IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

IN RE MATTER OF:	
MARVELL SEMICONDUCTOR, INC.,	
Petitioner,	
vs.	
CREDO TECHNOLOGY GROUP, LTD.,	IPR2025-01220
Patent Owner.	

DEPOSITION OF DR. TIM ARTHUR WILLIAMS

REMOTE VIA VIDEOCONFERENCE

TUESDAY, JULY 21, 2026

Stenographically Reported by:

HEATHER J. BAUTISTA, CSR, CRR, RPR, CLR

Realtime Systems Administrator

California CSR License #11600

Oregon CSR License #21-0005

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Texas CSR License #10725

DIGITAL EVIDENCE GROUP
1730 M. Street, NW, Suite 812
Washington, D.C. 20036
(202) 232-0646

Marvell Semiconductor, Inc. - Ex. 1050, Page 000001
IPR2025-01220 (Marvell Semiconductor, Inc. v. Credo Technology Group Ltd.)

DEPOSITION of DR. TIM ARTHUR WILLIAMS, taken before Heather J. Bautista, CSR No. 11600, a Certified Shorthand Reporter for the state of California, with principal office in the county of Santa Clara, commencing on TUESDAY, JULY 21, 2026, 9:02 a.m., remotely via videoconference.

APPEARANCES OF COUNSEL:

For Petitioner:

Sheppard Mullin Richter & Hampton LLP
BY: FANGZHOU QIU, ESQ.
WENTAO WU, ESQ.
1540 El Camino Real
Suite 120
Menlo Park, California 94025
Phone: (650) 815-2652/Fax: (650) 815-4683
fqiu@sheppard.com
wwu@sheppard.com

For Patent Owner:

Benesch Friedlander Coplan & Aronoff LLP
BY: MIRCEA TIPESCU, ESQ.
71 South Wacker Drive
Suite 1600
Chicago, Illinois 60606
Phone: (312) 212-4949
mtipescu@beneschlaw.com

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NO EXHIBITS MARKED DURING THIS DEPOSITION

TUESDAY, JULY 21, 2026

9:02 a.m.

--oOo--

THE STENOGRAPHER: Good morning. We are on the record. Today's date is July 21, 2026, and the time is 9:02 a.m.

This is the deposition of Dr. Tim Williams in the matter of Marvell Semiconductor, Inc., v. Credo Technology Group, Ltd., Case No. IPR2025-01220, venued in the United States Patent and Trademark Office.

My name is Heather Bautista, and I am a Certified Shorthand Reporter licensed by the State of California. My license number is 11600.

This deposition, and any transcript produced therefrom, will be handled pursuant to Federal Rule of Civil Procedure Section 30.

As the deposition officer, I will be retaining my duties and responsibilities under the Code.

At this time, I'll ask all counsel to state your appearance for the record, starting with the

noticing attorney, please.

MR. QIU: Yes. This is Fangzhou Qiu with the law firm Sheppard. I represent the petitioner, Marvell, in this case.

MR. TIPESCU: And this is Mircea Tipescu with the Benesch law firm representing patent owner, Credo, in this case.

THE STENOGRAPHER: Thank you.

Dr. Williams, can you please raise your right hand so I can swear you in.

DR. TIM ARTHUR WILLIAMS,

having been first duly sworn, was examined and testified as follows:

THE WITNESS: I do.

THE STENOGRAPHER: Thank you.

Please state your full name for the record.

THE WITNESS: Tim Arthur Williams.

THE STENOGRAPHER: Thank you.

Counsel, you can begin.

EXAMINATION

BY MR. QIU:

Q. Good morning, Dr. Williams.

A. Good morning.

Q. Let me start with the ground rules. I know you have been going over this many times, but let's just have them for the record.

So you understand you're under oath to tell the truth today?

A. Yes.

Q. For this deposition, we'll need verbal responses from you, because it is being transcribed; understood?

A. Yes.

Q. And we can take breaks today when you need to. I'll just ask that there's no question pending when you request a break; is that okay?

A. Yes.

Q. You understand you are not allowed to discuss your testimony with your counsel during breaks today?

A. Yes.

Q. If you don't understand a question, let me know, and I'll rephrase. Unless you say otherwise, I'll assume you understood the question; is that

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fair?

A. Yes.

Q. You have to answer my questions today unless your attorney instructs you otherwise; understood?

A. Yes.

Q. Is there any reason you wouldn't be able to provide accurate and truthful testimony today?

A. No.

Q. Are you here to give testimony in the Inter Partes Review proceedings involving U.S. Patent No. 11,032,111?

A. I am.

Q. Today, we'll refer to the patent as the '111 patent; is that all right?

A. Yes.

Q. What documents do you have with you?

A. I'm in front of my computer, so I have all the documents.

Q. What do you mean by "all the documents"?

A. I have the documents -- if you let me open my file, I can tell you the numbers.

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Q. Um-hum.
A. Is that okay?
Q. Sure.
A. I have electronic versions of the petition, the decision grant, the patent owner's response, Exhibit 1001 through Exhibit 1030, and Exhibit 2017 to 2027.
Q. Is that all the documents that you have?
A. Yes.
Q. Are those all the documents that have been filed in this proceeding?
A. I don't know.
Q. Are all the documents clean copies?
A. Yes.
Q. Do any of the documents have notations or markings?
A. Not that I know of.
Q. Dr. Williams, I just ask that when you access a document, please let me know during the deposition.
A. You can give them to me if you want. That would be fine.

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Q. Right. Yeah, I'll give you documents, but if you access -- like, decide to open a certain document, please announce it.

A. Yeah. In general, I don't do that.

Q. So one of the things that we are probably going to talk about today is the person of ordinary skill in the art. Are you familiar with that phrase?

A. I am.

Q. If we use the term "POSITA," P-O-S-I-T-A, will you understand that refers to the person of ordinary skill in the art?

A. I will.

Q. Are there any errors in your declaration or anything you want to change?

A. Yes.

Q. What is that?

A. Can I have the declaration?

Q. Yes, please. I'll upload it to the chat box. And it's Exhibit 2017.

(Stenographer clarification.)

MR. QIU: I think it's not necessary since

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they're already marked; like, filed in this case.

(Stenographer clarification.)

THE STENOGRAPHER: We're off the record. The time is 9:10 a.m.

(Recess taken from 9:10 a.m. to 9:20 a.m.)

THE STENOGRAPHER: We're back on the record. The time is 9:20 a.m.

Q. (By Mr. Qiu) And so, Dr. Williams, what's the error or errors that you were talking about?

A. In Exhibit 2017, Page 48 of 98, native Page 45, so that's PDF Page 48.

Q. Okay.

And the --

A. The third -- sorry.

Q. Go ahead.

A. Yeah.

The third line down from the top, Ran's, R-a-n, apostrophe, s; strike that and insert Cornelius.

Q. Okay.

Is that the only error, or are there any other errors in your declaration?

A. Not that I know of at this time.
Q. How much time did you spend preparing your declaration?
A. Don't recall.
Q. What did you review when preparing your declaration?
A. The -- the patents, the complaint, the documents cited in the complaint, Dr. Chen's report, the file wrapper, and that's about the extent of it. Basically, the materials in the case.
Q. Did you consider anything that's not filed as an exhibit or paper in this case?
A. Not that I haven't cited.
Q. In total, how much time have you spent reviewing the '111 patent?
A. Don't recall.
(Stenographer clarification.)
MR. QIU: Sure.
Q. (By Mr. Qiu) Have you ever reviewed the entire specification of the '111 patent?
MR. TIPESCU: Objection. Form.
THE WITNESS: Yes.

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Q. (By Mr. Qiu) Do you believe you have an adequate understanding of the '111 patent?

MR. TIPESCU: Objection to form.

THE WITNESS: Yes.

Q. (By Mr. Qiu) Is there anything you think is unclear about the '111 patent?

A. Not at this time.

Q. Your declaration states you have over 40 years of professional experience in wireless communications and telecom technology; is that accurate?

A. Yes, over 40; and actually 50 this month.

Q. Congratulations.

Would you describe your primary area of professional expertise as wireless communications?

MR. TIPESCU: Objection to form.

THE WITNESS: No. All forms of commun- -- of electronic communications.

Q. (By Mr. Qiu) Are there differences between wired and wireless communications with respect to equalization?

A. Yes. Both disciplines require equalization

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for high-speed data transfer. Wireless is more complex and more variable and requires higher computational requirements.

But both are -- use similar algorithms, both use similar structures, and learnings in one area relate directly to the other.

Q. Are equalization algorithms for wired communication transferable to wireless communication?

A. Yes.

MR. TIPESCU: Objection to form.

THE WITNESS: Yes.

Q. (By Mr. Qiu) Does the difference in the media used play differences in the -- in terms of equalization?

A. To -- sorry. In the what?

MR. TIPESCU: Objection to form.

Q. (By Mr. Qiu) Yes. Does the difference in the media used create differences in terms of equalization techniques?

MR. TIPESCU: Same objection.

THE WITNESS: As I just described, wireless

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is more complex, but the basics are still there. There's --

(Stenographer clarification.)

THE WITNESS: -- still dispersion in both media. There are still frequency selective responses in each media. So the basic tenets are the same between the media.

Q. (By Mr. Qiu) Would a POSITA have found it obvious to apply equalization techniques in wireless communication to wired communication?

MR. TIPESCU: Objection to form.

THE WITNESS: You mean the legal interpretation of obvious, or the industrial -- standard usage of the word "obvious"? Don't understand the question.

Q. (By Mr. Qiu) Dr. Williams, you mentioned there's a legal interpretation of "obvious" and industrial usage of the word "obvious." What's the difference in terms of its meaning?

MR. TIPESCU: Objection to form.

THE WITNESS: I'm not an attorney. I can't speak to the legal bound- -- boundary of obvious,

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but obviousness is a criteria for invalidity of claims. Obvious, in common usage, has a different meaning.

Q. (By Mr. Qiu) What's the difference?

A. Again, I'm not an attorney. I can't specify the exact boundaries --

(Stenographer clarification.)

THE WITNESS: -- of each.

Q. (By Mr. Qiu) Let's -- let me rephrase the question to not use that word.

Was it a common practice for a POSITA to use equalization techniques in wireless communication in wired communication applications?

MR. TIPESCU: Objection to form.

THE WITNESS: Can I have the question again, please.

MR. QIU: Reporter, could you repeat the question.

(Record read.)

THE WITNESS: Yes.

MR. TIPESCU: Same objection.

THE WITNESS: Yes.

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Q. (By Mr. Qiu) But there are significant differences in the hardware architecture between wired communication and wireless communication; isn't that correct?

MR. TIPESCU: Objection to form.

THE WITNESS: I don't have examples in mind. Do you?

Q. (By Mr. Qiu) So it is your opinion that the hardware architecture for wired communication and wireless communication are generally similar?

MR. TIPESCU: Objection to form.

THE WITNESS: That's not my testimony.

Q. (By Mr. Qiu) Are you familiar with the hardware architecture used for wired serial communications?

MR. TIPESCU: Objection to form.

THE WITNESS: For wired communications over conductive media, yes. I've built products in that space.

Q. (By Mr. Qiu) Are you familiar with the hardware architecture for wireless communication -- wireless serial communication?

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MR. TIPESCU: Objection to form.

THE WITNESS: Yes. I've built products in that space.

Q. (By Mr. Qiu) So is it your opinion that the hardware architecture for wired serial communication and wireless serial communication are similar to each other?

MR. TIPESCU: Objection to form.

THE WITNESS: Are they identical? No, because the media is different. As I just testified, the media has different characteristics between wire line and wireless; wireless being more complex and requiring more sophisticated processing. However, the basics are the same.

Q. (By Mr. Qiu) What are some of the differences in the hardware architecture for wired and wireless serial communications?

MR. TIPESCU: Objection to form.

THE WITNESS: I don't have examples in mind.

Q. (By Mr. Qiu) So you cannot identify a single example in terms of the differences in

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hardware architecture for wired and wireless serial communications --

MR. TIPESCU: Objection to form.

Q. (By Mr. Qiu) -- is that right?

A. That's not my testimony.

Q. So you can identify examples in terms of the differences in hardware architecture for wired and wireless serial communications.

MR. TIPESCU: Objection to form.

THE WITNESS: Given the hardware architectures that you're going to show me, yes.

Q. (By Mr. Qiu) Can you give me example in terms of the difference in hardware architecture for wired and wireless serial communications?

MR. TIPESCU: Objection to form. Asked and answered.

THE WITNESS: Again, I don't have specific architectures in mind.

Q. (By Mr. Qiu) Can you give me an example architecture for wired communication?

MR. TIPESCU: Objection to form.

THE WITNESS: Architecture for what?

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Q. (By Mr. Qiu) For wired serial communication.

MR. TIPESCU: Same objection.

THE WITNESS: For -- for which aspect of wired serial communications?

Q. (By Mr. Qiu) What are the aspects that you have in mind?

A. Well, speaking generally, there's -- there would be input buffer receiving data to be transmitted, either in parallel or serial form.

There would be a structure that breaks that serial or parallel form down into lanes or -- lanes is the best word.

There would be a coding and modulation block; there would be a pre-equalization block; and then there would be a physical media interface for the transmitter. For the receiver, there would be a physical media interface, sometimes a continuous equalizer, followed by a -- by a equalizer and slicer followed by a --

(Stenographer clarification.)

