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Transcript of Randal Direen, Ph.D.

Date: November 14, 2024

Case: Samsung Electronics Co., Ltd. -v- WiPQTUS, Inc., et al. (PTAB)

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WORLDWIDE COURT REPORTING & LITIGATION TECHNOLOGY

1 UNITED STATES PATENT AND TRADEMARK OFFICE

2
3 BEFORE THE PATENT TRIAL AND APPEAL BOARD

4
5 SAMSUNG ELECTRONICS CO., LTD.

6 Petitioner,

7 v.

8 WIPQTUS, INC.

9 Patent Owner.

10
11 IPR2024-00023

12 U.S. Patent No. 10,038,339

13
14 DEPOSITION OF

15 RANDAL DIREEN, Ph.D.

16 Thursday, November 14, 2024

17 1:30 p.m. EST

18
19
20 Job No.: 561084

21 Pages 1 - 121

22 Reported by: APRIL REID, RPR, CRR (Stenographer)

1 Deposition of RANDAL DIREEN, Ph.D. held
2 virtually. All appeared remotely.

3

4 A P P E A R A N C E S

5

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A P P E A R A N C E S cont'd

ON BEHALF OF THE PATENT OWNER WIPQTUS,
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I N D E X

RANDAL DIREEN, Ph.D.	PAGE
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NO EXHIBITS MARKED

1 P R O C E E D I N G S

2 THE STENOGRAPHER: As we begin this
3 proceeding, I will ask our witness to please
4 raise your right hand.

5 THE WITNESS: (Complies).

6 THE STENOGRAPHER: Do you swear or
7 affirm that the testimony you're about to
8 give will be the truth, the whole truth, and
9 nothing but the truth?

10 THE WITNESS: Yes.

11 THE STENOGRAPHER: Thank you.

12 THEREUPON:

13 RANDAL DIREEN, Ph.D.

14 being first duly sworn or affirmed to
15 testify to the truth, the whole truth, and
16 nothing but the truth, was examined and
17 testified as follows:

18 THE STENOGRAPHER: We may begin.

19 EXAMINATION

20 BY MR. WARD:

21 Q. Good afternoon, Randy. Or maybe, good
22 morning to you. Depends on where you're at today.

1 Could you please state your full name
2 and address, for the record?

3 MR. CARPENTER: Well, before we do that,
4 we ought to enter appearances; right?

5 This is Brian Carpenter -- Brian
6 Carpenter for WiPQTUS, Inc.

7 MR. WARD: Thank you.

8 BY MR. WARD:

9 Q. Randy, if you could please state your
10 full name and address.

11 A. Yes. Randal Hugh Direen.

12 Q. It's good to see you again, Randy.

13 My name is Trent Ward, as you may
14 recall. I am a patent lawyer with the Law Firm of
15 Greenberg Traurig and I represent petitioner
16 Samsung.

17 Randy, do you understand you're here for
18 a deposition -- a deposition in connection with
19 the proceeding before the PTAB? I'll give you the
20 number, just so we have it in the record. It is
21 IPR 2024-23.

22 Correct?

1 A. Correct.

2 Q. All right.

3 MR. CARPENTER: Mr. Ward -- Mr. Ward,
4 I'd ask that you use Dr. Direen. I think
5 Randy's a little too informal for this
6 proceeding.

7 MR. WARD: Certainly.

8 BY MR. WARD:

9 Q. Dr. Direen, do you understand that
10 you're under oath today?

11 A. Yes.

12 Q. That means you're sworn to tell the
13 truth, as if you were in a courtroom with a judge
14 and jury; correct?

15 A. Yes.

16 Q. Is there any reason why you cannot
17 testify truthfully and accurately today?

18 A. No.

19 Q. Dr. Direen, I know you're familiar
20 because we did this exercise just a couple weeks
21 ago, but I'm going to just quickly refresh the
22 rules for our deposition today.

1 First, I'm going to ask you some
2 questions about documents involved with the IPR
3 proceedings. I'll do that by sharing those
4 documents on the screen.

5 The court reporter is going to
6 transcribe everything that you and I say, so it's
7 important that we don't talk over each other and
8 that we speak clearly so the court reporter can
9 make sure our conversation is accurately
10 documented.

11 I'll do my best to wait until you finish
12 answering a question and I'll ask that you wait --
13 to do your best -- to do the same. We'll probably
14 trip over each other sometimes. I know I have a
15 bad habit of doing that. But we'll keep that in
16 mind to try to have a clean record today.

17 Does that sound good, Dr. Direen?

18 A. Yes.

19 Q. And, Dr. Direen, when I ask you a
20 question, can you please tell me if you do not
21 understand the question?

22 A. Yes.

1 Q. And that means, if you answer my
2 question I'll assume that you've understood the
3 question. Does that sound good?

4 A. Yes.

5 Q. Is it fair for me to assume, then, that
6 if -- if -- unless you ask me to further explain a
7 question, that -- that you will -- understood my
8 question?

9 A. Yes.

10 Q. And if your counsel objects to a
11 question, are you aware that you're generally
12 required to answer the question unless instructed
13 otherwise?

14 A. Yes.

15 Q. The other thing for us to keep in mind
16 for purposes of the record is providing verbal
17 answers, like yes or no. So just avoid shaking
18 your head or a nonverbal response. Does that
19 sound good?

20 A. Yes.

21 Q. All right. So we're hopefully not going
22 to spend an entire day with today's deposition,

1 and I know I -- I represented to Mr. Carpenter
2 that this wouldn't last more than four hours, but
3 if you need a break, Dr. Direen, please let me
4 know. I'm certainly happy to take a break, if and
5 when you need one. Just like the last time we did
6 this exercise, I typically break on about the hour
7 basis. But let me know if you need a break.

8 Do you understand that you're not to
9 discuss the substance of your testimony with Mr.
10 Carpenter during break?

11 A. Yes.

12 Q. And, Dr. Direen, because this is a
13 remote deposition, I just want to get a sense of
14 what's in front of you.

15 So can you tell me what's -- maybe,
16 let's start with the electronics that you're
17 using. What -- what are you looking at?

18 A computer screen?

19 A. Yes. I have a wide screen that's
20 connected to my laptop.

21 Q. Okay. And what's visible to you on the
22 screen of your computer?

1 A. I have a file with Explorer open. I
2 have a web browser with my e-mail on it. And
3 then, I was looking at a couple of the documents
4 from PTAB. So I think I have the '339 patent
5 open. Yeah.

6 Q. Okay. Can I ask that you close any
7 applications other than the Zoom application? Is
8 that okay?

9 A. Yeah.

10 I'm going to start with that.

11 MR. CARPENTER: Well, counsel, I -- I
12 believe he is entitled to look at the PTAB
13 documents. In fact, that might speed things
14 up today, if he pulls them up, the exhibits
15 off there.

16 MR. WARD: That's a possibility, Mr.
17 Carpenter, but I want to be aware of if and
18 when he's doing that. So I'd ask that he
19 close anything that's visible to him now.

20 A. Yeah. Working on it. It's going to
21 take a couple of minutes.

22 I have to keep a couple of these running

1 in the background, how they -- they work.

2 Q. And when you say you have to keep a
3 couple running, Dr. Direen, what do you mean?

4 A. I do have my business Slack activated.
5 I would have to maybe turn off notify -- is there
6 a way to turn off notification?

7 Q. Doctor, it's fine. You can -- you can
8 leave that up. What I'll ask is, if you receive a
9 message electronically, can you just let me know
10 that you received a message? You don't have to
11 read me the message, obviously --

12 A. Okay.

13 Q. -- but just let me know that "I've
14 gotten a message and I'd like to respond to it."

15 Does that sound good?

16 A. Yeah. Absolutely. Yeah.

17 Q. Okay. So other than what you've
18 identified, anything else visible on your
19 computer?

20 A. Just my desktop background now.

21 Q. Okay. Anything visible to you on the
22 desk as far as documents or notes?

1 A. I have a -- a clean copy of my
2 declaration.

3 Q. And which --

4 A. And then --

5 Q. And which exhibit number is that?

6 A. Oh. I'm sorry. This is the IPR
7 2024-23. So Exhibit 2008.

8 Q. Thank you.

9 Anything else visible to you?

10 A. And -- yeah. I also have clean copies
11 of the -- the Cook and Lee patents.

12 Q. Okay.

13 A. Yeah.

14 And that's it. That's it.

15 Q. Do you have your phone with you,
16 Dr. Direen?

17 A. I have my phone here.

18 Q. Okay. And so, similar to your computer,
19 I would ask that if, just during the deposition,
20 you can let me know if you receive a message.

21 A. Yeah. Yeah.

22 Q. Okay. Great.

1 Dr. Direen, what did you do to prepare
2 for today's deposition?

3 A. I met with Brian Carpenter and Tim
4 Craddock yesterday for about a half an hour, and
5 then maybe a half an hour this morning. And then,
6 I rereviewed this declaration and the Lee and Cook
7 patents.

8 Q. And, Dr. Direen, when you say "I
9 rereviewed this declaration," do you mean Exhibit
10 2008?

11 A. Yes, 2008.

12 Q. You have multiple deposi- --
13 declarations in this proceeding.

14 A. I'm sorry. Yeah. 2008.

15 Q. Okay.

16 A. Oh. And I talked over you.

17 So, yes, I rereviewed Exhibit 2008.

18 Q. So you rereviewed Exhibit 2008, the Cook
19 reference and the Lee reference; correct?

20 A. That's right.

21 I also briefly reviewed, I think, a
22 couple of these -- well, these exhibits from the

1 declaration. On page 2 it says there is a paper
2 number 13 that I reviewed and then a -- a handful
3 of these exhibits on page 2 and 3.

4 Q. And can you identify those exhibits?

5 A. Yeah. Sure.

6 So on page 2 of the Exhibit 2008 I read
7 the petitioner's reply brief, number 13.

8 I read the '339 patent.

9 I briefly reviewed the Chatterjee and
10 Corbridge patents.

11 Let's see. Let's see.

12 And the '929 patent.

13 I looked at the -- briefly looked at the
14 '312 provisional application.

15 I briefly went through my transcript
16 from August 6th, 2024.

17 And I think I opened up -- just the --
18 just reverified the rest of these exhibits, but I
19 don't think I looked at them in any detail.

20 Yeah. I think that's right.

21 Q. Okay. Thank you, Dr. Direen.

22 I'm going to share on the screen now

1 Exhibit 2008.

2 A. Okay.

3 Q. And is that visible to you, Dr. Direen?

4 A. Yes.

5 Q. Okay. So do you recognize this
6 document?

7 A. Yes.

8 Q. And what is it?

9 A. This is the document I have in front of
10 me. It is the -- Exhibit 2008. It's my -- the
11 direct -- the Declaration of Dr. Direen --
12 Dr. Randal H. Direen in Support of Patent Owner's
13 Revised Motion to Amend.

14 Q. Thank you.

15 I just want to turn now -- on the screen
16 I want to turn to paragraph -- let's see. The
17 last page of the declaration appears at page 57.
18 Do you see that on screen?

19 A. Yes.

20 Q. And do you see a signature there on page
21 57?

22 A. Yes.

1 Q. And whose signature is that?

2 A. That's my signature.

3 Q. And what's the date of your signature?

4 A. Executed 9th day of October of 2024.

5 Q. And who wrote this declaration,
6 Dr. Direen?

7 A. I wrote -- wrote it and it was edited --
8 or worked on, I think, by Brian Carpenter and Tim
9 Craddock, and then I edited it. And these
10 represent my opinions.

11 Q. And when you say it was "worked on" by
12 Brian Carpenter, what do you mean?

13 A. Like, edited.

14 He also helped me formulate what sorts
15 of pieces needed to be in the document.

16 Q. I want to direct your attention to
17 paragraph 7 in your declaration.

18 A. Okay.

19 Q. And in paragraph 7 you state, "I
20 understand that WiPQTUS filed patent owner WiPQTUS
21 Motion to Amend under 37 C.F.R. 42.121 wherein
22 WiPQTUS proposed the following substitute claims,

1 among others," and there, in paragraph 7, you
2 reproduce a proposed substitute claim 21; correct?

3 A. Correct.

4 Q. And do you see the amended clause that's
5 shown in underlined text there in the middle for
6 an impedance network?

7 A. Yes.

8 Q. I want to read that clause for an
9 impedance network. It says, "An impedance network
10 comprised of two or more electrical components
11 from the list: (i), one or more passive
12 components; (ii), one or more active components;
13 or (iii), one or more switches."

14 Do you see that?

15 A. Yes.

16 Q. So here in paragraph 7 you're setting
17 forth the proposed substitute claims from
18 WiPQTUS's first motion to amend; correct?

