Transcript of Darrin J. Young, Ph.D.

Date: April 1, 2025
Case: Smaxtec Inc., et al. -v- ST Reproductive Technologies, LLC (PTAB)

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WORLDWIDE COURT REPORTING & LITIGATION TECHNOLOGY

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

SMAXTEC INC. and SMAXTEC ANIMAL CARE GMBH,	)	
Petitioners	)	CASE IPR2024-01067
	)	Patent No. 10,231,644
V.	)	
ST REPRODUCTIVE TECHNOLOGIES, LLC,	)	
Patent Owner	)	

ORAL, REALTIMED, VIDEOTAPED DEPOSITION OF

DARRIN J. YOUNG, Ph.D.

APRIL 1, 2025

JOB NO.: 577708

PAGES: 1 - 289

REPORTED STENOGRAPHICALLY BY:

ANNETTE PELTIER, CSR, CRR

ORAL, REALTIMED, VIDEOTAPED DEPOSITION OF DR. DARRIN J. YOUNG, produced as a witness at the instance of the Patent Owner, and duly sworn, was taken in the above-styled and numbered cause on April 1, 2025, from 9:11 a.m. to 5:46 p.m., before Annette Peltier, CSR, Texas Certified Realtime Reporter, in and for the State of Texas, reported by machine shorthand, at the offices of Dechert LLP, 515 Congress Avenue, Suite 1400, Austin, Texas, 78701, pursuant to the PTAB Rules of Civil Procedure and the provisions stated on the record or attached hereto.

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A P P E A R A N C E S

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Exhibits

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Exhibit 1004	International Publication Number WO 2008/108816 A1.	268
Exhibit 1005	US Patent Application Publication 2009/0187392 A1	230
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THE COURT REPORTER: 09:11:50
Mr. Fisher, you're getting realtime today. 09:11:53
And would you like a rough draft at the end 09:11:57
of the day? 09:12:00
MR. FISHER: That would be 09:12:01
great. 09:12:08
THE COURT REPORTER: Okay. 09:12:08
That's it. 09:12:10
MR. FISHER: In terms of the 09:12:10
final, what's your normal turnaround time on 09:12:11
that? 09:12:13
THE COURT REPORTER: I think 09:12:19
we've been requested to do -- delivery of the 09:12:20
final is 4/8, which is a week from today. 09:12:22
MR. FISHER: Yeah, that's fine. 09:12:24
THE VIDEOGRAPHER: Here begins 09:12:37
media number 1 in the videotaped deposition 09:12:42
of Dr. Darrin J. Young in the matter of 09:12:44
SmaXtec, Inc., and SmaXtec Animal Care GmbH 09:12:50
versus ST Reproductive Technologies, LLC, in 09:12:56
the United States Patent and Trademark Office 09:13:01
Before the Patent and Trial -- Patent Trial 09:13:04

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And Appeal Board, Case Number IPR2024-01067. 09:13:08

Today's date is April 1st, 09:13:17

2025. The time on the video monitor is 9:13 09:13:20

Central time. 09:13:23

The videographer today is 09:13:24

Kollin Casarez, representing Planet Depos. 09:13:26

This video deposition is taking 09:13:27

place at Dechert LLP, Austin. 09:13:31

Would counsel please 09:13:33

voice-identify themselves for the record and 09:13:33

state whom they represent. 09:13:38

MR. FISHER: Michael Fisher of 09:13:38

Dechert LLP, representing the petitioners. 09:13:39

MS. MAHONEY: And this is Megan 09:13:44

Mahoney of Akin Gump representing the Patent 09:13:45

Owner. 09:13:49

THE VIDEOGRAPHER: The court 09:13:49

reporter today is Annette Peltier, 09:13:51

representing Planet Depos. 09:13:52

The witness will now be sworn. 09:13:54

09:14:09

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DR. DARRIN J. YOUNG,

Having been first duly sworn, testified upon his oath as follows:

EXAMINATION

BY MS. MAHONEY:

Q. Good morning, Dr. Young. 09:14:24

A. Good morning. 09:14:25

Q. How are you doing today? 09:14:26

A. I'm good. 09:14:27

Q. Can you please state your full name for the record? 09:14:28

A. First name, Darrin, D-A-R-R-I-N, last name Young, Y-O-U-N-G. 09:14:30

Q. And, Dr. Young, you've been deposed before? 09:14:37

A. That's correct. 09:14:39

Q. Do you know how many times? 09:14:40

A. About 20 times. 09:14:41

Q. Okay. And when was the last time you were deposed? 09:14:43

A. Back in -- around December 2024. 09:14:44

Q. Okay. So I know you know the 09:14:47

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ground rules for the deposition; but just to remind you, the most important one -- as you know, we have a court reporter here who is recording everything that we say today. So to make her life easier, let's just try to please avoid talking over each other. 09:14:59 09:15:01 09:15:04 09:15:06 09:15:09 09:15:12

So what that means is please let me finish my questions, and I will let you finish your questions [sic]. Okay? 09:15:14 09:15:15 09:15:18

A. Sure. Thank you. 09:15:19

Q. And also, in answering my questions, please make sure to use actual words, like "yes" or "no," instead of nodding your head. 09:15:19 09:15:21 09:15:23 09:15:25

A. Sure. 09:15:26

Q. Dr. Young, is there any reason you cannot give truthful and accurate testimony today? 09:15:26 09:15:30 09:15:32

A. Not that I'm aware of. 09:15:33

Q. Okay. Dr. Young, the court reporter is handing you what's been marked as Exhibit 1002 in the IPR proceeding, 09:15:34 09:15:41 09:15:45

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(Whereupon Exhibit Number 1002 09:15:52

was marked for identification.) 09:15:55

(BY MS. MAHONEY) 09:15:55

Q. Titled "Declaration of Professor 09:15:55

Darrin J. Young." 09:15:57

Okay. Dr. Young, do you 09:16:24

recognize this as a copy of the declaration 09:16:29

you prepared for this proceeding? 09:16:31

A. Let me take a look at it. 09:16:32

Yeah, I recognize this. 09:16:56

Q. And this declaration pertains to 09:16:57

US Patent Number 10,231,644? 09:17:02

A. That's correct. 09:17:05

Q. Okay. And throughout the course 09:17:05

of today, would you understand it if I refer 09:17:08

to the -- if I refer to that patent as the 09:17:12

"'644 patent"? 09:17:13

A. Yeah, I understand that. 09:17:14

Q. Okay. And you understand that 09:17:15

smaXtec Inc. and smaXtec Animal Care GmbH are 09:17:21

what's called the Petitioners in this IPR 09:17:26

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proceeding? 09:17:29

A. That's correct. 09:17:29

Q. And would you understand that 09:17:29

when I refer to "smaXtec," I'm referring to 09:17:31

both smaXtec Inc. and smaXtec Animal Care 09:17:33

GmbH collectively? 09:17:35

A. Yes, I do. 09:17:36

Q. And would you understand that if 09:17:37

I refer to "the petitioner," I mean both 09:17:40

petitioners collectively? 09:17:43

A. Yes, I do. 09:17:45

Q. Okay. And do you understand that 09:17:45

ST Reproductive Technologies, LLC, is the 09:17:49

patent owner in this IPR proceeding? 09:17:53

A. Yes, I do. 09:17:55

Q. And would you understand that if 09:17:56

I refer to "ST" or "the patent owner," I'm 09:17:58

referring to ST Reproductive Technologies, 09:18:01

LLC? 09:18:08

A. Yes, I do. 09:18:09

Q. Okay. Now, Dr. Young, were you 09:18:09

hired by smaXtec's lawyers to provide an 09:18:11

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expert opinion regarding the validity of the '644 patent? 09:18:17 09:18:18

A. That's correct. 09:18:19

Q. How were you first contacted to serve as an expert in this proceeding? 09:18:20 09:18:22

A. If I remember correctly, it was sometimes back in May last year. There was a -- I guess a company called IMS Legal, who contact me first, asked me if I would be available and, you know, potentially serve as a expert witness for this case. 09:18:24 09:18:31 09:18:39 09:18:45 09:18:49 09:18:53

And I told them I would be available; I'm interested in, you know, working on the case. 09:18:57 09:18:59 09:19:01

I guess then, at that stage, they introduced me to the Decherts [sic] lawyer. I referred them to -- as my counsel, and then we move to start the work from there on. 09:19:03 09:19:05 09:19:11 09:19:17

Q. And which lawyers at Dechert were you introduced to? 09:19:19 09:19:24

A. Mr. Michael Fisher. 09:19:25

Q. Anyone else? 09:19:27

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A. I think that's the only one. 09:19:33
Q. Okay. So Mr. Fisher's the only 09:19:34
counsel at Dechert that you've been working 09:19:40
with in regards to this proceeding? 09:19:42
A. During the prep process, last few 09:19:44
days, I met Mr. Jeff -- what's his last name? 09:19:48
Sorry, I can't -- 09:19:53
MR. FISHER: Plies. 09:19:54
A. Plies. 09:19:55
MR. FISHER: That's P-L-I-E-S, 09:19:57
for the reporter. 09:19:59
(BY MS. MAHONEY) 09:20:01
Q. And the first time you met with 09:20:02
Mr. Plies was this week in preparing for 09:20:04
today's deposition? 09:20:06
A. We had a virtual prep session 09:20:07
last week. That was my first time to met 09:20:10
[sic] Mr. Plies. 09:20:14
Q. Okay. And that prep session was 09:20:14
with Mr. Fisher and Mr. Plies? 09:20:19
A. That's correct. 09:20:21
Q. Was anyone else there? 09:20:22

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A. No. 09:20:23

Q. So you said you met for a virtual prep session last week. 09:20:23 09:20:34

Was that just the one time last week? 09:20:36 09:20:38

A. Only one time last week. 09:20:38

Q. And how long was that prep session for? 09:20:40 09:20:41

A. About five hours. 09:20:42

Q. Was that the only session that you met to prepare for today's deposition? 09:20:44 09:20:48

A. I met Mr. Fisher yesterday. 09:20:51

Q. And that was in person? 09:20:55

A. That was in person. 09:20:56

Q. And yesterday's in-person prep session was just with Mr. Fisher? 09:20:57 09:21:02

A. Mr. Plies was around, but it was mainly me and Mr. Fisher yesterday, for yesterday. 09:21:06 09:21:09 09:21:11

Q. And was anyone else involved in your prep session yesterday? 09:21:12 09:21:18

A. No. 09:21:19

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Q. How long did you and Mr. Fisher meet yesterday? 09:21:19 09:21:21

A. About eight hours. 09:21:25

Q. And did you review any documents with Mr. Fisher yesterday? 09:21:26 09:21:33

A. Yeah. We went through, you know, my declarations, a number of prior art references during the prep session. 09:21:38 09:21:40 09:21:43

Q. Which prior art references did you review yesterday? 09:21:45 09:21:48

A. If I remember correctly, we reviewed -- yeah, my declaration; Harvey, the prior art reference; Riskey; Rettedal; Kunda. That's what I can remember. 09:21:50 09:21:53 09:22:00 09:22:10

Q. Did you review anything else in addition to your declaration or these prior art references? 09:22:11 09:22:19 09:22:21

A. These are the pretty -- pretty much the documents that I reviewed to prep -- to prepare for the deposition. 09:22:27 09:22:29 09:22:33

Q. And did you review anything else in your own time outside of your prep time 09:22:35 09:22:37

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with Mr. Fisher? 09:22:40

A. I reviewed those documents before 09:22:43
I came here -- before I came here to -- to 09:22:44
meet with Mr. Fisher for the in-person prep. 09:22:49

Q. And you reviewed those documents 09:22:51
after your virtual prep session last week and 09:22:57
before your in-person prep session yesterday, 09:23:00
correct? 09:23:03

A. I also reviewed those documents 09:23:04
before the -- the first virtual prep session. 09:23:07

Q. Okay. Dr. Young, what was your 09:23:11
process in drafting your declaration? 09:23:21

A. I worked with my counsel very 09:23:28
closely to -- to draft my declaration. You 09:23:31
know, I reviewed -- I reviewed the -- the 09:23:37
patent, the challenge to claims, and also the 09:23:41
prior art references that I just mentioned. 09:23:48

Then I worked with the counsel to 09:23:55
develop my report. 09:23:59

Q. So you worked with Mr. Fisher to 09:24:01
develop your report? 09:24:04

A. That's correct. 09:24:05

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Q. And was Mr. Fisher the only attorney who helped you draft your declaration? 09:24:05 09:24:09 09:24:10

MR. FISHER: Object to the form. 09:24:11 09:24:14

You can answer. 09:24:18

A. I -- yeah, I wouldn't say, you know, he's the only person, Mr. Fisher, that I worked with, but I worked with him very closely to draft my own declaration. 09:24:19 09:24:21 09:24:23 09:24:26

(BY MS. MAHONEY) 09:24:27

Q. Did you get any assistance from any nonattorneys when drafting your declaration? 09:24:32 09:24:33 09:24:36

A. What do you mean by -- can you please repeat that question again? 09:24:37 09:24:40

Q. Yeah, of course. 09:24:42

Did you get any assistance from any nonattorneys while you were drafting your declaration? 09:24:43 09:24:45 09:24:47

A. No. 09:24:47

Q. So just to confirm, you only 09:24:47

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worked with Mr. Fisher on this declaration, right? 09:24:57 09:24:59

A. That's correct. 09:24:59

Q. And, Dr. Young, sitting here today, do you stand by everything you wrote in your declaration? 09:24:59 09:25:08 09:25:09

MR. FISHER: Object to the form. 09:25:11 09:25:13

A. I stand by my -- by my opinions set forth in my report. 09:25:15 09:25:19

(BY MS. MAHONEY) 09:25:21

Q. Okay. Dr. Young, the court reporter is now handing you what's been marked as Exhibit 1003 in this IPR proceeding. 09:25:40 09:25:40 09:25:42 09:25:46

(Whereupon Exhibit Number 1003 was marked for identification.) 09:25:47 09:25:48

(BY MS. MAHONEY) 09:25:48

Q. It's titled "Curriculum Vitae Darrin J. Young." 09:25:48 09:25:52

And, Dr. Young, have you seen this document before? 09:26:15 09:26:18

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A. Yeah, this is my CV. 09:26:22
Q. And did you prepare this CV? 09:26:24
A. Yes. 09:26:28
Q. And for the purposes of this 09:26:29
IPR -- IPR proceeding, is this CV current? 09:26:34
A. Yes. 09:26:37
Q. Okay. So I'd like to walk 09:26:38
through a few of the things that you've 09:26:46
included here on your CV. Let's start at the 09:26:48
top of your CV. 09:26:52
It says here that you received a 09:26:53
Bachelor of Science degree in electrical 09:26:55
engineering and computer sciences from the 09:26:59
University of California at Berkeley; is that 09:27:01
correct? 09:27:01
A. That's correct. 09:27:04
Q. And so is that one degree or two 09:27:04
degrees? 09:27:06
A. That's one degree in -- from one 09:27:07
department called EECS, stands for electrical 09:27:11
engineering and the computer sciences. 09:27:14
Q. Okay. And is computer science, 09:27:17

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is that more focused on the computer hardware or the computer software? 09:27:21 09:27:25

A. Computer science is a part of the department name; and under our curriculum, we took the courses in both software -- software and hardware. 09:27:27 09:27:31 09:27:35 09:27:39

Q. Okay. You then went on to receive a Master's and a Doctorate degree in -- also in electrical engineering and computer sciences, right? 09:27:41 09:27:46 09:27:51 09:27:53

A. That's correct. 09:27:54

Q. And those were both from Berkeley, right? 09:27:54 09:27:57

A. That's correct. 09:27:57

Q. Okay. While you were at Berkeley, it looks like you were a research assistant with the electrical engineering and computer sciences department, right? 09:28:10 09:28:13 09:28:16 09:28:18

A. Yeah, I was a research assistant; as -- as a Ph.D. student, you know, we call it research assistant. 09:28:20 09:28:22 09:28:26

Q. Uh-huh. 09:28:27

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And what did your research entail? 09:28:29 09:28:30

A. My research mainly focused on MEMS device design/fabrication -- and "MEMS" stands for "microelectromechanical system" -- and also integrated circuits design to interface with MEMS. 09:28:31 09:28:37 09:28:41 09:28:46 09:28:50

Q. And so was all of this research in support of your Ph.D. thesis? 09:28:52 09:28:55

A. Yeah, my Ph.D. thesis body is formed based on the research results derived from these areas. 09:28:57 09:29:01 09:29:05

Q. And what were those results? 09:29:08

A. I design and fabricate the MEMS devices, sensors, tunable capacitors for tuning frequency for wireless communication applications. 09:29:10 09:29:14 09:29:20 09:29:23

Q. Was there a practical application? 09:29:26 09:29:28

A. The research was intended to support practical applications in wireless communication. 09:29:32 09:29:36 09:29:38

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Q. What kind of practical application? 09:29:38 09:29:40

A. Cellular telephony. 09:29:41

Q. Anything else? 09:29:43

A. In general, wireless communication applications. 09:29:46 09:29:48

Q. But primarily focused on cellular telephony? 09:29:49 09:29:54

A. Yeah. 09:29:57

That type of technology can be used for cell phone applications, can be used for, like, a cordless phone -- that's also wireless communication -- and could be also used for different types of, you know, wireless communication, including, like, wi-fi, GPS, you know, things that you needed to transmit data from one side to the other and to receive the data coming in from a transmitter. 09:29:58 09:30:00 09:30:02 09:30:06 09:30:09 09:30:12 09:30:17 09:30:19 09:30:23 09:30:26

Q. So as part of this research at Berkeley, did you work on any monitoring devices? 09:30:28 09:30:31 09:30:36

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MR. FISHER: Object to the form. 09:30:39 09:30:42

A. What specific monitoring device are you -- are you referring to? 09:30:42 09:30:45

(BY MS. MAHONEY) 09:30:46

Q. No specific monitoring device, but did you work on a category of devices that would be used to monitor, say, for example, physiological parameters? 09:30:50 09:30:53 09:30:57 09:31:00

MR. FISHER: Object to the form. 09:31:02 09:31:06

A. I worked on MEMS devices that can be used, for example, as an accelerometer to detect vibration, to detect movements. 09:31:09 09:31:11 09:31:15

I worked on electronic circuitry design. Part of those electronic circuitry design can serve as a temperature sensor. 09:31:19 09:31:23 09:31:26

(BY MS. MAHONEY) 09:31:32

Q. And were the -- was that research for any practical application? 09:31:32 09:31:34

A. You know, as I said previously, the main focus was to design/fabricate MEMS 09:31:46 09:31:51

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devices and integrate electronics to interface with the MEMS devices to enable wireless communication systems with better performance. 09:31:54 09:31:59 09:32:02 09:32:06

Q. And were any of those wireless communication systems intended to be used inside the body? 09:32:16 09:32:18 09:32:20

A. They can be used inside the body; but when I conduct the research, it was mainly looking at the wireless component systems in terms of its electrical performance. 09:32:24 09:32:27 09:32:29 09:32:33 09:32:35

Q. So your research at Berkeley did not focus on wireless communication devices that are internal to the body, correct? 09:32:36 09:32:41 09:32:45

A. I think that's a -- 09:32:48

MR. FISHER: Object to the form. 09:32:49 09:32:50

A. It's a bit mischaracterization. 09:32:52

It was a general technology development for wireless communication applications, and some of them can be 09:32:54 09:32:56 09:32:58

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potentially used for communication from inside the body, getting the data to a receiver outside the body. 09:33:00 09:33:04 09:33:07

(BY MS. MAHONEY) 09:33:09

Q. But you never focused on implementing those applications inside the body? 09:33:22 09:33:24 09:33:26

MR. FISHER: Same objection. 09:33:28

A. For what I did at Berkeley as part of my Ph.D. thesis study, those devices was mainly tested on the table, as I said earlier, to characterize its electrical performance. 09:33:30 09:33:32 09:33:37 09:33:41 09:33:44

(BY MS. MAHONEY) 09:33:51

Q. So that would be a "no"? 09:33:51

MR. FISHER: Same objection. 09:33:53

A. I suppose I answer your question right. 09:33:55 09:33:58

It was mainly tests on the table to characterize the electrical performance of the devices and of the systems that I built. 09:33:59 09:34:01 09:34:03

(BY MS. MAHONEY) 09:34:06

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Q. Okay. But you never tested those devices inside of a body? 09:34:06 09:34:08

A. That's correct. 09:34:10

Q. And you never tested those devices inside of an animal? 09:34:12 09:34:15

A. Not during my Ph.D. study; but after I became an assistant professor at the Case Western Reserve University, I conduct a lot of research building wireless implantable sensors that go into animals' body. 09:34:17 09:34:20 09:34:24 09:34:25 09:34:29

Q. So before we get to Case Western, it also looks like you were -- you interned with Rockwell Semiconductor Systems; is that correct? 09:34:36 09:34:39 09:34:44 09:34:44

A. That's correct. 09:34:48

Q. And was that at the same time you were pursuing your Ph.D.? 09:34:48 09:34:50

A. That's correct. 09:34:52

Q. Okay. And you did research while interning at Rockwell? 09:34:52 09:34:54

A. I did a -- they didn't call it research; it was development. 09:34:59 09:35:02

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Q. What do you mean by "development"? 09:35:05 09:35:07

A. Like, building circuits, building wireless communication circuits for their potential product usage, per se. 09:35:07 09:35:10 09:35:12

Q. What kinds of products were they intending to use these for? 09:35:16 09:35:19

A. For wireless communication devices that can go into cell phone devices, that can -- that can go into cordless phone. 09:35:20 09:35:22 09:35:25

Q. Was there anything else or just cell phones and cordless phones? 09:35:30 09:35:33

MR. FISHER: Object to the form. 09:35:37 09:35:38

A. That's what I know, what -- what that department focused on. Maybe there's something else they can use for other products, but I was not aware of that. 09:35:38 09:35:43 09:35:46 09:35:48

(BY MS. MAHONEY) 09:35:50

Q. And so as far as your work at Rockwell, you were focused mainly on cell phones and cordless phones? 09:35:52 09:35:54 09:35:57

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A. Wireless -- wireless communication devices that can go into cell phones or cordless phones. 09:35:59 09:36:00 09:36:04

Q. Okay. Okay. And you were also involved in some research with the Lawrence Livermore National Laboratory; is that correct? 09:36:05 09:36:23 09:36:27 09:36:27

A. That's correct. 09:36:29

Q. And what did that research entail? 09:36:29 09:36:31

A. That research was for -- was focusing on building a on-chip 3D coils to enable high performance wireless communication application. 09:36:32 09:36:37 09:36:48 09:36:51

Q. I'm sorry. Did you say "unchip"? 09:36:59

A. On-chip, yeah. O-N, hyphen, C-H-I-P. 09:37:02 09:37:05

Q. And what is that? 09:37:08

A. It means something like you can integrate on a silicon wafer and eventually combines them into a small form of a computer chip; that's what we call on-chip, some -- 09:37:10 09:37:13 09:37:17 09:37:19

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something that we build on-chip. 09:37:22

MR. FISHER: If we could pause 09:37:36

for just a second. It looks like my realtime 09:37:37

has died. 09:37:42

MS. MAHONEY: Yes, mine died --

has, as well.

MR. FISHER: Yours as well?

Do you want to take a pause and

try to fix that or --

MS. MAHONEY: Yeah, absolutely. 09:37:42

THE VIDEOGRAPHER: Perfect. 09:37:42

Please stand by. 09:37:42

We're going off the record. 09:37:43

The time is 9:37. 09:37:45

(Break taken from 9:37 a.m. to 09:37:49

9:41 a.m.) 09:41:08

THE VIDEOGRAPHER: We are now 09:41:10

back on the record. The time is 9:41. 09:41:17

(BY MS. MAHONEY) 09:41:19

Q. Okay, Dr. Young, we were talking 09:41:22

about your research involving on-chips, 09:41:23

correct? 09:41:26

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A. Yeah, on-chip 3D coil induct. 09:41:26

Q. And can you just explain what 09:41:37

that is? 09:41:39

A. The coil induct is just a 09:41:41

windings -- you know, you can -- you can take 09:41:46

a wire to -- wind it into a coil, make a 09:41:49

loop, you know, what you call a coil 09:41:54

inductor; and we want to build it using a 3D 09:41:57

configuration rather than a planar 09:42:02

configuration. 09:42:07

So there was some design, 09:42:07

fabrication technology, development needed in 09:42:09

order to fabricate that device. That's -- 09:42:12

that's part of my research work. 09:42:15

Q. And so why would you want to 09:42:17

fabricate a 3D coil inductor? 09:42:20

A. Most of the design, at that time, 09:42:25

if you look at on-chip inductor, is a planar 09:42:31

inductor; and we want to be able to explore 09:42:35

from the fabrication technology perspective 09:42:39

whether it was feasible to build something 09:42:42

3D, meaning kind of standing vertical with 09:42:47

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respect to a -- the planar surface, and it was -- there was some analysis, simulation I performed to show that a 3D device with respect to a 4D device on the silicon wafer can possibly achieve higher performance. 09:42:50 09:42:54 09:43:00 09:43:03 09:43:11

Q. What do you mean by "higher performance"? 09:43:14 09:43:15

A. Lower loss. 09:43:15

Q. Lower loss of what? 09:43:16

A. Energy loss. 09:43:18

Q. And so was there a practical application for this 3D inductor coil? 09:43:19 09:43:29

A. Yeah. That -- that -- the aim, the practical application was to enable wireless communication applications with better performance. 09:43:32 09:43:35 09:43:39 09:43:42

Q. And again, by "better performance," you mean lower loss of energy? 09:43:45 09:43:51

A. Lower loss of energy, and you can -- that can translate to better signal-to-noise ratio for the same power dissipation that go into a device. So 09:43:53 09:43:55 09:43:59 09:44:04

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overall, if you use better components in an electrical system, you can achieve better performance. 09:44:06 09:44:09 09:44:12

Q. And what kinds of devices were the targets of this research? 09:44:15 09:44:18

A. For this particular one that I worked with, Lawrence Livermore National Laboratory, was a on-chip 3D coil inductor, was lower -- was lower energy loss. 09:44:20 09:44:22 09:44:26 09:44:31

Q. But was there a device that you were intending to put this on-chip into? 09:44:36 09:44:38

A. Yes. 09:44:41

Q. What kind of devices? 09:44:42

A. It was a voltage-controlled oscillator. 09:44:44 09:44:49

Q. And what is that? 09:44:49

A. It's an oscillator that can generate a radio frequency signal; and through a voltage control means, one can adjust the frequency of the oscillator. 09:44:50 09:44:53 09:44:57 09:44:59

Q. And was the -- was this for use in cell phones, as well? 09:45:10 09:45:11

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A. Cell phone, cordless phone, or any type of wireless communication applications that required wirelessly transmitting data from -- from one side to the other. 09:45:13 09:45:15 09:45:16 09:45:20 09:45:23

Q. And what type of data was it transmitting? 09:45:24 09:45:36

A. Can be any type of data. 09:45:36

You know, an oscillator serves as a carrier signal, right? And the carrier signal can be used to carry any information that you want to transmit on top of that carrier signal. 09:45:39 09:45:42 09:45:44 09:45:46 09:45:49

Q. So it would be capable of transmitting, for example, both digital and analog information? 09:45:52 09:46:01 09:46:04

A. That's correct. 09:46:05

Q. Okay. So just -- just to make sure I'm understanding this, you would be able to use your 3D inductor coil to ensure that there was lower power loss -- 09:46:06 09:46:14 09:46:19 09:46:29

A. Lower energy loss. 09:46:32

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Q. Thank you. 09:46:33

-- lower energy loss for wireless 09:46:34

communication devices that are capable of 09:46:39

communicating both analog and digital 09:46:41

signals? 09:46:44

MR. FISHER: Object to the 09:46:45

form. 09:46:47

A. That's correct, but they -- 09:46:49

the -- the 3D coil inductor is just one of 09:46:51

the components that would need to go into 09:46:54

that type of system to achieve an overall 09:46:57

voltage controller oscillator that can be 09:47:01

used to wirelessly transmit signals or 09:47:04

information from one side to the other. 09:47:08

(BY MS. MAHONEY) 09:47:10

Q. Okay. Thank you. 09:47:11

And just to be clear, you can 09:47:12

wireless -- wirelessly transmit analog 09:47:15

signals? 09:47:17

A. Yes, yeah. You can -- analog -- 09:47:17

you can modulate analog data onto the carrier 09:47:19

signal, the transmitter. 09:47:24

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Q. Okay. And same for digital, you can wirelessly transmit digital signals? 09:47:26 09:47:30

A. Yes. 09:47:33

Q. And these wireless communication applications you were working on with Lawrence Livermore National Laboratory, they were not intended to be used in -- sorry, strike that. 09:47:33 09:47:40 09:47:42 09:47:45 09:47:47

The wireless communication applications you were working on with Lawrence Livermore National Laboratory, you did not test them as implantable devices inside a body? 09:47:47 09:47:52 09:47:55 09:47:58 09:48:05

A. Yeah. That -- those devices were not tested in -- in body, but they were fully characterized on the table so that we'd know their electrical performance on the table. 09:48:05 09:48:08 09:48:11 09:48:15

Q. And "on the table" is different than inside of the body, right? 09:48:20 09:48:22

MR. FISHER: Object to the form. 09:48:24 09:48:32

A. There will be some differences, 09:48:32

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but depending on how you -- what specific, you know, environment that you're looking at, how you package the device, how you package the system. 09:48:34 09:48:39 09:48:40 09:48:43

(BY MS. MAHONEY) 09:48:46

Q. What kinds of differences? 09:48:46

A. For example, if you put something on the table, you get -- you get a frequency, then you put it into the body, because there are tissues around you, let's say, around the device, that will cause certain frequency shift. 09:48:52 09:48:56 09:49:00 09:49:04 09:49:11 09:49:14

Q. What do you mean by "frequency shift"? 09:49:15 09:49:17

A. For example, if you want to design something coming up with one particular frequency on the table but if you put it inside the -- put it inside the body, and if you characterize the frequency, it will move a little bit. 09:49:18 09:49:21 09:49:23 09:49:26 09:49:29 09:49:31