THE WITNESS: -- decision feedback

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equalizer, leading to a buffer for presentation of the data to the output.

That would be a -- a general architecture for a transceiver for wired line communications.

Q. (By Mr. Qiu) For wireless serial communications, will the transceiver have the same components?

A. It can.

Q. Is there any differences between wired and wireless communications in terms of those components?

MR. TIPESCU: Objection to form.

THE WITNESS: Well, as I've testified several times, devil's in the details. The media is different, so the impairments are different.

The -- there are common types of impairments in the channels, so the processing for wireless is more sophisticated than wired line, in general.

Q. (By Mr. Qiu) What additional processing is there for wireless that is not in wired communication?

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MR. TIPESCU: Objection to form.

THE WITNESS: Can I have the question again, please.

Q. (By Mr. Qiu) Sure.

What additional processing is there for wireless communication that is not in wired communication?

MR. TIPESCU: Objection to form.

THE WITNESS: Wireless communications, depending on the type of wireless, you sometimes have doppler shift effects. So compensation -- rotation of the phaser for doppler shifts can be included in wireless communications, depending on the type of communications we're talking about.

Q. (By Mr. Qiu) Does a wireless transceiver technically have components that is not found in a wired transceiver?

A. Don't under- --

MR. TIPESCU: Objection. Form.

THE WITNESS: Don't understand the word "components."

Q. (By Mr. Qiu) So by "components," I mean

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the parts of -- like, that composes a transceiver.

So the question is: Does a wireless transceiver technically have parts that are not found in a wired transceiver?

MR. TIPESCU: Objection to form.

THE WITNESS: By "parts," you mean hardware?

Q. (By Mr. Qiu) That's correct.

MR. TIPESCU: Same objection.

THE WITNESS: They can have -- both can have identical hardware. Depends on the application they're in.

Q. (By Mr. Qiu) What is the field --

(Stenographer clarification.)

Q. (By Mr. Qiu) -- of the '111 patent?

A. Can I have the patent, please.

Q. Yes.

It is Exhibit 1001, and I'm uploading it into the chat box.

A. Can I have the question again, please.

Q. Let me cancel that question. I want to move on to the next questions.

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Can you explain to me what is equalization.

MR. TIPESCU: Objection to form.

THE WITNESS: Equalization is an attempt to compensate for effects of the channel.

Q. (By Mr. Qiu) What are the effects of the channel?

A. Well, dispersion is one. The frequency -- the frequency characteristic of the channel can be stable or unstable. And commonly, in a wired environment, the higher frequencies attenuate quickly with distance relative to the lower frequencies.

Q. Are these all the effects of the channel?

A. No.

Q. What other effects are there?

A. Well, you have cross-talk; you have --

(Stenographer clarification.)

THE WITNESS: I'll try to speak slower.

You have cross-talk; you have self-induced energy; you have near-end reflections; you have far-end reflections from impedence and mismatch in the terminations.

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You have temperature effects; you have -- you have induced -- capacitively induced energy from other sources impinging on the wired media.

Those are some of them.

Q. (By Mr. Qiu) Do these effects cause degradation or impairments to the signal being transmitted over the channel?

A. Yes. "Impairments" is the commonly used term.

Q. What are equalization coefficients?

MR. TIPESCU: Objection to form.

THE WITNESS: They are values to be used in particular architecture for an equalizer.

Q. (By Mr. Qiu) What are the equalization coefficients used for?

MR. TIPESCU: Objection to form.

THE WITNESS: The coefficients define the -- essentially, the frequency response of the equalizer.

Q. (By Mr. Qiu) Is the goal to have the equalizer's frequency response compensate for the impairment that -- let me -- let me reframe that

question.

Is the goal of the equalizer for the equalizer's frequency response to compensate for impairments on the channel?

MR. TIPESCU: Objection to form.

THE WITNESS: Some of the impairments, yes.

Q. (By Mr. Qiu) Is it fair to say that a -- a set of equalization coefficients has good performance when they match the properties of the channel?

MR. TIPESCU: Objection to form.

THE WITNESS: Well, there's several things wrong with that question, but I'll try to answer it this way: Performance is measured by watt; and then typically, the equalizer is inverting the characteristic of the channel.

Q. (By Mr. Qiu) So the equalizer typically creates good performance when it is a close inversion of the characteristics of the channel.

MR. TIPESCU: Objection to form.

THE WITNESS: That's the theoretical best equalizer for frequency variation in the channel --

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frequency-based gain variation in the channel.

Q. (By Mr. Qiu) How do those skilled in the art typically quantify the performance of the equalizer?

MR. TIPESCU: Objection to form.

THE WITNESS: For fixed equalizer, it would just be the -- a measurement like a Means Squared Error --

(Stenographer clarification.)

THE WITNESS: -- or a Bit Error Rate or a Block Error Rate.

Q. (By Mr. Qiu) How is the Means Squared Error calculated?

A. It would be the delivered waveform compared to the original waveform in a computation of average error squared over the duration of the symbol.

Q. Is this value calculated based on the amplitude of the signal over time?

MR. TIPESCU: Objection. Form.

THE WITNESS: "This value," you mean the Means Squared Error value?

Q. (By Mr. Qiu) That's correct; the Means

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Squared Error.

A. Yes. Basically, yes.

Q. How is the Bit Error Rate calculated?

A. Well, you would compare the original bit sequence with the delivered bit sequence and determine the number of errors over a period of time.

Q. How is the Block Error Rate calculated?

A. Because blocks are typically coded with error correct- -- detection and correction mechanisms, you would observe the errorred -- the delivered errorred bits after the block has been error detected and corrected.

Q. What are blocks in this context?

A. So a block is a collection of bits to be transmitted. So you could collect 1,000 bits and transmit that as a block and code over those thousand bits a particular error detection and correction code. And you transmit the code and the block -- and the bits themselves.

Q. Going back to the calculation of the Bit Error Rate, you mentioned the term "bit sequence."

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How is the bit sequence generated?

A. For the test?

Q. Sure.

A. I don't understand the question.

Q. Let me ask, what does the bit sequence mean?

A. Simply a sequence of bits, timed sequence of bits. Bits being discrete in time.

Q. Is the bit sequence related to the waveform of the signal transmitted?

A. In what? In what type of system?

Q. What are the types of systems --

MR. TIPESCU: Objection.

Q. (By Mr. Qiu) -- that are different?

MR. TIPESCU: Objection to form.

THE WITNESS: Let's go back to basics. So in the architecture I described, the bits are presented to the transceiver for transmission at the input buffer. Those bits are coded and modulated.

And the modulation process is the mapping of bits to symbols. And then the symbols are communicated down the media in analog form.

So the analog waveform that actually -- the wave that actually propagates down the media is related to the bits via the modulation process.

Q. (By Mr. Qiu) Okay.

Is it correct to say that the bit sequence is generated by modulating the analog waveform?

MR. TIPESCU: Objection to form.

THE WITNESS: No. So the bit sequence is the information the user wishes to convey from transmitter to receiver, for example.

In a test, like we were talking about earlier for determining Bit Error Rate, that sequence would be a known sequence. So the sequence would be known a priori between transmitter and receiver.

The sequence could also be just randomly inserted bits. Those bits become symbols, the symbols are discrete in time, and then those discrete-in-time symbols are converted into analog waveforms for presentation to the media, in that the media propagates the carrier plus the modulated bits to the other end of the media.

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So in analog domain, what you would see, if you put an oscilloscope on the wire, is you'd see an analog waveform that contained both the carrier wave and the modulated bit wave.

Q. (By Mr. Qiu) Is it correct to say that the analog waveform can be converted into a bit sequence?

MR. TIPESCU: Objection to form.

THE WITNESS: Wow. Okay.

So the analog waveform that -- the wave that is propagating down the media is the analog waveform, and that -- just seeing that that's comprised of a carrier and modulated information.

So now at the receiver, we need to remove the carrier and obtain the modulated information and then map the analog information to particular levels, called "slicing," in order to determine the bit representation of that particular analog waveform.

And then once we do that, then we have a bit representation. Then we can go through decoding, error detection and correction, and,

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finally, present the transmitted information to the user.

Q. (By Mr. Qiu) Got it. I appreciate that explanation.

Was the techniques for mapping analog information to particular levels by slicing well-known before 2018?

A. Oh, sure.

MR. TIPESCU: Objection to form.

THE WITNESS: Yeah. Those were known since the 1930s.

Q. (By Mr. Qiu) For the methods to quantify the performance, including Means Squared Error, Bit Error Rate, and the Block Error Rate, were they well-known before 2018?

A. Oh, yes. I used them in the '70s, '80s, '90s, '00s.

Q. Is the eye diagram another way to measure the performance of an equalizer?

MR. TIPESCU: Objection to form.

THE WITNESS: Sure. The eye diagram is just a -- a look at the levels -- the analog levels

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of the received waveform after it's been passed through the equalizer.

And the -- the -- what you're plotting is a collection of 1s and 0s as they're arriving at the receiver, and you're seeing the levels of those waveforms. And the more distinct those levels are, the easier it is for the slicer to determine whether the symbol that was sent is this symbol or the other symbol.

Q. (By Mr. Qiu) Is the term "margin" another way to measure the performance of the equalizer?

A. Margin? In what context? I mean, "margin's" a pretty generic word.

Q. Sure. Okay.

Let me ask another question.

So is it true that the -- the Means Squared Error and the eye diagram are both derived from the analog signals passing through the channel?

MR. TIPESCU: Objection to form.

THE WITNESS: The eye diagram, yes. Means Squared Error can be calculated from the same waveform, yes.

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Q. (By Mr. Qiu) Are you familiar with the feet-forward equalizer, or the abbreviation FFE?

A. I am. I've built many, many of them.

Q. FFE is a type of equalization filter; right?

A. It is.

Q. Would you agree that by 2018, FFE was a well-known and widely used equalization technique in high-speed serial communications?

MR. TIPESCU: Objection to form.

THE WITNESS: It was a widely known technique, yes.

Q. (By Mr. Tipescu) What is pre-equalization?

A. Pre-equalization is compensation at the transmitter for the effects of the channel for the waveform about to be transmitted.

Q. Can FFE be implemented at the transmitter side to perform pre-equalization?

A. Typically, an FFE is used in the receiver. I suppose you could use it in the transmitter.

Q. Are you familiar with the term "link training" in the context of high-speed serial

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communications?

A. Yes.

Q. What does link training mean?

MR. TIPESCU: Objection to form.

THE WITNESS: It means characterizing the link.

Q. (By Mr. Qiu) What are typical steps involved in link training?

MR. TIPESCU: Objection to form.

THE WITNESS: There are many different types of link training.

I'll describe one particular methodology, which is transmit a -- transmit a known sequence, known a priori to the transmitter and receiver, determine the effects of that transmission process, and then compensate for it in either the receiver or the transmitter.

Q. (By Mr. Qiu) So in this process, does the receiver measure the received signal to determine the effects of the transmission process?

A. Depends on what you mean by "measure the received signal." It determines the -- it

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determines the effects of the channel.

Q. How does it determine the effects of the channel?

A. By -- well, one method is by determining the Means Squared Error of the waveforms. The other is determining the Bit Error Rate or the Block Error Rate. Another way is to measure the eye opening.

Q. After the determination of the effects of the channel, does the receiver communicate with the transmitter regarding the --

MR. TIPESCU: Objection to form.

(Stenographer clarification.)

Q. (By Mr. Qiu) -- determined effects?

MR. TIPESCU: Objection to form.

THE WITNESS: Depends on the architecture, but in -- in some architectures, yes.

Q. (By Mr. Qiu) In the architectures that involve communication from the receiver to the transmitter, does the transmitter change the equalization settings based on the communication from the receiver?

MR. TIPESCU: Objection to form.

THE WITNESS: It can or it cannot. It is capable of changing the transmissions, yes. Not required to.

Q. (By Mr. Qiu) Can you give me an example of -- based on communication from the receiver, the transmitter changes the equalization settings --

MR. TIPESCU: Objection to form.

Q. (By Mr. Qiu) -- and how that works.

A. A hypothetical?

MR. TIPESCU: Objection to form.

THE WITNESS: Are you talking about a hypothetical architecture?

Q. (By Mr. Qiu) Yes.

A. Okay.

MR. TIPESCU: Objection to form.

THE WITNESS: So in one potential architecture, the receiver would receive the a priori's known sequence, would determine a particular Bit Error Rate and would determine a -- a relative figure of merit for that particular setting on the transmitter and receiver equalizers and then would communicate. The -- in the case where the

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receiver is the decision-maker, the receiver would communicate back to the transmitter the selection of a different set of values for the equalizers in the transmitter and select its own receiver equalizers as well.

And then there would be an initiation of another test to determine the figure of merit of that new setting of equalizer values.

Q. (By Mr. Qiu) In this process, what does the transmitter do?

A. The process I described, the transmitter transmits. The transmitter receives the communication being fed back from the receiver.

The receiver is the decision-maker, so the transmitter simply implements the decisions of the receiver in its own structures and then initiates a subsequent transmission.

Q. How does the transmitter implement the decision of the receiver in this case?

MR. TIPESCU: Again, objection to form.

THE WITNESS: There are many variations there. I'll just pick one and describe it.

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There could be a known table -- a table of values known between the transmitter and the receiver a priori, and the receiver could just indicate a particular table index number for the transmitter to use.

