely makes the conclusory contention  
13 that [s]uch an upgraded LR-DIMM would have worked  
14 even in Hazelzet's RDIMM platforms (with appropriate  
15 BIOS exchanges)."

16           The trouble is, the reference that  
17 Dr. Alpert uses from Exhibit 1036 talks about a  
18 controller that has to have the capability of doing  
19 address mirroring, and Hazelzet specifically does not  
20 use address mirroring. In fact, if you look at -- I  
21 believe it's paragraph 5. Let me find it for you.

22           In paragraph 5 in Hazelzet which is  
23 Exhibit 1014 page 19, Hazelzet specifically talks  
24 about, "Other possible fault-tolerant improvement  
25 methods such as memory mirroring, symbol slicing and

1 extensive forms of fault rejection and redundancy,  
2 provide enhanced memory system reliability, but due  
3 to negative impacts such as increased cost, power,  
4 and reduced performance have been considered only for  
5 niche applications where the price is not of high  
6 importance as these subsystem quality enhancements  
7 are very expensive to implement."

8           So specifically, Hazelzet taught away from  
9 using memory mirroring in his patent. It was too  
10 expensive, and he believed that his solution solved  
11 the particular problem that was shown in his  
12 architecture in Hazelzet in the RDIMM.

13           Now, in a different architecture, you might  
14 have different constraints and therefore need  
15 different proposals to solve those constraints  
16 because the architecture is completely different.  
17 But with respect to Hazelzet, he didn't need address  
18 mirroring, and so you don't find address mirroring in  
19 Element 19 in Figure 1 of Hazelzet.

20           Q. I think I may have confused you because you  
21 started referring to memory mirroring, and --

22           A. I'm sorry. Any statement I made about  
23 memory mirroring should be address mirroring.

24           Q. In Exhibit 1036 at page 5 where you quote  
25 the statement that "the controller must have the

1 capability to do address mirroring," is the  
2 controller in that quote the system memory  
3 controller?

4 A. I don't think it's specified here in this  
5 product description which is page 5 of Exhibit 1036.

6 Q. Is it your understanding --

7 A. Sorry.

8 Q. Go ahead.

9 A. If I could continue, it's quite clear  
10 that -- that address mirroring can be performed in  
11 multiple places either in the Memory Buffer or in the  
12 controller. You could even implement it in the  
13 LR-DIMM. I mean, in the DDR3 parts if you wanted.  
14 The -- the appearances from this document that -- it  
15 appears that the mirroring is done by the memory  
16 controller when the LR-DIMM is wired to use address  
17 mirroring.

18 Q. So if I understand correctly, LR-DIMM memory  
19 modules can be wired to use address mirroring, but  
20 they're not required to use address mirroring on the  
21 memory module? Is that a fair summary?

22 A. Well, not of this document. This document  
23 states, Since the wiring on the LR-DIMM is different  
24 to support this feature, meaning address mirroring,  
25 it must be used when the LR-DIMM is wired to use

1 address mirroring.

2 So it sounds like from this it's a condition  
3 of what was the design choice about address  
4 mirroring, and then was that design choice carried  
5 out in doing the wiring of the LR-DIMM, and then the  
6 choice of forcing the LR-DIMM to use address  
7 mirroring.

8 Q. Is it correct that an LR-DIMM can use  
9 address mirroring but is not required to use address  
10 mirroring?

11 A. I believe that's correct.

12 Q. Whereas the system memory controller must  
13 have the capability to do address mirroring in the  
14 event that the LR-DIMM is using address mirroring.  
15 Is that your understanding?

16 A. Sitting right here today, that's what I  
17 would get out of this paragraph of this document. Of  
18 course it's only a proposed document off the top of  
19 my head. I don't know whether this has gotten  
20 changed over the movement of the proposal or not.

21 Q. In the provisional application marked as  
22 Exhibit 1008 -- let me know when you have that.

23 A. I have it.

24 Q. If you look at pages 22 to 25 of the  
25 provisional application marked as Exhibit 1008, is

1 there any reference to the word "data" on those  
2 pages?