Q. And which frequency are you referring to? 09:49:34 09:49:35

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A. It's the frequency coming out of the -- the RF oscillator that -- you know, called "RF generator." 09:49:36 09:49:39 09:49:42

Q. Okay. So if you put an RF generator inside of the body and it transmits a signal through the body, the frequency would change? 09:49:43 09:49:48 09:49:51 09:49:55

MR. FISHER: Object to the form. 09:49:57 09:49:59

A. If you put an oscillator or RF generator in the body to -- to intend to generate a frequency, because of the tissue around it and some mass loading interaction, that frequency would -- would be deviated from your original frequency that you test on the table. 09:49:59 09:50:03 09:50:08 09:50:11 09:50:15 09:50:18 09:50:21

(BY MS. MAHONEY) 09:50:29

Q. You said "mass loading interaction." Can you explain what that means? 09:50:30 09:50:31 09:50:33

A. Yeah. 09:50:33

For example, if you just have 09:50:33

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some -- like, your muscle or your tissue, that's a mass, and that will create some electrical loading effects on the oscillator. 09:50:35 09:50:40 09:50:43

As a result, that frequency will shift. 09:50:47 09:50:52

Q. The frequency that the oscillator generates would shift? 09:50:52 09:50:55

A. Yes. 09:50:56

Q. Once it passes through the tissue? 09:50:57 09:50:59

A. I think that's correct, depending on, you know, where you test it, right? 09:51:10 09:51:12

If you test outside the tissue, you'd get the frequency. You can also maybe put a testing device inside the tissue, you know, in the body to -- to measure that frequency. 09:51:15 09:51:17 09:51:20 09:51:23 09:51:25

That frequency would -- will be shifted. Depending on the interaction, you know, the amount of shifting may not be the same. 09:51:26 09:51:28 09:51:31 09:51:34

Q. And what causes this shift? 09:51:36

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A. In my -- my understanding is that, you know, you have -- you have tissue around it, and that tissue -- that tissue is like a conductor, right? It's not a perfect conductor, but tissue has certain conductivity. 09:51:39 09:51:42 09:51:46 09:51:52 09:51:55 09:51:57

So if you have a conductive medium around your oscillator and that conductive medium can create a loading effect -- that's what I was saying, the mass loading interaction, the loading effect, can possibly cause a frequency shift. 09:51:58 09:52:01 09:52:05 09:52:08 09:52:11 09:52:15

Q. And can you just explain what you mean by "loading effect"? 09:52:20 09:52:22

A. You know, in an electrical system, for example -- well, maybe any electrical system, it has a loading, right? You know, there's something attached to it. Like, you know, you build a system; that system has a loading effect. 09:52:30 09:52:34 09:52:37 09:52:39 09:52:41 09:52:43

The loading effect may be you connect that device to another device. That 09:52:45 09:52:48

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another [sic] device will serve as a load, or even that device alone has some internal loading, right? 09:52:50 09:52:53 09:52:57

And -- but if you have conductors or tissues around that device, that will create a loading effect. It sees the load; the circuit sees that load maybe through a capacitive coupling. 09:52:58 09:53:01 09:53:08 09:53:11 09:53:14

As a result, the frequency will shift but can be compensated. If you know how much shift that you have, you can design your oscillator to account for that expected frequency loading so that at the end, when the signal, you know, transmit through the tissue, it still transmitting at your desired frequency. 09:53:16 09:53:18 09:53:21 09:53:22 09:53:25 09:53:28 09:53:31 09:53:35

Q. Which direction does the frequency shift? 09:53:39 09:53:40

A. It can go either up and down. 09:53:42

Q. Depending on what? 09:53:49

A. Depending on your design. 09:53:53

Q. So the direction that the 09:53:58

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frequency -- frequency shifts is based on the design of what? 09:53:59 09:54:04

A. Of the oscillator. 09:54:06

Q. Of the oscillator? 09:54:08

A. Yes. 09:54:09

Q. So the direction of the shift does not depend on the actual biomass or living tissue that the signal transmits through? 09:54:09 09:54:16 09:54:23 09:54:25

A. When you say "biomass" or "the tissue," I assume you refer to that -- the same tissue that we talk about, right? 09:54:28 09:54:32 09:54:34

Q. Yes, yes. 09:54:36

A. I have not thought about that, but I do notice, you know, when you put something in the body or a part of the -- implantable research that I did at the Case Western Reserve University, what you observe on the table in terms of the frequency location or the frequency position may not be the same as the frequency location or the frequency position that you observe once that 09:54:42 09:54:44 09:54:46 09:54:49 09:54:53 09:54:55 09:54:58 09:55:01 09:55:05

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device goes inside the body. 09:55:09

Q. Okay. So, Dr. Young, you said 09:55:23

that there are differences between a wireless 09:55:25

communication device acting on a table and a 09:55:32

wireless communication device acting inside 09:55:36

the body, right? 09:55:38

A. That is something that I 09:55:39

observed. 09:55:40

Q. And one of those differences is 09:55:40

this shift in frequency, correct? 09:55:42

A. That's correct. 09:55:45

Q. Are there any other differences 09:55:45

that you've observed? 09:55:48

A. I guess that's the main 09:55:57

difference that I observed, you know, in 09:55:58

terms of the frequency position being 09:56:00

shifted. 09:56:03

Q. Are there any other differences 09:56:04

that you know about? 09:56:06

A. I mean, that's what I can think 09:56:12

of at this point. 09:56:13

Q. So would it be fair to say that 09:56:14

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if you designed a wireless communication device to operate on the table, that you would have to make some adjustments before implanting it inside the body? 09:56:27 09:56:30 09:56:32 09:56:34

MR. FISHER: Object to the form. 09:56:36 09:56:39

A. You know, an engineer, we need to know the overall system well: What you get on the table, what you will get once you put inside the body. So with those information available, perhaps serving as a design guideline, and the engineer can design the system to account for those frequency shift. 09:56:39 09:56:43 09:56:45 09:56:50 09:56:53 09:56:56 09:56:58

(BY MS. MAHONEY) 09:57:04

Q. Okay. So with respect at least to the frequency coming out of the oscillator, for example, you would have to make some adjustment to account for that frequency shift when taking a device from the table to implanting it in a body, correct? 09:57:05 09:57:06 09:57:09 09:57:15 09:57:18 09:57:21

A. That's a part of the design process. 09:57:24 09:57:26

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Q. So yes? 09:57:27
A. That's part of the design 09:57:29
process. 09:57:31
Q. Okay. Let's move back to your 09:57:34
CV. 09:57:54
After you received your Ph.D., 09:57:54
you started as an assistant professor with 09:57:58
the electrical engineering and computer 09:58:02
science department at Case Western, correct? 09:58:04
A. Case Western Reserve University. 09:58:06
Q. Case Western Reserve University, 09:58:08
right? 09:58:09
A. That's correct. 09:58:09
Q. Okay. And then it looks like, in 09:58:10
2005, you became an associate professor at 09:58:15
Case Western Reserve University? 09:58:18
A. Around that time. 09:58:20
Q. Okay. And you've mentioned that 09:58:25
you -- you conducted research while you were 09:58:26
at Case Western, right? 09:58:28
A. That's correct. 09:58:30
Q. And what did this research 09:58:30

entail?
A. The research mainly focused on developing wireless microsystem-based sensing technology that can -- that can be used for a wide range of applications, including biomedical implant, including, you know, wearable sensing, industrial sensing applications, some consumer electronic sensing applications, environmental monitoring, and also those sensors can be used for personal navigation.
Q. Okay. And this research was the first time that your research was focused on a device that would be used inside of a body?
MR. FISHER: Object to form.
A. Some of the projects that I worked on at Case Western required devices that I built or electrical systems that I built to be tested inside the body.
(BY MS. MAHONEY)
Q. And so this was the first time you took your research from the table to

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inside the body, correct? 10:00:04
MR. FISHER: Same objection. 10:00:06
A. It was nature of the project, you know. I was working with a team of researchers, and we got funding from different government agency. Some of those fundings, depending on the nature of the project, will require device to be tested inside a body. 10:00:10 10:00:11 10:00:13 10:00:16 10:00:18 10:00:20 10:00:23
(BY MS. MAHONEY) 10:00:28
Q. But had you done that before Case Western? 10:00:28 10:00:31
MR. FISHER: Same objection. 10:00:31
A. I think I answered your question before, right? The stuff that I built at Berkeley was mainly -- 10:00:33 10:00:34 10:00:34
THE COURT REPORTER: I'm sorry, sir? 10:00:34 10:00:34
THE WITNESS: Things that I built at Berkeley as a Ph.D. student was characterizing electrical components, systems that I built, in terms of their performance 10:00:38 10:00:38 10:00:44 10:00:47

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for wireless communication application. 10:00:51

(BY MS. MAHONEY) 10:00:55

Q. But you only tested those on the 10:00:55

table, correct? 10:00:57

A. Yeah. We call it an engineering 10:01:00

laboratory where you do things on table. 10:01:02

Q. Okay. So you mentioned part of 10:01:05

your research had to do with wireless sensing 10:01:13

applications, right? 10:01:15

A. That's correct. 10:01:17

Q. What type of sensing applications 10:01:17

are you talking about? 10:01:19

A. For example, I built implantable 10:01:21

systems that -- that can go into laboratory 10:01:29

animals, mice and the rodent, to monitor 10:01:34

their blood pressure pulse waveform, to 10:01:37

monitor their body temperature, to monitor 10:01:40

their ECG signals, wirelessly transmit the 10:01:43

data from inside the body to receivers that's 10:01:53

outside the body; and I also built 10:01:56

implantable EMG sensors that can go into -- 10:01:59

under the -- on the tissue, under the skin, 10:02:03

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to -- to detect the electrical signal 10:02:06
associated with the muscle movement when you 10:02:09
move your arms; and I have built pressure 10:02:12
sensors, wireless implantable pressure 10:02:16
sensors, and also, you know, charging -- 10:02:19
battery charging system that can go into -- 10:02:23
underneath the mucosal layer of your bladder 10:02:28
to monitor the bladder pressure. 10:02:31
I also built accelerometers that 10:02:37
can go into your -- your middle ear. I don't 10:02:44
mean you, not in a -- in a personal sense -- 10:02:49
the middle ear. 10:02:51
And, you know, when -- when you 10:02:52
talk to that individual, likely, for example, 10:02:57
it's a deaf person who will need a cochlear 10:02:59
implant. You know, the acoustic pressure 10:03:04
will travel through the ear canal and the -- 10:03:06
push the eardrum. We call it a tympanic 10:03:09
membrane. 10:03:12
And so there is hearing bones 10:03:12
attached to the eardrum inside the middle 10:03:16
ear, so those bones will vibrate accordingly. 10:03:19

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So if we could put an accelerometer on top of the bone and detect the vibration signal of the bone and convert that into an electrical signal, that electrical signal will represent the speech information, right, as acoustic signal, maybe from my mouth to -- to that person's ear. 10:03:22 10:03:25 10:03:28 10:03:31 10:03:34 10:03:38 10:03:42

Q. Let's start with talking about the blood pressure monitoring device for the laboratory mice that you mentioned, okay? 10:04:03 10:04:05 10:04:08

A. Okay. 10:04:10

Q. How did this device work? 10:04:10

A. Yeah. That device basically -- is built using a -- we call it a cuff structure. 10:04:14 10:04:16 10:04:23

The goal is not to break the vessel of the animal because these are research laboratory animals; sometimes they -- you know, they very small. If you break the -- the blood vessel, they may die, you know, in the surgery, or cause -- even if they survive, it could cause a lot of trauma 10:04:24 10:04:26 10:04:28 10:04:33 10:04:35 10:04:39 10:04:44

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if there's a lot of bleeding, you know, due to breaking of the vessel. 10:04:48 10:04:50

So what we built was a cuff, elastic cuff, that could wrap around the vessel without breaking it. 10:04:51 10:04:56 10:04:58

Inside that elastic cuff, there are sensors and electronic circuits. 10:05:00 10:05:03

As -- as the vessel expand and contract due to every heartbeat, that expansion and the contraction can -- the motion can be coupled to a pressure sensor inside that cuff. 10:05:07 10:05:10 10:05:14 10:05:17 10:05:20

So the pressure sensor would detect the pressure information; moves up and down, representing the expansion and the contraction of the vessel. 10:05:23 10:05:26 10:05:31 10:05:34

So once that signal gets captured by the pressure sensor, we have electronic circuitry that can convert them to digital representations 0s and the 1s. 10:05:35 10:05:37 10:05:40 10:05:43

And we also have, you know, oscillators as transmitters that can transmit 10:05:45 10:05:49

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the digital representation of the -- of the blood pressure waveform from inside the body to a receiver that's outside the body -- may be built as part of the animals' cage. 10:05:54 10:06:00 10:06:03 10:06:06

So those blood pressure pulse waveform can be -- can be captured, basically, by an external computer. 10:06:09 10:06:12 10:06:16

Q. Is there a name for the pressure sensor that you used? 10:06:18 10:06:21

A. We call them -- in general, we call them MEMS pressure sensor, microelectromechanical system pressure sensor. 10:06:23 10:06:25 10:06:31 10:06:34

Q. And can you explain again how a MEMS press- -- pressure sensor works? 10:06:36 10:06:39

A. Most of the MEMS pressure sensor relies on a -- a deflectable membrane, a thin film, a membrane. 10:06:47 10:06:51 10:06:58

So when you -- when you -- let's say when you increase the pressure above the membrane or decrease the pressure above the membrane, let's say -- call it pressure 10:07:00 10:07:03 10:07:06 10:07:09

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difference, or you can maybe contact the membrane through forced -- forced transmission, forced coupling, that membrane would -- would deflect, right? 10:07:12 10:07:14 10:07:16 10:07:20

So underneath that membrane there is another electrode, so between -- another electrode, E-L-E-C-T-R-O-D-E. 10:07:21 10:07:24 10:07:29

So the membrane and that electrode -- in between, it's the -- it's a thin air gap, so it changes the air gap. 10:07:34 10:07:37 10:07:40

So from physics, we know that if you have two electrodes and if you can change the air gap or the air gap can be changed, the capacitance between that two electrodes will change. 10:07:43 10:07:46 10:07:49 10:07:53 10:07:59

So that reflects an electrical signal change responding to the membrane change, membrane position change; and that membrane position change is caused by pressure difference on top of the membrane or some force applied on top of the membrane. 10:07:59 10:08:04 10:08:07 10:08:11 10:08:15 10:08:18

Q. So the MEMS pressure sensor 10:08:26

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generates an electrical signal, right? 10:08:29

A. Generates a capacitive signal. 10:08:32

Yeah, we consider a electrical signal the 10:08:34

capacitance change. 10:08:41

Q. And the capacitive signal coming 10:08:50

out of the MEMS pressure sensor, that would 10:08:53

be an analog signal? 10:08:55

A. That's correct. 10:08:58

Q. Now, in this device, did the MEMS 10:08:58

pressure sensor generate a continuous 10:09:26

capacitive signal? 10:09:29

A. Yes, because the blood pressure 10:09:34

pulse waveform, right, is continuous. Every 10:09:37

heartbeat, you know, your -- the vessel 10:09:40

expands, contracts, expands, contracts. 10:09:41

If that sensor, for example, the 10:09:45

capacitive sensor, is monitoring that 10:09:47

expansion and contraction, then if you look 10:09:50

at the capacitance change, it moves up and 10:09:51

down continuously, is the way you put it. 10:09:55

Q. So it measures the pressure 10:10:03

continuously, right? 10:10:05

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A. That's correct. 10:10:07

Q. But does it generate a signal 10:10:08

continuously? 10:10:13

A. Yes. 10:10:17

Q. And then how does that signal 10:10:38

leaving the MEMS pressure sensor get utilized 10:10:41

by your system as a whole? 10:10:45

A. What do you mean by "utilized by 10:10:47

my system as a whole"? 10:10:50

Q. Where -- where does the pressure 10:10:52

signal -- strike that. 10:10:54

Where does the signal coming out 10:10:56

of the MEMS pressure sensor go? 10:10:58

A. The signal comes from -- the MEMS 10:11:01

pressure sensor will be -- will be interfaced 10:11:06

with something we call the -- a CV converter. 10:11:11

"CV converter" stands for 10:11:16

"capacitance to voltage converter." So it's 10:11:20

electronic -- it's electronic circuitry that 10:11:24

converts the capacitance change to an analog 10:11:26

voltage change or analog voltage waveform. 10:11:32

Q. Okay. So the ACV [sic] converter 10:11:43

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takes the analog capacitive signal and converts it to an analog voltage signal; is that correct? 10:11:46 10:11:50 10:11:51

A. That's correct. 10:11:51

I heard you say "ACV." I assume you say "CV converter." 10:11:51 10:11:54

Q. CV. 10:11:57

A. CV. 10:11:57

Q. It's just CV, thank you. 10:11:57

A. Yeah, I just want to make sure that we -- 10:11:58 10:12:00

Q. Yes, thank you. 10:12:00

A. Yeah, "CV" stands for "capacitance to voltage" -- 10:12:01 10:12:04

Q. Capacitance to voltage, Thank you. 10:12:13 10:12:13

A. -- "converter," yeah. 10:12:13

Q. Okay. And then what happens after the CV converter converts the capacitive signal to the analog voltage signal? 10:12:15 10:12:16 10:12:20 10:12:24

A. There -- there is a analog to 10:12:25

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digital converter that further converts the analog voltage signal into digital representation using 0s and the 1s. 10:12:28 10:12:31 10:12:36

Q. And why is there an analog to digital converter in the system? 10:12:53 10:12:56

A. Typically, these signals will be transmitted, you know, or even stored in the computer, right? And for transmission, we use digital transmission for better signal-to-noise ratio. You transmit the 0 and the 1, 1 versus 0. It's just a lot more robust in terms of wireless communication, transmitting digital data from one site to another site. 10:12:59 10:13:04 10:13:08 10:13:12 10:13:15 10:13:19 10:13:23 10:13:25 10:13:34

Q. Okay. So it's more robust, in your opinion, to transmit digital data as opposed to analog data, correct? 10:13:35 10:13:37 10:13:39

A. That's in the textbook, right? 10:13:43

Q. You tell me. 10:13:45

A. Yeah, I tell you, yeah, yeah, it's true that it's just more robust in terms of transmitting digital data versus analog 10:13:46 10:13:48 10:13:50

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modulation, and also, you know, a lot of, you know, storage, right? 10:13:54 10:13:58

You know, we store information -- we store 0s and the 1s, you know, in our electrical system. 10:14:00 10:14:03 10:14:07

Q. So I know you used this analog to digital converter, but it's possible to transmit this information in its analog form, right? 10:14:20 10:14:23 10:14:28 10:14:31

MR. FISHER: Object to the form. 10:14:36 10:14:40

A. I think that's -- you know, that's -- I guess you propose a possibility, right? 10:14:40 10:14:42 10:14:42

You know, just to be fair, you know, anything is possible, but you have to look at the overall system design, constraint, tradeoffs to design what would be your optimum design approach in terms of, you know, better performance. 10:14:44 10:14:48 10:14:49 10:14:53 10:14:57 10:15:00

(BY MS. MAHONEY) 10:15:07

Q. So, Doctor, in your opinion, you 10:15:07

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would get better performance by using digital transmission, but it is possible to use analog transmission? 10:15:10 10:15:13 10:15:15

MR. FISHER: Same objection. 10:15:18

A. You will get better performance using digital-based or digital signal protocol for wireless communication compared to analog approach. That's my understanding. 10:15:23 10:15:26 10:15:30 10:15:34

(BY MS. MAHONEY) 10:15:40

Q. But it's possible to use this analog approach, right? 10:15:40 10:15:42

MR. FISHER: Same objection. 10:15:44

A. You know, I think I answered that question, though if you said is it possible, I -- my take on it is everything -- anything is possible, but you have to look at a practical system design constraint in the consideration in the design, what would be an optimal approach. 10:15:46 10:15:47 10:15:49 10:15:53 10:15:56 10:16:00 10:16:03

(BY MS. MAHONEY) 10:16:13

Q. So in your opinion, using an analog transmission would not be the optimal 10:16:13 10:16:15

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approach? 10:16:20
A. I didn't say that. 10:16:20
I said that, you know, if you 10:16:22
asked me a possibility, just to be fair, 10:16:23
right, anything is possible; but when it come 10:16:25
to a practical design consideration, you 10:16:28
would need to consider the -- the design 10:16:32
requirements trade-off to decide what would 10:16:33
be an optimal design approach. 10:16:37
Q. But it would still work if you 10:16:43
were transmitting the data in an analog form, 10:16:46
right? 10:16:48
MR. FISHER: Object to the 10:16:49
form. 10:17:05
A. It depends on how you 10:17:05
characterize whether it will work or not. 10:17:07
You know, I think in a -- in a practical 10:17:09
system, you will have to look at the 10:17:14
performance, you know. If the performance is 10:17:17
too poor, it may not be considered a working 10:17:21
device. 10:17:31
THE COURT REPORTER: May not 10:17:31

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be? 10:17:31

THE WITNESS: May not be 10:17:24

considered a working system or a working 10:17:27

device. 10:17:31

THE COURT REPORTER: Thank you. 10:17:52

(BY MS. MAHONEY) 10:17:52

Q. So for your blood pressure 10:17:52

monitoring devices for the lab mice, if you 10:17:54

had used analog transmission, would the 10:17:58

device have still worked? 10:18:02

MR. FISHER: Same objection; 10:18:04

asked and answered. 10:18:06

A. Yeah, I believe I answered 10:18:12

that -- you know, I answered your question, 10:18:14

and what we -- what we decide was to use 10:18:15

digital transmission because we did some 10:18:18

study to find out that the digital-based 10:18:22

transmission would be more robust and -- 10:18:24

meaning that -- better performance in terms 10:18:27

of transmitting the data and then receiving 10:18:29

the data compared to an analog scheme. 10:18:31

(BY MS. MAHONEY) 10:18:36

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Q. And did you try using an analog scheme? 10:18:36 10:18:38

A. We did not build it, but we did some calculation to estimate the performance. 10:18:39 10:18:43

Q. So the analog scheme was an option that you considered? 10:18:45 10:18:56

MR. FISHER: Object to the form. 10:18:58 10:19:13

A. Yeah. We would conduct analysis, you know, make -- it's fair that -- to say, hey, you know, I look at analog and look at a digital. After the analysis, we decided to go with digital. That was the -- that was the final outcome. 10:19:13 10:19:15 10:19:17 10:19:20 10:19:22 10:19:24

(BY MS. MAHONEY) 10:19:38

Q. Would it be fair to characterize your blood pressure sensing device for lab mice as an implantable monitoring device? 10:19:38 10:19:39 10:19:48

A. That is an implantable monitoring device. 10:19:50 10:19:53

Q. Okay. Going back to your CV, it says in 2009 -- excuse me, in -- no, 10:20:15 10:20:21

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incorrect -- in 2009, strike that. 10:20:29

Going back to your CV, in 2009 it looks like you transitioned to the electrical and computer engineering department at the University of Utah; is that correct? 10:20:32 10:20:36 10:20:38 10:20:40

A. That's correct. 10:20:42

Q. Okay. And it says here that you are a USTART associate professor? 10:20:45 10:20:46

A. That's correct. 10:20:49

Q. What does that mean? 10:20:50

A. I was recruited by the University of Utah under a program called USTART. USTART stands for -- hopefully, I remember correctly -- stands for Utah Science Technology and the Research. 10:20:52 10:20:54 10:20:59 10:21:03 10:21:09

Q. And have you conducted research in your work at the University of Utah? 10:21:13 10:21:16

A. Yes, I have been conducting research. 10:21:19 10:21:21

Q. And what does your research entail? 10:21:21 10:21:23

A. Continue on what I did at Case 10:21:24

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Western. My research is still focused on developing wireless microsystem-based sensing technology for different types of sensing applications. 10:21:30 10:21:34 10:21:39 10:21:41

Q. And what types of sensing applications? 10:21:46 10:21:48

A. Including implantable, wearable, things that could go into the shoes for personal navigation, sensors that could go into soils, waters, to monitor the environmental condition. 10:21:50 10:21:56 10:21:58 10:22:03 10:22:09

Q. Okay. You said "wearable." What do you mean by that? 10:22:18 10:22:20

A. Oh, something that you can -- you can attach to, you know, the surface of your skin, something, for example, that go into your shoe. You can wear that, so it's a wearable sensors. 10:22:20 10:22:22 10:22:25 10:22:28 10:22:31

Q. So like an external sensor? 10:22:33

A. Yeah, those wearable are external sensors. 10:22:35 10:22:39

Q. Okay. And you mentioned you've 10:22:49

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done research on implantables again at University of Utah? 10:22:51 10:22:53

A. That's correct. 10:22:54

Q. What type of implants? 10:22:54

A. It was a -- a device that can monitor glucose level in your blood. 10:22:57 10:23:01

Q. For humans or animals? 10:23:06

A. It was a research project. I assume it can be -- can be used for both. 10:23:09 10:23:13

Q. Would that technology be interchangeable between humans and animals? 10:23:16 10:23:21

A. In terms of the -- the sensing principle, I think it would be the same; but in terms of the device longevity or reliability, there will be a difference for something going to the animal versus something going to the human body. 10:23:25 10:23:36 10:23:40 10:23:46 10:23:50 10:23:52

Q. In what way? 10:23:55

A. You know, I said longevity. For example, if you put something in the human, there will be certain minimum time frame it should survive, right? 10:24:01 10:24:07 10:24:10 10:24:16

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But if you go into animals, you know, their longevity requirement may not be as strict, right, as for human application. 10:24:17 10:24:21 10:24:24

Q. Okay. Going back to the wearable monitoring that you discussed -- 10:24:33 10:24:48

A. Uh-huh. 10:24:50

Q. -- what types of wearable devices did you focus on? You mentioned the one in the shoe. 10:24:51 10:24:58 10:25:02

A. Uh-huh. 10:25:02

Q. What else? 10:25:03

A. Wearable device that can be attached to a certain part of your surface skin to monitor blood pressure pulse waveform and also monitor pulse wave velocity. 10:25:04 10:25:07 10:25:10 10:25:14

Q. What is that? 10:25:18

A. It tells you how fast your blood pressure pulse wave will travel through a certain segment of a vessel. 10:25:19 10:25:22 10:25:26

Q. Were there any other external sensors you were working on? 10:25:31 10:25:33

A. As far as I can remember, these 10:25:37

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are the -- kind of the main ones that kept us busy for a number of years. 10:25:39 10:25:42

Q. And the focus of those wearables would have been for humans? 10:25:50 10:25:57

A. For the shoe, it's for human. 10:26:01

For the -- for the blood pressure pulse waveform heart rate information, it can be used for both human and animals. 10:26:04 10:26:08 10:26:13

Q. And did you test it on both humans and animals? 10:26:22 10:26:25

A. Yes. 10:26:27

Q. Dr. Young, are you an expert in electrical engineering? 10:26:28 10:26:45

MR. FISHER: Object to the form. 10:26:48 10:26:51

A. I'm an electrical engineer, right, as my CV indicates. You know, I received my Bachelor and Master degree, Ph.D. from electrical engineering in the computer science department at the University of California, Berkeley; so I will consider myself as knowledgeable, you know, with 10:26:51 10:26:53 10:26:56 10:27:00 10:27:02 10:27:04 10:27:07

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certain expertise in electrical engineering. 10:27:10
(BY MS. MAHONEY) 10:27:16
Q. What would you say your expertise 10:27:16
is? 10:27:18
MR. FISHER: Same objection. 10:27:20
A. You know, a lot of stuff that we 10:27:22
talk about, right, within maybe the past hour 10:27:25
or so, focusing on sensors, you know, 10:27:27
electronic circuits, you know, wireless data 10:27:31
communication for different type of areas, 10:27:35
that's my expertise. 10:27:39
(BY MS. MAHONEY) 10:27:39
Q. Okay. So you're an expert in 10:27:41
sensors? 10:27:43
MR. FISHER: Object to the 10:27:44
form. 10:27:45
A. I consider myself knowledgeable 10:27:47
about sensors. 10:27:49
(BY MS. MAHONEY) 10:27:49
Q. But you would not consider 10:27:53
yourself to be an expert in sensors? 10:27:54
MR. FISHER: Same objection; 10:27:56

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asked and answered. 10:28:00

A. Really depends on where you draw 10:28:00

the line, you know, characterizing an expert. 10:28:03

(BY MS. MAHONEY) 10:28:06

Q. Are you an expert in computer 10:28:17

science? 10:28:21

MR. FISHER: Object to the 10:28:21

form. 10:28:26

A. I can do programming, that's what 10:28:26

I can tell you, but computer science, it's 10:28:29

just a very broad field, right? You know, 10:28:33

I'm knowledgeable about certain aspects of 10:28:35

computer science, let's say. 10:28:38

Q. What aspects would those be? 10:28:39

A. Like programming. 10:28:41

Q. And what about computer hardware? 10:28:44

Are you an expert in computer hardware? 10:28:48

MR. FISHER: Same objection. 10:28:50

A. Computer hardware's a very broad 10:28:52

area. 10:28:55

Certainly I'm knowledgeable about 10:28:55

certain systems, components going inside the 10:28:57

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computer hardware. 10:29:01
(BY MS. MAHONEY) 10:29:01
Q. What computer hardware components 10:29:07
would you consider yourself to be an expert 10:29:09
in? 10:29:11
MR. FISHER: Same objection. 10:29:12
A. For example, logic circuits, 10:29:12
right? Finite state machine -- 10:29:15
THE COURT REPORTER: I'm sorry? 10:29:15
THE WITNESS: Logic circuits, 10:29:15
timing circuits, like finite state machine 10:29:20
that control system operation. These are -- 10:29:25
these are things that I'm knowledgeable 10:29:27
about. 10:29:29
(BY MS. MAHONEY) 10:29:33
Q. Can you explain what those are? 10:29:33
A. Logic circuits, you know, the 10:29:35
circuitry that manipulate digital logic 10:29:37
information, right? Timing circuits are 10:29:41
circuitry that generates clocks, timers that 10:29:44
can be used to control various -- various 10:29:48
system operation. State machine, right, is 10:29:51