Q. (By Mr. Qiu) And the transmitter uses the index number to pick the set of values to use; is that right?

MR. TIPESCU: Objection to form.

THE WITNESS: In the hypothetical architecture we're talking about, the receiver has made the decision to use a particular index number into the table for the transmitter. So the transmitter's being told to use that set of values as indicated by the index number.

Q. (By Mr. Qiu) Was the process you just described well-known and used by 2018?

A. Where?

Q. Are you asking for geographical location?

A. No. What field of endeavor?

Q. In high-speed serial communications.

MR. TIPESCU: Objection to form. Objection

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to form.

THE WITNESS: I don't have an example in mind.

Q. (By Mr. Qiu) So you are not sure whether the link training process that you described was used in serial communications before 2018?

MR. TIPESCU: Objection to form.

THE WITNESS: I don't have an example in mind. Certainly, the -- the concept was known.

Q. (By Mr. Qiu) So let's not ask about the specific process you talked about. Let's just say the -- was link training used in high-speed serial communications before 2018?

MR. TIPESCU: Objection to form.

THE WITNESS: I don't have an example in mind.

Q. (By Mr. Qiu) Are you familiar with the concept of back-channel adaptation?

A. In several contexts. So in what context are you asking?

Q. In the context of serial channel communications.

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A. Well, basically, that's what we've just been talking about.

Q. Do you have an opinion as to whether back-channel adaptation was used in serial communications before 2018?

A. I don't have an example in mind.

Q. What are the typical hardware components of an equalization circuit?

MR. TIPESCU: Objection. Form.

THE WITNESS: In what period of time? Using what technology? For what purpose? Don't understand the question.

Q. (By Mr. Qiu) For the period of time, let's say, just before 2018, for wired and serial communication channel, what are the typical hardware components of an equalization circuit?

MR. TIPESCU: Objection to form.

THE WITNESS: I don't have specific architectures in mind. None have been presented in this case. But implementation of these equalizers can take many, many forms.

Q. (By Mr. Qiu) How would those skilled in

the art before 2018 implement a filter?

MR. TIPESCU: Objection to form.

THE WITNESS: Just a filter? You can implement -- in discrete time or analog time? What -- I don't understand the question.

Q. (By Mr. Qiu) Would an equalization circuit include parts that correspond to the equalization filter that's being applied?

MR. TIPESCU: Objection to form.

THE WITNESS: Seems like a circular question. I don't understand the question.

Q. (By Mr. Qiu) What -- what is the meaning of "equalization circuit"?

MR. TIPESCU: Objection to form.

THE WITNESS: Well, I'm interpreting your words to being a circuit that implements equalization.

Q. (By Mr. Qiu) Does the circuit typically include devices that store the coefficients or tap values used for the filter?

MR. TIPESCU: Objection to form.

(Stenographer clarification.)

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MR. QIU: Tap, T-a-p.

MR. TIPESCU: Objection to form.

THE WITNESS: Which domain are we talking about?

Q. (By Mr. Qiu) Using domain equalization in the context of high-speed serial communications.

MR. TIPESCU: Same objection.

THE WITNESS: In analog domain, no. In discrete time domain, maybe.

Q. (By Mr. Qiu) What hardware component typically is used to implement link training?

MR. TIPESCU: Objection to form.

THE WITNESS: The collection of hardware components? Is that your question?

Q. (By Mr. Qiu) Sure.

I want -- I'm asking for the technical hardware components or hardware components that are typically used to implement link training over a serial communication channel.

MR. TIPESCU: Objection to form.

THE WITNESS: A wired channel?

Q. (By Mr. Qiu) A wired channel. Sure.

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MR. TIPESCU: Objection to form.

THE WITNESS: There's many, many ways to build that. I don't have a particular architecture in mind.

Q. (By Mr. Qiu) Is a -- some type of controller a pretty technical hardware component for implementing link training?

MR. TIPESCU: Again, objection to form.

THE WITNESS: By "controller," you mean a software instruction-based machine that implements control?

Q. (By Mr. Qiu) I mean, it can even -- either be a hardware circuit or be a software instruction-based machine.

MR. TIPESCU: Same objection.

THE WITNESS: There needs to be some establishment of state, so, in general, yes.

Q. (By Mr. Qiu) When there is a back-channel adaptation or link training, does that require a hardware component that manages communications through the back channel with the link partner?

MR. TIPESCU: Objection to form.

THE WITNESS: In the receiver?
Q. (By Mr. Qiu) Sure. In the receiver.
MR. TIPESCU: Objection to form.
THE WITNESS: Depends on the architecture.
Q. (By Mr. Qiu) So some architecture would have such a hardware component that manages communications between the receiver and the transmitter?
MR. TIPESCU: Objection to form.
THE WITNESS: By "manages," you mean what? Causes the initiation of?
Q. (By Mr. Qiu) Yeah, that causes the initiation of the communication. Sure. That's a good one.
MR. TIPESCU: Objection to form.
THE WITNESS: Yeah, there has to be some piece of intelligence in the receiver that causes the information it's obtained to be transmitted back to the transmitter.
Q. (By Mr. Qiu) Does there need to be some hardware parts in the transmitter that causes the -- that receives the information from the receiver?

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MR. TIPESCU: Objection to form.

THE WITNESS: I don't think that sentence is -- that question is well-formed. Could you --

Q. (By Mr. Qiu) Let me rephrase.

You mentioned that there has to be some pieces of intelligence in the receiver that causes the information to be transmitted back to the transmitter.

Based on that, my question is: Does the transmitter need to have some hardware component for receiving that information from the receiver?

MR. TIPESCU: Objection to form.

THE WITNESS: The transmitter has to have some piece of intelligence to interpret what's being told to it by the receiver and to implement what's being either instructed by the receiver or implement its algorithms to determine what to do next. Depending on where the -- who the decision-maker is, the transmitter or the receiver.

Q. (By Mr. Qiu) Are you familiar with the design of serial channels?

(Stenographer clarification.)

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THE WITNESS: I don't know what you mean.

Q. (By Mr. Qiu) Do you not understand what "design of serial channels" mean?

MR. TIPESCU: Objection to form.

THE WITNESS: Yes.

Q. (By Mr. Qiu) What are the types of devices that can provide high-speed serial channels in the time frame of 2017/2018?

A. I don't have any in mind. I don't think any have been produced in this case.

Q. Is an active cable a type of device that can provide high-speed serial channels?

A. Yes.

Q. So let's talk about active cable in the time frame of, for example, 2017 and 2018.

What are the components of a typical active cable?

MR. TIPESCU: Objection to form.

THE WITNESS: I don't have one in mind. None has been produced in this case.

Q. (By Mr. Qiu) Does an active cable typically include a wire?

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MR. TIPESCU: Objection to form.

THE WITNESS: If it's wire-based. Could be optical-based.

Q. (By Mr. Qiu) What is the component for optical-based active cable?

A. I don't have one in mind.

Q. So let's talk about the wire-based scenario.

Does the active cable typically have two plugs on the two ends of the cable?

A. A plug on each end of the cable? Yes.

Q. Does a plug typically include a chip inside if the plug is an active plug?

MR. TIPESCU: Objection to form.

THE WITNESS: I don't have an example in mind. None has been produced in this case.

Q. (By Mr. Qiu) How does an active plug get connected to a host connector?

MR. TIPESCU: Objection to form.

THE WITNESS: Through a receptacle, a jack.

Q. (By Mr. Qiu) And how is the signal transmitted from the receptacle through the active

cable?

MR. TIPESCU: Objection to form.

THE WITNESS: I don't understand the question.

Q. (By Mr. Qiu) What do you not understand?

A. How is it transmitted?

Q. So, let's say, if there's an active cable, there are signals transmitted through the active -- to the active plug into the host, and there are also signal transmitted from the host to the active plug; is that correct?

MR. TIPESCU: Objection to form.

THE WITNESS: Yeah, some people call that chip-to-module communication.

Q. (By Mr. Qiu) What -- what is the media that the signal for chip-to-module communication goes through?

A. Well, it can go through many types of media, but, typically, printed circuit board traces and connectors in the jack and the plug and then copper on the plug side.

Q. Are you familiar with the design process

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for a chip-to-module communication channel?

A. The design --

MR. TIPESCU: Objection to form.

THE WITNESS: Don't understand "design process."

Q. (By Mr. Qiu) Have you designed a pluggable module?

A. No.

MR. TIPESCU: Fred, we've been on the record for just a little over an hour, I think. Can we -- can we take a break?

MR. QIU: Sure. Yes. Let's take a break.

THE STENOGRAPHER: We're off the record. The time is 10:31 a.m.

(Recess from 10:31 a.m. to 10:51 a.m.)

THE STENOGRAPHER: We're back on the record. The time is 10:51 a.m.

Q. (By Mr. Qiu) Okay.

Dr. Williams, can you please go to Paragraph 66 of your declaration.

A. Yes.

Q. In that paragraph, you said, "Berke

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purportedly already" --

(Stenographer clarification.)

Q. (By Mr. Qiu) -- "operates in a SerDes," S-e-r-D-e-s, "context."

A. Capital S, capital D.

You read that correctly.

Q. So you used "purportedly" in that sentence. Does that mean you disagree that Berke teaches SerDes?

A. I'm not proving that Berke applies to SerDes. I'm accepting -- I'm commenting on Dr. Chen's comment, which is the purpose of my report.

Q. Do you have an opinion as to whether Berke teaches SerDes?

A. Not that I've expressed.

Q. I'm sharing with you Exhibit 1004, which is Berke.

Please let me know when you have access.

A. I have it.

Q. Okay.

Can you please go to Paragraph 14 of

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Exhibit 1004.

A. Yes. I'm there.

Q. Can you please read the first sentence of Paragraph 14.

A. Okay. Out loud?

Q. Sure.

A. "Transmitter 110 includes a channel output module 112, feet-forward equalization (FFE) module 114, a channel management module 116, and an equalization co-efficient whitelist 118."

Q. Here, the feet-forward equalization module 114, is that the module for performing equalization?

A. It is.

Q. Please go to Paragraph 68 of your declaration, which is Exhibit 2017.

A. I'm there.

Q. Can you please review this paragraph.

A. I've reviewed it.

Q. This paragraph, you commented that several elements of Berke do not exist in Cornelius' cable plug; is that correct?

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A. I say "none of these elements."

MR. TIPESCU: Objection. Form.

Q. (By Mr. Qiu) Right.

So you said, "None of these elements exists in Cornelius' cable plug"; is that accurate reading?

A. That's -- you read that correctly.

Q. What analysis did you perform to reach the conclusion that none of these elements exists in Cornelius' cable plug?

A. I examined Dr. Chen's statements, I examined Berke's documentation, as well as Cornelius' documentation, and reached a conclusion.

Q. Did you consider any elements in Cornelius' cable plug in reaching this conclusion?

A. Of course.

Q. What elements did you -- did you consider?

A. Can I have Cornelius.

Q. Sure.

Cornelius, I believe it's Exhibit 1005. I'll share it in the chat box.

A. Can I have that question again, please.

MR. QIU: The court reporter, could you

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repeat my question.

(Record read.)

THE WITNESS: All of the disclosed embodiments.

Q. (By Mr. Qiu) Did you mention any of the elements you considered in your declaration?

A. Yes. None of the elements.

Q. Can you give me example of the elements that you considered in Cornelius.

A. So in Cornelius, I don't see disclosure of Berke's FFE module, Berke's channel management module, Berke's equalization coefficient whitelists, and the registered base selection, the training architecture described in Berke.

So I don't see an equivalent set of capabilities in Cornelius.

Q. In your analysis, did you compare any elements that exist in Cornelius' cable plug with the enumerated elements of Berke?

A. Can I have the question again, please.

MR. QIU: Court reporter, could you please repeat the question.

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(Record read.)

THE WITNESS: As I say in my declaration, none of these elements exist, so it's impossible to directly compare Berke's disclosures with Cornelius' disclosure.

Q. (By Mr. Qiu) So is it right that you did not compare any element in Cornelius' cable plug to determine whether they are similar or perform the same function as Berke's elements?

MR. TIPESCU: Objection to form.

THE WITNESS: I attempted to do that. However, I identified no elements that exist in Cornelius' cable that relate to Berke's disclosures.

Q. (By Mr. Qiu) What are the elements in Cornelius' cable plug?

A. You can see those in Figures 5 and 6 of Cornelius.

Q. What does "CDR" stand for?

A. Clock and data recovery.

Q. Does your declaration include a comparison between CDR and any element in Berke?

A. My declaration is in response to Dr. Chen's

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declaration; and to the extent that he did not do that, I did not do that.

Q. Did you analyze whether Cornelius has any element that is similar to Berke's FFE module?

A. Yes.

Q. Can you point me to that analysis in your declaration.

A. I can point you to the conclusion. "None of these elements exist in Cornelius' cable plug," Paragraph 68, Line 5.

Q. So, Doctor, I understand that Berke's elements does not exist in Cornelius' system, since they are different systems, to the extent that's what you mean.

But I guess my question is: Did you analyze whether elements similar to Berke's elements exist in Cornelius' system?

A. I don't remember Dr. Chen doing that analysis. So to the extent I'm commenting on Dr. Chen's analysis, no.

Q. Please go to Exhibit 1005, which is Cornelius. Please go to Column 6 and the Line 50 to

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57.