19 A. That's correct.

20 Q. I'm going to move down to paragraph 9.
21 And in paragraph 9 you state, "I also understand
22 WiPQTUS will file, contemporaneous with the

1 supplemental declaration, a revised motion to
2 amend wherein the following revised substitute
3 claims will be proposed," and then you reproduce
4 proposed substitute claim 21; correct?

5 A. Yes.

6 Q. So for purposes of our discussion today,
7 Dr. Direen, is it okay if I talk about the "first
8 amended claims" being those in the first motion to
9 amend and the "second amended claims" being those
10 in the revised motion to amend or the second
11 motion to amend?

12 A. I may ask for you to clarify, just so
13 that I can keep it straight in my head, but yes.

14 Q. Understood.

15 Would it be better if I just refer to
16 these as the "revised proposed amended claims"?

17 A. Yes.

18 Q. Okay. So in paragraph 9 of Exhibit
19 2008, you reproduced the revised proposed
20 substitute claim 21 and in underlying language it
21 provides the amendment to the claim; correct?

22 A. Yes.

1 Q. So I want to read that clause for the
2 impedance network. It says, "An impedance network
3 comprising a collection of two or more electrical
4 components, one of which must be a passive
5 component and one of which must be either an
6 active component or a switch."

7 Do you see that?

8 A. Yes.

9 Q. So my question to you, Dr. Direen, is:
10 What is the difference in this clause for
11 impedance network in the revised amended claim and
12 the previous clause for impedance network in the
13 first amended claim?

14 A. I believe it's a clarification. The
15 first amended clause didn't make it clear that one
16 of the pas- -- one of the components needed to be
17 passive and one of the components needed to at
18 least make that impedance modifiable with the use
19 of an active component or a switch.

20 Q. And so you're saying it wasn't clear
21 with the first amended claim those requirements;
22 is that correct?

1 A. I believe this came out of -- it would
2 have been my prior declaration, on page 24 or
3 paragraph 56 of the declaration. I said, "In my
4 prior declaration, I construed impedance network
5 as follows..."

6 Therefore, the term "impedance network"
7 should be construed further based upon the above
8 analysis. I concluded that a POSITA taking the
9 phrase "impedance network" in the context of the
10 claim read in light of the specification would
11 understand it to mean a collection of two or more
12 electrical components from the list where have, 1,
13 one of -- or more passive components, 2, active
14 components and, 3, switches.

15 And then I said, "I further interpret
16 impedance network as being separate from the
17 induction call and -- and used to transmit and
18 receive power, as is evident from figures 1, 2 and
19 5, and also separate from the switch network as
20 will be discussed below in connection with
21 limitation 1(e)."

22 And then, I point out in this

1 declaration, emphasize that "the impedance network
2 must be capable of having its impedance
3 controllably varied during at least the received
4 being power mode."

5 And then, further, it says -- during my
6 deposition, Counsel for Samsung questioned me
7 regarding paragraph 110 and I agreed to a slight
8 modification: "A POSA would understand that two
9 or more passive elements alone would not have the
10 capability to -- to be configured to change
11 impedance, but the one or more active elements of
12 the switches would be necessary to provide the
13 functionality as required by limitation 1(e)."

14 And then, I said, "Nevertheless, to make
15 this point absolutely clear, I agree that a more
16 clear construction would be a collection of two or
17 more electrical components, one of which must be a
18 passive component and one of which must be either
19 an active component or switch."

20 So that's what that came out of for
21 clarifying the -- the -- the original versus the
22 revised.

1 Q. So, Dr. Direen, looking at the screen
2 and the clause there in paragraph 7 of your
3 declaration for impedance network, where it says
4 "An impedance network comprised of two or more
5 electrical components from the list," could that
6 claim limitation have been satisfied with just two
7 passive components?

8 A. Just two passive --

9 MR. CARPENTER: Objection to the form.
10 Objection, form.

11 THE WITNESS: Sorry.

12 A. No.

13 It would need to be -- consistent with
14 the limitation 1(e), it would need to be
15 modifiable. So it would need one passive
16 component and something that can make it
17 modifiable, such as an active component or a
18 switch.

19 Q. So would you agree that the first
20 proposed amended claim in paragraph 7 of your
21 declaration, the impedance network, required at
22 least one passive component and at least one

1 active component or a switch?

2 A. Yes.

3 Q. And so what is the difference between
4 the first amended claim for an impedance network
5 and the revised amended claim for an impedance
6 network?

7 A. I don't believe there is a difference.
8 I just believe it's more clear.

9 In the first, we -- we don't
10 specifically say it must be a passive and an
11 active element, but from the context of the rest
12 of the claim, 1 -- 1(e), for the impedance to be
13 modifiable it needs to have an active or -- an
14 active element or a switch.

15 Q. So is it your position that properly
16 construed, the first amended claim 21 is the same
17 as the second amended claim 21?

18 MR. CARPENTER: Objection to form. It's
19 not. It misstates his testimony.

20 A. Can -- can you ask that one more time?

21 Q. Would you agree that if properly
22 construed, the first amended claim 21 is the same

1 as the second amended claim 21?

2 MR. CARPENTER: Objection to form.

3 A. I -- I -- by "properly construed," I
4 might be misunderstanding something. Do you
5 mean -- do you mean interpreted?

6 Q. Yes.

7 A. I believe that the first -- in -- sorry.
8 In the original proposal, I believe it's
9 the same construction as the second one, as the
10 revised one, if properly interpreted.

11 Q. So you would agree if properly
12 interpreted, the first amended claim 21 is the
13 same as the second amended claim 21?

14 MR. CARPENTER: Objection to form.

15 A. I don't believe there's a difference
16 between the original and the revised. It was just
17 a clarification.

18 Q. And, Dr. Direen, I want to show to you
19 as well in paragraph 7 -- and I have on screen now
20 page 5 of your declaration -- the continuation of
21 the first proposed claim 21.

22 Do you see the underlined language where

1 it says, comma, "While configured to receive said
2 power, the impedance..."?

3 A. I see that.

4 Q. And I want to then show you as well
5 paragraph 9 where you've reproduced proposed --
6 you revised proposed claim 21 and the same clause
7 provides that underlined amendment again. It
8 says, "While configured to receive said power, the
9 impedance..."

10 Correct?

11 A. Yes. I see it.

12 Q. So is it your understanding that no
13 changes were made to this second amendment to
14 claim 21?

15 MR. CARPENTER: Objection, form.

16 A. Are you saying -- are you asking, is
17 there any changes between the original and the
18 revised?

19 Q. Are there any changes between the first
20 proposed claim 21 and the revised claim 21 with
21 respect to this clause "while configured to
22 receive said power"?

1 A. Let me just double-check.

2 There appears to be no change.

3 Q. I want to move now, Dr. Direen, to
4 paragraph 23 of your declaration. Do you see that
5 on screen?

6 A. Yes.

7 Q. In paragraph 23 you state that -- in the
8 middle of the paragraph you state, "Further, the
9 specification describes at least five topologies:
10 1, a nonsynchronous full-bridge rectifier; 2, a
11 half-synchronous full-bridge rectifier; 3, a
12 fully-synchronous full-bridge rectifier; 4, a
13 half-bridge inverter; and 5, a full-bridge
14 inverter."

15 Do you see that?

16 A. Yes.

17 Q. Dr. Direen, can you explain to me what
18 is a nonsynchronous full-bridge rectifier?

19 A. Sure.

20 A classic bridge rectifier might use
21 diodes. So you have it in a configuration with
22 four -- four different diodes. And then you're

1 able to split the signal from -- you -- you -- you
2 take the -- both sides of the sign wave and then
3 you turn them into humps. So it's a diode-based
4 full-bridge rectifier.

5 Q. So would you agree that the goal of the
6 rectifier is to convert an AC input voltage into a
7 DC output voltage?

8 A. Yes. I believe that's the general
9 understanding of a rectifier.

10 Q. And when you say the "humps," what are
11 you talking about?

12 A. You have a sign wave coming in, or any
13 kind of AC type signal, you'll have a voltage and
14 a current that end up being positive some of the
15 time and then they'll end up being negative some
16 of the time. Depending on your sense, let's say
17 positive, what you do is you take the negative
18 parts and then you produce them to be positive.
19 So you'll still have the positive parts, but then
20 the negative parts become positive. That's what
21 a -- a rectifier -- a full-bridge rectifier does.

22 Q. And what makes it nonsynchronous?

1 A. Within the context of the patent, the
2 synchronous version will actually switch out the
3 diodes so that you can boost the efficiency.

4 Q. And what does the nonsynchronous version
5 do?

6 A. What does the nonsynchronous version do?
7 It's less efficient just naturally
8 because of the forward voltage of the diodes.

9 Q. And can you explain that to me? What is
10 the forward voltage of the diode?

11 A. Sure.

12 So a diode, act- -- to act- -- well,
13 let's start with what a diode does. A diode will
14 allow current to flow in one direction and make it
15 tricky or hard for current to flow in the opposite
16 direction. Because -- the -- from the underlying
17 details of how a diode works, in order to get it
18 to flow positive, for the current to flow
19 positive, there has to at least be a little bit of
20 a voltage drop before current can flow through,
21 so...

22 In, like, kind of your standard, like, I

1 think it's, like, 1N555 or 5B5 -- I can't remember
2 the number. That's speculation. However, some
3 diodes will have a .7 volt drop. Schottky diodes
4 will have, like, a .2 volt drop. Some of your
5 bigger, fatter diodes will have a 1.1 volt drop.
6 LEDs, for example, will have even a higher voltage
7 drop. So every -- so that's what's the forward
8 voltage of the diode is.

9 Q. And so you have to -- you have to bias
10 the diode in order for current to flow through the
11 diode; correct?

12 A. You don't -- you don't bias it. That
13 would be if you have a separate -- separate set of
14 wires coming in producing a different voltage,
15 which does end up getting used if you want to use
16 a diode as a switch.

17 It's simply that you have to -- if you
18 have a diode and you want current to flow through
19 it, you bring the voltage up, bring the voltage up
20 and all of a sudden the current starts flowing
21 through.

22 Q. And is the current at the input reduced

1 by the amount of the voltage drop at the output?

2 You say -- for instance, you said for a
3 Schottky diode it's a .2 volt drop. So are you
4 losing .2 volts in the diode?

5 A. Yes.

6 Point -- well, by loss, are you talking
7 about like a power drop?

8 Q. Yes.

9 A. So -- yeah.

10 So if you have a current flowing through
11 it and you have a voltage across it, you'll have
12 a -- a power loss that's V times I .

13 Q. And so is it understood, then, that
14 diodes have an inherent inefficiency due to their
15 voltage drop?

16 A. That's correct.

17 Q. And so does a nonsynchronous full-bridge
18 rectifier represent that inefficiency due to its
19 use of four diodes?

20 A. The -- just using regular diodes, yeah,
21 you'll have an inefficiency, just because you're
22 using diodes.

1 Q. Is it possible to use different diodes
2 that aren't inefficient?

3 A. Well, that's why you would -- might go
4 to Schottky diodes that have like a .2 voltage
5 drop.

6 But you're -- I don't know -- I don't
7 personally know any diodes that have a smaller
8 drop than that, but they could exist.

9 But I know that's why you end up trying
10 to get diodes out of there, because of that
11 voltage drop.

12 Q. So, for that reason, are nonsynchronous
13 full-bridge rectifiers known to be relatively
14 inefficient rectifiers?

15 A. Relative to a synchronous rectifier,
16 yes.

17 Q. What would be a situation, then, in
18 which you would want to use a nonsynchronous
19 full-bridge rectifier if it's known to be less
20 efficient?

21 A. I think the wall warts. All the ones
22 that, like, you use on your phone. You have

1 plenty of power coming out of the wall, so to
2 reduce complexity you may just use a
3 full-bridge -- a rectifier. I would say, many
4 devices that come straight out of mains will
5 likely use just a -- a full-bridge rectifier using
6 a set of diodes.

7 Q. And you -- we're speaking about a
8 nonsynchronous full-bridge rectifier using four
9 diodes; correct?

10 A. Yes, nonsynchronous.

11 Q. And what is a more -- a more efficient
12 rectifier?

13 A. You want to get rid of that forward --
14 the forward voltage on the diode. So what you can
15 do is you can put switches in there or, like,
16 transistors that when you turn them on there's no
17 voltage drop. So you can -- well, there's a small
18 voltage drop, but it's less than the diode. So
19 you can toggle the transistors on and off
20 synchronously with the signal coming in so that
21 you can eliminate that voltage drop.

22 Q. Do you agree that in those situations

1 you have to have control logic to then cycle the
2 transistors?