3 MR. ROE: Objection. Vague.

4 THE WITNESS: And what exactly is the  
5 definition of data you're using or you want me to  
6 consider?

7 BY MR. CHANDLER:

8 Q. I was just using the word "data" in its  
9 ordinary fashion.

10 A. So "data" is just information then?

11 MR. ROE: Objection. Calls for a legal  
12 conclusion.

13 BY MR. CHANDLER:

14 Q. It was really the word "data" or an  
15 abbreviation for data or specifically data.

16 MR. ROE: Same objections.

17 THE WITNESS: So I -- I am not able to find  
18 the word "data" literally stated here; however, I  
19 find multiple references to information being passed  
20 in various directions which, depending upon your  
21 definition of data, would be data and would  
22 understand to be data.

23 So the literal word itself I cannot find in  
24 the document.

25

1 BY MR. CHANDLER:

2 Q. How about data referring to DQ signals?

3 MR. ROE: Objection. Vague.

4 THE WITNESS: Well, since the word "data" at  
5 least from my search today I cannot find, data that  
6 would be tagged or identified as data for a DQ  
7 signal, I wouldn't -- I don't see that here either.

8 Nonetheless, I would say that quite a few  
9 people of ordinary skill in the art understand what a  
10 memory subsystem is and the fact that it handles data  
11 and stores data and gives data back, but if you just  
12 want to know whether the -- whether the English word  
13 "data" or "DQ" is in this document, I don't see them  
14 here.

15 BY MR. CHANDLER:

16 Q. In your opinion would a person of ordinary  
17 skill in the art know about read-or-write operations  
18 on a memory module that are not associated with  
19 training?

20 MR. ROE: Objection. Calls for a legal  
21 conclusion.

22 THE WITNESS: I'm sorry. You specifically  
23 said read-or-write memory operations that are not  
24 specific to training?

25

1 BY MR. CHANDLER:

2 Q. Would a person of ordinary skill in the art  
3 know about read-and-write operations on a memory  
4 module that are not associated with training?

5 MR. ROE: Objection. Vague.

6 THE WITNESS: Yes, I believe they would.

7 BY MR. CHANDLER:

8 Q. Would a person of ordinary skill in the art  
9 know about read-and-write operations on a memory  
10 module that are associated with training?

11 MR. ROE: Objection. Vague. Incomplete  
12 hypothetical.

13 THE WITNESS: Yes, I believe there are  
14 systems that predate the patent or that predate the  
15 provisional that had read-and-write operations that  
16 were not -- that were -- I'm sorry, read-and-write  
17 operations that were part of training; correct?

18 BY MR. CHANDLER:

19 Q. Yes. That was my --

20 A. Is that the question?

21 Q. Yes. So let me ask it again. Would a  
22 person of ordinary skill in the art know about  
23 read-and-write operations on a memory module that are  
24 associated with training?

25 MR. ROE: Objection. Vague. Incomplete

1 hypothetical and lacks foundation. Calls for legal  
2 conclusion.

3 THE WITNESS: Yes, I believe one of ordinary  
4 skill in the art would have known about memory  
5 operations, memory read-and-write operations that  
6 would have been part of training.

7 BY MR. CHANDLER:

8 Q. In the provisional application marked as  
9 Exhibit 1008, is the only training that is disclosed,  
10 quote, MB training, end quote?

11 A. Are you asking if that's literally the only  
12 time the word "training" is used?

13 Q. Let's start there. Is literally the only  
14 time that the word "training" is used in the  
15 provisional application marked as Exhibit 1008,  
16 quote, MB training, end quote?

17 A. Yes. From my scan right now, the only  
18 literal use of that term I can find is in a note  
19 below Figure 3 on page 25.

20 Q. Is it fair to say that your opinion is that  
21 the provisional application marked as Exhibit 1008  
22 does not describe any training occurring during  
23 normal operation?