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also logic circuitry, control circuitry that controls the system design, operation, depending on which state they are in. 10:29:57 10:30:00 10:30:03

Q. Would you consider yourself to be an expert in computer memory? 10:30:14 10:30:15

A. I'm knowledgeable -- 10:30:18

MR. FISHER: Object to the -- object to the form. 10:30:19 10:30:20

A. -- I'm knowledgeable about computer memory. 10:30:22 10:30:25

(BY MS. MAHONEY) 10:30:26

Q. Dr. Young, are you familiar with Dr. Edwin Kan from Cornell University? K-A-N? 10:30:50 10:30:52 10:30:58

A. I came across the name. 10:30:58

Q. And in what context? 10:31:01

A. I was reviewing a Dr. Kan report. 10:31:03

Q. So you don't know Dr. Kan outside of his report? 10:31:07 10:31:10

A. I have to look at the face. You know, sometimes I go to meetings, I run into professors from, you know, different 10:31:19 10:31:20 10:31:23

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universities; but I have to look at the face in order to see whether I met that person or not. 10:31:24 10:31:30 10:31:32

MS. MAHONEY: Well, we've been going for over an hour, if now is a good time to take a quick break. 10:31:46 10:31:47 10:31:50

MR. FISHER: Yeah, that's fine. 10:31:52

THE WITNESS: Yeah, thanks. 10:31:54

THE VIDEOGRAPHER: We are going off the record. The time is 10:31. 10:31:56 10:31:57

(Break taken from 10:32 a.m. to 10:51 a.m.) 10:32:00 10:51:24

THE VIDEOGRAPHER: We are now back on the record. The time is 10:51. 10:51:24 10:51:25

(BY MS. MAHONEY) 10:51:52

Q. Okay. Dr. Young, before the break, we were kind of going over some of your research history and your -- and your CV, correct? 10:51:55 10:51:58 10:52:01 10:52:05

A. Yes, that's correct. 10:52:07

Q. How would you define an "implantable monitoring device"? 10:52:09 10:52:37

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MR. FISHER: Object to the form. 10:52:43 10:52:44

A. It is a device that implant in the body -- you know, can be human, can be animals -- for monitoring certain parameters of interest. 10:52:50 10:52:54 10:52:57 10:53:01

(BY MS. MAHONEY) 10:53:03

Q. What types of parameters? 10:53:09

MR. FISHER: Same objection. 10:53:11

A. That depends on your application. 10:53:15

(BY MS. MAHONEY) 10:53:19

Q. Would it be fair to say that an implantable monitoring device is used internally? 10:53:31 10:53:33 10:53:36

MR. FISHER: Object to the form. 10:53:37 10:53:40

A. "Internally" meaning inside the body? 10:53:40 10:53:45

(BY MS. MAHONEY) 10:53:45

Q. Yes. 10:53:46

A. I think that's fair. That's where a, you know, common person, maybe a 10:53:46 10:53:48

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person of ordinary skill in the art, will understand the meaning of an "implantable device." 10:53:51 10:53:53 10:53:56

Q. Are you an expert on implantable monitoring devices? 10:54:02 10:54:04

MR. FISHER: Object to the form. 10:54:05 10:54:09

A. I'm knowledgeable about implantable devices. 10:54:09 10:54:11

(BY MS. MAHONEY) 10:54:11

Q. But you would not consider yourself to be an expert? 10:54:20 10:54:21

MR. FISHER: Same objection; asked and answered. 10:54:22 10:54:25

A. I guess we talk about it before, right? 10:54:27 10:54:29

You know, I would say I'm an expert. It really depends on how you define, you know, the qualification -- you know, what takes you to claim yourself to be an expert, but I think it's -- I'm comfortable to claim that I am very knowledgeable about 10:54:30 10:54:32 10:54:34 10:54:36 10:54:38 10:54:40

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implantable devices. 10:54:43

(BY MS. MAHONEY) 10:54:52

Q. Okay. And just to be clear, you 10:54:52

would agree -- strike that. 10:54:54

A POSA would also agree that an 10:54:55

implantable monitoring device is used 10:54:59

internally? 10:55:04

A. What I said was, an average 10:55:04

person, for example, a person of ordinary 10:55:07

skill in the art, would understand when you 10:55:10

talk about implantable monitoring device, 10:55:14

that device operates or gets something from 10:55:17

inside the body. 10:55:21

Q. So a POSA would understand that 10:55:30

an implantable monitoring device is used 10:55:32

internally? 10:55:35

A. When you say "internally," I want 10:55:39

to make sure that we're on the same page, 10:55:42

right? 10:55:44

If you are referring "internally" 10:55:45

as something that goes inside the body, then 10:55:46

I think a POSA will understand an implantable 10:55:49

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device at least would need to have some features, like going into -- going inside a body. 10:55:52 10:55:54 10:55:58

Q. And based on your research, you're familiar with implantable monitoring devices for lab mice, right? 10:56:04 10:56:06 10:56:09

A. Lab rodents. 10:56:11

Q. Lab rodents? 10:56:12

A. Yeah, mice and the rodents; depends how small and the large size. 10:56:14 10:56:17

Q. Do you have experience with implantable monitoring devices for any other animals? 10:56:19 10:56:23 10:56:25

A. Not that I remember of. 10:56:27

Q. So only lab mice and rodents? 10:56:36

A. That's what I can remember at this point. 10:56:40 10:57:00

Q. Are there different design considerations between an implantable monitoring device for a -- lab mice versus, say, for example, a large ruminant animal like a cow? 10:57:00 10:57:02 10:57:04 10:57:09 10:57:13

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A. Could you repeat that question again, please? 10:57:17 10:57:19

Q. Of course. 10:57:20

Are there different design considerations between an implantable monitoring device for the lab mice versus a large ruminant animal like a cow? 10:57:21 10:57:22 10:57:25 10:57:30

MR. FISHER: Object to form. 10:57:37

A. I think that things that go into laboratory mice would need to be small enough that fit into the body or certain area of body of -- of -- of a mouse, whereas something going to a larger animal, you would have similar considerations, but the -- the area, the volume available for you to put a device could be a little bit bigger compared to the space available in the laboratory mouse. 10:57:38 10:57:41 10:57:43 10:57:46 10:57:50 10:57:53 10:57:57 10:58:00 10:58:03 10:58:06

(BY MS. MAHONEY) 10:58:18

Q. Would you use different types of sensors between a lab mouse and a larger animal? 10:58:18 10:58:20 10:58:24

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MR. FISHER: Object to form. 10:58:25

A. I have to look at a specific -- 10:58:30

you know, what type of sensors that you are 10:58:32

talking about, then I can give you a better 10:58:34

answer. 10:58:35

(BY MS. MAHONEY) 10:58:36

Q. So what about the blood pressure 10:58:36

sensor that you used in the lab mice? 10:58:37

MR. FISHER: Same objection. 10:58:44

A. In terms of the pressure sensor, 10:58:47

the MEMS pressure sensor, they can be similar 10:58:51

type or maybe even the same MEMS pressure 10:58:56

sensor, but in terms of the -- the cuff size, 10:59:00

I would have to look at the size of the 10:59:06

vessel, right, inside a laboratory mouse 10:59:08

versus the size of a vessel that you want to 10:59:11

wrap around your cuff, around the vessel 10:59:14

inside a larger animal, because the vessel 10:59:18

dimension being different, small animal 10:59:21

versus large animal. That design would need 10:59:24

to be adjusted accordingly; otherwise, it 10:59:27

just wouldn't fit. 10:59:31

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Q. But the actual sensor itself, would there be changes to that blood pressure sensor between the small lab mouse and the larger animal? 10:59:33 10:59:36 10:59:39 10:59:42

A. I would have to look at it more carefully. 10:59:45 10:59:47

I would say similar type of device can be used, but whether it's exactly the same or not, I need to look at the requirements. 10:59:47 10:59:49 10:59:51 10:59:54

Q. So based on your research, you're also familiar with wearable monitoring devices, right? 11:00:13 11:00:15 11:00:19

A. That's correct. 11:00:22

Q. How would you define a "wearable monitoring device"? 11:00:22 11:00:25

A. Something that you -- you can wear, right? You can wear a -- outside your body, you know. I think I mentioned that to you earlier. For example, sensors that go into shoes, you know, is considered a wearable sensor, right? A sensor that can be 11:00:30 11:00:32 11:00:36 11:00:39 11:00:42 11:00:45

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maybe attached to a certain part of your body scheme is considered a wearable device. 11:00:48 11:00:52

Q. And you mentioned working on a wearable monitoring device that used a blood pressure sensor; is that right? 11:01:00 11:01:03 11:01:06

A. Used -- used wearable monitoring device to monitor blood pressure waveform from which we can determine blood pressure level, heart rate and heart rate variability. 11:01:08 11:01:11 11:01:15 11:01:18

Q. So that's a different blood pressure monitor -- or strike that. 11:01:24 11:01:27

That's a different -- different pressure sensor than the one that you used inside of the lab mice? 11:01:28 11:01:30 11:01:33

A. We actually tried the -- both type of sensors, and the -- for prototyping purpose initially just to prove the concept, we used a MEMS pressure sensor, very similar to the one that we use for -- for the laboratory mouse implant. 11:01:41 11:01:49 11:01:54 11:01:57 11:02:00 11:02:03

Then later on, we designed -- we designed something different in terms of, you 11:02:06 11:02:12

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know, different sensing principles to measure blood pressure pulse waveform from -- you know, from a certain part of your scheme, body scheme. 11:02:15 11:02:21 11:02:25 11:02:33

Q. So the MEMS pressure sensor that you used in the implantable device did not work when you used it in the wearable device? 11:02:34 11:02:38 11:02:41

A. That's not correct. 11:02:43

It worked, but it's a very small sensor; so you -- you would have to kind of align it right, and you get a signal expected. Before a practical application, you want to build something like a patch or -- right, that had a lot of sensing points, so when you attach to a certain body of the sensor, a potential user, per se, doesn't have to move that thing around to find the sweet spot, right? You put on it because there's an array of sensors. You would be able to get the signal that you wanted. 11:02:44 11:02:47 11:02:50 11:02:53 11:02:55 11:02:58 11:03:00 11:03:02 11:03:06 11:03:09 11:03:11 11:03:14 11:03:16

Q. So it would be fair to say that 11:03:20

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you had to make some adjustments between the device that was used internally and the device you were going to use externally? 11:03:39 11:03:42 11:03:44

A. I think it's fair to say that, you know, in all engineering design, certain adjustments, right, certain design trade-offs, would be needed. 11:03:48 11:03:50 11:03:54 11:03:58

Q. So in other words, you couldn't just take the -- the blood pressure sensor that you were using in the mouse inside of the mouse and go use it externally? 11:04:05 11:04:07 11:04:09 11:04:11

A. For the pressure sensor, not the cuff, right? You know, you can use the pressure sensor outside the body, you know, as I explained to you earlier. 11:04:15 11:04:25 11:04:28 11:04:29

If you just use that pressure sensor alone, you have to find that sweet spot, the vessel, to get the pulse waveform. That works if you said, I'm willing to find it. 11:04:31 11:04:33 11:04:36 11:04:39 11:04:41

But in a practical application, right, if somebody designed a patch attached 11:04:42 11:04:43

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to a certain part of the body, you want to make sure that that patch is designed without, you know, having a user to find the sweet spot. You can get a signal without -- without moving things around to find the sweet spot. 11:04:46 11:04:48 11:04:51 11:04:54 11:04:59 11:05:01

Q. And so would the reverse also be true, you'd have to make some adjustments taking the external monitoring device and turning it into that internal monitoring device? 11:05:09 11:05:12 11:05:14 11:05:16 11:05:21

A. You know, we talked about that before. That type of adjustment, you know, or modification or design trade-offs, what -- it's just always needed when you go from one type of application to the other. That's just kind of expected for engineering work, right? 11:05:21 11:05:23 11:05:26 11:05:31 11:05:33 11:05:36 11:05:39

Q. In addition to the adjustments to the sensor that you've already talked about, what other type of -- types of modifications would you have to make to take an external 11:05:48 11:05:50 11:05:52 11:05:55

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monitoring device and turn that into an internal monitoring device? 11:05:59 11:06:03

A. You know, for example, you have to make things very clean that go inside the body, right? 11:06:07 11:06:17 11:06:20

You would need to maybe coat the package with something we called a biocompatible coating just to avoid undesirable tissue interaction. I use the word "interaction." You know what I'm talking about, right? They're just foreign bodies, they may not mix well, so you need a certain type of coating; whereas, you know, outside the body, it's less of a concern, right? 11:06:21 11:06:26 11:06:29 11:06:31 11:06:36 11:06:37 11:06:40 11:06:43 11:06:45 11:06:48

And also, you know, if you're going to -- inside the body, depending on the application, the location, size, you know, weight, like, can be a critical consideration; and the designers will often choose to adjust their form factors in order to -- in order to meet the requirements. 11:06:48 11:06:50 11:06:54 11:06:57 11:07:02 11:07:04 11:07:07

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Q. So what about in terms of the device's ability to communicate wirelessly? What adjustments would you have to make to take an external monitoring device and turn it into an internal monitoring -- monitoring device? 11:07:25 11:07:28 11:07:33 11:07:35 11:07:39 11:07:41

A. Like, for external monitoring, sometimes you can just have a wire, right, connect your device to -- to a data log to directly log the data; whereas something going to the body, you have to build a wireless data transmitter, right, a data communication system. It's just not practical or safe to have a wire that goes through the skin. 11:07:49 11:07:54 11:07:56 11:07:59 11:08:01 11:08:04 11:08:08 11:08:10 11:08:13

So that is one type of adjustment I see that's needed versus -- you know, between designing wearable sensors and designing implantable sensors. 11:08:14 11:08:16 11:08:20 11:08:24

Q. And so what about when the wearable sensor is wireless? 11:08:26 11:08:29

A. Yeah, I think that also ties to, 11:08:33

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you know, things that we discussed earlier, right? 11:08:36 11:08:38

When you go inside the body, there could be a frequency shift due to the tissues around that sensor, and that would need to be considered as part of your design process. 11:08:38 11:08:41 11:08:45 11:08:48 11:08:53

Engineers, you know, we need to characterize the system, then they know -- then they would know how to do it. 11:08:55 11:08:57 11:08:59

Q. What type of adjustments would you make to mitigate these -- the frequency -- frequency shift that happens when you bring a device from external to internal? 11:09:07 11:09:29 11:09:35 11:09:37 11:09:40

MR. FISHER: Object to the form. 11:09:40 11:09:51

A. If you characterize system, you know, you can find out -- for example, a range of frequency shift, it will occur when you go from outside the body to inside the body at a specific location, per se. 11:09:51 11:09:57 11:10:06 11:10:10 11:10:13

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Then, depending on that shift, you know, you would need to design your, you know, radiofrequency generator, for example, an oscillator, with a corresponding frequency shift, perhaps on the opposite direction to compensate that shift. 11:10:16 11:10:19 11:10:22 11:10:26 11:10:30 11:10:33

So at the end, you know, what signal -- whatever frequency coming out of your body would be your desired frequency. 11:10:34 11:10:37 11:10:40

(BY MS. MAHONEY) 11:10:54

Q. And just to clarify, you said the range of frequency would shift as it goes from outside your body to inside the body? 11:10:55 11:10:59 11:11:02

A. There would -- 11:11:04

Q. Did you mean the opposite? 11:11:05

MR. FISHER: Object to the form. 11:11:08 11:11:11

A. If I understood your question correctly, you were asking me what will happen if you take a device from outside the body to inside the body, right? 11:11:11 11:11:14 11:11:17 11:11:21

And my -- my answer was, when you 11:11:25

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take a -- a device -- for example, you know, you talk about the wireless communication link, right, data communication capability. When you take that from outside the body to inside the body, there would be a frequency shift; and as I said, engineers, we need to characterize the system to know what is the shift or what is the range of frequency shift. 11:11:28 11:11:31 11:11:34 11:11:37 11:11:39 11:11:42 11:11:50 11:11:52 11:11:54

Once that is known, then the designers can design the RF generator, for example an oscillator, with a corresponding frequency shift towards the opposite direction so that you compensate it. 11:11:54 11:11:57 11:12:04 11:12:08 11:12:12

(BY MS. MAHONEY) 11:12:23

Q. So it's the RF generator that accommodates for the shift in frequency? 11:12:23 11:12:35

A. That's one of the components that I'm aware of. There could be other components that may can be used to accommodate a frequency shift. 11:12:39 11:12:41 11:12:43 11:12:48

Q. What other components? 11:12:49

A. I mean, as far as I know, if you just look at the frequency shift, that is the frequency coming out of the RF generator. There could be others that I may not be aware of. You know, I'd have to investigate it. 11:12:51 11:13:06 11:13:08 11:13:13 11:13:15

Q. Are you familiar with resonant circuits? 11:13:19 11:13:22

A. Yes, I am familiar with resonant circuit. 11:13:23 11:13:25

Q. What is a resonant circuit? 11:13:25

A. It's a circuit that's designed at resonate -- resonate at a resonant frequency. 11:13:27 11:13:30

Q. And what is resonant frequency? 11:13:33

A. If you have a resonator, the resonator will resonate at a -- at its own defined resonant frequency. 11:13:36 11:13:38 11:13:43

Q. But what is resonant frequency? 11:13:57

A. Put in a simple way, if you looked at a resonator, if you look at the frequency response, and you typically to see there is a strong peak at the particular frequency, and that is the resonant 11:14:09 11:14:12 11:14:15 11:14:18 11:14:21

frequency. 11:14:24

Q. What do you mean by "peak"? 11:14:25

A. If you look at the -- as I say, 11:14:27

you look at the frequency response and 11:14:30

specifically you look at the frequency 11:14:33

spectrum plot, you know, you will see a -- 11:14:36

you will -- for example, you -- you have 11:14:41

to -- if you -- if you define certain 11:14:44

parameter, maybe the impedance, you know, you 11:14:53

will see a -- either a very strong impedence 11:14:57

rise, then falls down; so they're -- like a 11:15:02

spike, right? So -- but they are spike, a 11:15:05

curse (phonetics) at a particular frequency, 11:15:09

and that frequency is a -- is called the 11:15:11

resonant frequency. 11:15:14

Q. And so you said that a resonant 11:15:23

circuit is designed to resonate at that 11:15:25

resonant frequency; is that correct? 11:15:28

A. The reson- -- a resonator is 11:15:31

designed to exhibit a resonant frequency, and 11:15:34

that resonant frequency is -- it's inherent, 11:15:37

it's internal or intrinsic behavior. You 11:15:41

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design the resonator; the resonator is designed by somebody to exhibit a resonant frequency. 11:15:45 11:15:47 11:15:51

Q. So what is the purpose of a resonant circuit? 11:15:52 11:15:56

MR. FISHER: Object to the form. 11:15:59 11:16:02

A. The purpose of resonant circuit -- depending on your application; but to be fair, for the oscillator, for example, you know, the resonant circuit is used when trying to set the frequency of the oscillator. 11:16:02 11:16:09 11:16:11 11:16:13 11:16:16 11:16:19

(BY MS. MAHONEY) 11:16:26

Q. So in your opinion, Dr. Young, the resonant circuit sets the frequency of the oscillator? 11:16:26 11:16:28 11:16:33

A. The resonant circuit is used as a part of the oscillator design to help determine the frequency of the oscillator in the oscillator design example, but there are many other examples where you can use a 11:16:42 11:16:45 11:16:47 11:16:51 11:16:54

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resonator, you know, as a filter, right, filter -- filter informations, and for that particular application as a filter. You're not building an oscillator; you're just providing filtering function. 11:16:57 11:17:01 11:17:04 11:17:07 11:17:10

Q. So does the resonant circuit modify the frequency of the signal coming out of the oscillator? 11:17:17 11:17:19 11:17:23

A. If there's influence, external influence on the -- on the resonator, it would. 11:17:24 11:17:26 11:17:29

Q. What do you mean by "external influence"? 11:17:29 11:17:32

A. Depending on type of resonators. 11:17:32

You know, for example, if you have, like, the piezoelectrical-based -- piezoelectric-based resonator, you know, if there are external loading force on that resonator, it would change the resonant frequency. 11:17:35 11:17:37 11:17:44 11:17:46 11:17:50 11:17:54

Q. And can you explain what you mean by "external loading force"? 11:18:08 11:18:10

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A. For example, if you have a piezoelectrical material, you design -- you use the material to build in a resonator; and that resonator, under your design, will exhibit certain resonant behavior. 11:18:13 11:18:19 11:18:24 11:18:28 11:18:33

For example, you see that maybe the impedence has a strong peak, then comes down, right? The peak occurs at your designed resonant frequency. But if you apply certain force on it, maybe use a pencil tip, press on it, that will -- that additional force that you add onto it, it would change the position of the peak. 11:18:35 11:18:36 11:18:39 11:18:42 11:18:45 11:18:50 11:18:53 11:18:57

Q. And what does that mean when the position of the peak changes? 11:19:05 11:19:07

A. That means the resonant frequency shifted. 11:19:09 11:19:12

Q. Okay. So just to make sure I'm understanding here, a resonant circuit can work with an oscillator to help determine the frequency of the signal coming out of the oscillator; is that correct? 11:19:27 11:19:29 11:19:34 11:19:39 11:19:41

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A. Yeah, to the first order, that's correct. 11:19:46 11:19:47

Q. And a POSA would agree with that, too? 11:19:47 11:19:51

A. I think so. 11:19:56

Q. What components are in a resonant circuit? 11:19:58 11:20:06

A. Depends on type of resonator that you build. 11:20:07 11:20:10

Q. Do you have an example? 11:20:14

A. For example, you can use -- you can use a semiconductor material to build a -- to build a membrane, and that membrane, depending on the material property and the dimension of that material, the beam, it will have its resonant frequency. 11:20:17 11:20:27 11:20:34 11:20:41 11:20:44 11:20:48

You can build a resonator using electrical components -- for example, inductors, capacitors -- that will also form a -- a resonance or resonant frequency. 11:20:52 11:20:54 11:20:57 11:21:00

Q. So is it required for a resonant circuit to have a capacitor? 11:21:04 11:21:18

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A. Depends on the type of resonator that you build. 11:21:23 11:21:26

Q. Are there resonators that don't have capacitors? 11:21:27 11:21:29

A. Yeah. 11:21:42

For example, for the first example I described, if you build a -- a membrane, you know, you can call it a, maybe, clamped -- clamped beam, right? That beam will have its resonant frequency, and that resonant frequency to the first order is determined by the material properties and also the dimension of the resonator. 11:21:43 11:21:44 11:21:48 11:21:55 11:21:58 11:22:01 11:22:09 11:22:14

Now, if you ask me is there capacity in there, I have to look at it more carefully before I can give you a -- a -- kind of a more fixed answer. 11:22:19 11:22:24 11:22:26 11:22:28

Q. Okay. But sitting here today, are you aware of any resonators that don't have a capacitor? 11:22:30 11:22:36 11:22:38

MR. FISHER: Objection, asked and answered. 11:22:40 11:22:42

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A. I mean, that's a very, you know, broad question. I would -- I have not thought about that; but if you present to me a specific design, say, "Hey, I got this thing here, it's a resonator," I would have to look at it carefully to tell you in a more formed -- you know, confirm the manner whether there is a capacitor there or not. 11:22:53 11:22:55 11:22:56 11:22:59 11:23:02 11:23:05 11:23:07 11:23:11 11:23:14

Q. Would you agree that a capacitor is a common element in a resonant circuit? 11:23:17 11:23:20

A. I think this relates back to what we just discussed, right? 11:23:25 11:23:29

You know, I'm not sure what resonate -- resonant circuit you're talking about. You know, you would need to be a bit more specific, say that, "Hey, this is the resonator I have, this is how it was built." Then when I look at that design, I'll be able to tell you whether there is a capacitor there or not. 11:23:31 11:23:32 11:23:34 11:23:36 11:23:39 11:23:43 11:23:45 11:23:47

Q. Can a capacitor generate a radio 11:23:54

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signal? 11:24:04

MR. FISHER: Object to the 11:24:05

form. 11:24:09

A. Again, it's a very general 11:24:09

question. 11:24:12

If you just put a capacitor on 11:24:13

the table by itself, my understanding is that 11:24:15

it wouldn't be able to generate the 11:24:23

radiofrequency signal, right? 11:24:27

But if you put the capacitor into 11:24:30

other electronic system that generates the 11:24:32

radiofrequency signal collectively, the 11:24:35

capacitor is a part of that system. Then the 11:24:36

overall unit, right, the overall system will 11:24:38

be able to generate a radio signal. 11:24:41

(BY MS. MAHONEY) 11:24:46

Q. I see. So the capacitor -- 11:24:47

strike that. 11:24:49

The capacitor itself does not 11:24:49

generate a radio signal on its own, correct? 11:24:54

A. If you just put on the table, 11:24:58

nothing else attached to it, I just do not 11:25:00

see how that capacitor on the table, nothing attached to it, can generate a radiofrequency signal, not that I -- not that I know of. 11:25:03 11:25:07 11:25:11

Q. It would need some sort of other radio signal generator, like an oscillator, to produce that radio signal? 11:25:12 11:25:15 11:25:18

A. You know, using an oscillator, right, is a -- one of the examples that a radio signal can be generated, and building that oscillator, it may require some capacitors. You know, if you -- if you're talking about the same capacitors on the table, it cannot generate a radio signal; but if that capacitor is inserted or incorporated into an oscillator design, then the overall design would generate a radio signal. 11:25:22 11:25:28 11:25:32 11:25:35 11:25:38 11:25:41 11:25:42 11:25:45 11:25:48 11:25:51

Q. Okay. And just to make sure I'm understanding, if you have a system with a radio signal generator and a capacitor, the capacitor would not be generating a signal different from the radio signal generator? 11:26:18 11:26:20 11:26:24 11:26:28 11:26:31

A. Sorry, with all due respect, I 11:26:40

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must tell you that's a very convoluted question. Maybe you could repeat it again. I'm trying to understand your question. 11:26:42 11:26:44 11:26:47

Q. Of course. 11:26:48

So if you have a system, you have a radio signal generator and, down the line, a capacitor -- 11:26:50 11:26:52 11:26:55

A. What do you -- what do you mean by "down the line a capacitor"? 11:26:56 11:26:57

Q. If you have a system with a radio signal generator and separately a capacitor, if the radio signal generator is generating a signal, can the capacitor independently generate its own signal? 11:27:00 11:27:13 11:27:18 11:27:22 11:27:24

MR. FISHER: Object to form. 11:27:32

A. I think I heard what you said, but let me digest what you said. You -- correct me if I didn't phrase your question the same way. 11:27:34 11:27:36 11:27:40 11:27:43

You said that if you have a system, that system has a radiofrequency generator and that system also has a 11:27:43 11:27:45 11:27:49

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capacitor, does that capacitor generate the same radiofrequency as the radiofrequency generator? Is that -- is that what you asked me? I just want to make sure that I'm on the same page with you, you know. 11:27:53 11:28:03 11:28:07 11:28:11 11:28:14

(BY MS. MAHONEY) 11:28:15

Q. Of course. 11:28:16

Can that capacitor generate a different radio signal than the radio signal generator, a different -- a signal at a different frequency than the radio signal generator? 11:28:16 11:28:18 11:28:22 11:28:27 11:28:29

MR. FISHER: Same objection. 11:28:30

A. I have to look at the design more carefully. I'm not ready to just give you a yes or no question [sic]. You know, it is a bit more -- it's a broad question, you know. I wouldn't be able to give you a fixed answer. 11:28:39 11:28:41 11:28:44 11:28:48 11:28:50 11:28:53

(BY MS. MAHONEY) 11:28:53

Q. And, Dr. Young, what is an inductor? 11:28:56 11:28:57

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A. Inductor is a -- it's an inductive element that can store -- it can store magnetic energy. 11:29:00 11:29:03 11:29:07

Q. Are inductors used in resonant circuits? 11:29:09 11:29:14

A. Depending on type of resonant circuit that you are talking about. 11:29:15 11:29:18

Q. So there could be a resonant circuit that does not have an inductor in it? 11:29:21 11:29:25

A. I would need to look at your specific resonator design before I can give you a more confirmed answer. 11:29:34 11:29:35 11:29:38

Q. But at this moment, you don't know of any resonant circuits that do not have an inductor? 11:29:40 11:29:44 11:29:47

A. I have not thought about that. 11:29:51

Q. Okay. You said inductors can store magnetic energy, right? 11:29:52 11:30:26

A. Just one of this -- you know, if -- there could be many different features of the inductors, right? 11:30:28 11:30:29 11:30:31

And, you know, on top of my head, 11:30:33

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I can tell you that inductor is an element that stores magnetic energy or generates magnetic field. 11:30:34 11:30:36 11:30:38

Q. Do inductors generate a signal? 11:30:40

A. Circling back to the same question you asked me about the capacitor, right? If you just take an inductor and put on the table, nothing attached to it, as far as I know it does not generate a signal. 11:30:45 11:30:48 11:30:50 11:30:53 11:30:55

Q. Would you ever use an inductor in a system to generate a signal? 11:30:57 11:30:59

A. There are systems that use inductor to generate a signal. 11:31:02 11:31:04

Q. Do you have an example of that? 11:31:08

A. For example, you can build a -- an oscillator that can generate a signal, and that oscillator can have an inductor in there to help generate that signal. 11:31:12 11:31:18 11:31:21 11:31:25

Q. So in that example, the inductor is helping the oscillator to generate a signal? 11:31:27 11:31:30 11:31:32

A. The inductor is helping the 11:31:35

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oscillator to generate a signal at a -- at a desired frequency. 11:31:38 11:31:42