3 A. I -- I would say some kind of control
4 logic.

5 You would have to detect when the
6 voltage goes through zero, so you know when it
7 goes from positive to negative. And at that
8 point, you would need to tell the transistors to
9 turn into a -- turn into a configuration. And to
10 do that, you at least need some kind of logic
11 to -- I would call it logic. Some transistors put
12 together cleverly to turn those transistors on and
13 off.

14 Q. And would those transistors -- would the
15 logic for those transistors need to have a
16 separate power source?

17 A. Separate power source from what?

18 Q. From the incoming power that's to be
19 rectified.

20 A. I would say that -- let's suppose you're
21 in a situation where there's no power stored in
22 your device. You would need to have some sort of

1 power to turn those tran- -- or voltage to turn
2 those transistors on and off.

3 So what you could do is, is you could
4 wait in a nonsynchronous version for some power to
5 get stored. And then once that power's stored,
6 you could be using that power that came from that
7 source to run the -- the fully synchronous version
8 of the rectifier.

9 Q. And in that situation, you would need to
10 have configured both the nonsynchronous
11 full-bridge rectifier and the fully synchronous
12 full-bridge rectifier; right?

13 A. If you wanted to change state and go
14 into that, yeah, you would have to have something
15 that allows you to change between the
16 nonsynchronous and the full synchronous.

17 Q. So does a fully synchronous full-bridge
18 rectifier have diodes?

19 A. I suppose there could be some
20 configuration that has diodes in -- in some
21 design, but it would be beneficial if you weren't
22 passing your main current through those diodes.

1 Q. Because of the inefficiency of the
2 voltage drop of those diodes; correct?

3 A. That's right.

4 Q. So the most efficient full-synchronous
5 full-bridge rectifier would be one that does not
6 pass current through diodes; correct?

7 A. Well, it would be up there with no
8 voltage drop current combination.

9 So if -- if it has a 1-volt drop and you
10 put an amp through there, you'll have a watt of
11 power get burnt up, just to heat.

12 Q. So why would one ever implement a
13 nonsynchronous full-bridge rectifier if they had
14 the capability to implement a fully-synchronous
15 full-bridge rectifier?

16 MR. CARPENTER: Object to form.

17 A. It -- it depends on how much of an issue
18 of ratios. They're coming out of the wall. You
19 have, what, 110, 120 volts. I think it's -- like
20 peak to peak it's 170 volts or something like
21 that. A voltage drop of 1 volt relative is not
22 that -- not that much compared to the current

1 that's going through.

2 But let's say you have only a few volts
3 that are coming across your diodes and then you
4 drop another volt, you could be -- you could be
5 dropping a fair amount of power.

6 Q. Dr. Direen, what is a half-synchronous
7 full-bridge rectifier?

8 A. I can imagine a particular configuration
9 where you only have two diodes and two
10 transistors.

11 In my declaration, Exhibit 2008, on page
12 15, I have a little drawing where there's two
13 diodes up at the top and two transistors or
14 switches down at the bottom. I believe that could
15 be a configuration for a half-bridge rectifier.

16 Q. And what does the output of a
17 half-bridge -- how does the output of a
18 half-bridge rectifier compare to the output of a
19 full-bridge rectifier?

20 A. I would imagine you would be more
21 efficient than just a fully-unsynchronized
22 rectifier, but I'm not -- I have not studied these

1 half-bridge rectifiers in enough detail, I think,
2 to give you a good analysis of why you would use a
3 half-bridge rectifier. I'd have to go back and
4 spend some time thinking about that.

5 Q. Does a half-bridge rectifier, does it --
6 we talked before about the humps, the cycle of the
7 sinusoidal wave. Is it converting the negative
8 cycle of the wave or just skipping that cycle of
9 the wave?

10 A. In this configuration, you wouldn't be
11 skipping it. But you could come up with a --
12 another type of rectifier that only does -- keeps
13 the top -- or, let's say -- let's say, keeps the
14 positive voltage and then skips the negative
15 voltage.

16 Q. Dr. Direen, just going back to your
17 declaration here, I'm sharing on the screen
18 paragraph 26 of your declaration. Do you see
19 that?

20 A. Yes.

21 Q. Tell me if my Zoom is -- you know, if
22 I'm zoomed in or out too much, let me know. I

1 want you to be able to see it.

2 But paragraph 26, you state, the
3 specification discusses changing the topology
4 during receive mode. For example, the
5 specification explains that depending on the level
6 of wireless power being received, the control
7 logic 105 adjusts the topology of the switch
8 network 102 of the first circuitry.

9 You go on to say, "More specifically,
10 the specification explains that," and then you
11 provide a quote from the specification on -- in
12 paragraph 26 of your declaration. And in that
13 quote you reproduce the language. And it starts
14 in the middle of the quoted paragraph there. It
15 says, "This means that in idle state, the switch
16 network of the dual-mode wireless power receiver
17 is configured as a rectifier to receive power from
18 a wireless power transmitter. On receiving
19 sufficient level of power from the wireless power
20 transmitter, the dual-mode wireless power receiver
21 powers up and starts communicating with the
22 wireless power transmitter. The dual-mode

1 wireless power receiver adjusts the impedance of
2 its network. The dual-mode wireless power
3 receiver also adjusts the topology of the switch
4 network. For example, from the default
5 nonsynchronous rectifier to fully-synchronous
6 rectifier."

7 Do you see that language reproduced
8 there in paragraph 26 of your declaration?

9 A. Yes.

10 Q. So what does it mean when it says "on
11 receiving a sufficient level of power from the
12 wireless power transmitter, the dual-mode wireless
13 power receiver powers up"?

14 A. Well, suppose you have a -- a device
15 that has no capacity for power in it, like a
16 capacitor or a battery. If it's completely
17 drained, you need to be able to charge that system
18 to a certain level before it's going to work.

19 Q. And why do you need to be able to charge
20 that system to a certain level?

21 Is that because, for instance, if you
22 were configuring a fully-synchronous rectifier

1 you'd need a certain level of power for the
2 transistors to be operable?

3 A. Yes.

4 Q. And for a nonsynchronous rectifier you'd
5 need a certain amount of power to overcome the
6 voltage drop for the diodes; correct?

7 A. For a nonsynchronous system you can
8 start collecting power without having to turn on
9 transistors which requires additional power. So
10 that's why you would do a nonsynchronous
11 rectifier, is because it requires no additional
12 power to turn it on and off transistors.

13 Q. Does the nonsynchronous rectifier
14 require certain amounts of power threshold in
15 order for current to flow through the diodes?

16 A. It just simply needs enough voltage and
17 a low enough impedance driving it for current to
18 go through them.

19 Q. And what dictates how much that voltage
20 is?

21 A. Oh. I haven't studied that for awhile,
22 but solid state physics. I would have to

1 speculate or go back and study what dictates that,
2 but it is a solid state physics problem.

3 Q. So the benefit of a nonsynchronous
4 full-bridge rectifier in this type of
5 implementation would be that it -- it would not
6 need store charge or other power in order to power
7 up; correct?

8 A. Correct.

9 Q. But the fully-synchronous full-bridge
10 rectifier would have to have some level of stored
11 power in order to operate the logic for the
12 transistors; correct?

13 A. Correct.

14 Q. And so is it known to have the benefit
15 of having both the nonsynchronous and
16 fully-synchronous rectifiers to permit both of
17 those situations?

18 A. Can you repeat that question?

19 Q. Is it known to have both rectifier
20 configurations, such that you can accommodate the
21 unpowered rectifier situation and the sufficient
22 level of power rectification?

1 MR. CARPENTER: Object to form.

2 A. What -- what do you -- what do you mean
3 by "known"? Known by who?

4 Q. Is it known to have a dual-mode wireless
5 power receiver that has both a nonsynchronous
6 rectifier and a fully-synchronous rectifier?

7 MR. CARPENTER: Same objection.

8 A. I know -- I would say I know definitely
9 from the '339 patent that that's a -- a
10 capability.

11 Q. In the bottom of this paragraph that you
12 reproduced in paragraph 26 of your declaration,
13 the statement is, "The dual-mode wireless power
14 receiver also adjusts the topology of the switch
15 network. For example, from the default
16 nonsynchronous rectifier to fully-synchronous
17 rectifier."

18 Do you see that?

19 A. Yes.

20 Q. So what's being described there?

21 A. I'm assuming from this -- what we've got
22 in this -- this section, it says, "On receiving

1 sufficient level of power" -- so we're in the
2 receiving configuration -- "from the wireless
3 power transmitter, the dual-mode wireless power
4 receiver powers up and starts communicating with
5 the wireless power transmitter. The dual-mode
6 wireless power receiver adjusts the impedance of
7 the impedance network. The dual-mode wireless
8 power receiver also adjusts the topology of the
9 switch network," and gives an example. It says,
10 "For example, from the default nonsynchronous
11 rectifier to the full-synchronous rectifier."

12 And I believe it does that because
13 it's -- it's an efficiency versus power situation.

14 Q. And what do you mean by an "efficiency
15 versus power situation"?

16 A. If the system has no energy inside of
17 it, it cannot use the synchronous mechanism
18 because it can't turn on those switches
19 coincidentally with the signal coming in.

20 So first must, maybe do something a
21 little less efficient, like use a nonsynchronous
22 diode configuration to first start charging. And

1 then, once it gets to a certain level, even though
2 that was maybe inefficient, it at least got them
3 over the hump to build up some energy. And then,
4 that energy can then be used to go into a
5 synchronous mode, which is more efficient.

6 Q. So there is no unusual level of power
7 needed for a nonsynchronous rectifier?

8 A. You simply need to get over the voltage
9 hump to start getting current into the batteries.

10 Q. So in this paragraph when it says, "On
11 receiving sufficient level of power from the
12 wireless power transmitter, the dual-mode wireless
13 power receiver powers up," is it referring to
14 powering up the nonsynchronous rectifier or the
15 fully-synchronous rectifier?

16 A. I think one of the things that it does
17 when it powers up is then provides the power
18 necessary for the full synchronous mode.

19 Q. So when the patent states "on receiving
20 sufficient level of power from the wireless power
21 transmitter," is it referring to the
22 nonsynchronous rectifier or the fully-synchronous

1 rectifier?

2 A. Are you asking before the sufficient
3 level of power from the wireless power
4 transmitter?

5 Q. Yes.

6 A. So before "receiving sufficient level of
7 power from the wireless power transmitter," I
8 believe, means that you're in a situation where
9 you can't run fully synchronous. So you're in the
10 nonsynchronous, less efficient rectifier mode.

11 Q. Dr. Direen, I want to share on the
12 screen now a copy of your earlier declaration in
13 this IPR. It's Exhibit 2003.

14 Do you see that in the bottom right-hand
15 corner of the document?

16 A. Yes.

17 Q. And do you recognize this as your
18 declaration in support of patent owner's response?

19 A. Yes.

20 Q. I want to move to paragraph 28 of the --
21 Exhibit 2003. In paragraph 28 you say, "It's my
22 understanding that the '339 patent claims priority

1 to the date of the filing of the Provisional
2 Patent Application No. 60/682,312 filed August
3 13th, 2012 ... Submitted here with as Exhibit
4 2004."

5 Do you see that?

6 MR. CARPENTER: And, counsel, I'll
7 interject here that this deposition is of
8 limited scope. It's his -- it should be to
9 his new declaration, latest declaration. And
10 I'll give you some leeway, but you certainly
11 could have asked about this paragraph in the
12 last deposition.

13 A. Are you asking if I see this paragraph?

14 Q. Do you remember making this statement,
15 that it's your understanding that the '339 patent
16 claims priority to the '312 provisional
17 application?

18 A. Yes.

19 Q. So I want to bring on screen now a copy
20 of the provisional application which is Exhibit
21 2004 in this IPR.

22 Do you see the document labeled "Exhibit

1 2004" on the screen, Dr. Direen?

2 A. Yes.

3 Q. So what I'd like to ask you to do, going
4 back to your Exhibit 2008, where you reproduced a
5 paragraph from the '339 patent, at the end of the
6 paragraph is a sentence that we were just talking
7 about, it says, "The dual-mode wireless power
8 receiver also adjusts the topology of the switch
9 network ... For example, from the default
10 nonsynchronous rectifier to fully-synchronous
11 rectifier."

12 My question to you, Dr. Direen, is:
13 Now, looking at Exhibit 2004, the provisional
14 patent application, can you identify for me the
15 disclosure in the provisional that supports that
16 disclosure that you quoted from the '339 patent?

17 A. Can I open up this on the -- is it the
18 PTAB?

19 Q. Yes.

20 You have a copy of Exhibit 2004 on your
21 computer, Dr. Direen?

22 A. I do.

1 Q. Okay. Yeah, feel free to open it up.

2 A. I'm sorry. What exhibit did you say the
3 number was?

4 Q. Yeah. It's Exhibit 2004.

5 A. Okay.

6 MR. WARD: And let me know if you
7 don't -- if you can't easily access a copy of
8 it, Brian, or -- I can send you one.