A. Yes. I'm there.

Q. Can you please review that paragraph for yourself.

A. I have.

Q. In this paragraph, what -- in this paragraph, what does "operational parameters" mean?

A. The parameters controlling the operation of the device.

Q. Can you give me an example of an operational parameter for a plug circuitry.

A. Well, this disclosure is for multiple -- in Paragraph -- in Column 6, Lines 42 to 49, they're talking about configuration of the cable, and these are examples of operational parameters that can be set.

In addition, Lines -- Column 6, Lines 58 to 62 describe other types of operational parameters.

Q. Is -- are parameters for controlling equalization part of the operational parameters?

A. It's not defined.

Q. Would a POSITA read this sentence saying

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operational parameters of plug circuitry -- what would a POSITA understand it to include?

A. What I've testified to.

Q. So I didn't hear your answer. Could you repeat it.

A. What I have testified to previously.

Q. What does "modes" mean?

A. I'm sorry?

Q. What does "modes" mean --

A. What does --

Q. -- in this sentence -- in -- in the paragraph --

A. "Most"?

Q. -- between Lines 50 to 57.

A. "Modes," M-o-d-e-s.

Q. That's right.

A. That's -- would be a mode of operation of the circuit.

Q. Can you give me an example of a mode of operation.

MR. TIPESCU: Objection to form.

THE WITNESS: I don't think any have been

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specified in Cornelius.

Q. (By Mr. Qiu) When a POSITA reads modes of operation, what a POSITA would have understood?

MR. TIPESCU: Objection to form.

THE WITNESS: I don't know. I don't think Dr. Chen opined on this.

Q. (By Mr. Qiu) What are parameters for control in this paragraph?

A. They are settings that affect the control of the circuits in this --

(Stenographer clarification.)

THE WITNESS: -- embodiment.

Q. (By Mr. Qiu) Is it limited to certain aspects of the circuit or the control of all aspects of the circuits?

MR. TIPESCU: Objection to form.

THE WITNESS: Not specified; not commented on by Dr. Chen; haven't reached a conclusion here.

Q. (By Mr. Qiu) What are parameters for diagnostics?

A. Not specified; not disclosed by Dr. Chen or analyzed by Dr. Chen; don't have an opinion.

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Q. Is it right that you don't have an opinion about what the parameters for diagnostics are?

A. As disclosed by Cornelius? No.

Q. Do you have opinion about what the parameters for tests are?

A. As disclosed by Cornelius and commented on by Dr. Chen? No.

Q. Do you have an opinion as to what the parameters for configuration are in Cornelius?

A. Same answer.

Q. So could you state your answer.

A. As disclosed in Cornelius and commented on by Dr. Chen? No.

Q. Do you have an opinion about what the parameters for circuit monitoring are in Cornelius?

A. As disclosed by Cornelius and analyzed by Dr. Chen? No.

Q. At the end of this paragraph, there's a sentence stating, quote, "The ability to configure a cable in this way allows cables to adapt to new hosts and devices as the cable is used in various system applications," end of quote.

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Do you see that sentence in that paragraph?

A. You read that correctly.

Q. What does "adaptation to new hosts" mean?

A. That the cable is able to be configured to interface with new hosts, whatever -- whatever "new" means.

Q. So what kind of configurations are relevant to adapting to a new host?

MR. TIPESCU: Objection to form.

THE WITNESS: Physical form factor, electrical amplitudes, currents, pin-outs, speeds, modulation types, lane assignments. Those are sorts of things that might be configured but aren't disclosed by Cornelius or discussed by Chen.

Q. (By Mr. Qiu) Please go to Column 6, Lines 63 to 67 of Cornelius, which is Exhibit 1005. Can you please review that paragraph for yourself.

Please let me know when you are finished.

A. I've finished.

Q. Do you see the term "other signal pins" in this paragraph?

A. No.

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Q. It's -- it's at the -- the end of Line 66 and the beginning of Line 67.

A. My Line 66 says, "State may include providing" --

(Stenographer clarification.)

THE WITNESS: -- "a supply voltage of 3.3 volts, while the high-power state may include providing a supply of 12."

Q. (By Mr. Qiu) Are you -- are you looking at Exhibit 1005 at Column 6?

A. Oh. Column 6. Okay.

Column 6, Lines 63 to 67?

Q. That's correct.

A. Okay.

I was looking at Column 5. Can I have your question again, please.

Q. Sure.

Do you see the term "other signal pins" in this paragraph?

A. I do.

Q. What are those other signal pins in Cornelius?

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A. Well, presumably, it's pins other than Pins 9 and 11.

Q. Is it your opinion that the signals on Pins 9 and 11 are low-speed?

MR. TIPESCU: Objection to form.

THE WITNESS: That's Cornelius' characterization.

Q. (By Mr. Qiu) Do you know whether the signals on the other pins are high-speed or low-speed?

A. Cornelius Column 6, Lines 16 to 20, says, "Specifically, active plug 500 provides high-speed transmission signals on Pins 3 and 5 and receives high-speed signals on Pins 4 and 6."

Q. So Cornelius teaches that the other signal pins provide high-speed signals; is that correct?

A. Cornelius --

MR. TIPESCU: Objection. Form.

THE WITNESS: Cornelius teaches that there are pins in his implementation that provide high-speed transmission and reception.

Q. (By Mr. Qiu) Please go to Exhibit 1004,

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which is Berke, at Paragraph 19.

A. Yes.

Q. And can you please read Paragraph 19 to yourself.

I realize it's a long paragraph. You're free to read it to yourself, but I want to point to a certain sentence in the paragraph.

A. Give me the sentence.

Q. It is -- it is on Page 3. If you count the left column, four lines from that in that left column, at the end of Line 4, starting with, "In a particular embodiment, management module 116 and channel management module 142 represent a separate side-band communication channel for communication -- communicating adaptive instructions -- adaptation instructions between transmitter 110 and receiver 130."

Do you see that sentence?

A. I do.

Q. What are the adaptation instructions in this sentence?

A. So these are instructions conveyed from the

transmitter to the receiver for adapting the operation of the receiver.

Q. Does it include any instructions from the receiver to the transmitter?

A. Not that I see.

Q. How -- how do you tell that the instructions are from the transmitter to the receiver?

A. The sentence says, "A -- represent a separate side-band communication channel for communicating adaptation instructions between a transmitter and the receiver" -- "between transmitter and receiver."

Q. So because it says "between transmitter and receiver," you interpret it to be one-directional from transmitter to the receiver; is that correct?

A. Yes.

MR. TIPESCU: Objection. Form.

Q. (By Mr. Qiu) Does Berke impose any requirements on how the adaptation instructions should be transmitted?

A. Don't understand the question.

Q. So the question is: Does Berke specify any requirements on how the adaptation instructions should be transmitted?

A. Sounds like the same question. I don't understand the question.

Q. What do you not understand?

A. The extent of the disclosure you're asking about.

Q. Yeah. I'm asking about what Berke discloses or teaches.

And the question is: Does Berke specify any requirements on how the adaptation instructions should be transmitted?

A. That's the third time you asked the same question. I don't understand the question.

Q. I thought, like, you asked for clarification about whether it's about Berke's teaching, and I confirmed it is for Berke's teaching. So what do you not understand in that question?

A. I need clarification on how.

Q. Uh-huh.

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A. You're talking about an algorithm? You're talking about a physical mechanism? You're talking about software process? You're talking about a management process? What are you talking about?

Q. Let's go through them one by one.

Does -- does Berke impose any requirements on the algorithm for transmitting the adaptation instructions?

MR. TIPESCU: Objection to form.

THE WITNESS: Don't understand the question. Berke talks about an implementation and embodiment.

Q. (By Mr. Qiu) Does Berke specify a minimum requirement on the channel that is needed to transmit adaptation instructions?

A. I don't recall.

Q. Did you form an opinion as to whether Berke's -- sorry. Strike that question.

Did you form an opinion as to whether Berke provide any minimum requirement on the channel that is required to transmit the adaptation instructions?

A. All of my expressed opinions are included

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in my report.

Q. Can you point me to your opinion as to whether Berke provide any minimum requirement on the channel that is required to transmit the adaptation instructions in your report.

A. No.

Q. And sitting here, do you currently have an opinion as to whether Berke specifies a minimum requirement on the channel that is used to transmit the adaptation instructions?

A. I have not formed that opinion.

Q. Please go to Exhibit 1004, and I want to go to Figure 1 on that exhibit.

A. Yes.

Q. Do you see a transmitter and a receiver on Figure 1?

A. I see block labeled 110 as the transmitter and block labeled 130 as the receiver.

Q. Are the transmitter and receiver on the same device?

A. No.

Q. Please go to Paragraph 97 of your

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declaration, which is Exhibit 2017.

A. Yes.

Q. Can you please read that paragraph to yourself.

Please let me know when you finish reading it.

A. I'm done.

Q. What does "endpoint-to-endpoint operation" mean in this paragraph?

A. Can I have the question again, please.

Q. Sure.

What does "endpoint-to-endpoint operation" mean?

A. It means a -- as I've discussed in Paragraph 96, that Cornelius "does not constitute a suggestion to implement Berke's elaborate coefficient whitelist, register selection, and training architecture."

So the -- in Paragraph 97, "a single information handling system and receiver has full observability and control of the channel's effects on the transmitted signal."

So it's a more sophisticated implementation embodiment in Berke.

Q. That doesn't quite answer my question.

So let me ask this: What do you mean by "endpoint"?

A. Delivered bits to the cable and receive bits from the cable.

Q. So endpoint refers to some bits?

MR. TIPESCU: Objection. Form.

THE WITNESS: The purp- -- the purpose of the invention is to deliver user information from one point to another.

Q. (By Mr. Qiu) Does Berke teach an endpoint?

A. Yes.

Q. What -- what is the -- the device that Berke teaches is the endpoint?

A. Elements -- as we were just looking at the figure, element 1- -- 110 is one element; 130 is another element.

Q. Okay.

So in Figure 1 of Exhibit 1004, which is Berke --

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A. I misspoke.

110 is one endpoint; 130 is another endpoint.

Q. Okay.

So -- so you're saying the transmitter and the receiver are both endpoints; is that correct?

A. Yes, basically.

Q. So is any operation between a transmitter and a receiver an endpoint-to-endpoint operation?

A. No.

Q. So how do you tell if something is an endpoint-to-endpoint operation?

A. Well, as we just discussed, Berke has much more sophisticated process for information sharing between the transmitter and the receiver, and that is communicating between the endpoints.

Q. So what kind of -- sorry -- strike that.

What kind of process is required for an operation to be endpoint-to-endpoint operation?

MR. TIPESCU: Objection to form.

THE WITNESS: Well, in this case, Berke discloses a coefficient whitelist, a registration

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selection, and training architecture that is an endpoint-to-endpoint architecture.

Q. (By Mr. Qiu) So an endpoint-to-endpoint architecture must have a whitelist, registration selection, and training architecture?

A. That's not my testimony.

Q. Is that true?

A. That is not --

MR. TIPESCU: Objection. Form.

THE WITNESS: That is not my testimony.

Q. (By Mr. Qiu) Is it your opinion that an endpoint-to-endpoint architecture must have a whitelist, registered selection, and training architecture?

A. That is not my opinion.

Q. Is there any component that an endpoint-to-endpoint architecture must have?

A. Yes.

Q. What is such a component?

A. Communication between the receiver and the transmitter regarding operation.

Q. So as long as there is communication

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between receiver and transmitter regarding operation, we can say that the architecture is an endpoint-to-endpoint architecture; is that correct?

A. In general, yes, as I use the term.

Q. And in Paragraph -- let's go back to Paragraph 97 of your declaration, which is Exhibit 2017.

A. Yes.

Q. There, you mentioned the phrase "full observability and control of the channel's effect on the transmitted signal."

Do you see that phrase?

A. I do.

Q. What does that mean?

A. That the receiver has full observability and control of the channel's effect on the transmitted signal.

Q. Is it your opinion that Berke's receiver controls how the channel affects the transmitted signal?

MR. TIPESCU: Objection to form.

THE WITNESS: No. Berke's receiver has

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observability of the effects impinging on the transmitted signal and control of the transmitted signal.

Q. (By Mr. Qiu) Which passage in Berke led to your conclusion that there is full observability and control?

A. The entire disclosure.

Q. What mechanism allows the receiver to have full observability and control in Berke?

A. The training architecture.

Q. Does that include the back-channel adaptation process in Berke?

A. As disclosed by Berke, yes.

Q. Why does that training process provide full observability and control?

MR. TIPESCU: Objection. Form.

THE WITNESS: What do you mean by that, "process"?

Q. (By Mr. Qiu) Sorry. Let me rephrase my question.

Why does that training architecture provide full observability and control?

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MR. TIPESCU: Objection. Form.

THE WITNESS: Because the receiver has observability into the effects caused by the channel on the transmitted waveform, and it has control of the transmitted waveform via the feedback channel.

Q. (By Mr. Qiu) How does a transmitter get observability into the effects caused by the channel on the transmitted waveform?

A. By implementing the training process.

Q. Does that involve the receiver receiving and measuring the signals transmitted by the transmitter?

A. What do you mean by that?

Q. So how does the training process give the receiver full observability?

MR. TIPESCU: Objection. Form.

THE WITNESS: Through the training process, which results in a figure of merit for various transmitter settings.

Q. (By Mr. Qiu) Let's go back to Paragraph 97 of your declaration.

You mentioned a term called "cable-to-host

boundary"; is that correct?