24 A. Can you reference me to a portion of my  
25 declaration that talks about that?

1 Q. Take a look at paragraph 52 of your  
2 Exhibit 2027. See if that refreshes your  
3 recollection.

4 A. Yes. So as stated as my opinion in  
5 Exhibit 2027 of the '218 declaration, my declaration,  
6 the provisional does not describe any training  
7 occurring during normal operation.

8 Q. In your opinion is it possible for training  
9 to occur during normal operation, or do you not have  
10 any opinion on that?

11 MR. ROE: Objection. Incomplete  
12 hypothetical.

13 THE WITNESS: At this point in time I  
14 haven't been asked to opine on that, and I reserve my  
15 right to do that at a later date.

16 BY MR. CHANDLER:

17 Q. In your opinion is it possible for training  
18 to occur after initialization of the memory module,  
19 or do you have no opinion on that?

20 MR. ROE: Objection. Incomplete  
21 hypothetical.

22 THE WITNESS: So if I understand the  
23 question correctly, I have two choices: Training can  
24 happen after initialization or training can happen  
25 before initialization; correct?

1 BY MR. CHANDLER:

2 Q. No. So my question is, after initialization  
3 of the memory module and during that initialization  
4 maybe there's training, maybe there's not training.

5 But my question is, after the initialization  
6 of the memory module, is it possible for there to be  
7 training after initialization, or do you not have an  
8 opinion on that?

9 MR. ROE: Objection. Vague. Incomplete  
10 hypothetical.

11 THE WITNESS: My opinion with respect to  
12 training and initialization is in my report in the  
13 last two lines of page 28, Exhibit 2027, page 28 in  
14 the '218, continuing to the next two lines on page 29  
15 of the same document. And it's my opinion that the  
16 provisional only discloses training that occurs  
17 during initialization. That is the MB-DRAM training.  
18 That's my opinion.

19 BY MR. CHANDLER:

20 Q. My question is a little different. In your  
21 opinion is it possible for training to occur after  
22 initialization of the memory module, or do you not  
23 have an opinion on that?

24 MR. ROE: Objection. Vague. Foundation.  
25 Incomplete hypothetical.

1 THE WITNESS: I don't believe I've been  
2 asked to give an opinion on that, and at this point  
3 in time I will not be doing that. I reserve my right  
4 to add to that at a later date.

5 BY MR. CHANDLER:

6 Q. Could you turn to -- toward the beginning of  
7 your expert declaration marked as Exhibit 2027 in  
8 IPR2022-00062 and go to paragraph 29.

9 MR. ROE: Counselor, are we switching topics  
10 here? We've been going well over an hour.

11 MR. CHANDLER: We can take a quick break if  
12 you want.

13 MR. ROE: Do you want a break, Mr. Murphy?

14 THE WITNESS: Yes.

15 THE VIDEOGRAPHER: We are going off the  
16 record at 5:21 p.m.

17 (Recess taken from 5:21 p.m. to 5:33 p.m.)

18 THE VIDEOGRAPHER: Going back on the record  
19 at 5:33 p.m.

20 BY MR. CHANDLER:

21 Q. Mr. Murphy, would it be fair to say that  
22 Netlist did not invent the memory module? In other  
23 words, memory modules were known before  
24 June 12, 2009?

25 MR. ROE: Objection. Vague.

1 THE WITNESS: So would you -- are you  
2 specifically talking about memory modules that are --  
3 that have DRAMs on them or any kind of memory on them  
4 or --

5 BY MR. CHANDLER:

6 Q. Any kind of memory.

7 MR. ROE: Objection. Vague. Outside the  
8 scope. Lacks foundation.

9 THE WITNESS: Yeah. I think that that is a  
10 true commentary that Netlist didn't invent memory  
11 modules.

12 BY MR. CHANDLER:

13 Q. Netlist did not invent printed circuit  
14 boards with edge connections; correct?

15 MR. ROE: Objection. Vague. Outside the  
16 scope. Lacks foundation.

17 THE WITNESS: That's correct also.

18 BY MR. CHANDLER:

19 Q. Netlist did not invent the RDIMM memory  
20 module; correct?

21 MR. ROE: Objection. Vague. Lacks  
22 foundation. Outside the scope.

23 THE WITNESS: I believe that's correct also.

24 BY MR. CHANDLER:

25 Q. Netlist did not invent the LR-DIMM memory

1 module; correct?