9 MR. CARPENTER: I've got it.

10 A. Provisional application. Okay, I've got
11 it. And now it's open on my desktop.

12 Q. Great.

13 MR. CARPENTER: Can I have the question
14 read back, please?

15 THE STENOGRAPHER: Sure. Just a moment.

16 (Record read back by Stenographer.)

17 MR. CARPENTER: Object to the form.

18 A. I did just receive a message on my
19 computer.

20 Q. Do you need to respond to it?

21 A. I do not.

22 Q. Okay.

1 A. I did just receive another message. I
2 don't need to respond it.

3 Q. Okay.

4 MR. CARPENTER: These are not from me;
5 right, Randy?

6 A. These are not from counselor -- or from
7 counsel.

8 Another bank alert message. Not from
9 Brian.

10 Q. Okay. Understood.

11 A. Just got a message from accounting.
12 Just received on my phone a meeting --
13 business meeting Zoom invite I, obviously, will
14 not be going to.

15 A reminder for a meeting came up.

16 Got a message from a colleague on Slack.
17 Not Brian.

18 In my declaration on page 51 there's a
19 table. At the bottom of the table --

20 Q. I'm sharing on the screen now page 51 of
21 your declaration.

22 A. Page 51.

1 For the provisional, this is the '312
2 provisional, which -- which is Exhibit 2004. Is
3 that correct?

4 Q. Yes.

5 A. I point to "the provisional discloses at
6 least the first circuit based on an input from the
7 control logic circuit is configured to change the
8 impedance of the impedance network and topology of
9 the switch network to obtain a modified form of
10 the received power and apply the modified form of
11 power to the load device. For example, a
12 battery."

13 So in this case the provisional
14 discloses that -- that while in the received mode,
15 the system is configured to change the impedance
16 of the impedance network and the topology of the
17 switch network to obtain the modified form of
18 received power.

19 Q. Can you identify where in the
20 provisional it discloses the statement "the
21 dual-mode wireless power receiver also adjusts the
22 topology of the switch network. For example, from

1 default nonsynchronous rectifier to a
2 fully-synchronous rectifier"?

3 A. (No response).

4 Q. Let me put the question a different way,
5 Dr. Direen.

6 Is there any disclosure in the
7 provisional application about switching from a
8 nonsynchronous rectifier to a fully-synchronous
9 rectifier?

10 A. On page 19 of the 2000 -- Exhibit 2004,
11 paragraph 45.

12 Q. Yes.

13 A. This paragraph simply states that
14 "provides a configuration of a full-wave
15 rectifier."

16 It says, in the second sentence, "The
17 switch network 102, as exemplarily illustrated in
18 Fig. 6B, is configured as a full-wave rectifier;
19 for example, a full-synchronous full-wave
20 rectifier by keeping Vbat path off and keeping
21 switches S1a and S3a in an off state. Switches
22 S1b, S2, S3b, and S4 are driven with the timing

1 relationship as exemplary -- exemplarily
2 illustrated in Fig. 6B in full-synchronous
3 full-wave rectifier mode. In embodiment switches
4 S1b, S2, S3b, and S4 are driven in
5 half-synchronous full-wave rectifier mode."

6 So the -- paragraph 45 shows two
7 different kinds of rectifiers, a full-wave
8 synchronous and a half -- a half-wave. And though
9 it doesn't specifically say in this paragraph that
10 those are being switched between, as an example,
11 the -- the -- the statement on page 2, paragraph 4
12 says that "the first circuit based on an input
13 from the control logic circuit is configured to
14 change impedance of impedance network and topology
15 of switch network to obtain modified form of the
16 received power and apply the modified form of the
17 power to the load device. For example, battery."

18 And it does so while it's in the
19 received mode. So to change topology while
20 receiving. The only topology you can change
21 between are various rectifiers.

22 Q. But you would agree, neither paragraphs

1 4 nor paragraph 65 disclose adjusting the topology
2 of the switch network by switching from one type
3 of rectifier to another type of rectifier;
4 correct?

5 MR. CARPENTER: Object to form.

6 A. Well, in going -- going back and
7 referring to my declaration, in paragraph 26 on
8 page 13, you point out the statement, at the
9 bottom of the quote, from the '929 patent, "The
10 dual-mode wireless power receiver also adjusts the
11 topology of the switch network..."

12 In this specification they give a for
13 example, from the default nonsynchronous rectifier
14 to fully-synchronous rectifier.

15 I would agree that in the provisional
16 they do not provide an example.

17 Q. So would you agree that the provisional
18 doesn't disclose adjusting the topology of the
19 switch network by switching from one rectifier to
20 another type of rectifier?

21 MR. CARPENTER: Objection to form.

22 A. I believe in paragraph 4, page 2 of the

1 provisional, I believe the middle of the
2 paragraph, it says, "The dual-mode wireless
3 charging receiver can operate in a charging mode
4 and a communication mode. In the charging mode,
5 dual-mode wireless charging receiver configures
6 the first circuit to receive the power from a
7 wireless power transmitter. The first circuit,
8 based on input from the control logic circuit, is
9 configured to change the impedance -- the
10 impedance network and topology of the switch
11 network to obtain a modified form of received
12 power, and apply the modified form power to the
13 load device. For example, a battery."

14 No example was provided in here, like I
15 said earlier, from the '929 patent, but this
16 topology change within the context of a charging
17 mode -- I don't know what two topologies can be
18 changed between other than two different kinds of
19 rectifiers.

20 Q. Dr. Direen, just one additional question
21 on this point.

22 I want to direct you to paragraph 46 of

1 your declaration, Exhibit 2008. Paragraph 46 you
2 say, "In addition, the following passage does not
3 appear in the '312 provisional application..."

4 And the passage that is reproduced in
5 paragraph 46 is a portion of this quote from the
6 '339 patent that we were previously analyzing that
7 starts "on receiving sufficient level of power
8 from the wireless power transmitter..."

9 Do you see that in paragraph 46?

10 A. Yes.

11 MR. CARPENTER: Objection to form.

12 You misstated it. The quote was from
13 the '929.

14 Q. Is it your understanding that the
15 paragraph quoted in the middle of paragraph 46 of
16 your declaration does not appear in the '312
17 provisional application?

18 A. I agree with my original statement, that
19 in addition the following passage does not appear
20 in the '312 provisional application, but does
21 appear in the '310 application and the '929 patent
22 as well as the '070 application.

1 Q. Thank you.

2 MR. WARD: We've been on the record
3 about an hour and 20 minutes. Why don't we
4 take a break.

5 MR. CARPENTER: Almost two hours, I
6 believe.

7 MR. WARD: So are you opposed to a break
8 or you want a break?

9 MR. CARPENTER: I just -- want a break.
10 I just want the record to reflect the time on
11 the record.

12 THE WITNESS: I would like a break.
13 Thank you.

14 MR. WARD: Sounds great. Let's go off
15 the record.

16 THE STENOGRAPHER: We're off the record.
17 (Recess in proceedings.)

18 THE STENOGRAPHER: We are back on the
19 record.

20 BY MR. WARD:

21 Q. Dr. Direen, I want to share on the
22 screen now with you a copy of your declaration,

1 Exhibit 2008. And we're looking at paragraph 31
2 of the declaration. You state, "The
3 nonsynchronous version shown below to stable
4 switches S3, S4, S5, S6 during received mode. S2
5 isn't able to source power to the load for
6 charging. The switches are fixed, not cycling
7 during this nonsynchronous mode of operation."

8 So do I understand correctly that
9 opening the switches -- and I'm looking at the
10 diagram that you provided at the bottom of page 14
11 of your declaration. Opening switches S3, S4, S5
12 and S6 modifies the circuit so that current flows
13 through the body diodes?

14 A. Yeah, the diodes.

15 I don't know if this specifically
16 describes -- I can't remember if it specifically
17 describes MOSFETs or something that would have a
18 body diode.

19 But the diagram, yeah, those -- those --
20 how it's indicated there, those switches being
21 opened, indicates that the current will only flow
22 through the diodes.

1 Q. So what we talked about before, the
2 nonsynchronous rectifier has the benefit of not
3 requiring a certain level of power upcharge;
4 correct?

5 A. That's -- that's correct. You don't
6 need any -- anything to happen to those diodes for
7 them to operate. If you have --

8 Q. So in the -- in the configuration -- in
9 your annotation of Fig. 6A of the '339 patent at
10 the bottom of page 14 of your declaration, is it
11 your understanding, then, that the switches, S3,
12 S4, S5 and S6, would be open by default; i.e.,
13 control logic -- power to control logic would not
14 be necessary to open those switches?

15 A. Well, you would need those to be
16 configured into the open position.

17 I just got another message from a
18 colleague.

19 Q. And wouldn't that require -- if they had
20 to be configured to be in the open position,
21 wouldn't that require some level of initial power?

22 A. If you were at complete battery drain --

1 I don't know how these -- or what the intent was
2 for these things. Maybe one or two of them are
3 on. Maybe it's a half-bridge rectifier. And --
4 so you could potentially get rectification through
5 one of those diodes. Then maybe, if it gets
6 enough power, it goes, oh, maybe I need to open
7 all of those for a little while.

8 I think there's multiple scenarios that
9 I think I would have to think through and study as
10 to what the configuration of those switches would
11 have to be on initial boot-up.

12 Q. In the next paragraph, 32, you state, "A
13 configuration for a half-synchronous rectifier
14 topology is shown below. In this half-synchronous
15 topology S3 and S5 are open and S4 and S6 are
16 cycled."

17 What do you mean by "S4 and S6 are
18 cycled"?

19 A. To bypass the diodes and still perform
20 rectification, those would have to be open and
21 shut during the phase that they would, you know,
22 cut the -- the signal off. So by opening and

1 closing those you're -- presumably, the current's
2 going through those -- only going through those
3 switches and not the diodes.

4 Q. So as we talked about before, thinking
5 about the sinusoidal curve of the incoming input
6 AC signal, the switches S4 and S6 are cycled in
7 accordance with the transition of that sinusoidal
8 wave?

9 A. That's correct.

10 Q. And what would be the benefit of having
11 the circuit perform half-synchronous versus
12 full-synchronous?

13 A. It would be slight speculation by --
14 I -- I can think of maybe a scenario where if this
15 were a configuration with MOSFETs, to power up
16 those top switches you would need to have a -- I
17 believe they call it a high-drive setup. And
18 maybe you don't have power to -- to have those
19 switches cycle yet. That is a hypothetical
20 estimate.

21 I would just say that the attempt would
22 be to make the rectifier more efficient.

1 Q. You state in paragraph 33, "Note that
2 body diodes associated with switch S4 and S6 are
3 removed; a POSA would understand that no current
4 flows through these nodes and is, thus, not part
5 of the present circuit that functions as a
6 half-synchronous rectifier topology."

7 How is it that no current flows through
8 the diodes of S4 and S6?

9 A. If you imagine that the -- the switches
10 are closed, then the path of least resistance is
11 through the switch. And then, if they're open and
12 you have the -- if it's -- if it's unopened and
13 you have voltage in press such that it's trying to
14 reverse bias the diode, the diode still won't have
15 current going through it. So you basically --
16 only when you're having current go through, you've
17 closed the switch to bypass the -- the diode. And
18 then that --

19 Q. And does this --

20 A. Oh. I'm sorry.

21 Q. Sorry.

22 Is that because the switch then -- the

1 closed switch has less resistance than the diode?

2 A. That's right. Yeah.

3 Q. And you say at the end of paragraph 33,
4 "The function of the circuit is similar to the
5 nonsynchronous version but is more efficient since
6 the diodes associated with S4 and S6 have been
7 taken out."

8 And is it more efficient because they --
9 the diodes associated with S4 and S6, the voltage
10 drop associated with those diodes is no longer
11 part of the circuit?

12 A. That's correct.

13 Q. At the end of paragraph 33 you say, "The
14 fully-synchronous version of the circuit is shown
15 below," and then at the top of page 16 you give an
16 annotated figure of 6A.

17 And in paragraph 34 you state, "In this
18 version, switches S3, S4, S5 and S6 are cycled
19 synchronously within the incoming signal from the
20 impedance network."

21 And what do you mean when you say that
22 they, the switches -- those four switches are

1 cycled synchronously?

2 A. So when the -- when the circuit detects
3 that it's gone through a zero -- or when -- when
4 the -- when the voltage has gone through a zero,
5 where it needs to, like, flip the negative voltage
6 up to a positive voltage, when it detects that,
7 then it will synchronize to that zero crossing.

8 Q. And you say in paragraph 34, "This
9 circuit also has a similar function to the two
10 previous circuits, but is the most efficient of
11 the group because all four diodes have been
12 removed."