A. I do.

Q. What does cable-to-host boundary mean?

A. It's the -- the side of the communication between a host and a cable that is the plug and jack.

Q. It is your opinion that there cannot be endpoint-to-endpoint operations across a cable-to-host boundary; correct?

A. Not my opinion.

MR. QIU: Counsel, I think the deposition has been going for a while. Do you think this is a good time -- and definitely, Dr. Williams, do you think this is a good time for break or lunch break?

THE WITNESS: That would be good. Let's do 45 minutes.

MR. QIU: 45 minutes. So we come back at --

THE WITNESS: 12:45.

MR. QIU: Okay.

THE STENOGRAPHER: We are off the record. The time is 11:52 a.m.

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(Lunch taken from 11:52 a.m. to 12:48 p.m.)

THE STENOGRAPHER: We're back on the record. The time is 12:48 p.m.

Q. (By Mr. Qiu) Dr. Williams, did you communicate with anybody during the break that just happened?

A. No.

Q. Please go to Exhibit 1001, which is the '111 patent.

Can you please go to Claim 1 of this exhibit.

A. Yes.

Q. Do you see the limitation "selecting one of multiple registers to specify initial pre-equalizer coefficient values, each of the" --

(Stenographer clarification.)

Q. (By Mr. Qiu) -- "multiple registers corresponding to a different channel model"?

A. You read that correctly.

Q. What does the term "model" mean?

MR. TIPESCU: Objection to form.

THE WITNESS: What does the term "multiple"

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mean?

Q. (By Mr. Qiu) "Model."

MR. TIPESCU: Objection to form.

THE WITNESS: Are you saying "model" or "multiple"?

Q. (By Mr. Qiu) "Model."

A. "Model."

Well, the channel model is a mathematical representation of the characteristics -- of frequency characteristics of the channel.

Q. How is a -- let's see.

What do you mean by "frequency characteristics"?

A. Exactly that.

Q. What does --

(Stenographer clarification.)

Q. (By Mr. Qiu) What does it mean for a set of pre-equalizer coefficients to correspond to a channel model?

MR. TIPESCU: Objection to form.

THE WITNESS: Do you see those words? I don't understand the question.

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Q. (By Mr. Qiu) Claim 1 states that -- okay.

Claim 1 states that "each of the multiple registers corresponding to a different channel model"; is that correct?

A. Yes. You read that correctly.

Q. What does "corresponding" mean in this sentence?

MR. TIPESCU: Objection to form.

THE WITNESS: It means that the contents of the multiple registers relate to different channel models, and each register relates to a different channel model.

Q. (By Mr. Qiu) How would a POSITA determine whether a set of coefficient values correspond to a channel model?

A. To any channel model?

Q. Sure.

MR. TIPESCU: Objection to form.

THE WITNESS: Inherently, equalizer coefficients would correspond to some channel model.

Q. (By Mr. Qiu) So a -- a set of equalizer coefficients always correspond to a channel model?

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MR. TIPESCU: Objection to form.

THE WITNESS: Given a set of coefficients, those coefficients correspond to some channel model.

Q. (By Mr. Qiu) Claim 1 recites "selecting one of multiple registers to -- register to specify initial pre-equalizer coefficient values"; correct?

A. You read that correctly.

Q. Is Claim 1 limited to a certain manner of selecting?

A. No.

Q. According to Claim 1 of the '111 patent, once you select the initial pre-equalizer coefficient values, do you further modify the values?

MR. TIPESCU: Objection to form.

THE WITNESS: Are you asking if there's a temporal relationship between selecting and updating?

Q. (By Mr. Qiu) I -- I think my question did not specifically refer to a temporal relationship.

But I guess I can -- does Claim 1 require further modifying the pre-equalizer coefficient

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values after selecting the initial values?

A. There is a temporal relationship between selecting and updating.

Q. In this process, what is the process of the updating step -- sorry. Let me clarify that.

Regarding the temporal relationship, which occurs earlier and which occurs later?

A. Selecting followed by updating.

Q. What is the purpose of the updating step?

A. There's no stated purpose in the claim.

Q. Would a POSITA have understood there to be a purpose for the updating step?

A. Yes.

Q. What would the POSITA understand to be the purpose?

A. An attempt to improve the performance of the pre-equalizer.

Q. How does the updating step improve the performance of the pre-equalizer?

A. Doesn't necessarily do so.

Q. How would a POSITA expect the updating step to achieve its goal in improving the performance of

a pre-equalizer?

A. So instead of taking initial pre-equalizer coefficient values in the first claim element and executing based on those, the -- Claim 1 calls for the updating of those coefficients based on information gained during a training phase.

Q. Is one of the motivation for doing the training phase that the actual channels' characteristics does not actually match those of the channel model?

MR. TIPESCU: Objection to form.

THE WITNESS: I think I heard the question directly, but could you please repeat it.

Q. (By Mr. Qiu) Yeah. Sure. Sure.

So my understanding is that you need a -- like, one needs a training phase, because the characteristics of an actual channel model -- sorry. Strike that question.

Let me try it again.

My understanding is that one needs a training phase, because the characteristics of the actual channel often does not exactly match that of

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a channel model; is that a correct understanding?

MR. TIPESCU: Objection to form.

THE WITNESS: Well, by modifying the pre-equalizer coefficients, you are changing the relationship to create a new -- a correspondence to a different channel model.

So to the extent that what the initial values store are some set of values that were established earlier in time, the updating provides a mechanism to adjust those coefficient values based on information obtained by actually probing and measuring the channel during the training phase.

It's not to say that the training phase will actually improve the performance. May or may not, but that's not a requirement of the claim; just that there be an updating.

Q. (By Mr. Qiu) Does Claim 1 allow the possibility that multiple candidate set of initial pre-equalizer coefficient values are -- can act as a starting point for a channel?

MR. TIPESCU: Objection to form.

THE WITNESS: Yes. So it says "selecting

one of multiple registers."

Q. (By Mr. Qiu) Please go to your declaration, which is Exhibit 2017. Please go to Paragraph 75.

A. Yes. I'm there.

Q. This paragraph mentions a term named --

(Stenographer clarification.)

Q. (By Mr. Qiu) -- "model-based register" --

(Stenographer clarification.)

Q. (By Mr. Qiu) -- "organization."

What does this term mean?

A. Claim 1 of the '111 requires a structure with multiple registers, and those registers are differentiable by their relationship to different channel models.

Q. How do you -- how would a POSITA tell if registers are organized in a way that is model-based?

MR. TIPESCU: Objection to form.

THE WITNESS: Because the -- the value contained within the registers represents different channel models.

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Q. (By Mr. Qiu) Does it require a data structure that stores the --

(Stenographer clarification.)

Q. (By Mr. Qiu) -- representation information?

A. What is "it"?

Q. "It" means the model -- the term you used, the model-based register organization.

Does this term require a data structure that stores, like, information regarding which register represents which channel model?

MR. TIPESCU: Objection to form.

THE WITNESS: I've not expressed that opinion.

Q. (By Mr. Qiu) So how would a POSITA know that the value contained within the registers represents different channel models?

MR. TIPESCU: Objection to form.

THE WITNESS: As we discussed earlier, different equalizer coefficient values represent different channel models.

Q. (By Mr. Qiu) Please go to Paragraph 77 of

your declaration.

A. Yes.

Q. There, you mention the term called "input characterization."

My question is: What does that term mean?

A. So Berke -- Berke's whitelist is based on experientially observed performance and just remembers what has occurred in the past, as opposed to determining a particular channel model and obtaining coefficients for that channel model.

Q. I understand that's a -- that's opinion on Berke; what Berke teaches.

But my question is: What -- what does "input characterization" mean?

(Stenographer clarification.)

MR. QIU: That's correct.

THE WITNESS: Yes.

So Berke is trying something and observing the output, and the claim calls for characterizing what a channel -- potential channel model is as an input. So Berke -- as a result, the claim calls for actually a priori looking at different channel

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models.

So the concrete example, a particular wire that is a certain length, certain gauge, a certain metal composition, will have a particular frequency response and free space. That is mathematically determined.

A set of coefficients for a pre-equalizer can be a priori determined for that cable at a certain operating temperature.

Q. (By Mr Qiu) So the --

(Stenographer clarification.)

MR. QIU: Sorry. It's my accent.

THE WITNESS: The metal composition.

Q. (By Mr. Qiu) Yeah.

Regarding the properties like the wire's length, gauge, and metal composition, are those properties that are known during the design and manufacturing of the channel?

A. Of a cable? Could be.

Q. Sure.

A. Could be. If it's a wired cable.

Q. And you also mentioned the operating

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temperature. Is that something only known during operation of the cable?

A. Well, engineeringwise, there would be a set of specs for operating environment.

Q. Oh. So, basically, during design, the engineers can specify the -- a range of operating temperature for the cable; is that correct?

A. Correct. That's just a concrete example.

Q. Is it your opinion that Claim 1 requires a process where one must first determine an -- let me strike that question. Sorry.

Are the ones you mentioned earlier, are they the only input characterization, or are there other input characterizations?

A. You mean are there other parameters that affect the channel model? Is that what you --

Q. No. I mean, I'm specifically asking for the meaning of your input characterization term.

A. Oh. It's what we're talking about. So given I'm -- given that you're building a two-meter cable with particular gauge of wire with a particular -- with a particular wrap pattern for the

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wire with a particular set of insulation with particular impedence setting, et cetera, that -- you can mathematically characterize what you think the channel model should be as an initial value, and then you can adapt from there based on training.

That's -- that's fundamentally what the claim is talking about.

Q. Are properties like insulation and the impedence also things that are specified and known when a wire is designed?

MR. TIPESCU: Objection to form.

THE WITNESS: Specified as known? Yes, they can be.

Again, we're just -- we're talking about a concrete example. There are other examples here.

Q. (By Mr. Qiu) Can you think of other characterizations that would fall under input characterization?

A. Well, if we go on to the dependent Claim 2, we're talking about a chip-to-model channel. So in that case, it would be the type of printed circuit board, the -- the trace characterization, the

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connector pins characterization, the -- the wire from the plug to the actual transmitter. Those sorts of details would all affect the channel model. In other words, the physical -- the physical parameters of how that wave is going to be transmitted and received.

Q. Are -- are these physical parameters all known at the time the hardware that provides the channel is designed or -- I don't know, manufactured?

A. Some are --

MR. TIPESCU: Objection. Objection to form.

THE WITNESS: Some are; some aren't.

Q. (By Mr. Qiu) Can you please tell me which ones are knowable -- are known at the design stage and which are not known at the design stage.

A. Well, off the top of my head, I don't think I can give you a comprehensive list. But, in general, the -- the distance of the wire, the characteristics of the connectors, the composition of the wire, the gauge of the wire, the -- the

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frequency that the cable is intended to convey.

These are all aspects that are known as you build the cable or design the cable. The operating temperature, you can specify range, like we discussed, but the actual operating temperature of course will change.

The relationship with the cable to other cables for capacitive injection of energy into the cable, the injection of noise from other elements of the printed circuit board, the -- if you're plugging the cable into multiple different types of hosts, the actual design of the host electronics will change its layout, its composition, et cetera.

Q. Okay.

So the -- the categories that you mentioned later, such as temperature and testing the injection of energy and injection of noise, those are things that are only known during operation of the cable; is that correct?

A. In my example, yes.

Q. Is it your opinion that Claim 1 requires one to first characterize all of those features of a

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channel and then select a set of pre-equalizer coefficients?

A. No.

Q. Is there any of these characterizations that must be determined before one selects a set of pre-equalizer coefficients under Claim 1?

MR. TIPESCU: Objection to form.

THE WITNESS: No.

Q. (By Mr. Qiu) In that case, isn't it true that Claim 1 does not require one to first determine any characterization before selecting the pre-equalizer coefficients?

MR. TIPESCU: Objection to form.

THE WITNESS: Claim 1 doesn't require characterization of the channel.

Q. (By Mr. Qiu) Please go to Paragraph 78 of your declaration.

A. Yes.

Q. It mentions a term "discrete channel characteristics"; is that correct?

A. It does.

Q. How do you know when channel

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characteristics are discrete or not?

A. I guess you could put -- instead of "discrete," you could put particular channel characteristics in that sentence.

"Discrete" here just means that they're identifiable characteristics causing the creation of the channel model. For example, linked to the cable.

So Berke -- Berke has no concept of how long the cable is, for example, a priori. Berke just gains experiential knowledge based on his testing.

Q. You talked about physical properties of the channel and the environment. What about electrical properties of the channel such as, like, insertion loss and the frequency response? Are these discrete channel characteristics?

A. Yes.

Q. What are these properties -- sorry. That's a bad question. Scratch that.

Are these properties knowable during the design of a channel or only during operation of the

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channel?

MR. TIPESCU: Objection to form.

THE WITNESS: Let's take them one at a time.

Insertion loss depends on the environment that the cable's been placed in. So that's not knowable at manufacturing time. But there are ranges of insertion loss for particularly -- particular impedance-matching designs. So there's a -- there's a compromise value there.

And your other one was frequency response?

Q. (By Mr. Qiu) That's correct.

A. Frequency response -- the frequency response is the channel model. So not sure I understand what your question is there.

Q. So what other electrical properties are assessed and known during design of a channel?

A. Frequency of operation, the insulator, electrical characteristics, the physical -- the physical cable electrical characteristics in terms of susceptibility to outside noise, voltage range; things like that.