Q. But the inductor is not generating the signal on its own, right? 11:31:42 11:31:49

A. If you -- now, if you just -- if you -- if you just take the inductor on the table just like the capacitor, nothing attached to it, I -- I don't see how it can generate a signal by itself. 11:31:54 11:31:57 11:31:59 11:32:02 11:32:05

Maybe there are ways, I'm just not aware of it; but if you put that inductor into a oscillator, that generates a signal, that -- then that inductor would be a part of that overall system which generates that radiofrequency signal. 11:32:08 11:32:09 11:32:13 11:32:18 11:32:20 11:32:25

Q. If you put a radio signal generator on the table, would it be capable of generating a signal? 11:32:25 11:32:32 11:32:35

A. Let me make sure I understand your question. You're asking me if I put a radiofrequency generator on the table, would it be able to generate a radio signal? 11:32:39 11:32:43 11:32:52 11:32:57

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Q. Correct. 11:33:02

A. If that radio signal generator is properly designed and is energized by sufficient power source, then that radio signal generator, as you characterized, sitting on the table, will be able to generate a radio signal. 11:33:04 11:33:07 11:33:12 11:33:16 11:33:17 11:33:20

Q. So if an inductor was sitting on the table and it was energized by a sufficient power source, would that inductor be able to generate a radio signal? 11:33:22 11:33:34 11:33:37 11:33:40

A. Can you be more -- more specific about what you mean by "sufficient power source"? 11:33:47 11:33:50 11:33:55

Q. Well, you tell me what sufficient power source is. 11:33:55 11:34:02

A. When I used the "sufficient power source," I was referring to that radiofrequency generator that you used as an example, sitting on the table. 11:34:07 11:34:09 11:34:13 11:34:18

And that power source can be a battery, right, to supply energy to the RF 11:34:19 11:34:22

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generator. If the battery has sufficient -- 11:34:28
sufficient -- sufficient voltage, for 11:34:34
example, or sufficient current driving the 11:34:40
oscillator, and assuming that -- I guess I 11:34:43
used the word "oscillator," but just to be 11:34:51
clear, you used the word "RF generator." 11:34:53
So let's say that we go back to 11:34:56
the RF generator. If that battery has 11:34:58
sufficient energy, maybe sufficient amount of 11:35:01
battery level, the voltage level, and a 11:35:03
sufficient amount of current that can deliver 11:35:06
into that radiofrequency generator and 11:35:10
assuming that radiofrequency generator is 11:35:13
properly designed, then you put that thing on 11:35:15
the table, that radiofrequency generator will 11:35:18
be able to generate a radio signal. 11:35:23
Q. Dr. Young, what is a resistor? 11:35:41
A. A resistor is a -- is a 11:35:53
electrical element. I assume you refer to 11:35:57
resistor as an electrical resistor, right? 11:36:01
Q. Yes. 11:36:04
A. Yeah, it's a -- it's a electrical 11:36:05

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element that will provide certain resistance to the current flow inside a circuit. 11:36:07 11:36:11

Q. Can a resistor modify the frequency of a radio signal? 11:36:30 11:36:35

MR. FISHER: Object to form. 11:36:52

A. Your question is: Can a resistor modify the frequency of a radio signal? 11:37:04 11:37:07

(BY MS. MAHONEY) 11:37:11

Q. Correct. 11:37:12

MR. FISHER: Maintain the objection. 11:37:25 11:37:26

A. Depending on -- I guess depending on the specific design, you know, how that resistor is used, right, inside that radiofrequency generator. 11:37:27 11:37:28 11:37:30 11:37:34

(BY MS. MAHONEY) 11:37:44

Q. Can a combination of capacitors and resistors modify the frequency of a radio signal? 11:37:44 11:37:46 11:37:51

MR. FISHER: Same objection. 11:37:51

A. Depends on specific design. 11:37:58

(BY MS. MAHONEY) 11:38:00

Q. What do you mean? 11:38:01

A. You -- you're asking me can I do it? 11:38:02 11:38:05

I have -- I have to look at your specific -- specific design in order to say, "Hey, for that type of design, it's doable." 11:38:06 11:38:07 11:38:10

Q. Can a combination of capacitors and resistors create a resonant circuit? 11:38:14 11:38:21

MR. FISHER: Same objection. 11:38:29

A. If you assume there is no inductance in there, to my understanding, if you just have a resistor capacitor, you may not be able to form a resonant circuit. 11:38:38 11:38:42 11:38:47 11:38:56

(BY MS. MAHONEY) 11:38:59

Q. Why is that? 11:38:59

A. You have to go through the math to see if there is a resonant behavior that occurs, for example, at the particular frequency based on a circuit that only has a resistor and a capacitor. 11:39:07 11:39:10 11:39:14 11:39:17 11:39:25

Q. Okay. So just to be clear, if you have a -- strike that. 11:40:05 11:40:07

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Just to be clear, if you assume there is no inductor, if you have just a resistor and a capacitor, you may not be able to form a resonant circuit? 11:40:08 11:40:10 11:40:14 11:40:16

A. Based on my understanding. 11:40:19

Q. And would a POSA agree with that? 11:40:21

A. I think that a POSA would agree with that. 11:40:29 11:40:32

Q. Would it be fair to say that an inductor is a necessary element of a resonant circuit? 11:40:39 11:40:40 11:40:44

MR. FISHER: Object to form. 11:40:45

A. Again, depends on how you build the resonant circuit, right? 11:40:49 11:40:52

As we talked about earlier, there are different types of resonant circuits. Some of them may need an inductor, some of them may not need an inductor. I have to look at specifically what reson- -- resonant circuit or resonator you are -- you are talking about. 11:40:53 11:40:56 11:40:57 11:41:00 11:41:03 11:41:05 11:41:07

(BY MS. MAHONEY) 11:41:08

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Q. But at this moment, you don't know of any resonant circuits that do not have an inductor, right? 11:41:08 11:41:14 11:41:17

MR. FISHER: Same objection. 11:41:18

A. I need to think about it before I can give you a more confirmed answer. 11:41:18 11:41:21

(BY MS. MAHONEY) 11:41:30

Q. Can a resonant circuit generate a signal? 11:41:31 11:41:33

MR. FISHER: Object to form. 11:41:37

A. I need to know what resonant circuit are you talking about. 11:41:39 11:41:43

(BY MS. MAHONEY) 11:41:46

Q. So there could be a resonant circuit that generates a signal? 11:41:47 11:41:48

A. That's not what I said. I need to -- my response to your earlier question is: I need to know what resonant circuit are you talking about. 11:41:50 11:41:52 11:41:55 11:41:58

Q. Can a resonant circuit change the frequency of a radio signal? 11:42:11 11:42:14

MR. FISHER: Same objection. 11:42:18

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A. It's possible. 11:42:24

(BY MS. MAHONEY) 11:42:35

Q. And that would be one of the 11:42:35

reasons to include a resonant circuit in a 11:42:37

system, right? 11:42:39

MR. FISHER: Same objection. 11:42:40

A. Your question is broad. I try to 11:42:50

answer, but I need to clarify a few things 11:42:54

before -- before I get on the same page with 11:42:57

you. 11:43:00

When you say in the "system," 11:43:00

what system are you referring to? 11:43:02

(BY MS. MAHONEY) 11:43:14

Q. Are there systems that exist that 11:43:15

you would include a resonant circuit to 11:43:18

change the frequency of the radio signal? 11:43:23

A. Yeah. There are oscillators, 11:43:36

right, that you can use a resonant circuit. 11:43:39

As I said earlier to you, that 11:43:41

resonant circuit can help determine the 11:43:43

frequency of the oscillator, but that 11:43:46

resonance can be changed, depending on how 11:43:47

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you work with that -- how you -- how you work with that resonator. 11:43:50 11:43:53

Q. Okay. And so just to be clear, you could use a combination of capacitors and inductors in combination with an oscillator to help determine the frequency of the oscillator? 11:44:13 11:44:16 11:44:22 11:44:27 11:44:29

MR. FISHER: Object to the form. 11:44:31 11:44:32

A. I think I know what you're asking, but if I may maybe clarify something, we will be on the same page. 11:44:38 11:44:39 11:44:43

You said that, to be clear, a inductor and a capacitor, together with an oscillator to help determine the frequency of the oscillator is your question? 11:44:44 11:44:48 11:44:52 11:44:57

(BY MS. MAHONEY) 11:44:59

Q. Yes. 11:44:59

MR. FISHER: Same objection. 11:45:00

A. I would say, if you have an oscillator... the oscillator have inductor, capacitor, or inductors or capacitors; those 11:45:01 11:45:09 11:45:29

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components can determine the oscillator frequency, and those components can also change the oscillator frequency. 11:45:37 11:45:42 11:45:46

(BY MS. MAHONEY) 11:45:50

Q. And "those components," being the inductor and the capacitor, they would be acting as a -- as a resonant circuit to change the frequency of the oscillator? 11:45:59 11:46:01 11:46:04 11:46:06

A. They would need to be a part of the resonant circuit in order to change the frequency of the oscillator. 11:46:11 11:46:14 11:46:17

Q. Okay. And just to be clear, that's the frequency of the signal coming out of the oscillator? 11:46:18 11:46:20 11:46:23

A. That's correct. 11:46:26

Q. Okay. And, Dr. Young, you're familiar with impedence matching, right? 11:46:31 11:46:32

A. That's correct. 11:46:34

Q. What is impedence matching? 11:46:34

A. You want to match impedence. 11:46:38

Q. What is impedence? 11:46:40

A. Impedence is a -- is a typical 11:46:42

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term used in electrical engineering to represent -- to represent impedence. That is something that can maybe resist current flow. 11:46:46 11:46:52 11:47:00

Q. And why would you want to match impedence? 11:47:04 11:47:06

A. There are multiple reasons in the electrical system design that you want to match the impedence. And some systems are designed to see certain impedence, and that impedence may need to be matched or modified to match to the designed impedence. It may not come out exactly that, right? 11:47:09 11:47:26 11:47:28 11:47:36 11:47:39 11:47:45 11:47:48

It requires a matching network that match the impedence; and in some system, you know, matching -- impedence matching can help in a more efficient operation in terms of delivering power from one side to the other. 11:47:51 11:47:53 11:47:55 11:48:00 11:48:05 11:48:08

So there are, you know, a number of reasons why an impedence matching is necessary in electrical system design. 11:48:08 11:48:09 11:48:13

Q. Okay. You said "matching 11:48:19

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network." What is a matching network? 11:48:21

A. It -- it -- a network made out of 11:48:26

different components that provides the 11:48:30

matching function. 11:48:32

Q. What types of components are in a 11:48:36

matching network? 11:48:38

A. In electrical system, matching 11:48:41

network can be made by using resistors, 11:48:44

capacitors, and possibly inductors. 11:48:49

Q. Can a resonant circuit be a 11:48:54

matching network? 11:48:59

A. Say it again. 11:49:00

Q. Can a resonant circuit be a 11:49:01

matching network? 11:49:05

A. It's possible. I have not come 11:49:10

across that. 11:49:13

You know, when I design a 11:49:14

resonator, I design the resonator for the 11:49:15

resonant behavior, that resonant frequency 11:49:18

purpose; but just to answer your question, it 11:49:22

is possible to use some of the resonators. 11:49:25

Again, depends on the type of resonator 11:49:28

that -- that you are -- you are talking about. I have to look at the structure of the resonator before I can say this can do something such as impedence matching. 11:49:30 11:49:33 11:49:35 11:49:39

Q. So what is the difference between a matching network and a resonant circuit? 11:49:41 11:49:43

A. The resonant circuit is designed to provide or to exhibit certain resonant behavior at a designed resonant frequency. 11:49:47 11:49:51 11:49:55

And we talk about earlier that you may have an impedence that booms very high and then comes down, right? And that peak occurs at a frequency typically characterized as resonant frequency. That's a resonator. 11:50:01 11:50:03 11:50:06 11:50:08 11:50:12 11:50:15

And a -- and a impedence matching network is a -- is a -- is a -- is a circuitry that provides the impedence matching. 11:50:17 11:50:24 11:50:25 11:50:28

Q. Okay. You mentioned that a matching network can be made using resistors, capacitors, and possibly inductors; is that 11:51:02 11:51:03 11:51:08

correct? 11:51:10

MR. FISHER: Object to the 11:51:10

form. 11:51:11

A. I recall that's what I said, but 11:51:11

you know, these components that are 11:51:14

resistors, inductors, capacitors can be used 11:51:16

to form -- to form a matching network. 11:51:19

(BY MS. MAHONEY) 11:51:22

Q. So can you have a matching 11:51:22

network without an inductor? 11:51:24

MR. FISHER: Same objection. 11:51:29

A. I suppose you can. Really 11:51:37

depends on what you're trying to match or 11:51:39

what the situation is. 11:51:40

(BY MS. MAHONEY) 11:51:47

Q. So in your view, an inductor is 11:51:47

an optional element for a matching network? 11:51:50

A. No, I wouldn't go that far, 11:51:52

saying "optional element." 11:51:55

These are the necessary element 11:51:56

needed to build the matching networks, but 11:51:58

depending on -- depending on specific design, 11:52:01

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right, you know, I would look at a thing, I can tell you whether it's needed or not. 11:52:02 11:52:05

Likewise, I wouldn't say resistors, capacitors are optional elements; I wouldn't go that far. 11:52:07 11:52:09 11:52:13

Q. So an inductor would be necessary for building a matching network? 11:52:21 11:52:23

MR. FISHER: Object to the form. 11:52:25 11:52:26

A. I think I -- you know, I answered that question to you earlier, right? 11:52:27 11:52:28

These are the necessary elements. Depending on specific design, a designer would know what to use and what to pick. I wouldn't go that far and say that that is needed, that is not needed. It's just really depending on specific applications that you are looking at. 11:52:30 11:52:33 11:52:36 11:52:39 11:52:41 11:52:46 11:52:51

(BY MS. MAHONEY) 11:53:10

Q. Are you aware of any matching networks that do not have an inductor? 11:53:10 11:53:12

MR. FISHER: Object to the 11:53:14

form; asked and answered. 11:53:15

A. I came across -- you know, came 11:53:25

across, you know, matching networks that may 11:53:29

have different components in there, and it's 11:53:31

really depending on their intended design 11:53:33

application, right? Those components are in 11:53:35

there for certain design objectives. 11:53:38

(BY MS. MAHONEY) 11:53:54

Q. But sitting here today, you're 11:53:54

not aware of any matching networks that do 11:53:55

not have an inductor? 11:53:57

MR. FISHER: Object to the 11:53:58

form; asked and answered. 11:54:00

A. I think I said that to you 11:54:09

earlier. I can cross, you know, various type 11:54:10

of matching networks that have different 11:54:13

components in there; and depending on 11:54:15

specific applications, some components are in 11:54:18

certain designs, some components are in a 11:54:22

different type of design. 11:54:26

(BY MS. MAHONEY) 11:54:27

Q. Okay. 11:54:27

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MS. MAHONEY: I'm going to object to that as nonresponsive. 11:54:27 11:54:28

A. I did respond to your question, right? 11:54:34 11:54:36

(BY MS. MAHONEY) 11:54:55

Q. Dr. Young, have you ever seen a matching network that has not had an inductor? 11:54:55 11:54:57 11:55:00

MR. FISHER: Same objections. 11:55:01

A. Not that I can remember. 11:55:07

(BY MS. MAHONEY) 11:55:14

Q. Would a matching network work if it did not have an inductor? 11:55:14 11:55:16

MR. FISHER: Object to the form. 11:55:20 11:55:25

A. Depends on your design. 11:55:25

(BY MS. MAHONEY) 11:55:28

Q. In what way? 11:55:28

A. Depends on your design. You know, I need to know more specific what you are -- what you are -- what you are looking at, right? 11:55:29 11:55:32 11:55:35 11:55:37

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Then I can tell you whether you need an inductor there or whether you need a capacitor there or whether you need a resistor there or whether you need some combination of them or you need all of them. 11:55:38 11:55:40 11:55:42 11:55:45 11:55:49

Q. Would the combination of capacitors and resistors be sufficient to perform impedence matching? 11:55:50 11:56:12 11:56:18

MR. FISHER: Object to the form; asked and answered. 11:56:22 11:56:23

A. Depends on specific matching network and the type of impedence you want to match, you know. You have to -- it's a design options, right? You know, you -- as I said, you can have inductor, capacitor, resistor. You can have all of them or some of them. 11:56:27 11:56:29 11:56:32 11:56:34 11:56:37 11:56:40 11:56:42

If you ask me is there one that you can just ignore, I wouldn't go that far, right, to say you just drop one. I need to look at your specific design requirements and your design objective, then I can tell you 11:56:43 11:56:44 11:56:48 11:56:51 11:56:53

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how to design that matching network. 11:56:56

(BY MS. MAHONEY) 11:57:40

Q. Dr. Young, you would agree that 11:57:40

antennas have a Bode-Fano limit, right? 11:57:41

MR. FISHER: Object to the 11:57:47

form. 11:57:57

A. You need to be more specific 11:57:57

about, you know, the antenna that you are 11:58:02

talking about. You're asking me very general 11:58:04

questions, you know. 11:58:08

I take on as -- any type of 11:58:09

antenna that would have certain behavior, 11:58:11

right, will have certain radiation pattern, 11:58:14

but that varies from antenna to antenna. 11:58:18

(BY MS. MAHONEY) 11:58:33

Q. Are you aware of any antennas 11:58:33

that do not have a Bode-Fano limit? 11:58:35

MR. FISHER: Object to the 11:58:38

form. 11:58:49

A. It's a very broad question. See, 11:58:49

I don't want to say "yes" or "no." 11:58:53

But if you just have an antenna, 11:58:54

I say they have certain behavior in terms of the radiation pattern. 11:58:56 11:58:58

(BY MS. MAHONEY) 11:59:00

Q. And what is a Bode-Fano limit? 11:59:03

A. It tells you what is your -- what is your antenna radiation pattern in terms of its magnetic field and electrical field profile. 11:59:05 11:59:08 11:59:13 11:59:16

Q. And so, sitting here today, you're not sure whether all antennas have a Bode-Fano limit? 11:59:39 11:59:40 11:59:44

MR. FISHER: Object to the form; mischaracterizes prior testimony; asked and answered. 11:59:45 11:59:47 11:59:51

A. I -- you know, as I mean -- as I said to you, right, you know, depending on type of antenna, each one would have its own radiation pattern, right, to transfer or to transmit power to radiate energy from the antenna, but you need to be more specific. 11:59:56 11:59:58 12:00:00 12:00:03 12:00:09 12:00:11

I don't want to give you a very general answer, or I'm not ready to give a 12:00:14 12:00:16

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general answer. 12:00:20

(BY MS. MAHONEY) 12:01:09

Q. Dr. Young, is it possible to have an antenna without a Bode-Fano limit? 12:01:10 12:01:12

MR. FISHER: Same objections. 12:01:15

A. You asked again very general question. You asked whether, you know, it's possible or not, you know. 12:01:18 12:01:20 12:01:21

I -- I guess, you know, I -- anything's possible, but I'm not ready to give you a more confirmed answer, right, without looking at a specific type of antenna that you are talking about. 12:01:22 12:01:24 12:01:26 12:01:29 12:01:32

(BY MS. MAHONEY) 12:01:34

Q. How does the Bode-Fano limit change depending on the antenna? 12:01:53 12:01:55

A. Depending on antenna design. 12:02:02

Q. What do you mean by that? 12:02:05

A. Depending on the size of the antenna, the shape of the antenna, right, the -- it has a lot of components associated with a trace, with, you know, the -- the 12:02:06 12:02:10 12:02:16 12:02:18

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dielectric constant material that involved building the antenna. All of that would impact the performance of the antenna. 12:02:21 12:02:26 12:02:27

Q. So you said "dielectric constant." 12:02:34 12:02:37

A. Yeah. 12:02:37

Q. Do you mean permittivity? 12:02:37

A. Yes, yeah, permittivity of materials incorporated in building the antenna. 12:02:40 12:02:42 12:02:45

Q. And how does permittivity affect antennas? 12:02:46 12:02:51

A. Again, depends on your antenna, your antenna -- antenna design geometry, structures, right? 12:02:52 12:02:56 12:03:02

And, you know, if you look at some antenna equations, that permittivity is in the equation to describe the antenna's performance in terms -- for example, it's bandwidth. 12:03:03 12:03:08 12:03:13 12:03:18 12:03:22

Q. Do you know the permittivity of air? 12:03:39 12:03:42

A. That's 1. 12:03:42

Q. And what about the permittivity 12:03:42

of water? 12:03:45

A. I happen to remember. I happen 12:03:48

to remember. It's pretty high. I think it's 12:03:53

somewhere around maybe 60-, 70-ish, but don't 12:03:58

quote me on it. I have to look at the books, 12:04:14

but I just -- I just know it's higher than 12:04:16

air. 12:04:19

Q. Do you happen to know the 12:04:19

permittivity of grass, dry grass? 12:04:22

MR. FISHER: Object to the 12:04:30

form. 12:04:32

A. I came across those numbers 12:04:32

before, but I don't remember exact -- the 12:04:37

exact number -- maybe 2 or 3 or so. I could 12:04:44

be wrong, but -- you know, but it's -- I came 12:04:53

across the numbers. It's in the book, you 12:04:56

know, but I -- if you asked me to bet on it, 12:04:58

I would say probably around 2 or 3, maybe 4. 12:05:01

It's -- you know, I don't remember all these 12:05:04

numbers. 12:05:07

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(BY MS. MAHONEY) 12:05:07
Q. But you'd agree that the 12:05:08
permittivity of grass is closer to that of 12:05:09
air than it is of water? 12:05:12
MR. FISHER: Object to the 12:05:14
form. 12:05:17
A. If it's very dry grass, what you 12:05:17
said, I think it's true; but if it's wet, 12:05:21
it's got a lot of moisture in there, that can 12:05:24
change, you know. All these constants is -- 12:05:27
it's -- it's a function of the material 12:05:29
property. Those can change. 12:05:30
(BY MS. MAHONEY) 12:05:31
Q. So the more moisture that is in 12:05:31
the grass, the higher the permittivity value 12:05:33
would be? 12:05:37
A. I think that's true; but if you 12:05:43
want me to confirm, I have to, you know, 12:05:45
maybe look at some references or do some 12:05:48
experiments in my lab, right, look at a dry 12:05:51
grass, moisturize the grass just to see what 12:05:54
that -- what -- what the dielectric constant 12:05:58

change look like as a function of moisture level. 12:06:00 12:06:03

Q. Are you familiar with the term reticulorumen? 12:06:14 12:06:21

A. It's one of the those components in ruminant animal's stomach. 12:06:21 12:06:24

Q. And so you would agree that the reticulorumen of a cow, for example, would contain -- would contain at least a mixture of water and dry grass? 12:06:38 12:06:40 12:06:45 12:06:47

MR. FISHER: Object to the form; assumes facts not in evidence. 12:06:49 12:06:51

MS. MAHONEY: Mr. Fisher, as you know, the objection should be limited to form. 12:06:55 12:06:57 12:06:59

MR. FISHER: The objection stands. 12:07:01 12:07:02

A. I just want to wait until you finish talking, you know, if you -- 12:07:07 12:07:09

MR. FISHER: You can answer. 12:07:11

THE WITNESS: Okay. Thank you. I just... 12:07:11 12:07:12

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A. I think it's -- you know, it's fair to say that, right, depending on what -- what that animal eats. 12:07:14 12:07:19 12:07:22

(BY MS. MAHONEY) 12:07:36

Q. Would you also agree that the mixture of water and dry grass inside the reticulorumen of a ruminant animal would change its relative proportions throughout the day? 12:07:37 12:07:38 12:07:41 12:07:46 12:07:49

MR. FISHER: Same objections. 12:07:49

A. Could you -- I heard, you know, you said something -- could you repeat that again? 12:07:57 12:07:59 12:08:01

(BY MS. MAHONEY) 12:08:01

Q. Of course. 12:08:01

Would you agree that the mixture of water and dry grass that is inside the reticulorumen of a ruminant animal, that the relative proportions of water and dry grass may change throughout the day? 12:08:04 12:08:05 12:08:10 12:08:13 12:08:17

MR. FISHER: Same objections. 12:08:19

A. My gut feeling, probably will. 12:08:32

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(BY MS. MAHONEY) 12:08:36
Q. And would the change of the 12:08:37
proportions between water and grass also 12:08:39
affect the permittivity? 12:08:42
MR. FISHER: Same objections. 12:08:44
A. My gut feeling, it will, but -- 12:08:59
you know, but I would need to do some 12:09:03
experiments, as I said earlier, to really 12:09:04
confirm that with you. 12:09:07
(BY MS. MAHONEY) 12:09:17
Q. Would you agree that the 12:09:18
permittivity of the reticulorumen of a cow is 12:09:19
not a constant value throughout the day? 12:09:24
MR. FISHER: Object to form. 12:09:27
A. When you talk about permittivity, 12:09:36
what -- what -- what substance permittivity 12:09:37
are you referring to? 12:09:42
(BY MS. MAHONEY) 12:09:45
Q. What do you mean? 12:09:45
A. I just don't know because I -- 12:09:46
earlier you said that -- dielectric constant 12:09:48
of air, right? You know, we talk about air 12:09:50

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as a substance, right, dielectric constant of water; but when you talk about rumen dielectric constant or permittivity, I just want to know what -- are you talk [sic] about the tissue from the rumen, or what -- what -- what are you referring to? I just want to know more context about that question. 12:09:53 12:09:56 12:10:02 12:10:05 12:10:10 12:10:15 12:10:18

Q. Sure. 12:10:19

At this point, let's just focus on the actual contents that would be inside the reticulorumen, so a combination of water and dry grass. 12:10:20 12:10:21 12:10:24 12:10:27

A. Okay. Combination of water and dry grass, okay. 12:10:28 12:10:30

MR. FISHER: Same objection. 12:10:31

A. The amount may change, the ratio may change, but if you ask me dielectric constant change or not -- I think I mentioned that -- to you that it's my gut feeling it may well, but I need to do some experiments just to confirm that. 12:10:37 12:10:46 12:10:49 12:10:50 12:10:53 12:10:56

It's more of a technical answer, 12:10:57

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right? I need to do some experiments to confirm that with you. 12:10:59 12:11:02

MR. FISHER: Counsel, it's, I guess, about a little after 12:10. Perhaps now would be a good time for a lunch break. 12:11:12 12:11:14 12:11:19

MS. MAHONEY: If I may just wrap up a few more questions. 12:11:23 12:11:24

MR. FISHER: All right. 12:11:26

MS. MAHONEY: Then we'll be there. 12:11:27 12:11:28

(BY MS. MAHONEY) 12:11:38

Q. Dr. Young, do you know the permittivity of biomass or living tissue? 12:11:38 12:11:40

MR. FISHER: Object to form. 12:11:53

A. I don't remember the number off my -- off my head. 12:12:04 12:12:05

(BY MS. MAHONEY) 12:12:07

Q. Would you say it's closer to that of air or water? 12:12:11 12:12:12

MR. FISHER: Same objection. 12:12:13

A. Perhaps somewhere in between. 12:12:22

(BY MS. MAHONEY) 12:12:35

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Q. So to transmit a signal from inside the reticulorumen of a cow, you would agree that that signal would need to pass through some combination of water, grass, living tissue, and air, correct? 12:12:35 12:12:38 12:12:43 12:12:45 12:12:48

MR. FISHER: Same objection. 12:12:51

A. Inside the body, you mean? 12:12:59

(BY MS. MAHONEY) 12:13:02

Q. Yes. 12:13:02

MR. FISHER: Same objection. 12:13:02

A. Yeah, if those -- the substance that you are describing are inside the stomach, right, for example, the signal may need to go through some of them but may not be all of them. Really depends on the -- the position, right, of those materials that you are describing in the body. 12:13:16 12:13:18 12:13:21 12:13:44 12:13:46 12:13:49 12:13:52

(BY MS. MAHONEY) 12:14:03

Q. Would it be fair to say that the overall permittivity gradient of this combination of air, grass, water, and living tissue is more complex than the permittivity 12:14:03 12:14:06 12:14:09 12:14:12

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of just free air? 12:14:17

MR. FISHER: Object to the 12:14:18

form. 12:14:19

A. I wouldn't say more complex, 12:14:22

right? 12:14:24

You know, air is a constant, 12:14:25

right; but if you look at the different 12:14:26

materials, they have its own permittivity, so 12:14:28

it's just -- it's just the nature of the 12:14:31

material composition, right, with respect to 12:14:33

the permittivity of the air. 12:14:36

But I wouldn't characterize it 12:14:37

more complex. It is -- it is just the nature 12:14:39

of that material. 12:14:41

(BY MS. MAHONEY) 12:14:41

Q. Would you say it's more 12:14:42

unpredictable? 12:14:43

MR. FISHER: Same objection. 12:14:44

A. You can predict it with certain 12:14:52

range. 12:14:56

(BY MS. MAHONEY) 12:14:58

Q. What do you mean by that? 12:14:59

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A. You can ask me -- 12:15:00
MR. FISHER: Hold on. 12:15:02
Same objection. 12:15:03
Please make sure I get my 12:15:04
objection in. 12:15:05
THE WITNESS: Sorry. 12:15:06
A. I mean, if you ask me what is -- 12:15:08
what is the dielectric constant now, right, I 12:15:10
probably wouldn't be able to tell you, but 12:15:15
if -- if I do the characterization of -- of 12:15:18
those substance, I would be able to tell you 12:15:19
what is the range of the permittivity. 12:15:22
(BY MS. MAHONEY) 12:15:26
Q. And a POSA would agree with that? 12:15:47
MR. FISHER: Same objection. 12:15:50
A. At least I look -- if I put 12:16:00
myself as a POSA, I would agree with that. 12:16:05
(BY MS. MAHONEY) 12:16:10
Q. Okay. 12:16:10
MS. MAHONEY: I think now is a 12:16:11
good time to take a lunch break, if that 12:16:12
works. 12:16:14