13 And so what is it that makes this the
14 most efficient?

15 A. All of the reverse -- the forward
16 voltages of the diodes are no longer there.

17 Q. And just looking back at your diagram
18 for the half-synchronous, the forward voltages of
19 the diodes associated with S3 and S5 are still a
20 part of the circuit; correct?

21 A. Yes.

22 Q. And that makes it less efficient than

1 the full synchronous version in which all diodes
2 have been removed?

3 A. Yes.

4 Q. In paragraph 35 you state, "Dr. Phinney
5 argues that continually switching the switches
6 present within a power bridge circuit, during
7 power receive mode, amounts to a topology change
8 (see, for example, paragraph 121 and 122 of
9 Exhibit 1015), which indicates that he believes
10 the static configuration of the switches S3-S6 in
11 the figures above amount to individual
12 'topologies.'"

13 If the switches S3 and S6 are
14 continuously cycled, how is it that you represent
15 them to be a static configuration, Dr. Direen?

16 A. Are you asking why I think there's a
17 static -- I'm sorry. Can you repeat that
18 question?

19 Q. Sure.

20 You state in paragraph 35 that, quote,
21 "He believes the static configuration of the
22 switches S3-S6 in the figures above amount to

1 individual 'topologies.'"

2 My question to you is: If these
3 switches are continuously cycled, switches S3-S6,
4 how are they in a static configuration?

5 A. When they're being cycled they're not
6 statically configured.

7 Q. So when they're being cycled they're
8 actively configured; correct?

9 A. When they're being cycled they're
10 functioning -- they're performing the function of
11 a rectifier, they're actively changing.

12 Q. You state also here in paragraph 35,
13 "The individual switches themselves are not being
14 used to select a topology with a well-defined
15 function such as a half-synchronous rectifier, a
16 fully-synchronous rectifier..."

17 Correct?

18 A. Yes, I state that.

19 Q. And then you also state here in
20 paragraph 37 that "a subset of the switch
21 network's switches rapidly turn on and off to
22 implement the selected functionality."

1 Correct?

2 A. Correct.

3 Q. So would you agree that the individual
4 switches are relied upon to create a particular
5 type of rectifier, such as cycling S3-S6 to create
6 a fully-synchronous rectifier?

7 MR. CARPENTER: Object to the form.

8 A. I think what you asked is, is that do I
9 agree that if the switch is being switched on and
10 off in the configurations that I showed up above,
11 if that act of switching those on and off
12 implement rectification? And the answer to that
13 would be yes.

14 Q. And, for example, with respect to a
15 fully-synchronous rectification, would you agree
16 that the cycling of switches S3-S6 create that
17 fully-synchronous rectifier?

18 A. Maybe you're asking a very clear
19 question, but what I'm thinking you're saying is:
20 Do you have to turn those switches on and off to
21 make a fully-synchronous rectifier? And the
22 answer to that is yes.

1 Q. So in order to have a fully-synchronous
2 rectifier, you have to continuously cycle; i.e.,
3 synchronously cycle switches S3 to S6; correct?

4 A. You have to synchronously cycle those
5 switches with respect to the incoming signal to
6 implement a fully-synchronous rectifier.

7 Q. And in contrast, cycling only two of
8 those switches results in a half-synchronous
9 rectifier; correct?

10 A. I would say that the depiction I provide
11 there, like I stated in the paragraph above, is
12 a -- a potential implementation of a
13 half-synchronous rectifier. But in this -- in
14 this depiction, in this one topology of a
15 half-synchronous rectifier, yes, you cycle on S4
16 and S6 synchronously with the incoming signal.

17 Q. In paragraph 36 you state that "the
18 specification also discusses changing topology as
19 a transition between a rectifier and an inverter."

20 So do you agree that changing from a
21 rectifier to an inverter is changing a topology?

22 A. In paragraph 42 of my declaration -- the

1 declaration, the exhibit, 2008, I state that the
2 configure -- configured to change topology to mean
3 "configured to change the topology in a way that
4 changes the type of a -- of rectifier or the type
5 of inverter or a rectifier to an inverter or an
6 inverter to a rectifier of the switch network
7 circuit."

8 Does that answer the question?

9 Q. Let me restate it.

10 So you agree that changing from a
11 rectifier to an inverter satisfies changing a
12 topology?

13 A. The topologies considered in these
14 documents refer to inverters and rectifiers. So
15 changing between rectifier and rectifier is a
16 topology change. Changing from inverter to
17 inverter is a topology change. And changing --
18 yes, changing from an inverter to a rectifier or
19 vice versa is a topology change.

20 Q. Does the configuration of the switches
21 of a switch network determine the topology of the
22 switch network?

1 MR. CARPENTER: Objection, form.

2 A. You asked me if the switches of the
3 switch network, their configure- -- yeah, maybe I
4 need that...

5 Q. I'll restate the question.

6 A. Okay.

7 Q. Dr. Direen, does the configuration of
8 the switches of a switch network determine the
9 topology for a switch network?

10 A. I would say that the way that the
11 switches are being used in the switch network
12 determines how they -- the -- the topology of the
13 switch network.

14 Q. So looking at your annotated version of
15 Fig. 6A on page 16 of your declaration, you see
16 the dash box that outlines the switch network;
17 correct?

18 A. Correct.

19 Q. And would you agree that the
20 configuration of the switches in that switch
21 network determine the topology of the switch
22 network?

1 A. Can you explain what you mean by
2 "configuration"?

3 Q. Yes.

4 Whether or not the -- the switches are
5 open or closed.

6 A. In the switch network, some of the
7 switches will be turned on and off at a rate that
8 is synchronous with the signal coming in. And at
9 least in one -- in one case, the S1a, which is
10 inside the switch network, may or may not be
11 static or stationary while the rest of the
12 switches are turning on and off.

13 So I think it's a little bit more
14 complicated than a yes or no, as to what the
15 configuration of those switches are, because you
16 have to take into the -- the dynamics of the
17 synchronized switches.

18 Q. Would you agree that a half-synchronous
19 rectifier and a full-synchronous rectifier
20 represent two different topologies for the switch
21 network?

22 A. Yes.

1 Q. And looking at your annotations of Fig.
2 6A in your declaration, would you agree that the
3 only differences you show in your drawings between
4 the half-synchronous configuration and the
5 full-synchronous configuration is the
6 configuration of switches S3 and S5?

7 A. No.

8 I believe that the S3 and S5 are
9 configured in this case as being open and the S4
10 and S6, I believe -- I believe I'm reading that
11 right, S4 and S6, the two bottom switches, are
12 configured so that they rapidly turn off and on
13 synchronously with the incoming signal.

14 Q. So you would agree that the -- the
15 difference between half-synchronous and
16 full-synchronous is the configuration of the
17 switches S3 and S5?

18 A. The difference between half-synchronous
19 and full-synchronous is that in the
20 half-synchronous S3 and S5 remain open during the
21 operation of the rectification and in the
22 full-synchronous version none of the -- the --

1 those four switches stay stationary during the
2 operation, they all synchronously turn on and off
3 with the incoming signals.

4 Q. So would you agree, then, that it is the
5 configuration of these switches that determines
6 the topology of the switch network?

7 MR. CARPENTER: Objection to form.

8 A. If you include configuration as being
9 one part having stationary switches open or
10 closed -- or open during a period of time that the
11 other switches are being synchronously turned on
12 and off.

13 Q. Up in paragraph 22, Dr. Direen, you
14 state that "a POSA would understand topology in
15 the context of the '929 or '339 patents to mean a
16 collection of circuit components that perform a
17 type of rectification or a type of power
18 inversion."

19 So do you equate a topology to a
20 function of the circuit?

21 MR. CARPENTER: Objection to form, asked
22 and answered.

1 A. In the context of the '929 and the '339
2 patents, topology refers to the components used in
3 the switch network for performing the operation of
4 rectification and power inversion.

5 Q. And what -- can you explain to me what
6 you mean by that?

7 A. Sure.

8 I have an example. In paragraph 440, on
9 page 18 --

10 Q. Yes.

11 A. -- in the Lee patent, he uses the
12 concept of a topology that I believe is familiar
13 to POSAs and people in the industry. He calls it
14 a filter topology. So the operation that's
15 happening in the context of Lee's patent is he's
16 talking about filters. And there's different
17 kinds of filters that can be made with components.
18 And you have different ways of making those
19 filters. And it's often called a topology.

20 So one of the examples he gives is a
21 notch filter. Another topology would provide --
22 would -- could also be a different type of notch

1 filter but it could also be a low-pass filter or a
2 high-pass filter or the impasse filter. And in
3 each of those cases, it's often -- I would say
4 those -- those configurations are often called
5 topologies.

6 So a topology -- in the context of these
7 patents that we've talked about, I believe that
8 it's proper to describe a topology as a collection
9 of circuit components that perform a type of
10 rectification or a type of power inversion.

11 Because, as opposed to what Lee was
12 talking about in filters and in the -- in this
13 context, the context of these documents, we're
14 talking about rectification and types of power
15 inversion.

16 Q. So is a filter a type of a switch
17 network as set forth in the claims?

18 MR. CARPENTER: Objection to form.

19 A. No.

20 I was merely pointing out the parallel
21 of how a topology is often used.

22 And in this case, I believe a person of

1 ordinary skill in the art would -- based on the
2 context of these documents that we're -- we're
3 discussing, would identify a topology as a
4 collection of circuit components that perform a
5 type of rectification or a type of power
6 inversion.

7 Q. So, Dr. Direen, would these terms, like
8 topology, have a different meaning to you in
9 another context, not within the -- these documents
10 that we're addressing today?

11 A. If I was reading the Lee document, he
12 discuss- -- discusses in context filter
13 topologies, one of them being a notch filter. You
14 can have that sort of thing. In other electronics
15 books, where you have maybe mixers and you have
16 different mixer topologies, you can have different
17 amplifier topologies. And usually it's -- I would
18 say it's very common to speak like that in various
19 electronics contexts.

20 Q. This last sentence of paragraph 40 you
21 state, "So rather than 'a collection of circuit
22 components that perform a type of rectification or

1 a type of power inversion,' Lee would identify a
2 'topology' as a collection of circuit components
3 that perform a type of filtering."

4 So is a topology a type of filtering?

5 A. So just up above, it says, "The context"
6 -- in the sentence it says, "The context Lee is
7 working within is filtering."

8 So if he's talking in the context of
9 filtering, then topology is a type of filter.

10 If he were to work in a -- be working on
11 a different type of circuit, he would, perhaps,
12 call an amplifier -- talk about different types of
13 amplifier topologies.

14 Q. So is it your position, then, that Lee's
15 disclosure of a notch filter discloses a topology
16 with a certain function?

17 A. Say that again.

18 Q. Is Lee's disclosure of a notch filter a
19 disclosure of a topology with a particular
20 function?

21 A. Yeah. He's talking about filters, so.
22 The topology is different types of filters. So a

1 notch filter is a -- will have -- will have a
2 certain kind of topology or configuration of
3 components.

4 Q. So is performing a type of rectification
5 not a topology?

6 A. Not the performance. The way it's
7 configured. Right?

8 So I have it -- I have it here on
9 paragraph 22, in the context of -- of these
10 documents, like the '929 and the '339, "a
11 collection of circuit components" -- a topology
12 would be "a collection of circuit components that
13 perform a type of rectification or a type of power
14 inversion."

15 Q. Are you familiar with different classes
16 of rectifiers, Dr. Direen? A class D rectifier
17 and a class E rectifier.

18 A. In -- in -- in the past. I haven't
19 studied them recently. But usually, they're a way
20 of input shaping.

21 I think of class D would be something
22 like using a pulse-width modulator to output a

1 form that looks like a sign using pulse-width
2 modulation and then filtering it to make it look
3 like a perfect sign so that you get rid of the
4 harmonics.

5 Q. So does a class D rectifier have a
6 different topology than a class E rectifier?

7 A. I don't think I'm prepared to talk about
8 that. I think I would have to study that offline.

9 Q. Let's take a look at paragraph 45.
10 Paragraph 45, you say, "As is clear from the plain
11 meaning of the original claim language, the term
12 in limitation 1(e), the phrase 'configured to
13 change' applies to the entire phrase 'impedance of
14 said impedance network and topology of said switch
15 networks.'"

16 "As discussed extensively in my
17 declaration at 111 to 120, the '312 provisional
18 supports this understanding as it applies to the
19 impedance network. The same passages I cited
20 therein I also include -- the same passages I
21 quoted therein also included changing topology of
22 said switch network."

1 Is it your understanding that the
2 disclosures in the '312 provisional that support
3 changing topology of the switch network are those
4 that you previously identified earlier in your
5 deposition today from the provisional application?