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Q. And are there electrical properties that are knowable -- knowable only during operation of the channel?

MR. TIPESCU: Objection. Form.

THE WITNESS: Yes.

Q. (By Mr. Qiu) Can you give me a few examples.

A. We talked about energy injection from capacitive coupling; reflection coefficients, near end and far end; the insertion loss. Those are all particular electrical characteristics of the actual operating environment that the cable finds itself in.

Q. How about package loss?

A. Packet loss?

Q. Package loss.

A. Package loss? Please clarify.

Q. So my understanding of package loss is a -- a signal loss caused by the packaging of the cable --

A. Oh. Well, that's what we've been talking about -- sorry. That's what we've been talking

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about. The -- the size of the insulators, the creation of the -- the number of twists per linear foot of the cable, the composition of the -- the connectors, the pin composition; those sorts of things are all characteristics of the physical build of the cable.

Q. And those -- those features were known at the design of the cable, I would assume; is that right?

MR. TIPESCU: Objection to form.

THE WITNESS: They're intended to be, yeah. Um-hum. So you can -- given -- given the design, you can calculate what you think the channel model should be. You don't have to experimentally determine it like Berke does.

Q. (By Mr. Qiu) Is it your opinion that Claim 1 excludes experimentally determining channel models?

MR. TIPESCU: Objection to form.

THE WITNESS: I have seen no disclosure in this case that would indicate that is true.

Q. (By Mr. Qiu) And then in Paragraph 78, it

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also mentions a phrase called "discrete model."

Does that refer to the mathematical concept of the numbers being discrete or continuous?

A. "Discrete" just meaning separate from the others.

Q. And "separate" here means different?

A. Yes. In Claim 1, there has to be different channel model -- there have to be registers corresponding to different channel models.

Q. And Paragraph 78 also mentions "define, characterize, or index to discrete models."

What does "defining a discrete model" mean?

A. So like we talked about, as you design the cable, you can -- you can create a channel model based on your design parameters. So it's defining a channel model.

Q. Is it your opinion that Claim 1 requires a step of defining a channel model?

A. I've not expressed that opinion.

Q. Sitting here, do you have an opinion on that topic?

A. Claim 1 requires that there be an initial

set of pre-equalizer coefficient values. That initial set has to correspond to different channel models, so that that is -- as opposed to Berke's method of experimentally determining the pre-equalizer coefficient values.

Q. What does "characterizing a channel model" mean?

A. "Characterize" can be either mathematically characterize or characterize a test, a manufacturing test.

Q. And how -- how does characterizing by manufacture test work?

A. There's a test jig that establishes a known environment for the cable, and a set of training capabilities is performed, the results of which are modeled to a channel model.

The results of that channel model would be inserted into one of the multiple registers of Claim 1.

Q. What does the "results of the channel model" mean?

A. The coefficient values for the particular

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architecture you're using for the pre-equalizer.

Q. So is it correct for me to understand that a channel model can be characterized either mathematically or using tests?

MR. TIPESCU: Objection to form.

THE WITNESS: A channel model is a mathematical model. So you would create the mathematical model based on -- based on design criteria.

You could also create the mathematical model based on experiential tests.

Q. (By Mr. Qiu) What does "indexing to channel models" mean?

A. In Berke, there's no concept of an index to a discrete channel model. It's just -- Berke just remembers "I did this before and it had this result, so I'm going to" -- "going to save that result."

Q. Thank you for your opinion on Berke, but I'm more interested in what you mean by "indexing to channel models."

How -- how would a POSITA tell that there is an index to channel models?

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MR. TIPESCU: Objection to form.

THE WITNESS: To discrete models?

Q. (By Mr. Qiu) Sure.

A. They would -- they would see a structure to allow an index to specify different channel models.

Q. Is that a data structure stored in memory?

A. Could be. There could be other ways to do that.

Q. What are other ways that you can think of?

A. Physical registers, rotary switches, resistors and capacitors. Lots of -- lots of ways to do discrete logic.

Q. Is it your opinion that Claim 1 requires a data structure representing an index that is saved somewhere?

MR. TIPESCU: Objection to form.

THE WITNESS: My opinion is that Claim 1 requires multiple registers and the ability to select those multiple registers.

Q. (By Mr. Qiu) That doesn't quite answer my question. Let me try again.

Is it your opinion that Claim 1 requires a

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data structure representing an index to that -- strike that.

Is it your opinion that Claim 1 requires a data structure index to discrete models that is stored in some storage medium?

MR. TIPESCU: Objection to form.

THE WITNESS: I don't see that in the claim.

Q. (By Mr. Qiu) And then please go to Paragraph 79.

That paragraph mentions a term, "predefined channel representation."

Do you see that term?

A. I do.

Q. What is a channel representation?

A. Channel representation is a set of pre-equalizer coefficients that are representative of the channel model.

Q. How -- what does "predefined" mean in this term?

A. In the claim?

Q. Not in the claim; in -- in your

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declaration, Paragraph 79, the term "predefined."

A. As we discussed before, the input-based creation of the equalizer -- the pre-equalizer coefficient values, as opposed to experimentally determined pre-equalizer values.

Q. Does predefined require certain time?

A. Before now.

Q. Is it correct for me to understand that "predefined channel representation" means pre-equalizer coefficients that are derived based on characteristics of the channel?

(Stenographer clarification.)

MR. QIU: Predefined channel representation.

MR. TIPESCU: Objection -- I'm sorry. Go ahead.

(Stenographer clarification.)

(Record read.)

THE WITNESS: Yes.

Q. (By Mr. Qiu) Paragraph 79 of your declaration includes a phrase -- oh, actually, it's a sentence, that, "The organizing principle in Berke

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is output quality" --

(Stenographer clarification.)

Q. (By Mr. Qiu) -- "(robust eye performance), not an input model of the channel"; is that correct?

A. You read that correctly.

Q. How does Berke organize coefficients based on output quality?

A. Don't recall.

Q. So you concluded that the organizing principle in Berke is output quality, but you do not know how it organizes coefficients based on output quality; is that correct?

MR. TIPESCU: Objection. Form.

THE WITNESS: No. You're importing structural requirements into the word "organizing."

So the basic principle in Berke is output quality, not an input model of the channel. Organizing means -- that doesn't mean structurally -- creating structure.

Q. (By Mr. Qiu) How do you tell what the organizing principle is in Berke?

A. Read Berke and understand what he's talking

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about.

Q. How -- how would a POSITA know that the organizing principle is an input model of the channel?

MR. TIPESCU: Objection to form.

THE WITNESS: Because the pre-equalizer coefficients would be designed to model different channels.

And as I say in Paragraph 79, there's no disclosure in Berke that each whitelisted set of coefficients is organized around, indexed by, or defined to match a defined model of the channel or its characteristics as alleged by the petition.

Q. (By Mr. Qiu) How do you tell if a set of coefficients are indexed based on models of the channel?

A. In the claim, it's that each of the registers corresponds to a different channel model.

Q. I understand your reading of the claim, but my question is: How would a POSITA know that a certain system have sets of coefficients indexed based on models of the channel?

A. They would look at the register contents and observe that those registered contents relate to pre-equalizer coefficients that are corresponding to different channel models.

Q. What are the -- what is the registered contents?

A. The pre-equalizer coefficient values.

Q. By looking at the pre-equalizer coefficient values, how does a POSITA know that -- whether they are indexed or not indexed to different channel models?

A. If they are different, they are indexed to different channel models.

Q. Please go to Paragraph 80 of your declaration.

A. Yes.

Q. There, you mention a term called "model-based selection."

Do you see that term?

A. I do.

Q. What does "model-based selection" mean?

A. As I say in the declaration, "The claims

imply a model-based selection where the system identifies or assumes a channel model and selects the register that corresponds to it. Berke provides no mechanism for identifying a channel model or mapping an identified model to a particular register."

Q. How does a system identify a channel model? Is that by certain software programs?

MR. TIPESCU: Objection to form.

THE WITNESS: That's outside the scope of the claim. Don't understand why you're asking that question.

Q. (By Mr. Qiu) I ask that because you mentioned it, and I'm a little confused about what you mean by "the system identifies or assume a channel model."

I think you represent that as a limit -- a requirement by Claim 1. So I want to understand what you mean by that term.

A. I don't import that limitation. So let's talk about a specific case. Maybe that will clarify things.

This is just an example. If I plug a 1-meter cable into a host, that host is capable of -- and the cable are capable of understanding that the cable is a 1-meter cable. And the channel models corresponding to a 1-meter cable can be prestored in the cable for communication between the host and the cable.

So that intelligence, that algorithm that you're looking for is not part of the claim, but that's an example of how a POSITA would -- would use it.

Q. So model-based selection would mean -- I don't want to put words in your mouth, but my understanding is that you used model-based selection to mean that the selection of a set of pre-equalizer coefficients is based on knowledge about certain characteristics of a model. Is that a --

A. Yes. Yes, that's what I mean by input-based rather than output-based.

So Berke just tries whatever he can and -- and captures whatever the result was, rather than looking at the mathematics of the situation.

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Q. Is it -- is it your opinion that Claim 1 requires model-based selection?

A. As opposed to experimental-based selection, yes; that's my -- that's one of the distinctions with Berke and the -- and the '111 patent.

Q. Is it your understanding that Claim 1 excludes trying multiple sites of pre-equalizer coefficients and taking the best from them by experimental measurements?

MR. TIPESCU: Objection to form.

THE WITNESS: In situ?

Q. (By Mr. Qiu) I didn't hear.

A. In situ?

Q. In situ?

A. In place. Operating.

Q. Sure. Sure. Let's say in situ.

A. Can I have a clean question.

(Stenographer clarification.)

MR. QIU: Maybe I should rephrase it.

Q. (By Mr. Qiu) Is it your opinion that Claim 1 excludes the approach of running and testing multiple sets of pre-equalizer coefficients in situ

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and selecting one of them based on experimental measurements?

A. Yes.

Q. Please go to Paragraph 153 of your declaration.

A. I'm there.

Q. One of the sentence near the end is that, "One could simply select the preset that corresponds to the current channel model which would be much more efficient."

Do you see that sentence?

A. I do.

Q. What does the term "one" refer to?

A. A POSITA.

Q. What does the phrase "the current channel model" mean?

A. The -- the model corresponding to the environment that the cable is currently being deployed in.

Q. So in that sentence, are you assuming that there is already a preset that perfectly matches this model?

A. Doesn't have to be perfect.

MR. TIPESCU: Objection to form.

THE WITNESS: That's why you update in the claim.

Q. (By Mr. Qiu) And how do you -- how would a POSITA select the preset that corresponds to the current channel model in that scenario?

A. Well, as we discussed before, knowledge that you're dealing with a 1-meter cable and you're plugging into a Dell server, for example, that gives you a particular set of information about what the channel model is.

Q. So is it correct to understand that you can pick the corresponding preset by determining certain characteristics of the current channel and use them to pick the preset?

A. Certain --

MR. TIPESCU: Objection to form.

THE WITNESS: Certain characteristics of the current environment, not the channel.

Q. (By Mr. Qiu) Right.

A. So all that intelligence is outside of the

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claim; need the algorithm to figure that out.

Q. Please go to Paragraph 75 of your declaration. There, you mention the phrase called "general background awareness of channel conditions" --

A. Yes.

Q. -- is that right?

What does "general background awareness of channel conditions" mean?

A. Answering your question, "Is that right?" yes, those words are in that.

Q. Sorry. I should wait for you to read it.

A. Yeah. What does that mean?

Q. Um-hum.

(Stenographer clarification.)

THE WITNESS: Please ask another question.

Q. (By Mr. Qiu) Sure, sure.

What does "general background awareness of channel conditions" mean?

A. In other words, the general understanding of the temperature, the operation, the noise environment, the electrical environment; that sort

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of thing.

Q. Please go to Paragraph 82 of your declaration.

A. Yes.

Q. There's a sentence -- it's the second sentence, "But awareness that channel characteristics influence equalization is fundamentally different from defining discrete channel models and indexing equalization coefficient registers to those models." Do you see that sentence?

A. Yes.

Q. What is the difference between background awareness and channel models?

A. So in one case, you're -- you're aware of the characteristics of the channel; in the other case, you have a model based on the mathematics of the situation that is defining the pre-equalization coefficients.

Q. If you see a system with multiple sets of pre-equalizer coefficients stored, how do you tell those coefficients are generated based on background

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knowledge of the -- based on background awareness of channel conditions or whether they are created based on channel models?

A. Well, as we talked about before, any set of register values would relate to a channel model, but the initial pre-equalizer coefficient values that are corresponding to different channel models are different than initial pre-equalizer coefficient values that were just randomly determined.

Q. Is the key requirement the -- the procedure to determine the pre-equalizer coefficient values?

MR. TIPESCU: Objection to form.

THE WITNESS: I have not expressed that opinion.

(Stenographer clarification.)

Q. (By Mr. Qiu) Does Claim 1 require deriving a mathematical model for a channel?

MR. TIPESCU: Objection to form.

THE WITNESS: Deriving -- as I testified, the channel model is a mathematical model, and that relationship between the pre-equalizer -- the pre-equalizer values that are contained with the

multiple registers initially and the channel models must be present.

MR. QIU: Okay.

I think we can take a break.

THE STENOGRAPHER: We're off the record. The time is 2:02 p.m.

(Recess taken from 2:02 p.m. to 2:17 p.m.)