2 MR. ROE: Objection. Vague. Lacks  
3 foundation.

4 THE WITNESS: Yes. I believe that's correct  
5 also.

6 BY MR. CHANDLER:

7 Q. Netlist did not invent the FBDIMM memory  
8 module; correct?

9 MR. ROE: Objection. Vague. Lacks  
10 foundation. Outside the scope.

11 THE WITNESS: Yes, that's correct.

12 BY MR. CHANDLER:

13 Q. Netlist did not invent the AMB, Advanced  
14 Memory Buffer; correct?

15 MR. ROE: Objection. Vague. Lacks  
16 foundation. Outside the scope.

17 THE WITNESS: That's correct. They did not  
18 invent the Advanced Memory Buffer.

19 BY MR. CHANDLER:

20 Q. Netlist did not invent Dynamic Random Access  
21 Memory or DRAM; correct?

22 MR. ROE: Objection. Vague. Lacks  
23 foundation. Outside the scope.

24 THE WITNESS: That's correct. They did not  
25 invent DRAM.

1 BY MR. CHANDLER:

2 Q. Netlist did not invent DDR memory devices or  
3 DDR2 memory devices or DDR3 memory devices; correct?

4 MR. ROE: Objection. Vague. Lacks  
5 foundation. Outside the scope and compound.

6 THE WITNESS: Yes, that's correct. They did  
7 not invent any of those DDR devices that you  
8 mentioned.

9 BY MR. CHANDLER:

10 Q. Netlist did not invent an initialization  
11 mode for memory modules; correct?

12 MR. ROE: Objection. Vague. Lacks  
13 foundation. Outside the scope.

14 THE WITNESS: That's correct. It did not  
15 invent initialization for memory modules.

16 BY MR. CHANDLER:

17 Q. Netlist did not invent a normal mode for  
18 memory module; correct?

19 MR. ROE: Objection. Vague. Lacks  
20 foundation. Outside the scope.

21 THE WITNESS: Yes, that's correct. It did  
22 not invent normal operation mode.

23 BY MR. CHANDLER:

24 Q. Netlist did not invent training sequences  
25 for memory modules; correct?

1 MR. ROE: Objection. Vague. Lacks  
2 foundation. Outside the scope.

3 THE WITNESS: Yes, that's correct.

4 BY MR. CHANDLER:

5 Q. Netlist did not invent training sequences  
6 for LR-DIMM memory modules; correct?

7 MR. ROE: Objection. Vague. Lacks  
8 foundation. Outside the scope. Calls for -- calling  
9 for a legal conclusion.

10 THE WITNESS: Well, do you consider the type  
11 of notification signal that's identified in the '218  
12 of the '595 patent to be a part of training?

13 BY MR. CHANDLER:

14 Q. My question is about a training sequence.  
15 So maybe -- let me ask you, do you consider a  
16 notification signal part of a training sequence?