6 MR. CARPENTER: Objection to form.

7 A. Based on the fourth paragraph of Exhibit
8 2004, in the middle of the paragraph, it says, "In
9 the charging mode dual-mode wireless charging
10 receiver configures the first circuitry to receive
11 the power from a wireless power transmitter. The
12 first circuitry, based on input from the control
13 logic circuit, is configured to change the
14 impedance of the impedance network and topology of
15 the switch network to obtain a modified form of
16 received power, and apply the modified form of the
17 power to the load device. For example, a
18 battery."

19 If we're within the charging mode and
20 we're receiving power, the only way I think you
21 can change topology or be configured to change
22 topology is if you're going from one type of

1 rectifier to another.

2 So, yes, I believe the -- the -- Exhibit
3 2004 or the provisional permits changing topology
4 from --

5 Q. Dr. Direen, in paragraph 48 of your
6 declaration you state, "My opinion as to the
7 meaning of claim limitation 1(e) has not changed.
8 Furthermore, I understand proposed substitute
9 claim 21 and the amendment 'while in receiving
10 power mode' to be commensurate in scope as
11 limitation 1(e) and simply makes more explicit
12 that the claimed first circuitry must have the
13 capability to be configured so as to make the
14 requisite changes while in the receiving power
15 mode."

16 So does the circuit have to be in the
17 receiving power mode or does the circuit have to
18 be actively receiving power, Dr. Direen?

19 MR. CARPENTER: Objection to form.

20 A. I'm not sure I understand the subtlety.
21 Can you explain that?

22 Q. Yeah.

1 You state there in paragraph 48, "I
2 understand the proposed substitute claim 21 in the
3 amendment 'while in receiving power mode" -- that
4 clause, "while in receiving power mode," does that
5 clause require that the receiver is simply in
6 receiving power mode but doesn't dictate whether
7 or not it's actually receiving power?

8 MR. CARPENTER: Objection to form.

9 And it was asked in his prior
10 deposition.

11 A. While you're in the receiving power
12 mode, I don't believe you have to be receiving
13 power necessarily.

14 Q. Paragraph 50 you state, "This
15 modification affects the overall electrical
16 behavior of the circuit, such as how current
17 flows, how voltages are distributed, and how the
18 circuit responds to various inputs."

19 Dr. Direen, do you agree that the
20 cycling of switches in a fully-synchronous
21 rectifier affects how current flows and how
22 voltages are distributed in the rectifier?

1 MR. CARPENTER: Objection to form.

2 A. I -- sorry. These questions are
3 starting to feel similar.

4 I'm not quite sure what you're asking,
5 what you --

6 Q. I'll read -- I'll read my question
7 again.

8 Do you agree that the cycling of
9 switches in a fully-synchronous rectifier affects
10 how current flows and how voltages are distributed
11 in a rectifier?

12 MR. CARPENTER: Object to the form.

13 A. Well, certain -- yeah. Are you asking
14 me to agree with my statement there?

15 The modification affects the overall
16 electrical behavior of the circuit, such as how
17 current flows, how voltages are distributed and
18 how the circuit responds to various inputs.

19 Q. I'm asking: With respect to a
20 fully-synchronous rectifier, would you agree that
21 the continuous switching of the switches in the
22 fully-synchronous rectifier allows for a smoother

1 and more consistent DC output of the rectifier?

2 MR. CARPENTER: Object to the form.

3 A. I don't remember talking about smoother
4 and more consistent DC output.

5 Q. Didn't we talk about the fact that a
6 fully synchronous rectifier is more efficient than
7 the other two types of rectifiers we identified?

8 A. Yes. I don't believe we were talking
9 about, like, smoothing of a DC signal. The
10 out- -- pure output of a rectifier is a bunch of
11 humps, right.

12 So what do you mean by the smoothing of
13 a DC signal?

14 Q. Meaning that the -- the output of the
15 fully-synchronous rectifier is a -- a better
16 output than the output of the half-synchronous or
17 the nonsynchronous rectifier. Would you agree
18 with that?

19 A. I think you need to tell me what you
20 mean by "better."

21 Q. Better, meaning it is -- provides a DC
22 output of a more consistent voltage.

1 A. It's not a DC output that comes out
2 of -- right out -- right out of the switch
3 network.

4 Q. And what is the output out of the switch
5 network?

6 A. A series of humps if it's a sign wave.
7 Or if it's a square wave it would be like a --
8 a -- probably like some sort of trapezoidal type
9 of looking thing.

10 Q. What is the output of the
11 fully-synchronous rectifier?

12 A. Same thing.

13 Q. And would you agree that it is the
14 cycling of the switches in that fully-synchronous
15 rectifier that impact how -- impact the output of
16 the fully-synchronous rectifier?

17 MR. CARPENTER: Object to the form.

18 A. Certainly -- certainly cycling those
19 switches will impact the output of the signal.

20 Q. Will they impact how current flows in
21 the signal that's output?

22 A. I would say, I guess it depends on how

1 high that impedance is that you're -- you're --
2 you're trying to load. But I would say, yeah, in
3 some way current is affected at the output of
4 the -- the switches.

5 Q. I want to move to paragraph 54 of your
6 declaration.

7 A. Okay.

8 Q. In 54 you say, "Note that each of these
9 diagrams also contains a set of switches that
10 continuously flip on and off as shown in the
11 attendant waveforms. The switching of these
12 devices, however, does not change the topology of
13 the switch network to obtain a modified form of
14 received power; rather, this switching action
15 merely implements the selected rectifier
16 functionality of the switch network."

17 Looking at the diagram that you provided
18 there in paragraph 54, which is annotation of Fig.
19 6B of the '339 patent, is it your understanding
20 that the functionality of the fully-synchronous
21 rectifier is dependent upon the continuous
22 switching of switches S3-S6?

1 A. I'm sorry. You -- does -- does affect?
2 What output?

3 Q. Looking at Fig. 6B in paragraph 54 of
4 your declaration --

5 A. Yes.

6 Q. -- would you agree that the continuous
7 cycling of switches S3 to S6 are why the
8 fully-synchronous rectifier?

9 A. I'll -- I mean, based on what we were
10 talking about. I think that was what we were
11 discussing. Right? You turn on those switches
12 synchronously to the input coming signal, that
13 will give you a -- a rectified output.

14 Q. And if we were only cycling switches S4
15 and S6 and held open switches S3 and S5, we would
16 have a half-synchronous rectifier; right?

17 A. I believe that would implement a
18 half-synchronous rectifier.

19 Q. So did -- is it your understanding that
20 the -- the type of rectifier is dependent upon
21 which of the switches, S3 to S6, are cycling?

22 A. Are we talking in general? In any

1 random order? Or are we just talking about the
2 examples that I gave above?

3 Q. The examples that you gave above.

4 A. Yeah. Well, if they're consistent with
5 the examples I gave above, then I agree with what
6 I said above.

7 Q. So you would agree that the type of
8 rectifier is dependent upon which of the switches,
9 S3 to S6, are cycling; correct?

10 A. That's -- that's part. And then
11 which -- and also in part with which switches are
12 left open during the operation of the
13 rectification.

14 Q. In paragraph 55 you state, "As discussed
15 above, there are multiple examples within the '929
16 and the '339 patents (described above) that
17 indicate that changing topology is associated with
18 things like changing from a type of inverter to a
19 type of rectifier, or from one type of rectifier
20 to another type of rectifier."

21 Can you identify specifically what
22 you're referencing in your -- in your statement

1 that the multiple examples within the '929 to '339
2 patents are described above?

3 A. Sure.

4 I can give you one example. Paragraph
5 26, page 13. In the bottom of that paragraph, it
6 says, "The dual-mode wireless power receiver also
7 addressed the topology of the switch network. For
8 example, from the default nonsynchronous rectifier
9 to fully-synchronous rectifier."

10 So that's one example of going from
11 rectifier to rectifier.

12 Q. And, Dr. Direen, would you agree that
13 that one example's not disclosed in the '312
14 provisional?

15 MR. CARPENTER: Objection, asked and
16 answered.

17 A. Yeah. I believe I answered that.

18 Q. Are there any other examples?

19 A. If you go down to 28, the least the
20 specification says, "In communication mode the
21 first circuit of the dual-mode wireless power
22 receivers is configured to change the impedance of

1 the impedance network and change the topology of
2 the switch network to an inverter. For example,
3 the class D half-bridge inverter, the class D
4 half-bridge inverter, a class D full-bridge
5 inverter to transmit part of the stored power to
6 power up the secondary wireless power receiver."

7 Q. Any other examples?

8 A. So it looks like in 20 -- paragraph 23
9 of my declaration, that I have called out multiple
10 locations where the -- the specification talks
11 about topology such as a nonsynchronous
12 full-bridge rectifier, a half-synchronous
13 full-bridge rectifier, a full-synchronous
14 full-bridge rectifier, a half-bridge inverter, a
15 full-bridge inverter. I say, see examples from
16 the '929 patents. And there's a handful of them.
17 So those are a handful of examples of topologies.

18 And then if you go to paragraph 46, I
19 think the -- there's a couple of unique references
20 in here, but it said -- I can't remember because I
21 feel like we've gone over these a few times.

22 But at the bottom of page 20, "On

1 receiving sufficient level of power from the
2 wireless power transmitter, the dual-mode wireless
3 power receiver powers up and starts communicating
4 with the wireless power transmitter. The
5 dual-mode wireless power receiver adjusts the
6 impedance of the impedance network. The dual-mode
7 wireless power receives al- -- receiver also
8 adjusts the topology of the switch network." And
9 then it says, "For example, from the default
10 nonsynchronous rectifier to the fully-synchronous
11 rectifier."

12 So it uses a couple of examples from
13 the -- the list of rectifiers of what -- what
14 could be changed there.

15 And then I provide the references at the
16 top of page 21.

17 Q. And at the beginning of page -- of
18 paragraph 46 of your declaration you identify that
19 that passage that you just read does not appear in
20 the '312 provision; correct?

21 A. That particular passage that's at the
22 bottom of 20 is not exactly represented in the

1 213 -- '312 provisional application.

2 Q. Paragraph 56, you state -- at the bottom
3 of the paragraph, last sentence, it says,
4 "Nevertheless, to make this point absolutely
5 clear, I agreed that a more clear construction
6 would be: A collection of two or more electrical
7 components, one of which must be a passive
8 component and one of which must be either an
9 active component or a switch."

10 Dr. Direen, is a switch a type of active
11 component?

12 A. In general, no.

13 Q. What do you mean "in general"?

14 A. My light switch back here doesn't --
15 isn't an active component.

16 Q. But a switch in the context of the
17 circuits disclosed in the '339 patent, is that
18 considered an active component?

19 A. I don't think it necessarily has to be.

20 I'd have to go back and see it. Be very
21 careful about what I mean -- what -- what is meant
22 by active. But a relay may be considered a --

1 just a regular switch.

2 Q. What -- how would you define "active
3 component"?

4 A. Like, a -- a device that requires
5 additional power to do what it needs to do. That
6 may be -- I -- I'd have to go back and -- and
7 look -- look up the exact definition of active.

8 But a transistor is generally regarded
9 as a active component.

10 Q. Would you agree that a switch requires
11 power in order to do what it needs to do?

12 A. Unless it's, like, a toggle switch.

13 Q. You would agree some switches require
14 power in order for them to do what they need to
15 do?

16 A. Yes.

17 But you can -- there's various types of
18 switches that you can make out of transistors or
19 in -- in coils and -- for, like, let's say,
20 relays. Those are -- or, let's say -- I would
21 say, yes, you can certainly make switches out of a
22 set of transistors.

1 Q. So would you agree that some -- some
2 types of switches could be considered active
3 components?

4 A. I would have to go back and maybe find
5 a -- a dictionary or something like that and see
6 where the context is for -- for defining a switch
7 as an active component.

8 I believe that switches can be built
9 from active components. I'd have to get a
10 dictionary definition, I think, of "active"
11 component to say that all switches are active
12 components.

13 Q. My question isn't are all switches
14 active components.

15 My question is: Can some switches be
16 considered active components?

17 A. I would have to find a definition.
18 May- -- maybe there's a definition out there in
19 some dictionary.

20 But I would say that some switches can
21 be implemented with active components.

22 Q. And if a switch was implemented with

1 active components, wouldn't that make it an active
2 component?

3 A. I wouldn't call a microprocessor a
4 active component based on, like, you know, my
5 usual way of using the term and if composed of
6 trans- -- of active components. I think that
7 would be a -- it would not be a common way of
8 calling a micro -- like a microcontroller.

9 Q. And would you consider a microprocessor
10 to be a type of switch?

11 A. No.

12 A microprocessor is a collection of
13 probably, you could say, active components. Like,
14 a switch is -- also could be made up of a
15 collection of active component.