THE STENOGRAPHER: We're back on the record. The time is 2:17 p.m.

Q. (By Mr. Qiu) Dr. Williams, can you please go to Exhibit 1004, which is Berke, and Paragraph 13.

A. Yes.

Q. There's a sentence -- the first sentence of this paragraph, it says, "Serial channel 100 operates to provide back-channel adaptation where transmitter 110 and the receiver 130 communicate with each other to optimize and adjust various compensation values within the transmitter and the receiver to compensate for the insertion loss and other signal degradation of transmission channel 120."

Is that an accurate read of that sentence?

A. You read that correctly.

Q. So a POSITA reading this, how would a POSITA understand the nature of the communication between the transmitter and the receiver in this mechanism?

A. The mechanism of the communication --

Q. Um-hum.

A. -- is not specified.

Q. Would a POSITA have a general understanding of back-channel adaptation?

MR. TIPESCU: Objection. Form.

THE WITNESS: Well, not that term specifically, but they would have an understanding of providing a back channel to convey information between the two ends of the channel.

Q. (By Mr. Qiu) Was it a common approach for the receiver to send instructions to the transmitter requesting the transmitter to modify its equalization coefficients?

MR. TIPESCU: Objection. Form.

THE WITNESS: At what point in time? In

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what technology?

Q. (By Mr. Qiu) In serial communication, and in the 2017/2018 time frame.

A. Don't recall.

Q. Does a back channel allow the receiver to directly modify the coefficients used by the transmitter?

MR. TIPESCU: Objection to form.

THE WITNESS: Depends on the characteristics of the back channel and the algorithms, which aren't specified.

Q. (By Mr. Qiu) Are you able to give me an example as to how the transmitter and the receiver can communicate with each other to optimize and adjust compensation values?

(Stenographer clarification.)

MR. TIPESCU: Objection to form.

MR. QIU: Compensation values.

THE WITNESS: You want me to invent a methodology? I don't understand the question.

Q. (By Mr. Qiu) No, I'm not asking you to invent a methodology.

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But let me ask this way: Do you know of any method where the transmitter and the receiver can communicate with each other to optimize and adjust various compensation values that was known before 2018?

A. In the field of adaptive cables?

Q. Sure.

A. Not that I recall.

Q. Please go to Paragraph 19 of Berke.

A. Yes.

Q. Let me see where that is.

Please go to -- and it's on Page 3 -- one, two, three -- about 15 lines from the top on the left, there's a sentence starting with "In another embodiment."

A. Paragraph what? 19?

Q. Yes.

A. Page 3 -- oh, Page 3. 15 from the top. "In another embodiment, management module 116"?

Q. That's correct, yes.

A. Okay. I'm there.

Q. That sentence reads, "In another

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embodiment, management module 116 and" --

(Stenographer clarification.)

Q. (By Mr. Qiu) -- "channel management module 142 represent management traffic between transmitter 110 and receiver 130 that is communicated over transmission channel 120 and an additional transmission channel from receiver 130 to transmitter 110."

A. You read that correctly.

Q. What do you understand "management traffic" to mean?

A. Well, typically, in the -- in a communication -- in all communication environments, there's two types of information: One is user information; the other is structural management overhead information, control information.

That's -- it's talking about nonuser information.

Q. Why does there need to be management traffic?

A. In what?

MR. TIPESCU: Objection to form.

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Q. (By Mr. Qiu) In the system. Why does there need to be management traffic in the system of Berke?

MR. TIPESCU: Objection to form.

THE WITNESS: In the system of Berke, there has to be a way of communicating the decisions of the receiver back to the transmitter.

Q. (By Mr. Qiu) What is that decision?

A. Don't recall.

Q. Please go to Paragraph 33 of Berke.

Can you please review this paragraph for yourself and let me know when you finish.

A. I've read it.

Q. Is the control logic module 140 located at the transmitter or the receiver?

A. Figure 1 shows element 140 in the receiver.

Q. The paragraph also -- also mentions equalization coefficient whitelist 118 and 144. Where are they located?

A. Figure 1 shows element 118 in the transmitter, and Figure 1 shows element 144 in the receiver.

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Q. And let's go back to Paragraph 33, the last sentence in that paragraph.

It states, "If the performance of serial channel 100 falls below the desired performance level, then control logic module 140 selects a second wireless set of equalization coefficients from equalization coefficient whitelist 118 and 144."

Is that an accurate read of that sentence?

A. It is.

Q. After the control module -- control logic module selects -- strike that question.

How does the control logic module select whitelist set of equalization coefficients from the whitelist 118 when the control logic module is on the receiver and the whitelist is on the transmitter?

A. I don't understand the question. The whitelist is present in both transmitter and receiver.

Q. Yeah, I'm -- let me reframe the question.

I want to focus on the whitelist 118 on the

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transmitter.

A. Yes. But, presumably, 118 and 144 contain duplicate copies of each other. So these are known -- this is known information at each end of the channel.

Q. After the selection of the second whitelist set -- let me -- strike that.

Please go to Exhibit 1001. It is the '111 patent.

The passage I want you to read is Column 14 from Line 12 to Line 56.

A. 12 to 56.

Q. That's correct. The column is 14.

A. Yes. Okay.

Q. Is it fair to say that this passage describes a process for selecting initial pre-equalizer coefficients and then adapting the coefficients?

A. Yes.

MR. TIPESCU: Objection to form.

Q. (By Mr. Qiu) Please read the sentence at Lines -- Column 14, Lines 47 to 51, starting with

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"In block 820."

A. Yes. Read it out loud?

Q. No. Just read to yourself. That's fine.

A. Okay.

Q. Is it correct to say that the controller is located at the receiver side?

A. It is.

Q. Please read the sentence at Column 14, Lines 38 to 40, starting with, "Then, in Block 812."

A. Yes.

Q. Which component provides the instruction to the remote transmitter?

MR. TIPESCU: Objection to form.

THE WITNESS: Which component? You mean which end of the -- of the channel?

Q. (By Mr. Qiu) That's fine too.

A. The receiver.

Q. Here, does the transmitter or the receiver select the best register?

A. The decision-maker is the receiver -- is in the receiver.

MR. TIPESCU: Objection to form on the last

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question too.

Q. (By Mr. Qiu) Please read the next sentence at Column 14, Lines 40 to 43 -- let me read it.

"The remote transmitter programs the pre-equalizer with the preset coefficients from the selected register and transmits a" --

(Stenographer clarification.)

Q. (By Mr. Qiu) -- "training" --

THE WITNESS: Pattern.

Q. (By Mr. Qiu) -- "pattern and/or data."

A. You read that correctly.

Q. In this step, does the remote transmitter select the coefficients in the register for programming the pre-equalizer?

MR. TIPESCU: Objection to form.

THE WITNESS: It's not clear from that sentence.

What is clear is the decision the -- the decision made in the receiver is communicated back to the transmitter, which causes new pre-equalizer coefficients to be established in the training -- in the transmitter and, subsequently, the transmitter

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transmits the training pattern and/or user data.

Q. (By Mr. Qiu) Who establishes the new pre-equalizer coefficients in the transmitter?

MR. TIPESCU: Objection. Form.

THE WITNESS: The actual values? Not -- it's not clear from this sentence.

Q. (By Mr. Qiu) Please go to Column 14, Lines 51 to 56.

A. Yes.

Q. I'll read the sentence.

"The adaptation information may be applicable to the CTLE filter, any FFE filter that may be present, and the feedback filter of the DFE (referred to herein as 'local' adaptation information info), as well as to the pre-equalization" --

(Stenographer clarification.)

Q. (By Mr. Qiu) -- "filter of the remote node (referred to herein as 'remote' adaptation info)."

A. You read that correctly.

Q. Which device applies adaptation information to the pre-equalization filter of the remote node?

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MR. TIPESCU: Objection to form.

THE WITNESS: Can I have the question again, please.

Q. (By Mr. Qiu) Which device applies adaptation information to the pre-equalization filter of the remote node?

MR. TIPESCU: Objection to form.

THE WITNESS: The transmitter.

Q. (By Mr. Qiu) Please go to Paragraph 87 of your declaration, which is Exhibit 2017.

A. Yes.

Q. Is it your opinion that Claim 1 requires one transceiver to perform all three steps, [1a], [1b], and [1c]?

A. Yes.

Q. Is it your opinion that no other transceiver can participate in this process?

MR. TIPESCU: Objection. Form.

THE WITNESS: The claim calls for a transceiver.

Q. (By Mr. Qiu) So it is your opinion that no other transceiver can participate in this process;

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correct?

MR. TIPESCU: Objection to form.

THE WITNESS: It's my opinion that the -- any transceiver means a singular article transceiver, not a transceiver -- not transmitter and receiver spread across the channel.

Q. (By Mr. Qiu) Does Claim 1 preclude another transceiver from contributing to performing the steps of [1a], [1b], and [1c]?

MR. TIPESCU: Objection to form.

THE WITNESS: Calls for a legal interpretation. I'm not a lawyer.

Q. (By Mr. Qiu) Sitting here, do you have an opinion as to whether Claim 1 precludes another transceiver from contributing to performing these steps?

MR. TIPESCU: Objection to form.

THE WITNESS: Yes.

Q. (By Mr. Qiu) What is your opinion?

A. That these steps have to be performed within a single transceiver.

Q. So your opinion is that Claim 1 does

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preclude another transceiver from performing Steps [1a], [1b], and [1c]; correct?

MR. TIPESCU: Objection to form.

THE WITNESS: No. My opinion is that a transceiver has to be -- has to be present for selecting in -- and performing the steps of the method of selecting --

(Stenographer clarification.)

THE WITNESS: -- for the method comprising selecting, updating, and using.

Q. (By Mr. Qiu) Does Claim 1 preclude another transceiver from being present for performing the steps of selecting, updating, and using?

MR. TIPESCU: Objection to form. Asked and answered.

THE WITNESS: Calls for a legal conclusion. I'm not an attorney.

Q. (By Mr. Qiu) Sitting here, do you have an opinion regarding whether Claim 1 precludes another transceiver from being present for performing the steps of selecting, updating, and using?

MR. TIPESCU: Objection to form. Asked and

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answered.

THE WITNESS: I've already answered that question.

Q. (By Mr. Qiu) What was your answer?

A. See the transcript.

Q. I don't believe you have answered that question, so -- because you made multiple statements about which of those statements apply to the answer of this question.

A. All of them.

MR. TIPESCU: Object -- hold on.

Objection to form.

There's no question pending.

Q. (By Mr. Qiu) Does Claim 1 require all three steps be exclusively performed by one transceiver?

MR. TIPESCU: Objection to form.

THE WITNESS: Yes.

Q. (By Mr. Qiu) Can you please open Exhibit 1001, which is the '111 patent.

A. Yes.

Q. Please go to Claim 11, which is on

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Column 16 of the document.

A. Yes.

Q. There's a limitation in Claim 11 stating that, "A controller having multiple registers, each of the multiple registers containing a set of initial coefficient values for which the port transceiver determines a performance characteristic"; is that correct?

A. You read that correctly.

Q. What does "performance characteristic" mean?

A. Some figure of merit --

MR. TIPESCU: Objection -- object to form.

THE WITNESS: Some figure of merit relative to the performance of -- of the circuit.

Q. (By Mr. Qiu) Can you give me an example of a figure of merit.

A. Bit Error Rate.

Q. Are there any other examples that you can give?

A. Means Squared Error.

Q. Anything else?

A. Block Error Rate.
Q. Anything else?
A. Packet Error Rate.
Q. Anything else?
A. Frame Error Rate.
Q. Anything else?
A. Can't think of anything else.
Q. How are the performance characteristics measured, typically, in the field?
MR. TIPESCU: Objection to form.
THE WITNESS: Depends which characteristic we're talking about.
Q. (By Mr. Qiu) Let's talk about Bit Error Rate. How -- how is the Bit Error Rate measured?
A. We discussed that this morning.
Q. Are the performance characteristics measured based on signals received by the receiver?
MR. TIPESCU: Objection to form.
THE WITNESS: Depending on the characteristic, can be.
Q. (By Mr. Qiu) Which of the characteristics is measured based on signals received by the

receiver?

MR. TIPESCU: Objection to form.

THE WITNESS: Bit Error Rate, Block Error Rate, Packet Error Rate, Frame Error Rate.

Q. (By Mr. Qiu) Is eye diagram generated based on signals received by the receiver?

MR. TIPESCU: Objection to form.

THE WITNESS: Generated? It is observed.

Q. (By Mr. Qiu) Is eye diagram observed based on signals received by the receiver?

A. Can be.

MR. TIPESCU: Objection to form.

Q. (By Mr. Qiu) Is there any performance characteristic that is not measured based on signals received by the receiver?

MR. TIPESCU: Objection to form.

THE WITNESS: Delivered power, signal-to-noise ratio, doesn't require a receiver.

Q. (By Mr. Qiu) Anything else?

A. Peak-to-average power.

Q. Anything else?

A. Not that I can think of.

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Q. Please go to Paragraph 106 of your declaration, which is Exhibit 2017. It's a very long paragraph. I'm looking at the last passage at the bottom of Page 45.

A. Okay.

Q. There's a sentence in this passage saying, "But Berke performs this evaluation and selection within a single endpoint system where the receiver directly observes the transmitter signal."

Do you see that sentence?