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MR. FISHER: Yeah. 12:16:14

THE VIDEOGRAPHER: Okay. 12:16:15

Everyone please stand by. 12:16:17

We are going off the record. 12:16:17

The time is 12:16. 12:16:19

(Break taken from 12:16 p.m. to 12:16:21

1:14 p.m.) 01:14:48

THE VIDEOGRAPHER: We are now 01:14:49

back on the record. The time is 3:14 -- 01:14:55

1:14. 01:14:58

(BY MS. MAHONEY) 01:14:59

Q. Okay. Welcome back, Dr. Young. 01:15:03

Did you discuss any of the 01:15:06

substance of your testimony today with your 01:15:08

counsel during the break? 01:15:10

A. No, I did not. 01:15:11

Q. Okay. Now, before the break, we 01:15:12

were talking about permittivity, right? 01:15:16

A. That's correct. 01:15:19

Q. And specifically, we were talking 01:15:19

about the permittivity of some combination of 01:15:22

water, dry grass, air, and living tissue, 01:15:26

right? 01:15:29

A. That's correct. 01:15:30

Q. Okay. And you testified that you could characterize the combination to determine the overall range of permittivity of that combination, right? 01:15:30 01:15:34 01:15:37 01:15:39

MR. FISHER: Object to the form. 01:15:41 01:15:43

A. I'm trying to recall what was discussed. 01:15:48 01:15:50

If I remember correctly, you were asking me about the permittivity, and I -- and I said that I may not be able to tell you the permittivity right there, for example. I'd probably be able to -- we need to do some experiments to characterize the substance in the body, right? 01:15:51 01:15:55 01:16:00 01:16:02 01:16:08 01:16:11 01:16:15

So I can give you maybe a range, what is the range of permittivity from certain value to certain value. 01:16:15 01:16:18 01:16:21

(BY MS. MAHONEY) 01:16:23

Q. And so that range would represent 01:16:23

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the lowest permittivity value up to the highest permittivity value? 01:16:24 01:16:28

A. I wouldn't say the lowest and the highest, all right? Sort of, maybe from the low end to high end. 01:16:33 01:16:35 01:16:37

You know, every time you do an experiment, you find a low end; next time, maybe something a bit lower, maybe a bit higher. So I wouldn't just limit that to be the lowest or the highest. It's just that reasonable range being low and then being high. 01:16:39 01:16:40 01:16:43 01:16:47 01:16:49 01:16:51 01:16:55

Q. Would it be fair to characterize this combination of water, grass, living tissue, and air as a nonuniform field of permittivity? 01:16:58 01:17:01 01:17:04 01:17:07

A. When you say a "nonuniform field of permittivity," are you saying -- I mean, if I understand what you're saying, I guess you are saying a nonuniform distribution of permittivity, right? 01:17:09 01:17:13 01:17:24 01:17:25 01:17:28

Q. Okay. Would that be a more 01:17:29

appropriate word here? 01:17:31

A. I just want to make sure that I 01:17:32

understand what you're trying to say because 01:17:33

when you say "nonuniform field," I just -- I 01:17:36

just don't want to guess what you mean by 01:17:39

"nonuniform field." 01:17:41

If you said "nonuniform 01:17:43

distribution," I -- I -- you know, I could 01:17:46

understand that better. 01:17:47

Q. Okay. So would it be fair to 01:17:48

characterize a combination of water, grass, 01:17:51

living tissue, and air as a nonuniform 01:17:54

distribution of permittivity? 01:17:57

A. If you look at these 01:18:10

substance to- -- collective -- collectively 01:18:12

together, as something in your stomach or an 01:18:14

animal's stomach, for example, in the body, 01:18:19

per se, there would be a -- there would be a 01:18:20

permittivity value, maybe a net permittivity 01:18:24

value for everything in there, right? 01:18:29

And -- but everything in there, 01:18:33

as you'd characterize them, may have, you 01:18:35

know, living tissues, water, you know -- you know, grass, whatever, right? 01:18:39 01:18:45

So there -- there would be some nonuniform distribution, per se; but it would be represented, perhaps, as just one value, right? You know, you got something in there, and that something has a relative permittivity value associated with it. 01:18:46 01:18:49 01:18:57 01:19:01 01:19:04 01:19:06

Q. Okay. But it would be fair to say that the specific permittivities are not uniform across the distribution of the entire combination? 01:19:09 01:19:16 01:19:18 01:19:22

MR. FISHER: Object to the form. 01:19:22 01:19:24

A. I think it would be fair to say that if you have different materials, kind of combined together, right? 01:19:27 01:19:29 01:19:33

You know, each material could be grass, could be dry, could be wet, could be water, or have its own permittivity value; but collectively, there would be one -- one number represents the relative permittivity 01:19:35 01:19:37 01:19:41 01:19:45 01:19:48

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for that overall substance. 01:19:52

(BY MS. MAHONEY) 01:20:14

Q. Would you say that free air has a nonuniform distribution of permittivity? 01:20:14 01:20:16

A. That's a very interesting question. I -- I mean, just to answer that question, I was told, right, you know the relative permittivity for air is equal to 1; but I have not personally characterized air -- air -- permittivity in air. 01:20:28 01:20:30 01:20:32 01:20:34 01:20:41 01:20:45

I would just take that as a given value, you know. 01:20:49 01:20:51

Q. So the permittivity of air is equal to 1, correct? 01:21:09 01:21:19

A. To be pre- -- more precise, it's the relative permittivity of the air. Sometimes textbook even refer that to -- vacuum is equal to 1. 01:21:22 01:21:24 01:21:29 01:21:31

Q. Okay. Okay. And you talk about calculating this range of permittivity or net permittivity of the combination of water, grass, living tissue, and air, right? 01:21:34 01:21:48 01:21:51 01:21:54

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A. I didn't talk about calculating. 01:21:56
I said that I will probably need to do some 01:21:58
experiments to determine the range of 01:22:01
relative permittivity for certain sub- -- 01:22:06
substance that you characterize inside the 01:22:09
animal's body. 01:22:12
Q. So you would need to run 01:22:16
experiments to know what the net permittivity 01:22:18
was of a combination of grass, water, living 01:22:20
tissue, and air? 01:22:24
MR. FISHER: Object to the 01:22:25
form. 01:22:29
A. Unless somebody told me the value 01:22:31
or unless those values are available in 01:22:32
literature, if you ask me what the values 01:22:35
are, I feel -- I would be uncomfortable to 01:22:38
guess the value, right? I will probably need 01:22:41
to do some experiments to measure them, then 01:22:42
I can tell you what is the range, right, of 01:22:46
relative permittivity for those substance. 01:22:50
I'll be more comfortable to give you those -- 01:22:53
those datas. 01:22:56

(BY MS. MAHONEY) 01:22:58

Q. And would the range of 01:22:59

permittivity change as the relative 01:23:00

proportions of each of those components 01:23:03

change? 01:23:05

A. I suppose it would have certain 01:23:09

impact on the overall permittivity that -- 01:23:12

one would do the experiment to measure that, 01:23:15

right, as the composition, the percentage, 01:23:17

you know, change within the overall 01:23:19

substance. 01:23:24

Q. So you'd have to do a separate 01:23:25

set of experimentations to understand what 01:23:29

the permittivity, the overall permittivity, 01:23:31

would be if the combi- -- if the -- strike 01:23:33

that. 01:23:36

Okay. So you agree that you 01:23:36

would need to run experiments to understand 01:23:53

the net permittivity of a combination of 01:23:55

grass, water, living tissue, and air, 01:23:58

correct? 01:24:01

MR. FISHER: Object to -- 01:24:02

A. That's not exactly what I said -- 01:24:02
MR. FISHER: Hold on. 01:24:04
THE WITNESS: Sorry. 01:24:05
MR. FISHER: Object to the 01:24:07
form. 01:24:07
A. That's not what I said, right? 01:24:08
I said that I would need to do 01:24:10
some experiments to determine the range of 01:24:11
permittivity of the substance that you 01:24:16
characterize inside the animal's body -- 01:24:20
unless those are available in literature, 01:24:23
then we can use it; but if it's not 01:24:25
literature available, if you ask me what they 01:24:27
are, I believe what I said was I probably 01:24:29
need to do some measurement to characterize 01:24:31
it so that I would feel comfortable to give 01:24:33
you the value. 01:24:35
(BY MS. MAHONEY) 01:25:10
Q. Would you determine this range of 01:25:10
permittivity when designing an RF device that 01:25:11
needs to transmit through a combination of 01:25:15
water, grass, living tissue, and air? 01:25:17

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A. I have not thought about that. I have not thought about that. 01:25:34 01:25:36

I mean, to be fair, it would be nice to have those data available so that, if needed, I'd be able to use them in considering my design, right? 01:25:38 01:25:54 01:25:58 01:26:00

And sometimes you have data available and then you find out those data may not impact the system performance as much, so I may not rely on those data as much. 01:26:01 01:26:03 01:26:05 01:26:08 01:26:12

Q. But you agree that the range of permittivities would be a design consideration for an RF device that needs to transmit through water, grass, tissue, and air? 01:26:12 01:26:28 01:26:30 01:26:33 01:26:36

MR. FISHER: Object to the form. 01:26:37 01:26:42

A. I wouldn't necessarily say that they are a required design consideration. 01:26:42 01:26:43

I think what I said was, you know, it would be nice to have these 01:26:46 01:26:48

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parameters so that, if needed, I can consider the impact of these parameters. 01:26:50 01:26:54

And depending on the design, sometimes, you know, certain parameters may not -- may not be that critical, right, may not influence the system performance that much, you know. I may not consider those parameters. 01:26:56 01:26:58 01:27:00 01:27:03 01:27:05 01:27:08

(BY MS. MAHONEY) 01:27:09

Q. Would you take an RF device that is configured to transmit through free air and expect it to perform the same way when it is inside the reticulum of a ruminant animal? 01:27:34 01:27:36 01:27:39 01:27:43

MR. FISHER: Same objection. 01:27:48

A. I recall we talk about that before, right, and we said -- I -- you know, I -- I remember you asking me -- asked me something similar, you know, whether you have something outside the body as a wearable sensor, having wireless communication capability, if you put those things in the body, you know, would that be changed or not. 01:27:52 01:27:54 01:27:56 01:27:59 01:28:02 01:28:06 01:28:08 01:28:10

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I recall my response is that you put in there, there may be some change; and I may anticipate certain change, but in terms of what the -- what the exact change is, I would need to characterize the system in order to know what that is. 01:28:12 01:28:15 01:28:19 01:28:23 01:28:26 01:28:27

(BY MS. MAHONEY) 01:28:35

Q. Specific to the change of permittivity, though, the range of permittivities, would you be able to take an RF device designed to transmit through air with a permittivity of 1 and expect it to perform the same way transmitting through a combination of materials such as water, grass, living tissue, and air? 01:28:36 01:28:37 01:28:39 01:28:44 01:28:48 01:28:52 01:28:57 01:28:59

MR. FISHER: Object to the form. 01:29:01 01:29:02

A. It's a very general question. I would need to look at a specific design before I can give you the answer. 01:29:06 01:29:09 01:29:11

(BY MS. MAHONEY) 01:29:13

Q. A specific design of what? 01:29:13

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A. Your -- your system. 01:29:14

Q. Okay. Dr. Young, you would agree 01:29:16

that monitoring devices typically have some 01:29:54

sort of sensor in them, right? 01:29:57

A. When you say monitor -- 01:30:11

"monitoring device," I assume you refer to a 01:30:12

device that is intended to monitor certain 01:30:17

parameters; is that right? 01:30:20

Q. Yes, so let me rephrase. 01:30:22

You would agree that a monitoring 01:30:29

device configured to monitor certain 01:30:32

physiological parameters would include a 01:30:36

sensor, right? 01:30:38

A. If that monitoring device is 01:30:40

designed to monitor, let's say, certain 01:30:43

specific physiological parameters, then it 01:30:48

would definitely make sense to have sensors 01:30:52

that are designed to monitor your -- your 01:30:56

target parameters. 01:31:00

Q. So, for example, the monitoring 01:31:00

device we've discussed with the lab mice and 01:31:10

the research that you've done, that had a 01:31:13

pressure sensor in it, correct? 01:31:15

A. That's correct. 01:31:17

Q. Was that the only sensor in that device? 01:31:17

A. If you just put that device alone as a pressure sensor, you can just have that device -- I mean, you can just have the sensor. 01:31:21

But we also incorporate a few other sensors as a part of the overall system. 01:31:23

For example, they can measure body temperature, they can also have -- measure the ECG waveform coming out of the -- cross over the heart. 01:31:31

Q. Okay. So there are sensors for measuring temperature, right? 01:31:39

A. That's correct. 01:31:41

Q. What types of sensors are available for measuring temperature? 01:31:43

A. There are a number of options, you know, and an engineer can consider 01:31:48

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measuring the temperature. 01:32:11

Q. Like what? 01:32:12

A. You can use a temperature probe, 01:32:13

for example, to measure temperature. You can 01:32:16

use a -- a semiconductor, for example; for 01:32:19

example, a p-n junction to measure 01:32:25

temperature. 01:32:28

Yeah, these are the -- I mean, 01:32:31

they are -- there could be other options, but 01:32:33

these are the two common options that I 01:32:35

typically use to measure temperature. 01:32:37

Q. Are those the most common 01:32:39

temperature sensors in a monitoring device? 01:32:45

A. I wouldn't say the most common, 01:32:47

right? To me, they are common, but, you 01:32:49

know, I don't want to be that extreme, 01:32:51

characterizing them as the most common. 01:32:54

There could be, you know, other 01:32:56

temperature sensors that -- also common, but 01:32:58

I have not used them for my work. 01:33:01

Q. Are you familiar with a 01:33:03

thermocouple? 01:33:12

A. Yes. 01:33:14

Q. And do you know how a thermocouple works? 01:33:14 01:33:17

A. Yeah, that's in the basic physics book. 01:33:19 01:33:22

Q. How does it work? 01:33:22

A. You have two different materials that form a junction, right? Depending on the temperature variation cross over that junction, you get the voltage change cross over two leads. 01:33:23 01:33:25 01:33:26 01:33:29 01:33:31

Q. And what does that voltage change represent? 01:33:32 01:33:36

A. The voltage change will represent the temperature change cross over the junction. 01:33:37 01:33:39 01:33:41

Q. What do you mean by "cross over the junction"? 01:33:41 01:33:44

A. Yeah, you have -- you have two materials that -- that joined together, right? That's the junction. 01:33:45 01:33:48 01:33:50

If the temperature at the 01:33:51

junction change, when you measure the voltage cross over the ends of the two leads, that voltage will vary; it can move up and down, depending on the temperature at the junction. 01:33:53 01:33:55 01:33:58 01:34:02

Q. How does the thermocouple generate the voltage? 01:34:05 01:34:16

A. That's also in the physics book. There's something called -- if I remember correctly, that's something called a Seebeck coefficient. You know, it's a function of the material that you use. 01:34:19 01:34:21 01:34:24 01:34:26 01:34:28

So the Seebeck coefficient tells you that -- how much voltage it will come out, depending on how much -- how much the temperature varies. 01:34:30 01:34:32 01:34:37 01:34:39

Q. And is a thermocouple generating that voltage at all times? 01:34:50 01:34:54

MR. FISHER: Object to the form. 01:34:57 01:34:57

A. Can you -- can you please say that again? 01:34:59 01:35:00

(BY MS. MAHONEY) 01:35:01

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Q. Is the thermocouple generating that voltage at all times? 01:35:06 01:35:09

MR. FISHER: Same objection. 01:35:14

A. Yeah, you know, you -- you like to focus on these extreme conditions, "at all times." 01:35:16 01:35:18 01:35:22

But I would say that, you know, if it's working, right, if the thermocouple is working, even if you put it on the table, you measure there is a voltage coming out, there's a voltage coming out, a -- so you -- you -- you're asking me whether it's all the time or not. 01:35:22 01:35:24 01:35:27 01:35:29 01:35:32 01:35:36 01:35:40

As long as it's not broken, let's say, there would be a voltage. 01:35:41 01:35:43

(BY MS. MAHONEY) 01:35:47

Q. Can a thermocouple be configured to only generate a voltage at certain times? 01:36:03 01:36:06

MR. FISHER: Same objection. 01:36:16

A. I heard what you said, you know. I think my -- my answer would be consistent with what I just described to you, right? 01:36:23 01:36:26 01:36:28

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You got a thermocouple, you can put on the table, there will be a voltage cross over the thermocouple. 01:36:30 01:36:33 01:36:35

As long as it's not broken, right, you know, the junction's not broken, let's say, there would be a voltage that you can measure. 01:36:37 01:36:40 01:36:44 01:36:47

(BY MS. MAHONEY) 01:36:48

Q. So a thermocouple sitting on a table connected to nothing else generates a voltage? 01:36:48 01:36:50 01:36:54

MR. FISHER: Same objection. 01:36:54

A. My understanding, there would be a voltage, you know. 01:37:16 01:37:17

You said that -- you know, what that voltage is, I'll probably have to characterize it. You know, if I'm not mis- -- misunderstanding anything here, there would be a voltage coming out of the thermocouple, you know, as long as it's not broken. 01:37:19 01:37:20 01:37:22 01:37:26 01:37:29 01:37:32 01:37:37

(BY MS. MAHONEY) 01:37:38

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Q. Okay. So a thermocouple doesn't require a power source? 01:37:38 01:37:41

MR. FISHER: Same objection. 01:37:42

A. Thermocouple -- my understanding is these are just devices that, without -- need a battery. It will come out with a voltage indicative of the temperature that thermocouple monitors. 01:37:50 01:37:54 01:37:57 01:38:01 01:38:04

(BY MS. MAHONEY) 01:38:06

Q. So a thermocouple doesn't require a power source? 01:38:07 01:38:09

MR. FISHER: Same objection. 01:38:10

A. I think I answered that question. It does not need a voltage -- it does not need a battery, or if -- you know, if you characterize it as a power source, yeah, it does not need an electrical power source to power up the -- a thermocouple. 01:38:11 01:38:12 01:38:15 01:38:17 01:38:20 01:38:22

(BY MS. MAHONEY) 01:38:25

Q. So when the thermocouple generates a voltage signal, that is an analog signal, correct? 01:38:34 01:38:36 01:38:41

A. That is an analog signal. 01:38:43

Q. And are you familiar with what a thermistor is? 01:38:46

A. Can you say that again? 01:39:02

Q. Are you familiar with a -- with what a thermistor is? 01:39:03

A. What do you mean by "thermistor"? I -- 01:39:05

Q. T-H-E-R-M-I-S-T-O-R. 01:39:07

A. Oh, a thermistor. Yeah, that's another form of temperature sensor. 01:39:09

Q. And you know how a thermistor works? 01:39:11

A. Yes. It has a temperature sensor in it. 01:39:14

Q. And how does that work? 01:39:23

A. Depending on how you build a -- build that device, you can use, you know, a thermocouple as one of the ways to build that device, or you can use other type of temperature sensor to build that device. 01:39:27

Q. So you can use a thermocouple 01:39:31

01:39:34

01:39:35

01:39:36

01:39:37

01:39:41

01:39:45

01:39:47

01:39:50

01:39:52

01:39:58

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inside of a thermistor? 01:40:00

A. It's possible. 01:40:02

Q. And does a thermistor also generate a signal? 01:40:03 01:40:16

A. If a device is designed properly and it's working properly, it should generate signal so that it will mean something, right? If it doesn't generate a signal, you know, what does it do? It doesn't do much. 01:40:17 01:40:19 01:40:24 01:40:27 01:40:29

Q. And is that also a voltage signal? 01:40:35 01:40:37

A. To my understanding, it can be in the form of a voltage signal. 01:40:40 01:40:41

Q. Can it be in the form of anything else? 01:40:44 01:40:47

A. Depending on your design. 01:40:47

Q. What other forms can it take? 01:40:50

A. It can be in the form of current. It can be in the form, maybe, charge. 01:40:52 01:40:55

Q. And if it's in the form of voltage, that is an analog signal, correct? 01:41:06 01:41:08

A. That's correct. 01:41:10

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Q. And if it's in the form of current, that's also an analog signal? 01:41:11 01:41:13

A. That's correct. 01:41:15

Q. And if it's in the form of charge, that's also an analog signal? 01:41:15 01:41:17

A. That's correct. 01:41:19

Q. Would you agree that all of the signals that a thermistor can generate are analog? 01:41:20 01:41:26 01:41:30

MR. FISHER: Object to the form. 01:41:31 01:41:32

A. I wouldn't go that far to say all of them, right? Based on the ones that I know, they generate a voltage, and if that -- but that voltage could be further processed maybe by using a analog-to-digital converter to output digital representation of that analog signal. 01:41:35 01:41:37 01:41:40 01:41:43 01:41:46 01:41:49 01:41:52

(BY MS. MAHONEY) 01:42:05

Q. But the signal that comes out of the thermistor before it goes into the analog-to-digital converter would be analog, 01:42:05 01:42:08 01:42:10

correct? 01:42:13

A. To my knowledge -- to my 01:42:13

knowledge, it would be an analog signal. 01:42:15

Q. Are you familiar with a platinum 01:42:26

resistance thermometer? 01:42:28

A. I heard about it. 01:42:30

Q. Do you know how a platinum 01:42:35

resistance thermometer works? 01:42:37

A. You know, you mentioned "platinum 01:42:52

resistance," right? You know, it has -- it 01:42:54

has resistance; so as the temperature change, 01:42:57

the resistance would change. So people 01:42:59

measure that resistance change as a way to 01:43:02

monitor or measure the temperature. 01:43:04

Q. Have you worked with a platinum 01:43:15

resistance thermometer before? 01:43:18

A. Not that I remember of. 01:43:20

Q. But it's your understanding that 01:43:35

a platinum resistance thermometer measures 01:43:36

temperature and would output resistance? 01:43:39

A. I think that's what I said. 01:43:48

If you just have a platinum 01:43:49

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strip, if the temperature change, you measure the resistance of the metal strip; the resistance of the metal strip will change as temperature changes. 01:43:51 01:43:53 01:43:55 01:43:58

Q. And the change in resistance would be an analog measurement? 01:44:02 01:44:04

A. The way you measure that resistance change can be in the form of analog. 01:44:08 01:44:10 01:44:12

Q. Is it always in the form of analog? 01:44:12 01:44:16

MR. FISHER: Object to the form. 01:44:17 01:44:19

A. I wouldn't go that far to say, you know, it's always or always not; but, you know, to my understanding, you know, the typical way of measuring the resistance is done, for example, using Ohm's law, right? 01:44:19 01:44:21 01:44:26 01:44:29 01:44:32

You put the voltage on it, you measure the current or you inject the current through the resistor, and you measure the resulting voltage developed across that 01:44:33 01:44:35 01:44:37 01:44:37

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resistor. 01:44:42

(BY MS. MAHONEY) 01:44:42

Q. But that resulting voltage would be analog, correct? 01:44:42

A. That's my understanding. 01:44:44

Q. Are there any sensors that you could use in an implantable monitoring device but not in an external monitoring device? 01:44:46

A. At least based on -- based on my experience, the sensors that go into the body to measure a number of parameters of interest inside a body can be used outside the body, at least similar type of sensors. 01:45:12

Q. Are you aware of any that only work in an external monitoring device? 01:45:45

A. I mean, can you -- can you give me some examples? You know, it's a -- it's a very broad question, right? 01:45:48

You know, I would say, based on -- based on the sensors that I worked with, if I remember correctly, you know, whatever that you measure outside the body, 01:45:52 01:45:56 01:46:00 01:46:15 01:46:16 01:46:22 01:46:24 01:46:26 01:46:28 01:46:30 01:46:33 01:46:37

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at least based on -- based on what I can remember of, you can -- you can use similar type of sensors, you know, put inside the body to measure certain parameters. 01:46:48 01:46:50 01:46:54 01:46:57

But I think we said that earlier, right, the similar principles; but in terms of the cleanness, the biocompatibility, the size, the weight, volume, those, you need to be -- you need to be -- you need to be a bit more careful when you go from outside a body to inside a body because the condition changed. 01:47:00 01:47:02 01:47:05 01:47:09 01:47:12 01:47:14 01:47:16 01:47:18

Q. Okay. Dr. Young, what is your understanding of an encoded signal? 01:47:33 01:47:38

A. Yeah, encoded signal is a -- 01:47:42

MR. FISHER: Object to the form. 01:47:45 01:47:46

Go ahead. 01:47:46

A. You know, you have a signal and you -- you will present -- you will present that signal in a different form, right? 01:47:54 01:47:55 01:47:59

That's called an encoded signal. 01:48:02

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(BY MS. MAHONEY) 01:48:04

Q. What do you mean by "a different form"? 01:48:04 01:48:07

A. For example, you can have an analog signal, and you can digitize that analog signal using an analog to a digital converter and a come out digital representation of the analog signal. So that would -- that would be an encoded signal. 01:48:07 01:48:08 01:48:12 01:48:17 01:48:21 01:48:24

Q. Okay. So in other words, it is your opinion, Dr. Young, that the digital representation of an analog signal would be an encoded signal, right? 01:48:26 01:48:29 01:48:31 01:48:34

A. Would be a encoded signal, that's correct. 01:48:36 01:48:38

Q. And just to be clear, an analog signal would not be encoded, right? 01:48:38 01:48:41

A. I have not thought about that. 01:48:48

You know, to me, an analog -- if you give me the analog signal, you said, "Hey, I measured, there's a voltage of one volt," I take that as a given voltage, and I 01:48:49 01:48:52 01:48:54 01:48:57

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can digitize that one-volt signal into a digital representation, right, using 0s and the 1s. 01:49:01 01:49:05 01:49:10

Then when I look at that digital representation, that digital representation is an encoded signal for that analog one volt. 01:49:11 01:49:13 01:49:15 01:49:19

Q. So it doesn't -- an analog signal doesn't become encoded until you've digitized it, correct? 01:49:20 01:49:38 01:49:41

A. If you are give -- if -- if I'm given an analog signal, after digitizing that analog signal, the digital representation of the analog signal would be considered an encoded signal. 01:49:47 01:49:49 01:49:53 01:49:57 01:50:00

Q. Right. 01:50:01

But before you digitized the analog signal, the analog signal is not encoded, right? 01:50:02 01:50:04 01:50:08

A. I do not know the -- I need to know the nature of the analog signal. 01:50:09 01:50:11

If you just give me an analog 01:50:13

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signal, I take that as a given. 01:50:16

Q. Okay. So we can go off your 01:50:18

example of one volt. 01:50:18

A. Uh-huh. 01:50:18

Q. That's an analog signal, correct? 01:50:22

A. That's correct. 01:50:22

Q. In its analog form, one volt is 01:50:22

not encoded, correct? 01:50:25

A. I have not thought about that. 01:50:26

I take that one volt as a given 01:50:27

signal. 01:50:30

Q. As a given analog signal? 01:50:31

A. A given analog signal, yes, you 01:50:33

are right. 01:50:36

Q. And once you have digitized that 01:50:36

analog signal, that one volt, then the 01:50:38

digital representation is an encoded signal, 01:50:41

correct? 01:50:44

A. That digital representation of 01:50:45

that one volt is an encoded signal. 01:50:46

Q. So the digital representation of 01:50:50

the one-volt analog signal is an encoded 01:50:54

signal? 01:50:59

MR. FISHER: Objection; asked 01:51:01

and answered. 01:51:02

A. I think you -- you know, you 01:51:04

asked -- yes, you asked me that question. I 01:51:07

think I gave you the answer. 01:51:09

The digital representation of the 01:51:10

analog one-volt signal will be considered as 01:51:12

an encoded signal for that analog one volt. 01:51:15

(BY MS. MAHONEY) 01:51:20

Q. But you cannot say that an analog 01:51:28

signal of one volt is not an encoded signal, 01:51:31

right? 01:51:34

MR. FISHER: Object to the 01:51:35

form. 01:51:37

A. I think that's a 01:51:37

mischaracterization of what I said. 01:51:38

I said that I do not know the 01:51:39

nature of the one-volt signal. I take that 01:51:42

as a given, right? 01:51:44

If you give me one volt, I take 01:51:46

that as one volt, and I digitize that one 01:51:48

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volt, come out with digital representation of the one volt. There I can say that, "Hey, that digital representation of one volt is the encoded signal for the analog one volt." 01:51:50 01:51:53 01:51:56 01:51:58

(BY MS. MAHONEY) 01:52:02

Q. What do you mean when you say you do not know the nature of the one-volt signal? 01:52:02 01:52:03 01:52:06

A. I'm just given that one volt. I don't know where it's coming from. You gave me that one volt. 01:52:06 01:52:10 01:52:11

Q. So if you know where the one volt is coming from, then you can determine if it's encoded or not? 01:52:12 01:52:18 01:52:20

A. I need to know more about -- I need to know -- I need to know -- I need to know more about the nature of the signal before I can tell you what that is. 01:52:21 01:52:23 01:52:26 01:52:28

Q. Okay. So you previously testified that a thermocouple output is an analog voltage signal, correct? 01:52:29 01:52:35 01:52:39

A. That's correct. 01:52:41

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Q. So it would also be possible for that thermocouple to output a one-volt signal, correct? 01:52:41 01:52:45 01:52:48

A. I think that's what I said. 01:52:49

Q. Okay. And that one-volt signal output from the thermocouple would be an analog signal, correct? 01:52:50 01:52:53 01:52:55

A. That's correct. 01:52:58

Q. Would the one-volt signal output from the thermocouple in analog form be an encoded signal? 01:52:58 01:53:04 01:53:07