16 MR. WARD: Okay. We've been on the
17 record a little over an hour. Do you guys
18 want to take a break?

19 THE WITNESS: All right.

20 MR. CARPENTER: Sounds good.

21 MR. WARD: Great. Thanks.

22 THE STENOGRAPHER: We're off the record.

1 (Recess in Proceedings.)

2 THE STENOGRAPHER: We're back on the
3 record.

4 BY MR. WARD:

5 Q. So, Dr. Direen, I wanted to turn back to
6 paragraph 23 of your declaration. And I'll share
7 it on the screen here.

8 Paragraph 23 is where you give this list
9 of types of topologies. You say, "Further, the
10 specification describes at least five topologies,"
11 and the fourth one you list is a half-bridge
12 inverter; correct?

13 A. Yes.

14 Q. And then in paragraph 28 -- you were
15 referencing this paragraph earlier. In paragraph
16 28 you provide a quote from the specification that
17 talks about the -- changing the topology of the
18 switch network to an inverter. For example, a
19 class D half-bridge inverter and a class E
20 half-bridge inverter.

21 So as you had said in paragraph 23, one
22 of the types of topologies is a half-bridge

1 inverter. And my question to you is: Is a class
2 D half-bridge inverter a different topology than a
3 class E half-bridge inverter?

4 A. I would have to go back and study to
5 know exactly what the -- the two differences are.

6 But I would say that clearly, if there's
7 two different -- there's a class D half-bridge
8 inverter and there's a class E half-bridge
9 inverter, then certainly there exists a
10 half-bridge inverter.

11 Q. Does the class D half-bridge inverter
12 have a different topology than the class D [sic]
13 half-bridge inverter?

14 A. I would have to go back and study that.
15 I did not study that for this -- preparing for
16 this -- for this deposition.

17 Q. Okay. Paragraph 61 of your declaration,
18 you state that "Chatterjee merely discusses using
19 a synchronous bridge rectifier, but never teaches
20 or suggests the possibility of using other types
21 of rectifiers or switching between rectifier types
22 during operation," and you cite a couple of

1 different paragraphs from Chatterjee, 7, 38, 61
2 and claim 4.

3 I want to place on the screen now a copy
4 of Chatterjee. It's Exhibit 1003 in the IPR. I
5 just want to turn to the paragraphs that you're
6 identifying from Chatterjee, paragraphs 7, 38, 61
7 and claim 4.

8 We'll start with paragraph 7. Paragraph
9 7 states, "Fig. 2 illustrates a prior art
10 synchronous bridge rectifier circuit for
11 delivering power from an AC power supply to a DC
12 load."

13 And then, moving to paragraph 38.
14 Paragraph 38 talks about "the power bridge circuit
15 311 is coupled to the power circuit 314 to convert
16 signals from DC to high-frequency form over
17 inductive link 330 when the inductive signal
18 interface is in the power transmit mode or from
19 high-frequency form DC when the inductive signal
20 interface 310 is in the power receive mode."

21 And later in the paragraph, at the end
22 of paragraph 38, it states, "As described below,

1 the three branches combine to effectively form an
2 H-bridge and synchronous bridge rectifier
3 combination for use with the inductive link 330."

4 And paragraph 61 of Chatterjee provides
5 disclosure with respect to Fig. 6A and it talks
6 about -- it says, "Meaning the power bridge
7 circuit includes an H-bridge branch, a synchronous
8 bridge rectifier branch, and a shared branch for
9 use with either the H-bridge or the synchronous
10 bridge rectifier branch."

11 And then finally, claim 4 of Chatterjee
12 that you cited in your declaration, states,
13 "Wherein two of the three branches operate to form
14 a synchronous bridge rectifier circuit while the
15 inductive signal interface operates in the power
16 receive mode."

17 So is it your understanding that
18 Chatterjee discloses in the power receive mode a
19 fully-synchronous rectifier?

20 MR. CARPENTER: Objection, form.

21 A. May I open up the Chatterjee exhibit?

22 Q. Yes, you may. Exhibit 1003.

1 A. 1003. Thank you.

2 And you were pointing to each one of my
3 references; is that correct? These --

4 Q. Yes. You had identified 7, 38, 61 and
5 then claim 4.

6 A. Very good.

7 Okay. I see in paragraph 61 that he
8 does have a synchronous bridge rectifier branch.
9 And I see that he's referring to Fig. 6A and --
10 yep, there's a synchronous bridge branch in that
11 image.

12 Q. And claim 4 that I have on screen here
13 says, "Wherein two of the three branches operate
14 to form a synchronous bridge rectifier circuit
15 while the inductive signal interface operates in
16 the power receive mode."

17 So is it your understanding that
18 Chatterjee discloses a fully-synchronous rectifier
19 when in power receive mode?

20 A. While receiving power it's making a
21 rectifier and synchronous bridge, so yes. In
22 the -- in the power receive mode the three

1 branches operate to form a synchronous bridge
2 rectifier.

3 Q. Okay. I want to turn to paragraph 62 of
4 your declaration.

5 A. Okay.

6 Q. You state, Corbridge does explain that
7 the power component of the AC signal is converted
8 to a DC power signal using a synchronous bridge
9 rectifier formed by diodes -- I'm sorry, that says
10 using a synchronous bridge or rectifier formed by
11 diodes. And you cite Corbridge paragraph 85.

12 And you say -- you also state in
13 paragraph 62, Corbridge also explains "a
14 half-synchronous bridge may alternatively be
15 used," and you cite paragraph 85 of Corbridge
16 there as well.

17 So I'd like to show to you now a copy of
18 Corbridge, which is Exhibit 1004 in the IPR. And
19 I'm going to turn to paragraph 85 that you cited
20 in your declaration.

21 Paragraph 85 of Corbridge states, "Fig.
22 7 is a circuit level diagram illustrating

1 exemplary circuit configurations of a portion of
2 the system shown in Fig. 7A. Circuit elements in
3 Fig. 7B include input/output ports 751 and 752,
4 transistor diodes Vbats 753, 754, 755 and 756, op
5 amps 757 and 758, smoothing capacitor 759,
6 decoupling elements 760, output data signal line
7 761, DC power line 762. I/O ports 751 and 752 may
8 represent coils which may be inductively coupled
9 to receive and transmit data and power. I/O ports
10 751 and 752 may represent a single
11 inductively-coupled coil, such as coil 722 of Fig.
12 7A. I/O ports 751 and 751 receive AC signals
13 through inductive coupling. The received AC
14 signals include at least one of a power component
15 and a data component. The power component of the
16 received AC signal is converted to a DC power
17 signal using a synchronous bridge or rectifier
18 formed by diodes 753, 754, 755 and 756."

19 Is it your understanding that that
20 disclosure in Corbridge discloses a synchronous
21 rectifier and a nonsynchronous rectifier that
22 would be formed by the four diodes?

1 A. I am looking up those, the figure and
2 the references that --

3 Q. Certainly.

4 A. -- were just read.

5 Q. I can.

6 This is the Corbridge. Yeah. Sorry.

7 A. Okay. This is the Corbridge. And we're
8 talking about 62.

9 Q. Paragraph 62 of your declaration, yes.

10 A. That's right, yes, paragraph 62 of my
11 declaration.

12 Q. Right.

13 A. And it looks like what I'm saying is --
14 what -- what's in here, it says that "Corbridge
15 does explain the power component of the received
16 AC signal is converted to DC power signal using a
17 synchronous bridge or rectifier formed by diodes."

18 And then, "Corbridge also explains that
19 a half-synchronous bridge may alternatively be
20 used."

21 Q. So this paragraph from Corbridge,
22 paragraph 85, is describing Fig. 7B that I have on

1 screen now. Do you see that?

2 A. Yes.

3 Q. And do you agree that what's shown in
4 Fig. 7B is a synchronous rectifier and a
5 nonsynchronous rectifier, meaning that the
6 synchronous rectifier would be composed of the
7 four switches of 753, 754, 756 and 755 and the
8 nonsynchronous rectifier would be composed of the
9 diodes of 753, 754, 756 and 755?

10 Correct?

11 A. I did not study this circuit in detail
12 in my paragraph 62 of the declaration. I quoted
13 that they had -- that Corbridge, for example, does
14 explain that the power components of the received
15 AC signal is converted to a DC power signal using
16 synchronous bridge or rectifier for- -- formed by
17 diodes. Corbridge explains that a
18 half-synchronous bridge may alternatively be used.

19 What I would say is, I agree that those
20 MOSFETs or those FETs can be used as switches and
21 that it does have diodes across the source and
22 drain.

1 Q. So you would agree that what's shown in
2 Fig. 7B is a circuit that provides both a
3 synchronous bridge and a rectifier formed by
4 diodes, as disclosed in paragraph 85; correct?

5 A. Paragraph 85 describes that circuit as
6 having that functionality.

7 Q. And at the end of paragraph 85, as you
8 noted, it says "a half-synchronous bridge may
9 alternatively be used."

10 Correct?

11 A. Correct.

12 Q. And as we discussed earlier today, no
13 additional components would be necessary for the
14 half-synchronous bridge from what is shown here in
15 Fig. 7B, just that you would be cycling only two
16 of the switches shown in Fig. 7B; correct?

17 MR. CARPENTER: Form. Objection to
18 form.

19 A. I do not see the control for a circuit.
20 I would have to study this circuit in more detail.
21 It would take a little bit. How they -- I don't
22 see how they turn on and off. I don't completely

1 understand how they turn on and off the high --
2 higher MOSFETs. I would have to study it.

3 But I would say that what is being
4 indicated is what's in paragraph 85.

5 Q. Taking a look at paragraph 67 of Cook --
6 I'm sorry, paragraph 67 of your declaration, it
7 references Cook. And you say, "Rather, in Cook
8 rectifier 250 is a nonsynchronous rectifier or a
9 synchronous rectifier. See Cook paragraph 112.
10 Cook does discuss the possible advantage of using
11 a synchronous rectifier despite its added
12 complexity, but Cook does not teach the
13 possibility of changing network topology between
14 the two based on received power," and you cite to
15 Cook's paragraph 114 and 272.

16 I'm going to show you on the screen now
17 a copy of Cook. It's Exhibit 1017 in the IPR.
18 And I want to turn to the paragraph that you cited
19 in Cook.

20 First is paragraph 112, which states,
21 "Rectifier 250 converts the AC power induced into
22 the receiver antenna into DC power. The rectifier

1 uses current rectifying electronic components such
2 as diodes with low-threshold voltage or electronic
3 circuitry such as transistors that switch
4 synchronously to the received AC."

5 You also cite paragraph 114, which says,
6 "Synchronous rectification may be more complex but
7 provides the potential of low power dissipation
8 particularly at low rectifier input voltages, the
9 low impedance case."

10 And so why is it that synchronous
11 rectification is more complex, Dr. Direen?

12 A. I didn't write that it was more complex.

13 Are you trying to get me -- or are you
14 asking me why I think Cook thinks synchronous is
15 more complex?

16 Q. Yes.

17 A. I could imagine Cook would say that it's
18 more complex because of the added control, the --
19 having to set up the topology for the H-bridge.

20 I would say, Cook might think that it's
21 easier to simply put four diodes in there rather
22 than add the transistors plus any of the

1 additional components that would be needed to
2 synchronize to the input signal and turn the
3 transistors on and off.

4 Q. The complexity is due in part to the
5 requirement of having some sort of control logic
6 for the transistors?

7 A. Diodes would not need additional signals
8 to turn them on and off. They can function as a
9 full rectifier without any additional signals.

10 Q. And this statement that it provides --
11 "synchronous rectification provides the potential
12 of lower power is sufficient" goes back to what
13 we've talked about and I think what you're just
14 referencing, that a diode-based rectifier has a
15 certain amount of power dissipation and the
16 synchronous rectifier has low power inefficiency?

17 A. A fully diode-based full-bridge
18 rectifier would be less efficient than a
19 synchronous full-bridge rectifier, which is at
20 least the point of the full-bridge rectifier -- of
21 the synchronous full-bridge rectifier.

22 Q. And you also cite at paragraph 272,

1 which says, "On the receive side, the rectifier
2 and load adaptation may be important. A rectifier
3 can be built with very little voltage drop and
4 ohmic losses. The rectifier may be inserted
5 directly into the antenna circuit, e.g. into a
6 series tank circuit, analogous to the transmitter.
7 Efficiency is again improved when the resistive
8 losses in the rectifier are minimized. Classical
9 rectifiers, e.g. Schottky diodes, might have too
10 high a loss and, hence, so-called synchronous
11 rectifiers based on synchronously switched
12 transistors may be preferred."