A. I do.

Q. What does this "single endpoint system" term refer to?

A. A system with a transmitter and a receiver in different locations. Not a -- not a transceiver.

Q. What is the single endpoint in this term?

A. A single transmitter, a single receiver.

Q. Is Berke's transmitter receiver separated by a channel?

A. Yes.

Q. So I'm confused -- or, actually, strike that.

What do you mean by, "The receiver directly observes the transmitter signal"?

A. Can I have the question again, please.

Q. Sure.

What do you mean by, "The receiver directly observes the transmitter signal"?

A. In both Berke and Cornelius, the -- the transmitter and the receiver are separated by a channel, and the receiver is directly listening to the transmitter, as opposed to the claim where this is a chip-to-module communications where there's a transceiver that's coupled to the pluggable module transceiver. There's a port transceiver coupled to the pluggable module transceiver.

The pluggable module transceiver itself includes the transmitter and the receiver, and the controller is implementing coefficient values for the port transceiver based on information obtained at the pluggable module transceiver. These are different architectures.

Q. For the architecture that you mentioned for the claim, is there a channel between the pluggable

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module transceiver and the port transceiver?

A. Yes.

Q. So what's the difference of that --

(Stenographer clarification.)

Q. (By Mr. Qiu) -- architecture from the architecture of Berke and Cornelius?

MR. TIPESCU: Objection to form.

THE WITNESS: So the decision-maker in 11 is the port transceiver, not a pluggable module transceiver receiver. The intelligence is at the other end of the channel.

Q. (By Mr. Qiu) And is it your opinion that for Berke and Cornelius, the decision-maker is in the pluggable module transceiver?

A. No. They don't disclose pluggable module transceivers. They just disclose the transmitter and receiver, and their decision-makers are the receivers.

Q. Is there any difference between the architecture of the Claim 11 and the architecture of Berke and Cornelius?

A. Yes.

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MR. TIPESCU: Objection to form.

Just hold on. I'm sorry. Just give me a chance to object.

So objection to form on that one.

Q. (By Mr. Qiu) What are -- what are other differences?

A. Well, principal one is who is the decision-maker. Also, Berke and Cornelius are not transceivers.

Q. Anything else?

A. There are other things. I can't think of them right off the top of my head.

Q. Can you please go to the bottom of Page 45.

There's a sentence, "Under Petitioner's mapping for Claim 11, this process must occur across the chip-to-module boundary. The port transceiver (host receiver) must evaluate coefficient sets stored in the module's controller and select among them."

Do you see that sentence?

A. I do.

Q. How does the port transceiver evaluate

coefficient sets stored in the module's controller?

MR. TIPESCU: Objection to form.

THE WITNESS: There's no restriction in the claim on how it determines that.

Q. (By Mr. Qiu) Can it -- well, strike that question.

A. Sorry. Let me extend --

Q. Sorry. Go ahead.

A. Let me extend that.

Dependent Claims 12, 13 -- yeah, 12 and 13, talk about particular performance characteristics.

Q. Does this evaluation allow the port transceiver to observe the signals from the module transceiver and use that to evaluate the coefficient sets at the module transceiver?

A. Yes.

MR. TIPESCU: Object to form.

THE WITNESS: Yes.

Q. (By Mr. Qiu) Please go to Exhibit 1009, which is the Mejia reference.

I'm sharing it in the chat box. Please let me know when you get access.

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A. Have it.
Q. Okay.
Can you please go to Paragraph 31 of Exhibit 1009.
A. I'm sorry. 31?
Q. Yeah. 31.
A. All right. Okay.
I'm there.
Q. Can you please read this paragraph to yourself.
A. Okay.
Q. The last sentence states, "Some embodiments may also recommend the best equalization preset values based on information from the RX (Receive) circuits."
Is that an accurate read of that sentence?
A. Yes, it is.
Q. What does "information from the RX (Receive) circuits" refer to?
A. Can I have the question again, please.
Q. Sure.
What does "information from the RX

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(Receive) circuits" refer to?

A. Sorry. I've lost the paragraph. 31?

Q. Yes. It is the last sentence of Paragraph 31.

A. I apologize. Can I have the question one more time.

Q. Sure.

What does -- what does "information from the RX, or receive, circuits" in this sentence refer to?

A. Answer: It's unclear.

Q. Do you have an opinion as to what this information refers to?

A. Not that I haven't expressed.

Q. Please go to Paragraph 162 of your declaration.

A. Yes.

Q. Let's see. There's a sentence in this paragraph. I'll read it.

"Whatever entity provides the recommendation in Mejia, it clearly is not the RX (Receive) circuits, because Mejia explains that

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the recommendation may be based on information from the RX (Receive) circuits."

Is that a correct reading of that sentence?

A. It is.

Q. Am I correct to understand that you are saying that Mejia's (Receive) circuit only determines the information used to make the recommendation but does not provide the recommendation itself; is that correct?

A. Yes.

THE WITNESS: I'd like to take a break.

MR. QIU: Okay.

Let's take a break then.

THE STENOGRAPHER: We're off the record. The time is 3:16 p.m.

(Recess taken from 3:16 p.m. to 3:30 p.m.)

THE STENOGRAPHER: We're back on the record. The time is 3:30 p.m.

Q. (By Mr. Qiu) Dr. Williams, can you please go to Paragraph 114 of your declaration.

A. Yes.

Q. Can you please read this paragraph to

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yourself.

A. I did.

Q. Okay.

What does "one-tap-at-a-time" mean in this paragraph?

A. Can I have the Ran.

(Stenographer clarification.)

THE WITNESS: Can I have the Ran reference.

Q. (By Mr. Qiu) Sure. Sure. You can access Ran reference, which is Exhibit 1006.

A. From my files, or are you going to give them to me?

Q. Let me see. Just give me a minute. Yeah, let me -- let me upload it. Sorry.

A. Can I have the question again, please.

Q. The question. What does the term "one-tap-at-a-time" mean?

A. The algorithm of Ran is just incrementing and decrementing a value and its exploration of the -- of the equalizer space.

Q. So -- so if adaptation mechanism can change more than one tap at a time, it would not be

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one-tap-at-a-time; is that correct?

A. Seems like a tautology.

Q. So do you agree with that?

A. Is more than one, more than one? Yes.

Q. So is it your opinion that Ran's equalization adaptation protocol allows changing, at most, one equalization coefficient at a time; is that right?

MR. TIPESCU: Objection to form.

THE WITNESS: Can I have the question again, please.

Q. (By Mr. Qiu) Yes.

It is your opinion that Ran's equalization adaptation protocol allows changing, at most, one equalization coefficient at a time; correct?

MR. TIPESCU: Objection to form.

THE WITNESS: Correct.

Q. (By Mr. Qiu) What does the term "comprehensive sweep" mean in the paragraph -- let me give the paragraph number -- in Paragraph 114 of your declaration?

A. In other words, changing multiple variables

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at the same time and then measuring the result and then changing another set of variables and measuring that result.

Q. Does it require the training process to never change an individual equalization coefficient at a time?

A. You mean -- what is "it"?

Q. Does comprehensive sweep require the training process to never change an equalization coefficient at a time?

A. Yes.

Q. It is your opinion that Berke does not allow changing one equalization coefficient at a time; correct?

A. It's not disclosed in Berke.

Q. Do you have an opinion as to whether Berke allows changing one equalization coefficient at a time?

A. Yes.

Q. What is your opinion?

A. Berke requires a comprehensive sweep changing multiple parameters simultaneously.

Q. Next, please go to Paragraph 113 of your declaration.

A. Yes.

Q. Can you please read this paragraph to yourself.

A. Yes.

Q. This -- this paragraph includes a sentence stating "Berke's system operates within a single endpoint"; is that right?

A. Yes. We discussed that before.

Q. What is the single endpoint in this sentence?

A. It operates in the receiver or in the transmitter, each of which is a single endpoint; not a transceiver.

Q. Again, this paragraph includes a sentence -- let me see. Where is it?

Is the key difference between Berke and Ran's systems that Ran's communication is not direct but includes a device that facilitates the communication?

MR. TIPESCU: Objection to form.

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THE WITNESS: You could say that.

Q. (By Mr. Qiu) Is there any other difference between the two systems?

A. Well, other than what I described in my declaration, not that I can think of.

Q. Please go to Paragraph 147 of your declaration.

A. Yes. Yes.

Q. There, you mention Ran's --

(Stenographer clarification.)

Q. (By Mr. Qiu) -- five-step request response selection procedures.

A. I do.

Q. What are the five steps?

A. Those are outlined in Paragraph 116 in my report.

Q. Paragraph 116 in your declaration?

A. Yes.

Q. This is a procedure for communicating an adjustment to equalizer settings from a receiver to a transmitter; correct?

A. What is "this"?

Q. Ran's five-step selection process.
A. Can I have the question again.
Q. Sure.
Ran's five-step request response selection procedures is a procedure for communicating an adjustment to equalizer settings from a receiver to a transmitter; correct?
A. Yes.
Q. Does the five steps involve making the decision as to which preset to select?
A. No.
Q. Does the five steps involve evaluating the performance of different presets of equalization coefficients?
A. No.
MR. QIU: Can we take a quick break. Also, I'll check whether I have any additional questions for Dr. Williams.
THE STENOGRAPHER: We're off the record. The time is 3:52 p.m.
(Recess taken from 3:52 p.m. to 4:06 p.m.)
THE STENOGRAPHER: We're back on the

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record. The time is 4:06 p.m.

MR. QIU: I just have a few more questions for Dr. Williams.

Q. (By Mr. Qiu) Doctor, have you heard about the term --

(Stenographer clarification.)

Q. (By Mr. Qiu) -- "Root Means Square"?

A. Yes.

Q. In what context did you hear about it?

A. My education.

Q. What is the concept "Root Means Square" used for?

MR. TIPESCU: Objection. Form.

THE WITNESS: I don't understand the question.

Q. (By Mr. Qiu) In what context do people calculate Root Means Square?

MR. TIPESCU: Objection. Form.

THE WITNESS: Voltage, current, power, et cetera. It's just a -- just a formula.

Q. (By Mr. Qiu) Is the use of Root Means Square limited to calculating random --

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(Stenographer clarification.)

Q. (By Mr. Qiu) -- jitter?

A. No. It's just a -- it's just a formula.

MR. QIU: Okay.

That's all my questions for Dr. Williams.

(Stenographer clarification.)

MR. TIPESCU: I have no question -- or questions for Mr. Williams.

THE STENOGRAPHER: Thank you.

Before we go off the record, Counsel, Mr. Tipescu, would you like to order a copy of today's transcript?

MR. TIPESCU: Yes, please.

THE STENOGRAPHER: Thank you.

Is it okay to go off the record?

MR. QIU: Yes.

MR. TIPESCU: Yes.

THE STENOGRAPHER: Thank you.

We are off the record. The time is 4:08 p.m.

(Whereupon, the deposition of DR. TIM ARTHUR WILLIAMS concluded at 4:08 p.m.)

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I, HEATHER J. BAUTISTA, CSR No. 11600, Certified Shorthand Reporter, certify:

That the foregoing proceedings were taken before me at the time and place therein set forth, at which time the witness declared under penalty of perjury; that the testimony of the witness and all objections made at the time of the examination were recorded stenographically by me and were thereafter transcribed under my direction and supervision;

That the foregoing is a full, true, and correct transcript of my shorthand notes so taken and of the testimony so given;

( ) Reading and signing was requested/offered.

(XX) Reading and signing not requested/offered.

( ) Reading and signing was waived.

I further certify that I am not financially interested in the action, and I am not a relative or employee of any attorney of the parties, nor of any of the parties.

I declare under penalty of perjury under the laws of California that the foregoing is true and correct.

Dated: July 27, 2026

HEATHER J. BAUTISTA, CSR, CRR, RPR, CLR

Case: Marvell Semiconductor, Inc. vs Credo Technology Group Ltd.
Witness Name: Dr. Tim Williams
Deposition Date: 07/21/2026

Please be advised that the transcript in the above referenced matter is now complete and ready for signature. The deponent may come to this office to sign the transcript, a copy may be purchased for the witness to review and sign, or the deponent and/or counsel may waive the option of signing. Please advise us of the option selected. Please forward the errata sheet and the original signed signature page to counsel noticing the deposition, noting the applicable time period allowed for such by the governing Rules of Procedure. If you have any questions, please do not hesitate to call our office at (202)-232-0646.

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SIGNATURE PAGE

Case: Marvell Semiconductor, Inc. vs Credo Technology Group Ltd.

Witness Name: Dr. Tim Williams

Deposition Date: 07/21/2026

I do hereby acknowledge that I have read and examined the foregoing pages of the transcript of my deposition and that:

(Check appropriate box):

( ) The same is a true, correct and complete transcription of the answers given by me to the questions therein recorded.

( ) Except for the changes noted in the attached Errata Sheet, the same is a true, correct and complete transcription of the answers given by me to the questions therein recorded.

_____ _____
DATE WITNESS SIGNATURE

_____ _____
DATE NOTARY

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Errata Sheet

NAME OF CASE: Marvell Semiconductor, Inc. vs Credo Technology Group Ltd.

DATE OF DEPOSITION: 07/21/2026

NAME OF WITNESS: Dr. Tim Williams

Reason Codes: 1. To clarify the record.

2. To conform to the facts.

3. To correct transcription errors.

Page _____ Line _____ Reason _____

From _____ to _____

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_____

DR. TIM WILLIAMS

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