A. It is just one volt. It's an analog signal. 01:53:09 01:53:56

I don't see, I guess, the underlying connection. 01:53:57 01:53:59

What are you really asking, right? You said -- output's one volt to me. It's just a one-volt signal. It is a one-volt analog signal; and if I apply an analog-to-digital converter to that one-volt signal, what's coming out of that analog-to-digital converter is a digital 01:54:00 01:54:02 01:54:05 01:54:07 01:54:10 01:54:14 01:54:17

representation of that one-volt signal. 01:54:21

So I would consider that as an 01:54:23

encoded signal for that one-volt analog 01:54:24

signal. 01:54:27

Q. You would consider it to be 01:54:28

encoded before it is digitized by the 01:54:29

analog-to-digital converter? 01:54:34

A. I have not thought about that. 01:54:41

Q. Okay. But just to make sure I'm 01:55:00

understanding here, a one-volt signal coming 01:55:04

out of a thermocouple is an analog signal, 01:55:07

correct? 01:55:12

A. That's my understanding. 01:55:12

Q. And you can store analog signals, 01:55:13

right? 01:55:22

MR. FISHER: Object to the 01:55:24

form. 01:55:30

A. What do you mean by "storing" an 01:55:30

analog signal? 01:55:34

(BY MS. MAHONEY) 01:55:36

Q. There are types of memory that 01:55:36

are capable of storing analog signals, right? 01:55:38

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MR. FISHER: Same objection. 01:55:42

A. I mean, to be fair, right, when we talk about storing a signal, like a memory, for example, we typically refer to memories that store 0s and the 1s. That is my understanding. 01:56:00 01:56:02 01:56:05 01:56:13 01:56:18

(BY MS. MAHONEY) 01:56:20

Q. You said "typically," though. 01:56:28

A. I don't want to exclude, you know, any speculation, right? 01:56:30 01:56:33

Maybe there are something that can store something, but my understanding is if you talk about memory, to store information perhaps in the modern days, these are memory storing 0 and the 1s, that 0 and the 1s will represent the information that's being stored in the memory. 01:56:34 01:56:36 01:56:42 01:56:45 01:56:47 01:56:56 01:57:00

Q. And what about before the modern days? 01:57:01 01:57:04

MR. FISHER: Object to the form. 01:57:06 01:57:11

A. I don't -- I do not remember 01:57:11

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exactly how things were done before the modern days. 01:57:13 01:57:15

(BY MS. MAHONEY) 01:57:16

Q. Are you not aware of any types of memory that are capable of storing analog information? 01:57:16 01:57:19 01:57:21

MR. FISHER: Same objection. 01:57:22

A. Maybe there were things like that available, but you have to look at the context, right? What are we talking about? 01:57:24 01:57:34 01:57:36

You know, I don't want to exclude a possibility, but at the same time, I don't want to be that affirmative and say all of them is yes, all of them is no, you know; really depending on a specific situation. 01:57:40 01:57:42 01:57:44 01:57:48 01:57:51

(BY MS. MAHONEY) 01:57:54

Q. Do you have an example of a type of memory that's capable of storing analog signals? 01:57:54 01:57:56 01:57:58

A. I don't remember. 01:58:07

Q. So sitting here today, you don't remember any types of memory that are capable 01:58:12 01:58:13

of storing signals in their analog form? 01:58:15

MR. FISHER: Object to the 01:58:19

form; asked and answered. 01:58:20

A. Based upon what I can remember, 01:58:24

I -- I do not recall. 01:58:27

(BY MS. MAHONEY) 01:58:28

Q. Would a POSA be aware of types of 01:58:52

memory that are capable of storing analog 01:58:54

signals? 01:58:57

MR. FISHER: Object to the 01:58:58

form. 01:59:06

A. A POSA may know or may not know. 01:59:11

But, you know, if you asked me -- you know, 01:59:15

the earlier question, I told you I do not 01:59:17

remember, you know, such things, or at least 01:59:18

I do not remember come across things like 01:59:20

what you described. 01:59:22

(BY MS. MAHONEY) 01:59:42

Q. Are you familiar with magnetic 01:59:42

storage? 01:59:44

A. I heard about it. 01:59:45

Q. Is magnetic storage capable of 01:59:47

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storing analog signals? 01:59:51

MR. FISHER: I'll object to the 02:00:06

form, I guess. 02:00:06

A. I guess it's a possible, right? 02:00:07

I have not personally used a magnetic 02:00:10

storage. 02:00:12

So to answer your questions, I 02:00:12

don't want to say no, it cannot be, right? 02:00:14

Maybe it's possible. I have not used them 02:00:17

yet. 02:00:20

(BY MS. MAHONEY) 02:00:23

Q. So in your opinion, it's possible 02:00:25

that magnetic storage can store analog 02:00:26

signals? 02:00:30

MR. FISHER: Object to the 02:00:30

form; asked and answered. 02:00:31

A. You know, I told you, I have not 02:00:33

used the magnetic storage, at least not that 02:00:35

I remember of using the magnetic storage. 02:00:38

In terms of whether possible or 02:00:41

not, I guess I'm not -- I cannot give you 02:00:44

a -- a firm answer or confirmed answer. I 02:00:49

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just don't have that experience using magnetic storage, so I do not know exactly whether it's doable or not. 02:00:53 02:00:55 02:00:58

(BY MS. MAHONEY) 02:00:59

Q. Are you familiar with capacitive storage? 02:01:03 02:01:06

A. I heard about capacitive storage. 02:01:13

Q. And is capacitive storage capable of storing signals in their analog form? 02:01:16 02:01:20

MR. FISHER: Object to the form. 02:01:23 02:01:26

A. I mean, when you talk about possibility, I suppose, you know, it is -- you know, anything is possible, right? 02:01:48 02:01:50 02:01:52

You can store digital signals, you can store maybe analog signals, but I need to know more context about what you're talking about. 02:01:54 02:01:57 02:01:59 02:02:02

If it's just something very general, you know, is it doable or not, it would be difficult for me to say that, no, it's not doable, or it's also difficult for 02:02:02 02:02:04 02:02:07 02:02:09

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me to say that, yeah, it's definitely doable. I just need to be -- to be provided with better context what you're talking about. 02:02:13 02:02:16 02:02:19

(BY MS. MAHONEY) 02:02:21

Q. What context do you need to know whether analog signals can be stored in their analog form? 02:02:22 02:02:24 02:02:27

A. I cannot tell you the specific context, but just, like, what I can tell you is based on the question you're asking me, which is kind of high-level general. 02:02:28 02:02:30 02:02:33 02:02:35

I feel like I'm -- I'm missing something more to understand what you're asking. 02:02:38 02:02:40 02:02:42

Q. So, earlier this morning you provided testimony about your research with the pressure sensors for -- strike that. 02:02:42 02:04:14 02:04:17

Earlier -- earlier today you provided testimony about your research regarding the implantable blood pressure sensors for lab mice, correct? 02:04:21 02:04:23 02:04:25 02:04:28

A. That's correct. 02:04:31

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Q. And you also testified that you had considered an analog scheme for those pressure sensors? 02:04:31 02:04:33 02:04:37

A. That's not what I said. That's not what I said. 02:04:39 02:04:42

I said I used a pressure sensor, built as a part of a monitoring cuff that goes around a vessel in the animal's body with the purpose of not breaking the vessel to measure the analog -- to -- to measure the -- the blood pressure pulse waveform. 02:04:43 02:04:50 02:04:54 02:04:59 02:05:02 02:05:06

As the vessel expand and it contracts, that pressure sensor can capture that signal. That's what I said. 02:05:08 02:05:14 02:05:16

Q. And in your monitoring device with the lab mice, you then converted that analog signal to its digital representation, right? 02:05:20 02:05:30 02:05:33 02:05:35

A. That's correct. 02:05:37

Q. And in developing this device, you conducted an analysis to understand whether analog or digital would have been the 02:05:37 02:05:54 02:05:57

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better approach, right? 02:06:00

A. In designing the wireless 02:06:07

transmission part of the system, I conduct 02:06:09

analysis to determine digital data 02:06:13

transmission would have a better performance 02:06:17

than the analog signal transmission through 02:06:20

the wireless link. 02:06:26

Q. So the device itself doesn't have 02:06:28

any memory on it? 02:06:30

MR. FISHER: Object to the 02:06:33

form. 02:06:37

A. That particular device does not 02:06:37

have any memory on it. It just -- you sense, 02:06:39

you digitize it, you transmit right away. 02:06:42

(BY MS. MAHONEY) 02:06:45

Q. And so if you were to use that 02:06:46

device using analog transmission, where would 02:06:48

those analog signals go? 02:06:54

A. Can you please -- what do you 02:07:01

mean by "where does the analog signal go"? 02:07:06

What -- what do you mean by that? 02:07:10

Q. It transmits out of the device, 02:07:11

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correct?
A. Yes, yeah. If you have a wireless transmitter, the -- the -- the intent of the wireless transmitter is to transmit signal from inside the body to an external receiver that is located outside the body.
Q. And what happens to the signal once the receiver receives it?
A. In my design?
Q. Yes.
A. It stores in the memory.
Q. It's stored in the memory of the transceiver?
A. It stores in the memory of the -- of the -- of the receiver, right?
For example, computer: You can plug in the computer, it saves the data in the memory.
Q. So in your system design, when you were considering using wireless analog transmission, what type of memory were you

using in the transceiver? 02:08:31

MR. FISHER: Object to the 02:08:35

form. 02:08:39

A. I want to make sure that at least 02:08:39

I'm on the same page with you. 02:08:41

When you -- you said something 02:08:42

about the analog transmission? I did not use 02:08:47

analog transmission. We used digital data -- 02:08:52

digital transmission, transmitting 0s and the 02:08:57

1s. 02:09:00

(BY MS. MAHONEY) 02:09:01

Q. Yes, but you explained earlier 02:09:02

that you had considered the option of using 02:09:03

analog transmission and ultimately decided 02:09:06

that digital transmission was more efficient, 02:09:09

right? 02:09:11

A. That's correct. 02:09:12

Q. So if you were to use analog 02:09:13

transmission, what storage would you use at 02:09:16

the transceiver? 02:09:19

MR. FISHER: Object to the 02:09:22

form. 02:09:24

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A. Okay. I think you -- yeah, I think I know what you're asking, but maybe I can clarify that analysis for you. 02:09:24 02:09:27 02:09:31

I was just mainly looking at, if you have an analog signal, when you want to transmit the analog signal versus the digital representation of the analog signal and you transmit the digital data, which one is better, which one is more robust in terms of the wireless data transmission channel? 02:09:33 02:09:35 02:09:38 02:09:41 02:09:43 02:09:47 02:09:51

That analysis has nothing to do with the memory storage you're talking about. I'm just looking at, if you have analog signal, if you give me one long transmission, one volt, and -- then maybe I digitize the one volt into a number of 0 and the 1s, transmitting the 0 and the 1s, representing the one volt from the transmitter to the receiver, which one is more robust; that's the analysis I was conducting. 02:09:55 02:09:58 02:10:02 02:10:04 02:10:08 02:10:11 02:10:14 02:10:18 02:10:21 02:10:24

(BY MS. MAHONEY) 02:10:24

Q. So how is it possible to do 02:10:26

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analog transmission, then, if there's no memory capable of storing analog signals? 02:10:27 02:10:29

A. At the transmitter side or at the receiver side? 02:10:40 02:10:44

Q. Either. 02:10:45

A. I guess, you know, when you receive -- when you receive the signal, you probably need to do analog-to-digital conversion, right, to convert them into 0 and 1, then trans -- then -- then save that in the computer. 02:10:47 02:10:49 02:10:51 02:10:54 02:10:58 02:11:01

Q. So the analog-to-digital converter would convert the analog signal before the transceiver receives it? 02:11:25 02:11:28 02:11:30

A. I'm not sure if what you said is correct. 02:11:46 02:11:48

Q. The transceiver would need to receive it first, and then it would go to the analog-to-digital converter? 02:11:55 02:11:57 02:12:00

A. That's correct, through the wire -- oh, I think I -- I understand what you mean now. 02:12:01 02:12:02 02:12:05

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When you say "transceiver," you mean transmitter and the receiver altogether? That's correct. 02:12:06 02:12:09 02:12:12

But specifically, if you use a transceiver as a transmitter, then we typically call that as a transmitter. If you use the receiver portion of the transceiver, then we said it's a receiver; but a transceiver can have both components in there. 02:12:13 02:12:15 02:12:18 02:12:21 02:12:24 02:12:27 02:12:30

So when you say "transceiver," I assume you are referring to the receiver side of the transceiver, right? 02:12:30 02:12:32 02:12:36

Q. Does either the transmitter or the receiver have storage capabilities? 02:12:39 02:12:41

A. Depending on design. 02:12:47

Q. So yes? 02:12:48

A. No, depending on design. If you -- 02:12:49 02:12:51

MR. FISHER: Object to the -- go ahead. Object to the form. 02:12:51 02:12:52

Go ahead and answer. 02:12:53

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A. I mean, if you received a signal, if you don't need to store them, then you don't need to store them, right? 02:12:54 02:12:56 02:12:59

If you say, "I received a signal, these are the blood pressure signals, I want to save them, I want to analyze them," then definitely you need to have some form of memory, right, to save the data that you can process and at least look at it later. 02:13:00 02:13:04 02:13:05 02:13:08 02:13:10 02:13:13

(BY MS. MAHONEY) 02:13:15

Q. So a transmitter and a receiver can have storage capabilities? 02:13:18 02:13:20

A. You tend to combine them together, right? A transmittal receiver is just a transmitter and a receiver. 02:13:28 02:13:31 02:13:34

You may have storage capability outside the transmitter, outside the receiver. It doesn't have to be a part of the transmitter, a part of the receiver. 02:13:37 02:13:40 02:13:43 02:13:48

Q. So how does wireless analog transmission work? 02:13:51 02:13:59

A. There are -- there are -- there 02:14:04

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are analog-based modulation form to transmit analog information. That's in the textbook. 02:14:15 02:14:23

You know, you may be familiar with, for example, FM radio, right? 02:14:26 02:14:28

In the FM radio, "FM" stands for "frequency modulation," right? You modulate the frequency of a carrier signal. 02:14:31 02:14:36 02:14:40

If you have an analog signal, the analog signal can change the frequency of that carrier signal. So when the receiver receives that, a carrier signal, and it can -- it went through a modulation process to receive -- to -- to -- to recover the original analog signal that is modulated onto the carrier signal that is being received by the receiver. 02:14:43 02:14:46 02:14:48 02:14:52 02:14:57 02:15:02 02:15:07 02:15:11 02:15:14

Q. So when the receiver receives the analog carrier signal, does it store that signal? 02:15:21 02:15:24 02:15:27

MR. FISHER: Object to the form. 02:15:34 02:15:35

Go ahead. 02:15:35

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A. It depends on what you want to do with the signal. 02:15:36 02:15:39

If you don't want to save the signal for later process, right, you just don't save them, right? If you said, "I want to receive -- I want to -- I want to keep those signals," then you need to save them so later on you can look at it. 02:15:39 02:15:41 02:15:46 02:15:49 02:15:51 02:15:54

(BY MS. MAHONEY) 02:15:55

Q. So the transceiver can save the analog signals. 02:15:55 02:15:58

MR. FISHER: Same objection. 02:16:00

A. I think you circled back to the same question. 02:16:02 02:16:05

The transceiver only performs transmitting in the receiving function for the wireless link, for wireless data transmission. 02:16:05 02:16:08 02:16:12 02:16:15

Once you receive the signal, there is additional circuitry or electronic system that would save the data, that would save the -- save the -- save the information 02:16:15 02:16:17 02:16:22 02:16:24

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you transmit. 02:16:25

How is that? 02:16:26

(BY MS. MAHONEY) 02:16:29

Q. Thank you, I misspoke there. 02:16:29

So the receiver can save the 02:16:31

analog signals, right? 02:16:34

MR. FISHER: Object to the 02:16:35

form. 02:16:38

A. The receiver provides a receiving 02:16:38

function. 02:16:42

Once the signal is received by 02:16:44

the receiver, if you need to save that 02:16:47

signal, there will be something else does the 02:16:51

saving, not the receiver. 02:16:53

(BY MS. MAHONEY) 02:16:56

Q. What does the saving? 02:16:56

MR. FISHER: Same objection. 02:17:00

A. Like a memory, right? You need 02:17:01

some -- you need some analog-to-digital 02:17:04

converter convert the signal into 0 and 1s. 02:17:06

Then you need circuitry that move the bits to 02:17:10

the memory and are saved in the memory. 02:17:14

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(BY MS. MAHONEY) 02:17:16

Q. So there is no way to save analog 02:17:16

signals on memory -- strike that. Let me 02:17:18

rephrase. 02:17:24

So in your opinion, Dr. Young, 02:17:25

there is no type of memory that is capable of 02:17:36

storing an analog signal? 02:17:40

A. You circular -- 02:17:44

MR. FISHER: Object to the 02:17:44

form. 02:17:44

Go ahead. You can answer. 02:17:45

A. Sorry. Maybe I need a sip of 02:17:47

water. I don't want to jump ahead of him. 02:17:51

I think somehow you -- you 02:17:57

circular [sic] back to the same question that 02:18:03

we discussed before. 02:18:06

You know, I don't want to say 02:18:08

that, "Hey, there is nothing like that can be 02:18:10

done, or there's something definitely can be 02:18:13

done," right? 02:18:15

What I said to you was, maybe 02:18:16

it's -- you know, it is possible you can save 02:18:18

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something in certain form, but what I am aware of, I think I used some -- some modern technology. I think that's what I said, right, you know, in the modern days. 02:18:20 02:18:24 02:18:27 02:18:29

If you want me to save a signal in that computer or in something here, I'm pretty confident it needs to be in the digital form. 02:18:31 02:18:34 02:18:37 02:18:39

(BY MS. MAHONEY) 02:18:41

Q. Would you have been able to save that signal in 1950? 02:18:42 02:18:43

A. I think it's doable, but I have not done that. 02:18:50 02:18:53

Q. Would it have been saved in its analog form in 1950? 02:18:54 02:18:56

A. What I said was: I think it was doable at that time. You know, there may be technology to save those signals in 1950. I personally have not done that. 02:18:58 02:19:01 02:19:04 02:19:08

Q. Was it possible to digitize an analog signal in 1950? 02:19:09 02:19:12

A. I have not studied the time 02:19:21

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history of that aspect, but I assume, you know, analog-to-digital converter were available, maybe, in the 50s, but I need to double-check on it. 02:19:22 02:19:29 02:19:31 02:19:34

You know, I know that a lot of these things were available before I was born, but I cannot tell you what was the first date a component like that was invented or built, right? 02:19:35 02:19:37 02:19:39 02:19:42 02:19:47

Q. So at some point in the past, not using modern-day technology, it would have been doable to store an analog signal? 02:20:09 02:20:11 02:20:14

A. I think that's fair to say, but I just want to, you know, give you -- my take on it is I have not personally come across that, at least I do not remember; but I think certainly if you -- if you take that broad perspective, said, "Hey, is it possible before certain time," I think the answer is very likely it's possible. 02:20:21 02:20:24 02:20:26 02:20:30 02:20:36 02:20:39 02:20:42 02:20:46

Q. Are you familiar with EEPROM? 02:20:48

A. Yes. 02:21:06

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Q. Are you familiar with analog EEPROM? 02:21:07 02:21:12

A. If I remember correctly, the EEPROM, we call it E square PROM, that I encountered is the digital-based version. 02:21:22 02:21:25 02:21:28

Q. So you're not aware of any analog storing capabilities that EEPROM has? 02:21:36 02:21:39

A. Not that I have encountered. 02:21:42

Q. Okay. And you mentioned analog-to-digital converters, right? 02:21:44 02:22:13

A. We talk about it. 02:22:15

Q. So just to be clear, an analog-to-digital converter is used when you need to convert analog data -- data to digital data, correct? 02:22:16 02:22:21 02:22:23 02:22:27

MR. FISHER: Object to the form. 02:22:29 02:22:30

A. My understanding is analog-to-digital converter, just by its name, provides a conversion between analog signal to digital representation of that analog signal. 02:22:32 02:22:35 02:22:37 02:22:40 02:22:43

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(BY MS. MAHONEY) 02:23:07
Q. Does an analog-to-digital 02:23:07
converter provide any other purpose? 02:23:09
A. Not that I know of, besides the 02:23:13
purpose I just described. 02:23:16
Q. Uh-huh. So if you have no need 02:23:17
to convert the analog data into its digital 02:23:19
representation, then you have no need to use 02:23:23
an analog to digital converter, right? 02:23:25
MR. FISHER: Object to the 02:23:27
form. 02:23:27
A. I mean, if -- if a person decide 02:23:44
not to convert the analog signal to the 02:23:46
digital representation, then probably it's 02:23:49
not needed. 02:23:51
(BY MS. MAHONEY) 02:24:02
Q. Are you aware of any systems that 02:24:03
only use analog data? 02:24:04
MR. FISHER: Object to the 02:24:06
form. 02:24:08
A. It's a very broad question you're 02:24:13
asking me, you know, system using analog 02:24:15

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data, right? 02:24:17

You know, analog signal, for 02:24:18

example, is -- is present in a system; for 02:24:22

example, a monitoring device. 02:24:30

The signal that you monitor is an 02:24:32

analog signal, so that is present in a 02:24:34

system; but that's only a part of the system, 02:24:36

right? The analog portion is there; but if 02:24:41

you want to do something after that in the 02:24:45

digital domain -- and a person of ordinary 02:24:47

skill in the art would use -- would use an 02:24:49

analog-to-digital converter to convert the 02:24:52

analog signal to digital representation. 02:24:56

(BY MS. MAHONEY) 02:25:01

Q. But if you didn't need the 02:25:02

digital representation of the analog signal, 02:25:04

then there would be no need for an 02:25:06

analog-to-digital converter, right? 02:25:09

A. I think that's what I said 02:25:10

earlier. 02:25:12

MS. MAHONEY: I'm at a good 02:25:40

stopping point if you want to take a very 02:25:42

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short break. 02:25:44

MR. FISHER: Sure. 02:25:45

THE VIDEOGRAPHER: Perfect. 02:25:46

Everybody please stand by. 02:25:48

We're going off the record. 02:25:49

The time is 2:25. 02:25:50

(Break taken from 2:25 p.m. to 02:25:52

2:43 p.m.) 02:43:20

THE VIDEOGRAPHER: We are now 02:43:21

back on the record. The time is 2:43. 02:43:26

(BY MS. MAHONEY) 02:43:29

Q. Okay. Dr. Young, before the 02:43:44

break, we were talking about different types 02:43:46

of storage. 02:43:50

Do you recall that? 02:43:52

A. Kind of. 02:43:53

Q. And you testified that you are 02:43:54

familiar with magnetic storage, correct? 02:44:04

A. That's incorrect. 02:44:10

Q. Incorrect. Okay. 02:44:12

So, Dr. Young, you are not 02:44:16

familiar with magnetic storage? 02:44:18

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MR. FISHER: Object to the form. 02:44:19 02:44:25

A. What I said was I have not personally used a magnetic storage. 02:44:25 02:44:27

(BY MS. MAHONEY) 02:44:32

Q. But are you familiar with magnetic storage? 02:44:32 02:44:34

A. I heard about it. 02:44:35

Q. You've heard about it? 02:44:35

A. Yes. 02:44:37

Q. What have you heard about it? 02:44:37

A. That's a good question. You know, it's a magnetic storage that you can store information in the magnetic form. 02:44:44 02:44:45 02:44:47

Q. What does "in the magnetic form" mean? 02:44:49 02:44:53

A. You can store them, maybe, in the magnets, in the magnetic material. 02:44:53 02:44:56

Q. Store what? 02:45:02

A. Store signals. 02:45:04

Q. What type of signals? 02:45:09

MR. FISHER: Object to form. 02:45:12

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A. I think you can store magnetic signals. 02:45:23 02:45:25

(BY MS. MAHONEY) 02:45:26

Q. What is a magnetic signal? 02:45:26

A. A magnetic signal is a signal that -- that present in the magnetic form. 02:45:28 02:45:32

Q. What does that mean? 02:45:38

A. For example, if you look at the magnetic material, it has Sota magnetic dipole in there. 02:45:42 02:45:44 02:45:50

THE COURT REPORTER: It has what? 02:45:50 02:45:50

THE WITNESS: It has Sota magnetic dipole in the magnetic form. You may -- you may -- you may be able to manipulate orientation of the dipole material -- the dipole in the magnetic form to store information. 02:45:50 02:45:51 02:45:53 02:45:55 02:45:58 02:46:00

(BY MS. MAHONEY) 02:46:05

Q. Is a magnetic signal analog? 02:46:05

MR. FISHER: Object to form. 02:46:15

A. You -- you -- well, I would say 02:46:20

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you need to give me a bit more specific magnetic signal, then I probably could provide you with a more firm answer. 02:46:22 02:46:25 02:46:28

(BY MS. MAHONEY) 02:46:33

Q. So you don't know whether a magnetic signal is analog or digital? 02:46:40 02:46:42

MR. FISHER: Same objection. 02:46:45

A. That's not what I said. 02:46:47

I said that you need to give me a more concrete example of the magnetic signal so that I can give you a more firm answer. 02:46:48 02:46:51 02:46:54

(BY MS. MAHONEY) 02:46:59

Q. Can a magnetic signal ever be analog? 02:47:00 02:47:03

A. I think it can be in analog form. 02:47:09

Q. And can a magnetic signal in its analog form be stored in magnetic storage? 02:47:11 02:47:13

MR. FISHER: Object to form. 02:47:21

A. I have not done that. I think I -- you know, I answered that question before. 02:47:33 02:47:36 02:47:38

You know, if you ask me what is 02:47:38

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doable or not or what is possible or not -- I think, you know, it's a very general question. Maybe it's possible, maybe it's doable, but I have not done that by myself. 02:47:40 02:47:43 02:47:47 02:47:49

Q. So sitting here today, you don't know whether it's possible for magnetic storage to store a magnetic signal in its analog form? 02:47:58 02:47:59 02:48:01 02:48:04

MR. FISHER: Same objection. 02:48:07

A. Can you say that question again? 02:48:09

(BY MS. MAHONEY) 02:48:12

Q. Uh-huh. 02:48:12

Sitting here today, you don't know whether it's possible for magnetic storage to store a magnetic signal in its analog form? 02:48:13 02:48:14 02:48:17 02:48:21

MR. FISHER: Same objection. 02:48:30

A. You know, when you say what is possible or not, right, it creates -- you know, you open up a lot of open area -- I mean, open-ended answer. 02:48:33 02:48:35 02:48:37 02:48:43

You know, maybe to be fair to say 02:48:43

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that, when you talk about possibility, anything's possible; but I also want to circulate back to what I told you earlier. I have not personally done that. 02:48:45 02:48:48 02:48:52 02:48:54

(BY MS. MAHONEY) 02:49:01

Q. Would a POSA have done that? 02:49:01

MR. FISHER: Same objection. 02:49:03

A. I'm not sure. 02:49:11

(BY MS. MAHONEY) 02:49:15

Q. So putting aside whether you have or have not personally dealt with magnetic storage, is it possible for magnetic storage to store a magnetic signal in its analog form? 02:49:19 02:49:22 02:49:25 02:49:28 02:49:32

MR. FISHER: Object to form; asked and answered. 02:49:33 02:49:34

A. Yeah, I think you asked that question, I answered, right? 02:49:35 02:49:37

You know, I said that if you talk about possibilities, you know, you open up a -- it becomes an open-ended question. 02:49:39 02:49:40 02:49:42

If you ask whether it's possible 02:49:46

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or not, you know, my response is, it's a very broad scope, anything is possible. 02:49:48 02:49:51

But I have not personally done that. 02:49:53 02:49:55

(BY MS. MAHONEY) 02:49:56

Q. But it is possible? 02:49:56

MR. FISHER: Same objections. 02:49:59

A. I mean, if your question is that broad, whether it's possible or not, you know, I -- you know, I recall what I told you earlier, right? 02:50:11 02:50:14 02:50:19 02:50:22

Anything is possible. 02:50:23

(BY MS. MAHONEY) 02:50:24

Q. Including magnetic storage storing a magnetic signal in its analog form? 02:50:28 02:50:30

MR. FISHER: Same objections. 02:50:33

A. If you ask me a question related to possibility, right, my response -- my response to you is anything's possible, but I have not personally done that. 02:50:34 02:50:38 02:50:42 02:50:44

(BY MS. MAHONEY) 02:50:45

Q. So you're not familiar with 02:50:54

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magnetic storage enough to know whether it's possible to store a magnetic signal in its analog form? 02:50:56 02:50:59 02:51:04

MR. FISHER: Same objections. 02:51:06

A. I'm going to -- as I told you before, you know, I heard about a magnetic storage; I have not personally done that. 02:51:10 02:51:12 02:51:14

So if you ask me a question about possibility, you know, my response is anything is possible; but I have not personally done that. 02:51:16 02:51:19 02:51:21 02:51:23

(BY MS. MAHONEY) 02:51:24

Q. Do you know of anyone who has? 02:51:25

A. Not that I can remember of at this point. 02:51:28 02:51:30

Q. Okay. And, Dr. Young, you said you were not familiar with capacitive storage; is that correct? 02:51:30 02:51:57 02:51:59

A. Is that what I said? I don't recall exactly what I said, but I do -- I do remember you asked me that question before. 02:52:00 02:52:02 02:52:05

Q. Are you familiar with capacitive 02:52:06

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storage? 02:52:09

A. Yeah, I -- I think I said that. 02:52:10

You asked me a very broad question, right? 02:52:12

You need to give me a more specific example 02:52:14

what you mean by "capacitive storage." 02:52:17

Q. Have you heard the term 02:52:20

"capacitive storage" before? 02:52:21

A. I heard about it. 02:52:22

Q. And what does it mean? 02:52:23

A. You use capacitor to store 02:52:26

information. 02:52:28

Q. What types of information? 02:52:30

A. I suppose it would be electrical 02:52:35

information. 02:52:37

Q. Like what? 02:52:37

A. You can store charge, right, in 02:52:45

the capacitor. 02:52:48

Q. And charge is an analog signal, 02:52:51

right? 02:52:53

MR. FISHER: Object to the 02:52:53

form. 02:52:54

A. Charge is charge, right? It can 02:53:01

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be in the analog form. 02:53:04