13 So is it your understanding that what
14 Cook is discussing here is the tradeoffs between
15 what it refers to as a classic rectifier based on
16 Schottky diodes and a synchronous rectifier?

17 A. Are you saying that -- again, it's my
18 understanding that what?

19 Q. Is it your understanding that Cook's
20 statement about -- Cook says "efficiency is again
21 improved when the resistive losses in the
22 rectifier are minimized."

1 MR. CARPENTER: Objection, form.

2 Q. Cook goes on to say "classical
3 rectifiers, e.g. Schottky diodes, might have too
4 high of a loss."

5 So do you understand that statement to
6 be Cook referencing the idea that a diode-based
7 rectifier has more loss than a synchronous
8 rectifier?

9 A. Yeah.

10 He says Schottky diodes might have too
11 high a loss and, hence, so-called synchronous
12 rectifiers based on synchronous switched
13 transistors may be preferred. So it would be
14 preferred because it would have -- it would not
15 have too high a loss, it would have lower loss.

16 Q. But as you previously identified, the
17 classical rectifier would be less complex and
18 would not require power to start up; correct?

19 MR. CARPENTER: Objection to form.

20 A. Are you asking what's the reason for
21 doing the diodes when there's -- when there's the
22 option of the synchronous --

1 Q. Yes.

2 A. -- rectifier?

3 Yeah, the -- the synchronous would be
4 more complex. That would be a reason not to do
5 it, like Cook suggests.

6 Q. Do you understand that Cook discloses
7 both types of rectifiers, both a diode-based
8 rectifier and a synchronous rectifier?

9 A. Yes. He's -- in that -- in that
10 paragraph he's describing -- describing a Schottky
11 diode-based rectifier and he's also describing a
12 synchronous rectifier.

13 Q. Paragraph 70 of your declaration, you
14 state, "Lee explains that various RF-to-DC
15 converters may be used, specifically identifying
16 partial and full rectifiers, regulators, bridges,
17 doublers, as well as linear and switching
18 converters."

19 I want to share with you on the screen
20 here a copy of Lee, which is Exhibit 1018 to the
21 IPR. And I want to turn specifically to the
22 paragraph you cite, paragraph 7 -- I'm sorry.

1 It's paragraph 70 of your declaration, and you're
2 citing to paragraph 55, Lee.

3 So paragraph 55 of Lee is talking about
4 the received circuitry 610. And you had quoted
5 from this last sentence from paragraph 55 of Lee
6 which says, "Various RF-to-DC converters may be
7 used, including partial and full rectifiers..."

8 What's your understanding of what is
9 meant by a -- partial and full rectifiers here,
10 Dr. Direen?

11 A. A full rectifier is generally one that
12 takes in a signal, like a sign wave, that has a
13 positive voltage and a negative voltage. And
14 choosing the sense of being in the positive, it
15 will keep the positive and it will take the --
16 what's going down in negative and flip it up to
17 the top. So then you'll have a signal at the
18 output that is what would be considered fully
19 rectified.

20 I know a half-rectifier would only keep
21 the top and -- but when it goes negative, it just
22 basically chops that off. So you would have a

1 hump and then something like near zero voltage,
2 hump, near zero voltage.

3 What he's talking about with a partial
4 rectifier -- I believe a half-rectifier would be
5 considered a partial rectifier. I don't know if
6 he means -- if he's -- if he's trying to allude to
7 something that's more general. I don't completely
8 understand what is meant by a "partial rectifier."

9 Q. But you would agree that Lee is
10 disclosing different types of rectifiers; correct?

11 A. So within my declaration, in 70, I do
12 say, like Cook, "while Lee explains that various
13 RF-to-DC converters may be used specifically
14 identifying partial and full rectifiers,
15 regular -- regulators, bridges, doublers, as well
16 as linear switches, converters," so it does
17 indicate that there's different kinds of
18 rectification. But then I go on to say, "Lee does
19 not teach the possibility of changing network
20 topology between the two -- two based on received
21 power."

22 Q. So do you --

1 A. So I do quote -- I do quote "various
2 RF-to-DC converters may be used," so that was -- a
3 part of paragraph 70 was identifying that various
4 RF-to-DC converters may be used.

5 Q. Paragraph 73 of your declaration, you
6 state, "A circuit being 'configured to change,
7 while configured to receive said power the...
8 topology of said switch network to obtain a
9 modified form of said received power' would
10 require at least additional control logic that is
11 able to monitor the power delivered to the battery
12 and the system and manage the topical changes."

13 Now, why is control logic necessary?

14 MR. CARPENTER: Mr. Ward, what paragraph
15 were you just reading from?

16 MR. WARD: It is the paragraph that's on
17 the screen now, paragraph 73 of Dr. Direen's
18 declaration.

19 MR. CARPENTER: Paragraph 73. Okay.
20 Thank you.

21 MR. WARD: Yes.

22 A. One example would be a full-bridge

1 rectifier implemented in pure diodes, just diodes
2 with -- like what I was describing earlier.
3 Something in the system would have to identify
4 when it -- when the system thinks it has enough
5 power to switch over to a different kind of
6 rectifier. So there has to be at least something
7 that decides when to go from one kind of rectifier
8 to a different kind of rectifier, at the very
9 least.

10 Q. And why is that required?

11 A. So a diode-based rectifier doesn't know
12 it's a diode-based rectifier. And a switch
13 rectifier doesn't know it's a switch rectifier.
14 Something, logic, computer program, something
15 would have to tell it to move from one rectifier
16 to another rectifier.

17 Q. So, Dr. Direen, in paragraphs -- these
18 next four paragraphs you start out the paragraph
19 in the same way. I'm just going to read them to
20 you and -- but it's a similar statement.

21 For example, paragraph 74, you say, "Lee
22 does not contain any control logic to monitor the

1 power delivered to a system battery for the
2 purpose of managing responsive topological changes
3 to the rectifier."

4 Similarly -- I'm going to start at
5 paragraph 75 -- you say, "Cook does not contain
6 any control logic to monitor the power system --
7 the power delivered to a system battery for the
8 purpose of managing responsive topological changes
9 to the rectifier."

10 Paragraph 76, you state, "Chatterjee
11 does not contain any control logic to monitor the
12 power delivered to a system battery for purposes
13 of managing responsive topological changes to the
14 rectifier."

15 And then finally, paragraph 77 you
16 state, "Corbridge does not contain any control
17 logic to monitor the power delivered to a system
18 battery for the purpose of managing responsive
19 topological changes to the rectifier."

20 So is it fair to summarize those by
21 saying that you don't believe Lee, Cook,
22 Chatterjee or Corbridge disclose control logic to

1 monitor power delivered to a system battery for
2 the purpose of managing responsive topological
3 changes to the rectifier?

4 MR. CARPENTER: Objection to form.

5 A. Based on those four sentences you just
6 read, the only difference between the sentence is
7 the name so I would say that you could -- let's
8 say it like this: Lee, Cook, Chatterjee and
9 Corbridge does not contain any control logic to
10 monitor the power delivered to the system battery
11 for the purpose of managing responsive topological
12 changes to the rectifier.

13 Q. So, Dr. Direen, turning back to
14 paragraph 9 of your declaration where you set
15 forth the revised proposed substitute claim 21,
16 can you identify for me the limitation for control
17 logic in that proposed claim 21?

18 A. Do you just want me to point at the
19 bottom of page 6, the third limit -- part up where
20 it says, "A control logic circuit..."?

21 Q. Do you consider that limitation as
22 meeting what you describe as a control logic to

1 monitor the power delivered to the system battery?

2 A. I believe that's what it's discussing on
3 the next page, in Fig. 5 where it says, "said
4 first circuit based on input from said control
5 logic circuit, configured to change, while
6 configured to receive said power -- said power,
7 the impedance of said impedance network and
8 topology of said switch network to obtain a
9 modified form of said received power, and apply
10 modified form of power to said load device."

11 MR. WARD: Okay. That's all the
12 questions I have.

13 MR. CARPENTER: Okay. Can we take a
14 short break? I may have one question.

15 MR. WARD: Certainly.

16 MR. THREE: You want to take five
17 minutes or something?

18 THE STENOGRAPHER: We're off the record.

19 (Recess in proceedings.)

20 THE STENOGRAPHER: Okay. We're back on
21 the record.

22 MR. CARPENTER: Back on the record.

1 I have no further questions. No -- any
2 questions, I guess, I should say. So I
3 guess, that concludes our depo.

4 (Off-the-Record Discussion.)

5 THE STENOGRAPHER: Mr. Carpenter, would
6 you like to order a copy and/or a rough
7 draft?

8 MR. CARPENTER: Yes, to both. And mini.

9

10 AND FURTHER THIS DEPONENT SAITH NOT.

11 SIGNATURE RIGHTS RESERVED.

12 (Deposition concluded at 5:36 p.m.)

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1 CERTIFICATE OF SHORTHAND REPORTER - NOTARY PUBLIC
2 I, April Reid, Registered Professional
3 Reporter, Certified Realtime Reporter and Notary
4 Public within and for the State of North Carolina
5 do hereby certify:

6 That RANDAL DIREEN, Ph.D., the witness
7 whose deposition is hereinbefore set forth, was
8 duly sworn by me before the commencement of such
9 deposition and that such deposition was taken
10 before me and is a true record of the testimony
11 given by such witness.

12 I further certify that the adverse
13 party, WIPQTUS, INC., was represented by counsel
14 at the deposition.

15 I further certify that the deposition of
16 RANDAL DIREEN, Ph.D. occurred remotely via Zoom on
17 THURSDAY, NOVEMBER 14, from 1:30 p.m. Eastern
18 Standard Time to 5:36 p.m. Eastern Standard Time.

19 I further certify that I am not related
20 to any of the parties to this action by blood or
21 marriage, I am not employed by or an attorney to
22 any of the parties to this action, and that I am

1 in no way interested, financially or otherwise, in
2 the outcome of this matter.

3 IN THE WITNESS WHEREOF, I have hereunto set my
4 hand this 18th day of November, 2024.

5 My commission expires: March 4, 2025.

6

7

8

A handwritten signature in cursive script, appearing to read "April Reid", is written over a horizontal line.

9 APRIL REID, NOTARY PUBLIC IN AND FOR THE
10 STATE OF NORTH CAROLINA, MECKLENBURG COUNTY.

11 Notary Registration No. 20012210079

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22

A	accordance 61:7 accounting 50:11 accurately 7:17, 8:9 across 31:11, 37:3, 104:21 act 29:12, 67:11 action 86:14, 120:20, 120:22 activated 12:4 active 18:12, 20:6, 20:19, 21:13, 22:11, 22:19, 23:17, 24:1, 24:11, 24:13, 24:14, 92:9, 92:10, 92:15, 92:18, 92:22, 93:2, 93:7, 93:9, 94:2, 94:7, 94:9, 94:10, 94:11, 94:14, 94:16, 94:21, 95:1, 95:4, 95:6, 95:13, 95:15 actively 66:8, 66:11, 81:18 actually 29:2, 82:7 adaptation 109:2 add 107:22 added 106:11, 107:18 addition 56:2, 56:19 additional 41:9, 41:11,	55:20, 93:5, 105:13, 108:1, 108:7, 108:9, 114:10 address 6:2, 6:10 addressed 89:7 addressing 76:10 adjusting 54:1, 54:18 adjusts 39:7, 40:1, 40:3, 43:14, 44:6, 44:8, 48:8, 51:21, 54:10, 91:5, 91:8 advantage 106:10 adverse 120:12 affect 87:1 affected 86:3 affects 82:15, 82:21, 83:9, 83:15 affirm 5:7 affirmed 5:14 afternoon 5:21 again 6:12, 26:7, 77:17, 83:7, 109:7, 109:17, 109:20 ago 7:21 agree 22:15, 23:19, 24:21, 25:11, 28:5, 33:22, 53:22, 54:15,	54:17, 56:18, 67:3, 67:9, 67:15, 68:20, 69:10, 70:19, 71:18, 72:2, 72:14, 73:4, 82:19, 83:8, 83:14, 83:20, 84:17, 85:13, 87:6, 88:5, 88:7, 89:12, 93:10, 93:13, 94:1, 104:3, 104:19, 105:1, 113:9 agreed 22:7, 92:5 al 91:7 alert 50:8 all 2:2, 7:2, 9:21, 30:20, 32:21, 60:7, 64:11, 64:15, 65:1, 73:2, 94:11, 94:13, 95:19, 118:11 allow 29:14 allows 35:15, 83:22 allude 113:6 almost 57:5 alone 22:9 also 13:10, 14:21, 17:14, 18:21, 21:19, 40:3, 43:14, 44:8, 48:8, 51:21, 54:10, 64:9, 66:12, 66:19, 68:18, 74:22,
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Transcript of Randal Direen, Ph.D.
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