17 MR. ROE: Objection. Vague.

18 THE WITNESS: I would certainly consider it  
19 to be part of a methodology that enables a training  
20 sequence to happen. I haven't -- I haven't thought  
21 about whether it's literally part of the sequence or  
22 not. I -- I don't think I can answer that --

23 BY MR. CHANDLER:

24 Q. Netlist did not --

25 A. -- today at least.

1 THE REPORTER: I didn't hear that.

2 MR. ROE: Are you done with your answer?

3 THE WITNESS: Yes.

4 BY MR. CHANDLER:

5 Q. Netlist did not invent --

6 THE REPORTER: I didn't hear that last  
7 statement. Sorry.

8 THE WITNESS: From who?

9 MR. ROE: From Counsel, from Samsung's  
10 counsel. We can't hear him.

11 BY MR. CHANDLER:

12 Q. Netlist did not invent an open drain output  
13 coupled with a pull-up or pull-down resistor;  
14 correct?

15 MR. ROE: Objection. Vague. Lacks  
16 foundation. Outside the scope.

17 THE WITNESS: That's correct.

18 BY MR. CHANDLER:

19 Q. Are there any corrections or clarifications  
20 that you would like to make to your testimony today?

21 A. As far as today is concerned, no, not right  
22 now.

23 MR. CHANDLER: All right. I pass the  
24 witness.

25 MR. ROE: Okay. Let's go off the record.

1 Do you agree, Counsel? We can't hear you  
2 over here.

3 MR. CHANDLER: Yes.

4 So Videographer, we can go off the record.

5 THE VIDEOGRAPHER: Sorry. Going off the  
6 record at 5:39 p.m.

7 (Recess taken from 5:39 p.m. to 5:58 p.m.)

8 THE VIDEOGRAPHER: Going back on the record  
9 at 5:58 p.m.

10 MR. ROE: Thank you, Mr. Murphy, for your  
11 time. I do not have any questions for you at the  
12 moment.

13 We will reserve the right to review and  
14 sign, and thank you very much.

15 THE WITNESS: Thank you.

16 MR. CHANDLER: Thank you.

17 And so for the court reporter, we'd like a  
18 rough either tonight or in the morning, and a final  
19 by -- in five days, which is Thursday, November 3rd.

20 THE VIDEOGRAPHER: And do all counsel need  
21 the video or just the noticing party?

22 MR. ROE: We can go off the record and do  
23 logistics.

24 MR. CHANDLER: Okay. Sounds good.

25 THE VIDEOGRAPHER: Okay. We are going off

1 the record at 5:59 p.m.

2 MR. ROE: So we'll -- I don't think we need  
3 a video.

4 THE VIDEOGRAPHER: Okay.

5 MR. ROE: I will circle back if we do want a  
6 video.

7 As far as the rough, send it when you have  
8 it, and we'll take the final when you send it to the  
9 noticing counsel.

10 THE REPORTER: Sounds great. Thank you very  
11 much.

12

13 (The remote video deposition concluded at  
14 6:00 p.m.)

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REPORTER'S CERTIFICATION

I, Susan F. Magee, RPR, CCRR, CLR, Certified  
Shorthand Reporter, in and for the State of  
California, do hereby certify:

That the foregoing witness was by me duly  
sworn; that the deposition was then taken before me  
at the time and place herein set forth; that the  
testimony and proceedings were reported  
stenographically by me and later transcribed into  
typewriting under my direction; that the foregoing is  
a true record of the testimony and proceedings taken  
at that time.

IN WITNESS WHEREOF, I have subscribed my  
name this 30th day of October 2022.



Susan F. Magee, RPR, CCRR, CLR  
CSR No. 11661

DEPOSITION ERRATA SHEET

Our Assignment No. J8710929

Case Caption: Samsung Electronics Co., Ltd. vs.  
Netlist, Inc.

DECLARATION UNDER PENALTY OF PERJURY

I declare under penalty of perjury that I  
have read the entire transcript of my deposition  
taken in the captioned matter or the same has been  
read to me, and the same is true and accurate, save  
and except for changes and/or corrections, if any, as  
indicated by me on the DEPOSITION ERRATA SHEET  
hereof, with the understanding that I offer these  
changes as if still under oath.

Signed on the \_\_\_\_\_ day of  
\_\_\_\_\_, 2022.

\_\_\_\_\_  
ROBERT J. MURPHY

DEPOSITION ERRATA SHEET

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ROBERT J. MURPHY

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25 ROBERT J. MURPHY