(BY MS. MAHONEY) 02:53:05

Q. So capacitive storage can store 02:53:22

charge in the analog form? 02:53:25

MR. FISHER: Same objection. 02:53:26

A. I said that you can store charge 02:53:31

in the capacitor. Charge itself can be in 02:53:33

analog form, but if you ask me whether -- 02:53:37

whether capacitive charge -- what was the 02:53:40

question, capacitive storage can store analog 02:53:43

form? 02:53:46

I -- I need to know more about 02:53:46

your specific setup, you know, what are 02:53:50

you -- what -- you -- I hope your question 02:53:52

can be a little bit narrower, right? If you 02:53:58

just ask me a very broad question, it would 02:54:01

be difficult for me to -- to provide you with 02:54:03

a clear answer. 02:54:06

(BY MS. MAHONEY) 02:54:23

Q. What other types of information 02:54:23

can capacitive storage store? 02:54:25

MR. FISHER: Object to the 02:54:27

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form. 02:54:31
A. I thought I -- you know, I 02:54:31
answered that question, right? 02:54:32
You asked me that question 02:54:34
before. I said it could store, for example, 02:54:36
charge in the capacitor. It's electrical -- 02:54:39
(BY MS. MAHONEY) 02:54:40
Q. Anything else? 02:54:40
A. -- it's electrical information. 02:54:41
Q. It -- 02:54:42
MR. FISHER: Counsel, I'd ask 02:54:43
you to let the witness finish his answer 02:54:44
before you interject with the next -- with 02:54:47
the next question. 02:54:50
I'm going to object to the 02:54:51
form. 02:54:52
(BY MS. MAHONEY) 02:54:54
Q. Can capacitive storage store 02:54:57
anything else other than charge? 02:54:59
MR. FISHER: Object to the 02:55:01
form. 02:55:02
A. Typically, it's used to store 02:55:02

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electrical charge. 02:55:08

(BY MS. MAHONEY) 02:55:08

Q. Can it store anything else? 02:55:10

MR. FISHER: Same objection. 02:55:12

A. Not that I know of. 02:55:20

(BY MS. MAHONEY) 02:55:21

Q. So to your knowledge, capacitive storage can only store charge? 02:55:34 02:55:37

MR. FISHER: Object to the form; asked and answered. 02:55:41 02:55:42

MS. MAHONEY: Counsel, please keep your objections to form. 02:55:44 02:55:45

MR. FISHER: The objections stand. You've asked the question multiple times, and I'm entitled to object to that. 02:55:47 02:55:48 02:55:55

A. I just want to wait -- make sure you guys done with conversation before I jump in, sorry. 02:56:02 02:56:05 02:56:07

MR. FISHER: Go ahead, you can answer. 02:56:08 02:56:09

A. You used the word "only." To me, it's a very narrow perspective, right? 02:56:09 02:56:12

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You know, I told you that capacitive storage can store charge, and that's what I know of. 02:56:16 02:56:19 02:56:23

(BY MS. MAHONEY) 02:56:28

Q. Okay. But you're not familiar with capacitive storage enough to know whether capacitive storage can store charge in the analog form, right? 02:56:29 02:56:30 02:56:33 02:56:36

MR. FISHER: Same objections. 02:56:37

A. I think that's the same question you asked me before, for many times. 02:56:37 02:56:39

My response to you was that, and it still is, you need to be more concrete about your specific setup so that I can give you a more confirmed answer. If it's very broad, you know, I just -- I do not feel comfortable to give you a -- a response that could be wrong. 02:56:43 02:56:46 02:56:48 02:56:52 02:56:55 02:56:59 02:57:01

(BY MS. MAHONEY) 02:57:08

Q. Are there examples of capacitive storage? 02:57:08 02:57:10

A. Yeah. If you use a capacitor, as 02:57:14

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I said, you can store charge on it. That is one example. 02:57:18 02:57:20

Q. And what do you mean by "store charge on it"? 02:57:27 02:57:29

A. You can -- you can put a -- you can -- you can -- you can put a charge on a capacitor. If the charge stays on the capacitor, then it means the charge is stored on the capacitor. 02:57:31 02:57:35 02:57:39 02:57:42 02:57:45

Q. And can the charge stay on the capacitor in analog form? 02:57:46 02:57:48

MR. FISHER: Object to the form. 02:57:51 02:57:53

A. I think you -- I told you that before, right? 02:57:53 02:58:06

A charge itself can be an analog signal. It's just a charge. And if you said that, you know, is it in analog form, I need to know more about your question. You know, you need to be more concrete what signal you put on or what's going on here. 02:58:07 02:58:10 02:58:13 02:58:16 02:58:19 02:58:22

If you just give me that very 02:58:24

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broad, high-level question, as I said to you earlier, I -- I -- I'm not ready to give you a firm answer simply because I don't want to give you a wrong answer. 02:58:26 02:58:28 02:58:33 02:58:35

(BY MS. MAHONEY) 02:58:38

Q. So what is an example of a charge signal? 02:58:38 02:58:43

A. A charge is an electronic charge, right? 02:58:43 02:58:46

Q. And what are the units for charge? 02:58:48 02:58:49

A. Coulomb. 02:58:50

Q. Can you spell that, please? 02:58:54

A. C-O -- C-O-L -- C-O-L-M -- M-M-B [sic]. I may have spelled it wrong, but I -- yeah, I can confirm that with you later on. I think C-O-L -- 02:58:55 02:59:14 02:59:16 02:59:27

MR. FISHER: I think there's only one "M" in it. 02:59:29 02:59:29

THE WITNESS: Yeah, yeah, you are right. Maybe I... 02:59:31 02:59:33

(BY MS. MAHONEY) 02:59:38

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Q. So an example of a charge signal could be, say, 10 coulomb; is that correct? 02:59:38 02:59:41

A. That's correct, yeah. 02:59:45

Q. And can capacitive storage store a 10-coulomb charge? 02:59:57 03:00:07

MR. FISHER: Object to the form. 03:00:21 03:00:30

A. Depends on how large the capacitor; depends on the value of the capacitor. 03:00:30 03:00:33 03:00:36

(BY MS. MAHONEY) 03:00:37

Q. What do you mean? 03:00:37

A. How large is your capacity, right, determines -- determines the amount of the charge you can put on it without raising a voltage cross over the capacitor to a -- to an unreasonable level. 03:00:39 03:00:47 03:00:50 03:00:56 03:01:04

Q. Does the size of the capacitor change whether or not capacitive storage can store a 10-coulomb charge in its analog form? 03:01:11 03:01:14 03:01:17

MR. FISHER: Object to the form. 03:01:21 03:01:23

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A. I mean, 10 coulomb is a unit, right? It tells you there's a certain amount of charge that you want to put on the capacitor. 03:01:28 03:01:30 03:01:32 03:01:34

And, as I've said to you earlier, depending on the size of the capacitor, you may be able to store the 10 coulombs in there without raising the voltage cross over the capacitor to -- in the -- a reasonable level. 03:01:35 03:01:38 03:01:40 03:01:44 03:01:47

(BY MS. MAHONEY) 03:01:53

Q. So would it be possible to store that 10-coulomb charge on capacitive storage in its analog form? 03:01:53 03:01:54 03:01:59

MR. FISHER: Same objection. 03:02:02

A. I mean, if you said 10 coulombs, 10 coulombs, you can store the ten coulombs charge on the capacitor. 03:02:05 03:02:09 03:02:14

As I said to you before, depending on the capacitor size, you may be able to store the 10-coulomb charge on the capacitor without raising the voltage cross over the capacitor to a unreasonable level. 03:02:15 03:02:17 03:02:19 03:02:23 03:02:27

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(BY MS. MAHONEY) 03:02:53
Q. And if the capacitor is a 03:02:53
sufficient size that you can store that 03:02:57
10-coulomb charge on the capacitor without 03:02:59
raising the voltage cross over the capacitor 03:03:03
to an unreasonable level, can the capacitive 03:03:06
storage store that 10-coulomb charge in its 03:03:09
analog form? 03:03:11
MR. FISHER: Object to form. 03:03:13
A. As I said to you earlier, the 03:03:20
capacitor, with reasonable size or sufficient 03:03:21
size, can store that 10-coulomb charge on the 03:03:28
capacitor. That's -- that's what I can tell 03:03:31
you. 03:03:32
You know, you got that charge 03:03:33
coming in, I can put on the capacitor if the 03:03:34
capacitor size is sufficiently large so that 03:03:36
the voltage drop across -- over the capacitor 03:03:39
will not reach an unreasonable level. 03:03:43
(BY MS. MAHONEY) 03:03:57
Q. So you don't know whether the 03:03:57
10-coulomb charge would be stored in an 03:03:59

analog form? 03:04:01

A. That's what I -- 03:04:02

MR. FISHER: Same objection. 03:04:03

A. What I told you was I -- I know 03:04:04

that the 10-coulomb charge can be stored in 03:04:06

the capacitor, assuming the capacitor has 03:04:11

sufficient large size so that when you store 03:04:14

the 10-coulomb charge on the capacitor, the 03:04:17

voltage drop cross over that capacitor will 03:04:20

not reach an unreasonable level. 03:04:22

(BY MS. MAHONEY) 03:04:31

Q. Can capacitive storage store 03:04:31

charge in the digital format? 03:04:33

MR. FISHER: Object to form. 03:04:37

A. A capacitor stores charge. 03:04:42

That's what I can tell you. 03:04:48

(BY MS. MAHONEY) 03:04:51

Q. So you don't know whether 03:04:52

capacitive storage can store charge in the 03:04:54

digital form? 03:04:56

MR. FISHER: Same objection. 03:04:57

A. I think that's a 03:04:58

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mischaracterization.

What I said was: A capacitor can store charge on the capacitor. That's what a capacitor does.

(BY MS. MAHONEY)

Q. In what form does the capacitive storage store the charge?

MR. FISHER: Same objection.

A. When you have certain amount of charge you want to put on the capacitor, that capacitor stores that charge. If the capacitor size is large enough, the resulting voltage cross over the capacitor will not reach an unreasonable level.

MS. MAHONEY: Dr. Young, I'm going to object to that as nonresponsive.

MR. FISHER: You can object if you want, but it was entirely responsive.

THE WITNESS: I agree. You asked me the same question many, many times. I gave you a consistent answer each time you asked me the question, so I was responding to

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your question. 03:06:20
(BY MS. MAHONEY) 03:06:30
Q. A capacitive storage storage 03:06:31
charge, is that in the digital or the analog 03:06:33
form? 03:06:35
MR. FISHER: Object to the 03:06:35
form. 03:06:36
A. What I said to you was a 03:06:38
capacitor can store charge on it, okay? 03:06:39
And if the capacitor is 03:06:44
sufficiently large, the charges stored on 03:06:49
capacitor will not reach -- will not develop 03:06:52
a voltage that -- that is -- that -- that's 03:06:54
unreasonable, you know, reach an unreasonable 03:06:57
level. That's what a capacitor does. 03:07:01
(BY MS. MAHONEY) 03:07:30
Q. Dr. Young, are you familiar with 03:07:30
floating gate MOSFETS, M-O-S-F-E-T? 03:07:31
A. Yes, I am familiar with that 03:07:36
device. 03:07:38
Q. Can you explain what that is? 03:07:39
A. It's a MOSFET device. It's a, 03:07:43

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you know, MOSFET -- M-O-S-F-E-T. 03:07:48

If you have a floating gate, 03:07:53

meaning that the -- you have a gate that is 03:07:54

floating inside -- inside the device. 03:07:56

Q. What is a gate? 03:08:04

A. A -- a gate is a electrode that 03:08:06

is typically used to control the operation of 03:08:09

a MOSFET device. 03:08:14

Q. And what is a MOSFET device used 03:08:22

for? 03:08:28

A. A MOSFET device can be used as 03:08:29

a -- as a transistor. 03:08:32

Q. In what context would you use a 03:08:53

MOSFET device as a transistor? 03:08:56

A. It behaves as a transistor so 03:09:05

that you can use that as a -- as a switch or 03:09:08

you can use that as a, like, amplifier, 03:09:11

right, amplifying a small incoming signal and 03:09:16

to produce a larger signal coming out of it. 03:09:19

Q. Does a floating gate MOSFET have 03:09:45

storage? 03:09:48

A. I am not sure if I understand. 03:09:55

You -- I heard what you said, but I'm not sure if I understand your question in a technical sense. 03:10:02 03:10:04 03:10:06

Q. Does a floating gate MOSFET generate a signal? 03:10:08 03:10:15

A. I heard what you said, but I'm not sure if I understand your question in the technical sense. 03:10:27 03:10:29 03:10:30

Q. So how is a floating gate MOSFET used? 03:10:43 03:10:48

A. The floating MOSFET can be used -- can be used to adjust the threshold voltage of that transistor. 03:10:48 03:10:59 03:11:04

Q. Are floating gate MOSFETS programmable? 03:11:32 03:11:37

A. It can be programmed. 03:11:38

Q. In what way? 03:11:39

A. You can -- you can control -- you can control the charge on the floating gate through programming. 03:11:42 03:12:02 03:12:05

Q. How does the floating gate MOSFET control the charge? 03:12:22 03:12:25

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A. Depending on -- depending on the voltage that you applied on that transistor, but you may have another gate that's not floating that is -- that can be connected to a -- to a controlled voltage source. 03:12:26 03:12:33 03:12:38 03:12:40 03:12:43

So depending on how you -- how you applied the voltage on that control voltage signal, you can control the charge that is stored in the floating gate. 03:12:46 03:12:49 03:12:53 03:12:56

Q. How is the charge stored in the floating gate? 03:13:10 03:13:12

A. You have the charge you can get onto the floating gate through -- for example, charge inject across over the insulator material around the floating gate. 03:13:31 03:13:33 03:13:35 03:13:37

Q. And how is it stored on the floating gate? 03:13:43 03:13:45

A. Because it's floating, when you get the charge on it, it stays there. 03:13:47 03:13:50

Q. And the charge on the floating gate would be in its analog form, right? 03:13:52 03:14:01

MR. FISHER: Object to the 03:14:03

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form. 03:14:04

A. The floating gate stores the 03:14:09

charge, that's what I can tell you, just like 03:14:11

a capacitor stores the charge. 03:14:13

(BY MS. MAHONEY) 03:14:25

Q. Can floating gate MOSFETS be used 03:14:25

with EEPROM memory? 03:14:28

A. Yes. 03:14:31

Q. And when EEPROM memory is used 03:14:31

with a floating gate MOSFET, the EEPROM can 03:15:09

be configured to store that charge as an 03:15:14

analog value, right? 03:15:17

MR. FISHER: Object to the 03:15:18

form. 03:15:20

A. The EEPROM can be configured to 03:15:20

store the charge in that device, that's what 03:15:24

I can tell you. 03:15:27

(BY MS. MAHONEY) 03:15:30

Q. When you say "in that device," 03:15:31

you mean in the EEPROM memory? 03:15:32

A. In the floating gate. The charge 03:15:34

is stored in the floating gate. 03:15:37

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Q. So the EEPROM does not store the charge? 03:15:39 03:15:44

A. EEPROM is a -- stands for electrical -- electrical, erasable read -- programmable read-only memory. It's a type of memory, but that type of memory can be built using floating gate transistors or, like, as you said, floating gate MOSFETS. 03:15:46 03:15:53 03:15:57 03:16:01 03:16:05 03:16:09

So the charge is stored inside the MOSFET as a transistor. 03:16:13 03:16:15

Q. Okay. So the floating gate MOSFET is part of the EEPROM; is that correct? 03:16:29 03:16:32 03:16:32

A. I would say the floating gate MOSFET is a building block element used to construct the EEPROM. 03:16:37 03:16:39 03:16:46

Q. And if the floating gate MOSFET can store charge in its analog form, then the EEPROM can also store charge in its analog form? 03:16:49 03:17:05 03:17:08 03:17:11

MR. FISHER: Object to the form. 03:17:12 03:17:14

A. I think that's a wrong characterization, right? 03:17:14 03:17:16

What I said to you was, double gate MOSFET is the building block element to construct EEPROM. The double gate MOSFET transistor can store charge in its -- on its double -- on its floating gate as a capacitive storage. 03:17:18 03:17:24 03:17:28 03:17:33 03:17:38 03:17:43

(BY MS. MAHONEY) 03:17:45

Q. Is there a difference between a double gate MOSFET and a floating gate MOSFET? 03:17:49 03:17:51 03:17:54

A. Yeah. When I say "double gate," meaning that -- that the second gate is the floating gate, yeah. 03:17:54 03:17:57 03:17:59

Q. Okay. 03:18:00

A. Yeah, thank you for the clarification. 03:18:01 03:18:02

Q. Okay. So just so I'm understanding, a floating gate MOSFET can be a building block of EEPROM memory, correct? 03:18:14 03:18:16 03:18:19

A. What I said was a floating gate 03:18:24

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MOSFET is a building block element used to construct EEPROM. 03:18:27 03:18:32

Q. Okay. A floating gate MOSFET is a building block element that can be used to construct EEPROM, right? 03:18:34 03:18:38 03:18:43

A. That's correct. 03:18:45

Q. And if an EEPROM is built with a building block of a floating gate MOSFET, the EEPROM would store the charge in the form that it is stored on the floating gate MOSFET, right? 03:18:46 03:19:04 03:19:09 03:19:12 03:19:16

A. I think that's correct, if you'd like to make that connection. 03:19:27 03:19:30

Q. Would a POSA also agree with that? 03:19:45 03:19:47

A. If I put myself as a POSA, that's my understanding. 03:19:51 03:19:53

Q. Dr. Young, are you familiar with what a bolus is? 03:19:54 03:20:07

A. Yes, I'm familiar with what -- what a bolus is. 03:20:10 03:20:13

Q. What is a bolus? 03:20:13

A. A bolus is a -- is -- it's an object that can be orally taken, as if by animals. 03:20:16 03:20:24 03:20:29

Q. Can it be orally taken by humans? 03:20:31

A. I have not thought about that. 03:20:35

Q. Did you know what a bolus was before being retained by petitioners? 03:20:40 03:20:43

A. Oh, I heard about a bolus, yeah. 03:20:46

Q. When did you first hear about a bolus? 03:20:48 03:20:50

A. Long time ago. 03:20:51

Q. Do you remember the context? 03:20:52

A. No, I don't. 03:20:56

Q. You would agree that a bolus can be used as an implantable monitoring device, right? 03:20:56 03:21:06 03:21:09

MR. FISHER: Object to the form. 03:21:17 03:21:20

A. I mean, if the animal, let's say the -- an animal takes a bolus down through the throat, right, and it stays inside the body; and if that bolus is designed to 03:21:28 03:21:29 03:21:34 03:21:37

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monitor certain, let's say, physiological parameter, per say, for the animal, then that bolus will be considered as an implantable device for monitor the animal. 03:21:39 03:21:44 03:21:47 03:21:50

(BY MS. MAHONEY) 03:22:03

Q. Okay. So for a bolus that is designed to monitor certain physiological parameters, it would be fair to say that the bolus was designed for internal use? 03:22:03 03:22:07 03:22:09 03:22:11

A. I heard what you said, but I'm trying to be on the same page with you. 03:22:29 03:22:32

You know, if a bolus is orally taken by the animal, right, the bolus goes inside the animal body, for example, stay in certain compartments of the stomach, that would be a -- at least considered as an internal use. That's my understanding. 03:22:33 03:22:36 03:22:38 03:22:39 03:22:41 03:22:44

Q. So for a bolus that is configured to monitor physiological parameters from inside of the particular rumen of a ruminant animal like a cow, it would need to be designed to remain operational for a number 03:23:33 03:23:37 03:23:42 03:23:50 03:23:53

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of years, right? 03:23:56

A. For a certain period of required 03:24:01

time. 03:24:02

Q. So in designing that bolus, there 03:24:03

would be certain design considerations that 03:24:16

would expand the lifespan of the bolus? 03:24:18

A. I think that's correct. 03:24:25

Q. And to extend the lifespan, it 03:24:26

would be important to conserve power within 03:24:43

the bolus, right? 03:24:46

A. I think that's fair to say. 03:24:57

Q. What would be some available 03:24:58

power-saving techniques? 03:25:04

A. I mean, there are a number of 03:25:17

design considerations a designer can consider 03:25:31

to save power. 03:25:34

Q. Like what? 03:25:38

A. You know, for example, you can 03:25:44

minimize your transmission as a frequency, 03:25:50

meaning that you do not transmit signals as 03:25:54

frequently as -- as needed, right, or you -- 03:25:58

you reduce that transmission frequency. 03:26:01

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And each time, you know, for example, you transmit a -- your frequency, trying to minimize your transmission time to save power, you know, you're trying to operate your system, you know, we call it in the low-power manner, right? 03:26:04 03:26:07 03:26:10 03:26:17 03:26:21 03:26:24

If there are certain building blocks that does not need to be turned on, you put them into -- you turn them off, or you're putting into, for example, the low-power mode or the sleep mode. 03:26:26 03:26:29 03:26:32 03:26:35 03:26:37

So there are a number of, you know, design techniques commonly used in -- in low-power system design, not necessarily the ones that go into the body, even for things that, for example, you wear, right? Wearable device on your wrist, you know, you don't want to run out of batteries; so there are a lot of low-power design techniques that can be incorporated in the overall electrical system design to save power. 03:26:39 03:26:40 03:26:45 03:26:47 03:26:50 03:26:53 03:26:55 03:26:59 03:27:02 03:27:04

Q. You mentioned certain building 03:27:06

blocks that can be turned on or off or put into sleep mode. 03:27:29 03:27:32

What are some examples of those building blocks? 03:27:33 03:27:35

A. For example, if you do not need to transmit a signal, you can certainly turn off the transmitter, right? 03:27:38 03:27:40 03:27:43

And, you know, in there -- I mean, I give you a kind of a high-level explanation. 03:27:45 03:27:48 03:27:51

You know if you look at the electrical system, there will be some building blocks needed to be on, there will be some building blocks that do not need to be on all the time; so it really depends on your system design, but you'd be able to -- or a person of ordinary skill in the art will be able to identify a certain number of building blocks may not be -- need to -- may not need to be on for that time period. 03:27:51 03:27:53 03:27:55 03:27:57 03:28:00 03:28:03 03:28:05 03:28:08 03:28:11 03:28:14

As a result, they can be put into the sleep mode or they can be put into the 03:28:16 03:28:18

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low power mode just for the sake of -- or for the purpose of saving power. 03:28:25 03:28:28

Q. What other building blocks can be turned off or put into low-power mode? 03:28:38 03:28:40

A. I -- I recall I just answered that question to you. 03:28:45 03:28:48

For example, the transmitter, right, if you do not need to transmit the data, you can just put it into the low-power mode or sleep mode. 03:28:49 03:28:51 03:28:54 03:28:57

Q. Is there anything in additional [sic] to the transmitter? 03:28:58 03:29:00

A. Yeah. There could be other components in the system. If you do not need to use them, you just turn them -- you just put them into the sleep mode. 03:29:01 03:29:03 03:29:05 03:29:08

Q. What other types of components? 03:29:09

A. It depends on specific design. 03:29:11

Q. Could you turn off a sensor? 03:29:15

A. You're asking me? I assume when you say "turn off the sensor," I assume you refer to turn off the electronics that 03:29:40 03:29:51 03:29:56

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interface the sensor. 03:29:59

Q. Correct. 03:30:01

A. That's possible, right? If 03:30:03

there's a timing control, you know that you 03:30:05

don't need to sample the data. You can turn 03:30:07

off the electronics that interface with the 03:30:10

sensor. 03:30:13

But when the time comes needed to 03:30:14

sense that the -- sensor information, you can 03:30:17

turn on the electronics that interface with 03:30:19

the sensor, performing the measurement. 03:30:22

Q. So if you turn off the 03:30:40

electronics that interface with the sensor, 03:30:51

is the sensor still taking measurements? 03:30:54

A. Depending on sensors, right? 03:31:05

You know, the sensor may still be 03:31:08

performing the measurement just for the 03:31:12

sensor part, but the -- the electrical 03:31:15

signal -- for example, we talk about the 03:31:17

analog signal where there's a volt also, 03:31:19

right? That may not be converted to the next 03:31:24

stage for additional electronic processing, 03:31:28

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per se, you know, amplifying, filtering, or analog-to-digital conversion. Those steps may not be enabled. 03:31:32 03:31:35 03:31:38

Q. Okay. So it's possible to have a sensor that is taking measurements, but the electronics that interface with the sensor are off such that the sensor is not sending out its signal? 03:31:48 03:31:50 03:31:53 03:31:55 03:32:00

A. The sensor -- again, depends on the sensor. 03:32:04 03:32:09

For example, if you have a sensor that just would sense the parameter, it monitors without requiring the interface electronics to be on, that sensors [sic] would just sense the information, maybe produce a voltage. That voltage may not be publicate (phonetics) to the later stage in the system because that interface electronic circuitry is powered off or is not enabled. 03:32:11 03:32:12 03:32:17 03:32:20 03:32:22 03:32:25 03:32:31 03:32:33 03:32:37

Q. Okay. Going back to your example of the blood pressure monitor with the lab mice -- 03:33:47 03:34:06 03:34:09

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A. Uh-huh. 03:34:10

Q. -- that pressure sensor was a MEMS-based blood pressure sensor, correct? 03:34:11 03:34:14

A. That's correct. 03:34:16

Q. And remind me, did the MEMS-based pressure sensor produce a voltage signal? 03:34:17 03:34:47

A. No. What I said to you was that particular MEMS pressure sensor produced a capacitive signal. That capacitive signal needs to be converted to something we talked about earlier; it's a CV converter. Then there will be a voltage signal coming out of the CV converter. 03:34:51 03:34:54 03:34:59 03:35:04 03:35:06 03:35:10 03:35:12

Q. Thank you. 03:35:13

In that system, were there electronics that interfaced with the MEMS-based blood pressure sensor? 03:35:33 03:35:36 03:35:38

A. Is that your question? 03:35:46

Q. Strike that. Let me try again. 03:35:48

With the MEMS-based blood pressure sensor, was there an electronics interface that controlled when the sensor 03:35:50 03:35:54 03:35:57

took a measurement or not? 03:36:00

A. Can you say that again? 03:36:12

I'm sorry, I heard what you said, 03:36:14

but I'm trying to connect all the things 03:36:16

together so I can -- I can be close to what 03:36:18

you're trying to ask. 03:36:20

Q. Okay. So you said you can turn 03:36:21

on or off the electronics that interface with 03:36:40

a sensor that's taking measurements, right? 03:36:43

A. If you need to save power, and I 03:36:46

said that that could be one of the ways to 03:36:49

save power, by turning off the interface 03:36:54

electronics -- electronic circuits for the 03:36:59

sensor. 03:37:03

The reason why I said that is 03:37:05

because you proposed a scenario. You said 03:37:07

that -- what if you don't need to do the 03:37:09

sensing, can you do something about it? 03:37:12

I said, yeah, if you don't need 03:37:14

to do the sensing, the sensor is still there, 03:37:15

but one can turn off or at least put the 03:37:18

elec- -- interface electronics for that 03:37:21

sensor into a low-power mode for the purpose of saving power. 03:37:23 03:37:25

Q. And when you turn off the electronics that interface with the sensor, does that stop the sensor from taking a measurement, or does that stop the sensor from sending out a signal? 03:37:30 03:37:35 03:37:40 03:37:43 03:37:45

A. You know, as I said that to you earlier -- you know, I'm happy to repeat that again, just to make sure that we're on the same page. 03:37:50 03:37:53 03:37:56 03:37:57

If you have a sensor that works even without power, that sensor will produce a output signal, let's say the analog signal. That analog signal stays there at the output of the sensor. 03:37:58 03:38:05 03:38:08 03:38:13 03:38:16

If the interface electronics for that sensor is powered off, meaning that it is not -- it's not passing that signal through, right, to the subsequent or following stage, if the interface electronic is turned off, then the electronics will do 03:38:17 03:38:22 03:38:26 03:38:30 03:38:32 03:38:36

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something with that voltage signal, right, 03:38:40
amplifying -- does it filter it -- followed 03:38:42
by, for example, an analog-to-digital 03:38:46
converter coming out with digital 03:38:48
representation of that signal. 03:38:51
Q. Okay. So if the interface 03:38:56
electronics are powered off, then nothing 03:38:58
happens with the output signal, correct? 03:39:07
A. The output -- you mean the output 03:39:12
signal of the sensor? 03:39:14
Q. Yes, thank you. 03:39:15
If the -- if the interface 03:39:16
electronics are powered off, then the system 03:39:18
does nothing with the output signal of the 03:39:21
sensor, right? 03:39:24
A. The signal does -- doesn't do 03:39:24
anything with the output signal of that 03:39:27
front-end sensor in the electrical sense. 03:39:31
Q. Okay. 03:40:38
MS. MAHONEY: It looks like 03:40:40
it's been another hour. Can we take a quick 03:40:41
five-minute break? 03:40:44

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MR. FISHER: Sure. 03:40:45
THE VIDEOGRAPHER: Please stand 03:40:46
by. 03:40:46
We're going off the record. 03:40:47
The time is 3:40. 03:40:49
(Break taken from 3:40 p.m. to 03:40:51
3:47 p.m.) 03:47:10
THE VIDEOGRAPHER: We are now 03:47:11
back on the record. The time is 3:47. 03:47:18
(BY MS. MAHONEY) 03:47:20
Q. Dr. Young, the court reporter is 03:47:45
going to hand you what's been marked as 03:47:46
Exhibit 1005 in this IPR proceeding. 03:47:49
(Whereupon Exhibit Number 1005 03:47:49
was marked for identification.) 03:48:09
(BY MS. MAHONEY) 03:48:09
Q. Dr. Young, this is U.S. Patent 03:48:09
Application Publication Number 2009/0187392. 03:48:11
A. That's correct. 03:48:34
Q. Dr. Young, do you recognize this 03:48:34
exhibit as a copy of the Riskey reference 03:48:35
that you cite in your declaration? 03:48:39

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A. That's correct. 03:48:40
Q. And will you understand it when I 03:48:41
refer to this as "Riskey"? 03:48:42
A. Yeah, sure. 03:48:44
Q. And have you reviewed Riskey in 03:48:46
its entirety? 03:48:48
A. Yes, I have. 03:48:49
Q. Okay. Can you please turn to 03:48:50
Page 11 of Riskey and look at paragraph 03:49:09
Number 35? 03:49:12
A. (Complying.) 03:49:12
You said paragraph 11? 03:49:33
Q. Page 11, paragraph 35 of Riskey. 03:49:36
A. Page -- I am at paragraph 35 of 03:49:40
Riskey. 03:50:09
Q. Okay. Now, Riskey discloses the 03:50:11
use of a sensor in a bolus, right? 03:50:15
A. Can I take a look at -- to 03:50:18
verify? 03:50:21
Q. Of course. 03:50:21
A. Okay. Yeah. 03:51:00
Q. Okay. And I'd also like you to 03:51:01

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take a look at paragraphs 83 to 85 in your declaration, which is Exhibit 1002. 03:51:03 03:51:06

A. (Complying.) You said paragraph 83 -- 03:51:11 03:51:29

Q. 83 to 85. 03:51:30

A. Okay. I'll take a look at it. 03:51:32

Yeah, I'm done with reading it. 03:55:02

Q. Okay. Dr. Young, in paragraphs 83 to 85 in your declaration, you discuss some of these sensors that Riskey talks about in paragraph 35, right? 03:55:05 03:55:10 03:55:14 03:55:18

A. That's correct. 03:55:19

Q. And in particular, you specifically cite a thermocouple and a thermistor, right? 03:55:20 03:55:24 03:55:27

A. That's correct. 03:55:29

Q. And, Dr. Young, earlier you testified that a thermocouple produces a voltage even when it's not connected to anything, like, for example, when it's sitting on a table. 03:55:30 03:55:40 03:55:44 03:55:46 03:55:48

Do you recall that? 03:55:49

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A. I recall that. 03:55:52
Q. Were you referring to the 03:55:53
phenomenon known as the Seebeck effect? 03:55:58
A. I think I mentioned something 03:56:03
like that. 03:56:04
Q. Okay. So the thermocouple 03:56:04
sitting on the table produces a voltage 03:56:11
potential that is caused by this Seebeck 03:56:14
effect, right? 03:56:17
A. Due to the temperature. 03:56:21
Q. And can you explain the Seebeck 03:56:23
effect? 03:56:40
A. Oh, Seebeck effect care -- means 03:56:42
that if you have two dissimilar materials 03:56:45
joined together, if the junction, the point 03:56:50
where joins the two dissimilar materials 03:56:55
together, it would generate a potential, a 03:56:59
voltage cross over the -- the two ends of the 03:57:03
two dissimilar materials. 03:57:09
Q. And the voltage produced -- 03:57:16
strike that. 03:57:22
The voltage caused by the Seebeck 03:57:22

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effect is a passive voltage, right? 03:57:25

A. I heard what you said, but I -- 03:57:32

but I want to make sure I understand what you 03:57:35

mean by a "passive voltage." I don't 03:57:39

understand what you mean by a "passive 03:57:46

voltage." 03:57:48

Q. Okay. So due to the Seebeck 03:57:48

effect, there is a generation of a voltage 03:57:58

differential between two dissimilar metals, 03:58:04

correct? 03:58:09

A. That's correct. 03:58:09

Q. And that voltage differential is 03:58:10

a passive voltage differential as opposed to 03:58:15

an active output signal, correct? 03:58:18

A. See, I heard what you -- you 03:58:24

introduced these two adjectives; one is 03:58:28

"passive," the other one is "active." I 03:58:35

heard what you said, but I just -- I just 03:58:37

want to hear more about that term. 03:58:40

What do you mean by "passive 03:58:41

voltage"? What do you mean by "active 03:58:43

voltage"? 03:58:45

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Q. What does "passive voltage" mean to you? 03:58:46 03:58:48

A. Doesn't mean anything to me. 03:58:49

Q. You've never heard that term before? 03:58:51 03:58:52

A. I've heard about voltage, but I don't use a term like that to characterize a voltage. 03:58:52 03:58:54 03:58:55

Q. So when a thermocouple produces a voltage differential that is caused by the Seebeck effect, it can do this without being connected to anything else, correct? 03:58:56 03:59:35 03:59:37 03:59:41

MR. FISHER: Object to the form. 03:59:43 03:59:49

A. It could produce a voltage differential, as you said, by itself. 03:59:49 03:59:51

(BY MS. MAHONEY) 03:59:55

Q. And the voltage differential produced by the Seebeck effect is different than the voltage output -- strike that. 03:59:59 04:00:00 04:00:03

How does the voltage output of a thermocouple change when connected to a power 04:00:14 04:00:33

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source? 04:00:40

A. I heard what you said, but I 04:00:47

don't really follow. What do you mean by 04:00:53

"when connected to a power source"? 04:00:55

Q. So if you have a thermocouple 04:00:58

sitting on the table alone, not connected to 04:01:03

anything, that thermocouple, in your opinion, 04:01:06

produces a voltage differential, correct? 04:01:09

A. That's correct. 04:01:12

Q. And that voltage differential is 04:01:13

caused by the Seebeck effect, correct? 04:01:15

A. Due to the temperature effect, as 04:01:17

well. 04:01:19

Q. And if you were to take that same 04:01:21

thermocouple and now incorporate it into a 04:01:24

system, how does that change the voltage 04:01:32

signal that is output from the thermocouple? 04:01:36

MR. FISHER: Object to the 04:01:40

form. 04:01:43

A. What system are you talking 04:01:43

about? 04:01:45

(BY MS. MAHONEY) 04:01:48

Q. So earlier we were talking about the ability to turn on and off the electronics that interface with a sensor performing a measurement, right? 04:02:16 04:02:18 04:02:20 04:02:24

A. Yeah, we did talk about that. 04:02:26

Q. So if you were to turn off the electronics that interface with a thermocouple, the thermocouple would generate a voltage differential due to the Seebeck effect, correct? 04:02:29 04:02:31 04:02:33 04:02:39 04:02:44

MR. FISHER: Object to the form. 04:02:45 04:02:47

A. That's correct. 04:02:47

(BY MS. MAHONEY) 04:02:48

Q. And if you were to turn back on the electronics that interface with the thermocouple, the thermocouple would produce a voltage signal in addition to the voltage differential caused by the Seebeck effect? 04:02:51 04:02:53 04:02:55 04:02:58 04:03:05

A. That's -- 04:03:09

MR. FISHER: Same objection. 04:03:09

THE WITNESS: Sorry. 04:03:10

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A. Technically, that's not true. 04:03:10

(BY MS. MAHONEY) 04:03:12

Q. So what would happen? 04:03:12

A. That thermocouple just monitors the temperature by itself, regardless of whether you turn down the electronics or not. 04:03:14 04:03:18 04:03:20

Q. So if the -- strike that. 04:03:25

If the temperature does not change and you turn back on the electronics that interface with the thermocouple, the voltage reading will stay the same? 04:03:28 04:03:31 04:03:34 04:03:37

A. The voltage -- 04:03:39

MR. FISHER: Objection -- object to the form. 04:03:41 04:03:42

A. Yeah, sorry to -- yeah, I apologize. It's -- yeah, maybe I'm too fast. 04:03:43 04:03:45

The -- the -- my understanding is the voltage coming out of the thermocouple remains as is if the temperature does not change. 04:03:49 04:03:54 04:03:57 04:04:01

(BY MS. MAHONEY) 04:04:19

Q. And the voltage remains as is, 04:04:19

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regardless of whether the electronics that interface with the thermocouple are on or off? 04:04:22 04:04:24 04:04:27

MR. FISHER: Same objection. 04:04:28

A. Yeah. I think I answered that question, right? 04:04:35 04:04:37

If -- if -- if the temperature doesn't change, you look at the output differential voltage coming out of the thermocouple. It will be the same output differential voltage with or without the electronics being turning on and off. That's my understanding. 04:04:37 04:04:39 04:04:42 04:04:45 04:04:48 04:04:54 04:05:00

(BY MS. MAHONEY) 04:05:00

Q. If the thermocouple is not connected to a circuit, is there a current flowing from the thermocouple? 04:05:34 04:05:35 04:05:40

MR. FISHER: Same objection. 04:05:43

A. Depending on the type of circuit that you're talking about. 04:05:53 04:05:55

(BY MS. MAHONEY) 04:06:30

Q. So a circuit could exist where a 04:06:30

thermocouple is not connected to the circuit and a current is still flowing through the thermocouple? 04:06:33 04:06:36 04:06:39

MR. FISHER: Same objection. 04:06:39

A. I heard what you said. I have trouble to connect them. 04:06:44 04:06:46

(BY MS. MAHONEY) 04:07:12

Q. If a thermocouple is not connected in a circuit, can you digitize the output voltage differential signal? 04:07:12 04:07:14 04:07:18

MR. FISHER: Object to the form; beyond the scope. 04:07:21 04:07:25

A. I heard what you said, but I think this time I probably can connect it better. 04:07:32 04:07:33 04:07:35

You said that if a -- if a thermocouple is not connected to a circuit, can you still digitize the voltage coming out of the thermocouple? Is that what you're saying? 04:07:35 04:07:38 04:07:48 04:07:54 04:07:55

(BY MS. MAHONEY) 04:07:55

Q. Yes. 04:07:56

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MR. FISHER: Same objections. 04:08:02

A. In principle, you could, if it's just a voltage signal coming out. You can just connect the voltage to an analog-to-digital converter and digitize their signal. 04:08:04 04:08:09 04:08:13 04:08:17 04:08:19

(BY MS. MAHONEY) 04:08:20

Q. Okay. Can you please turn to Page 12 of Riskey? 04:09:10 04:09:11

A. (Complying.) If you could maybe tell me the paragraph number -- 04:09:14 04:09:18

Q. Yeah. 04:09:19

A. -- it will be better, because, you know, it does have page number, but the paragraph number is way off. 04:09:20 04:09:21 04:09:24

Q. Yeah, so the -- the top left corner of Page 12 should be labeled paragraph 43, which technically starts back on Page 11. 04:09:27 04:09:29 04:09:32

MR. FISHER: I'm not seeing that, Counsel. 04:09:38 04:09:39

A. You said top left? 04:09:41

(BY MS. MAHONEY) 04:09:42

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Q. If you turn back to the bottom right corner of Page 11, it says paragraph 43. We're just going to start on the continuation on Page 12. 04:09:43 04:09:44 04:09:47 04:09:49

A. Okay. Okay, thank you. 04:09:51

MR. FISHER: Sorry, what paragraph? 43, you said? 04:09:53 04:09:54

MS. MAHONEY: Yeah, paragraph 43. 04:09:57 04:09:58

MR. FISHER: And you're saying that's on Page 12? 04:09:59 04:10:00

MS. MAHONEY: The continuation of paragraph 43 is on Page 12, yeah. 04:10:01 04:10:02

A. I can see paragraph 43. I guess on Page 11, right, indicated on the lower hand right corner of that page. Yeah. 04:10:11 04:10:15 04:10:18

MR. FISHER: Oh, you're referring to the stamped page numbers. I get it. 04:10:23 04:10:24 04:10:26

MS. MAHONEY: Oh, apologies, yes, I'm referring to Page 12 of Exhibit 1005. 04:10:27 04:10:28 04:10:31

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MR. FISHER: Fine. 04:10:32

A. Okay. Yeah, I'm there. 04:10:34

(BY MS. MAHONEY) 04:10:36

Q. You're in the same spot? Okay. 04:10:36

About nine lines down, do you see 04:10:38

where it says, "In another embodiment, one or 04:10:43

more sensors 220 may be configured to store 04:10:52

sensor measurements on memory unit 250"? 04:10:55

A. Let me read that. Yeah, I'm -- 04:10:58

I'm done with reading that passage. 04:12:51

Q. Okay. So you would agree that 04:12:52

Riskey says that one or more sensors 220 can 04:12:56

be configured to store their sensor 04:13:03

measurements on memory unit 250? 04:13:05

A. Can you please point to me that 04:13:07

specific line -- I think -- is that on 04:13:10

Page 12? I think -- 04:13:12

Q. It's on Page 12 of Exhibit 1005. 04:13:14

A. Okay. And how many lines down? 04:13:17

Q. Should be a -- starting about 04:13:19

nine lines down. 04:13:21

A. Okay. 04:13:22

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MR. FISHER: I'll to object to the form. 04:13:35 04:13:36

A. You know, can you please say that -- repeat your question again? I'm focusing on that line. 04:14:18 04:14:20 04:14:28

(BY MS. MAHONEY) 04:14:29

Q. Uh-huh. 04:14:29

A. I know I just need to count line 9 -- Number 9, right there. 04:14:30 04:14:32

Q. Yeah. 04:14:34

Do you see where Riskey says, "In another embodiment, one or more sensors 220 may be configured to store sensor measurements on memory unit 250"? 04:14:34 04:14:38 04:14:41 04:14:44

A. Yes, I do see that. 04:14:55

Q. So in other words, a sensor, like a thermocouple, could store its measurements on a memory unit employed by the Riskey system? 04:14:56 04:15:02 04:15:05 04:15:11

MR. FISHER: Object to the form. 04:15:11 04:15:20

A. What it says here, right, is -- 04:15:20

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Do you mind if I just follow your pen to mark? If I walk away from the line, it's hard to -- for me to get back in again. Let me just make a mark about that line. Number 9, right? 04:15:20 04:15:20 04:15:33 04:15:33 04:15:36

It says that, "In another embodiment, one or more sensors 220 may be configured to store sensor measurements on memory unit 250." 04:15:52 04:15:54 04:16:15 04:16:26

So a sensor is configured to store the sensor measurement on memory unit 250. So if you look at that drawing, right, Figure 2 provides some meaningful teaching of the passage. 04:16:28 04:16:32 04:16:36 04:16:39 04:16:45

So you have 250, that's -- that has a number of sensors, for example, accelerometers, you know, temperature sensors and some other sensors all the way down to sensor N, right, as a part of that building block. 04:16:46 04:16:48 04:16:52 04:16:56 04:16:59 04:17:02

And that building block -- the way a person of ordinary skill in the art 04:17:02 04:17:05

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would understand, that building block will contain other necessary electronic circuitry. 04:17:07 04:17:10

To take the output signal from the physical sense and do something about it, maybe amplify it, maybe filter, maybe convert that signal to -- analog signal to digital representation of the analog signal, then you can store in the memory. 04:17:14 04:17:17 04:17:21 04:17:27 04:17:30 04:17:34

(BY MS. MAHONEY) 04:17:47

Q. Riskey does not require a particular type of memory, right? 04:17:47 04:17:49

MR. FISHER: Object to the form. 04:17:53 04:17:59

A. I read through Riskey. You know, it talks about memories. I guess in the specification, it mentions certain type of memory as embodiments; but I do not recall whether the -- the claim limitation for this -- for this document -- maybe it's a patent application, per se, requires any specific memory type. 04:17:59 04:18:03 04:18:10 04:18:12 04:18:19 04:18:24 04:18:28 04:18:30

(BY MS. MAHONEY) 04:18:44

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Q. So you don't recall if Riskey requires a particular type of memory? 04:18:44 04:18:47

MR. FISHER: Same objection. 04:18:49

A. That's not what I said. I can repeat what I said. 04:18:52 04:18:54

In the specification of Riskey, it talks about certain types of memory as embodiments, as examples; but I do not recall whether the claim limitation in this document requires any specific type of memory. I can read through it to let you know, but if you ask me, is it in there, I just don't remember. 04:18:55 04:18:59 04:19:02 04:19:06 04:19:11 04:19:14 04:19:17 04:19:19

(BY MS. MAHONEY) 04:19:24

Q. Okay. So the specification of Riskey talks about certain types of memory, right? 04:19:25 04:19:26 04:19:29

A. It kind of mentions certain type of memory. 04:19:30 04:19:32

Q. And the specification of Riskey does not require the use of a certain type of memory, right? 04:19:33 04:19:35 04:19:39

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MR. FISHER: Same objection. 04:19:40

A. I looked at a specification as 04:19:43

embodiments, as examples, unless it says 04:19:47

that, "Hey, you got to use this," right? 04:19:50

Otherwise, I look at all these things as 04:19:53

embodiments. 04:19:55

(BY MS. MAHONEY) 04:19:56

Q. And if Riskey describes those 04:19:59

types of memory as embodiments, then Riskey 04:20:02

does not require the use of those types of 04:20:05

memory, right? 04:20:07

MR. FISHER: Same objection. 04:20:08

A. I look at these examples as 04:20:13

teachings of Riskey. 04:20:16

If you ask me whether to require 04:20:20

or not, you know, my understanding is I have 04:20:22

to look at -- I mean, at least for this 04:20:25

document, I have to look at the claim 04:20:28

limitation to see if the claims of this -- 04:20:30

let's say it's a patent or maybe a patent 04:20:32

application -- requires a specific type of 04:20:36

memory. 04:20:37

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But circling back to the specification, I look at whatever discussed in the specification as embodiments, as examples. 04:20:39 04:20:41 04:20:44 04:20:47

(BY MS. MAHONEY) 04:20:55

Q. But there's more than one type of memory that you can use in constructing the system disclosed by Riskey, right? 04:20:55 04:20:56 04:21:00

MR. FISHER: Same objection. 04:21:03

A. I would say that's your speculation. 04:21:10 04:21:12

(BY MS. MAHONEY) 04:21:16

Q. So then what type of memory does Riskey require? 04:21:16 04:21:18

MR. FISHER: Same objection. 04:21:20

A. As I said to you earlier, I think that's the same question, right? 04:21:23 04:21:26

Riskey's specification mentions certain memories as embodiments, okay? And I do not recall whether the claims require or puts a limitation on certain type of memory needed, right, for the system, needed for the 04:21:27 04:21:31 04:21:35 04:21:41 04:21:47

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system. 04:21:51

I look at the specification as 04:21:52

embodiments, as examples. 04:21:55

(BY MS. MAHONEY) 04:21:59

Q. But you would agree that those 04:22:00

embodiments and examples are different 04:22:01

options for performing the system in Riskey? 04:22:03

MR. FISHER: Same objection. 04:22:08

A. Different examples provides a 04:22:10

teaching to a person of ordinary skill in the 04:22:12

art reading the specification to understand 04:22:15

the teaching of the patent in the -- in a 04:22:18

more concrete manner. 04:22:20

(BY MS. MAHONEY) 04:22:23

Q. To understand the different types 04:22:23

of memory that you could use? 04:22:24

A. At least at -- 04:22:26

MR. FISHER: Same objection. 04:22:27

A. -- at least it teaches that, 04:22:28

right? 04:22:30

(BY MS. MAHONEY) 04:22:41

Q. Okay. Can you please turn to the 04:22:43

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abstract of Riskey, which is on Page 1 of Exhibit 1005? 04:22:43 04:22:47

A. (Complying.) 04:22:48

I am there. 04:22:50

Q. So four lines down, do you see where Riskey says, "The bolus may comprise a data transmitter in wireless communication with a base station"? 04:22:51 04:23:11 04:23:15 04:23:18

A. Yes, I see that. 04:23:25

Q. Is it fair to say that Riskey fails to describe a system that uses hardwired transmission? 04:23:25 04:23:31 04:23:34

MR. FISHER: Object to the form. 04:23:36 04:23:42

A. I'm not sure what you mean by "failed to describe" something, right? 04:23:42 04:23:44

You know, when I look at the -- the abstract, the line number that you point me to, it says that, "The bolus may comprise a data transmitter in wireless communication with a base station." That's what it says. 04:23:46 04:23:49 04:23:51 04:23:55 04:23:58

(BY MS. MAHONEY) 04:24:04

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Q. Does Riskey describe a system that uses hardwired transmission? 04:24:04 04:24:06

MR. FISHER: Same objection. 04:24:11

A. From the abstract? 04:24:13

(BY MS. MAHONEY) 04:24:16

Q. From the reference. 04:24:17

MR. FISHER: Same objection. 04:24:19

A. When you say "reference," you mean the -- the specification, right? 04:24:21 04:24:22

(BY MS. MAHONEY) 04:24:24

Q. Correct. 04:24:25

MR. FISHER: Maintain -- maintain the objection. 04:24:26 04:24:27

A. Based on what I -- what I can remember, it doesn't talk about a wired connection. Unless you -- you saw it, you can point it to me. You know, I'd be happy to look at it. 04:24:30 04:24:31 04:24:34 04:24:37 04:24:39

(BY MS. MAHONEY) 04:24:40

Q. And, Dr. Young, you've testified earlier today that analog signals can be transmitted wirelessly, right? 04:24:53 04:24:55 04:24:58

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A. I remember we talk about that thing, right? In -- in early part of the deposition you asked me something like that, and if I remember correctly -- you know, I don't have the script with me -- I said that you can transmit analog signal wirelessly. 04:25:02 04:25:09 04:25:14 04:25:16 04:25:18 04:25:22

Q. And Riskey does not describe any specific digital transmission protocols, right? 04:25:28 04:25:37 04:25:40

MR. FISHER: Object to the form. 04:25:42 04:25:43

A. I -- I -- I would have to -- I would have to look through Riskey to make sure that's the case because I do not remember word by word what's in there. 04:25:47 04:25:52 04:25:54 04:25:57

(BY MS. MAHONEY) 04:26:00

Q. And nothing in Riskey requires that the wireless communications must be digital, right? 04:26:08 04:26:10 04:26:12

MR. FISHER: Same objection. 04:26:13

A. I think I made some -- you know, a -- a statement in my declaration, right, 04:26:14 04:26:23

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talking about that aspect, you know. 04:26:32

I would need to look at my 04:26:39

declaration to make sure -- to make sure that 04:26:41

the -- the correct language are put into my 04:26:45

report. 04:26:49

If you ask me something, just, 04:26:49

you know, on the fly, I just don't want to 04:26:51

say yes or no so that it -- it does not 04:26:55

represent my opinions set forth in my report 04:26:59

correctly. 04:27:05

(BY MS. MAHONEY) 04:27:39

Q. Dr. Young, can you please turn to 04:27:40

paragraph 91 of your declaration? 04:27:44

A. (Complying.) 04:27:46

I am at paragraph 91. 04:28:01

Q. Can you please review paragraph 04:28:06

91? 04:28:11

A. Sure, thank you. 04:28:12

Yes, I'm done with reading that 04:28:13

paragraph. 04:30:34

Q. So Riskey does not require that 04:30:34

the wireless communications must be digital, 04:30:43

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right? 04:30:46
MR. FISHER: Object to the 04:30:46
form; asked and answered. 04:30:48
A. That paragraph is for claim 5E, 04:30:58
talks about enabling a radio signal generator 04:31:02
located with -- with -- inside the bolus. 04:31:07
Passage -- paragraph 91 is talking about that 04:31:13
particular claim limitation. 04:31:16
(BY MS. MAHONEY) 04:31:19
Q. Dr. Young, do you see your first 04:31:47
sentence in paragraph 91? 04:31:48
A. I see that sentence. 04:31:56
Q. Okay. And you state, "Riskey's 04:31:57
cattle bolus enables a radio signal 04:32:00
generator -- data transmitter 232 -- to 04:32:03
wirelessly transmit radio signals to a base 04:32:07
station via a connected antenna 233." 04:32:09
A. That's what that sentence says. 04:32:12
Q. And nothing in Riskey requires 04:32:14
that the wireless transmission of radio 04:32:41
signals to the base station must be digital, 04:32:44
right? 04:32:47

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MR. FISHER: Object to the form; asked and answered. 04:32:48 04:32:49

A. To confirm your question, I would have to go through Riskey again. 04:33:07 04:33:09

(BY MS. MAHONEY) 04:33:36

Q. Can you please turn to paragraph 48 of Riskey? 04:33:37 04:33:39

A. (Complying.) 04:33:42

I am at paragraph 48 of Riskey, yes. 04:33:52 04:34:01

Q. Okay. And this -- this paragraph describes changes in both polling frequency and transmission frequency, right? 04:34:02 04:34:04 04:34:07

MR. FISHER: Object to the form. The document speaks for itself. 04:34:09 04:34:13

A. Can I take a look at it? 04:34:16

(BY MS. MAHONEY) 04:34:17

Q. Of course. 04:34:18

A. Yeah, I'm done with reading that paragraph. 04:35:40 04:35:42

Q. Would you agree that this paragraph describes changes in both polling 04:35:43 04:35:47

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frequency and transmission frequency? 04:35:50

MR. FISHER: Same objections. 04:35:52

A. Yeah, in this nonlimiting example 04:35:55

or nonlimiting embodiment, that's true. 04:35:58

(BY MS. MAHONEY) 04:36:01

Q. Okay. Do you see on the third 04:36:02

line down of paragraph 48 where Riskey says, 04:36:03

"For example, machine readable instructions 04:36:08

252 may instruct processor 240 to increase 04:36:11

the polling frequency and/or sensor sampling 04:36:15

frequency of a temperature sensor 222 in the 04:36:20

event that the animal temperature exceeds a 04:36:24

threshold value"? 04:36:27

MR. FISHER: Same objections. 04:36:28

A. I see that. 04:36:31

(BY MS. MAHONEY) 04:36:31

Q. Okay. So just to make sure I'm 04:36:34

understanding, when Riskey talks about sensor 04:36:35

sampling frequency, Riskey is talking about 04:36:39

how often the sensor takes a measurement, 04:36:42

right? 04:36:45

MR. FISHER: Object to the 04:36:46

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form. I repeat my previous objections. 04:36:55

A. You know, you -- I heard what you said, but I think there is something not -- it's not exactly right. I mean, you -- you made it sound like these few lines describe the entire Riskey system operation. 04:37:05 04:37:07 04:37:11 04:37:13 04:37:18

These few lines just talk of -- talks about nonlimiting examples, right? 04:37:22 04:37:25

There are many other places in Riskey. Perhaps, you know, the next paragraph, 49, right, talks about a -- a different nonlimiting embodiment of sampling the signal or the sampling frequency. So I just want to make sure that, you know, this is not like what Riskey only does, right? This is just one of many nonlimiting embodiments. 04:37:28 04:37:31 04:37:34 04:37:38 04:37:42 04:37:45 04:37:47 04:37:52 04:37:55

(BY MS. MAHONEY) 04:37:59

Q. So to understand what Riskey means by "sensor sampling frequency," in your opinion you would need to look to the Riskey reference as a whole for context? 04:37:59 04:38:01 04:38:05 04:38:07

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A. Of course.
MR. FISHER: Object to the form.
Go ahead, you can answer.
A. Right. I mean, you know, I mean, if I read this -- if anybody reads these things, you have to read it in its entirety to get a better understanding of what's going on. You can't just focus on two, three lines, say that, "Hey, that's what it does."
I mean, that's certainly -- I mean, that's not how I would read it, and I don't believe another POSA would read it that way.
(BY MS. MAHONEY)
Q. How do you understand sensor sampling frequency as it's used in Riskey?
A. Sensor sampling frequency means -- again, at least with respect to context of this document, right, it tells you that -- what is the frequency at which you perform -- you perform the sensing or how --

what's the timing duration, right? You know, you have a frequency you can translate that to your periodicity. So a person of ordinary skill in the art would understand that if you specify a sampling frequency, you also -- equivalently, you specify the time duration between one sample and another. 04:39:18 04:39:21 04:39:23 04:39:28 04:39:29 04:39:34 04:39:37

Q. And how do you understand polling frequency as it's used in Riskey? 04:39:40 04:39:42

A. Let me take a look at a specific language. 04:39:46 04:39:48

Did I say something here, maybe? Did I? I mean, just reading that passage, 48 -- you know, I'm sure there are different place to talk about that frequency. 04:42:05 04:42:08 04:43:26 04:43:29

My -- my understanding is the polling frequency is the frequency related to -- related to polling the data, right? 04:43:32 04:43:33 04:43:48

You can sample the data, but the data may not be polled by -- by the rest of the system. So polling frequency, again, my -- just looking at that passage, sounds 04:43:52 04:43:55 04:43:58 04:44:00

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like it is the frequency that a system gets the data, but you can sample at a different frequency. Your sampling frequency may not necessarily be the same as the polling frequency. 04:44:03 04:44:07 04:44:10 04:44:13 04:44:20

Q. Okay. So Riskey provides this example where processor 240 can increase the polling frequency and/or the sensor sampling frequency if the animal's temperature goes above a certain threshold, Right? 04:44:20 04:44:25 04:44:30 04:44:32 04:44:36

MR. FISHER: Object to the form. 04:44:41 04:44:43

A. For this particular nonlimiting embodiment, that's what that passage says. 04:44:43 04:44:46

(BY MS. MAHONEY) 04:45:09

Q. And so one of the reasons why the processor 240 in Riskey may adjust the polling frequency or sensor sampling frequency is so that potential health risks and/or other changes in animal health state may be recognized as soon as possible? 04:45:10 04:45:15 04:45:19 04:45:21 04:45:24 04:45:27

Would you agree? 04:45:30

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A. In this -- 04:45:32
MR. FISHER: Object to the 04:45:33
form. 04:45:35
A. In this nonembodiment, that's -- 04:45:35
that's what it says. 04:45:38
(BY MS. MAHONEY) 04:45:39
Q. So in other words, if the animal 04:45:49
temperature goes up, exceeds a certain 04:45:51
threshold, the processor in this one 04:45:53
embodiment could increase both the polling 04:45:56
frequency and the sensor sampling frequency, 04:46:01
right? 04:46:04
MR. FISHER: Same objection. 04:46:04
A. In this nonlimiting embodiment, 04:46:05
that's what that paragraph talks about. 04:46:08
(BY MS. MAHONEY) 04:46:09
Q. And the reason for increasing the 04:46:21
polling frequency or the sensor sampling 04:46:24
frequency would be to collect more frequent 04:46:27
measurements, correct? 04:46:36
MR. FISHER: Same objection. 04:46:38
A. In this particular nonlimiting 04:46:43

example, that's what that passage talks about. 04:46:48 04:46:50

(BY MS. MAHONEY) 04:47:18

Q. What is your understanding of "transmission frequency" as it is used in Riskey? 04:47:18 04:47:20 04:47:22

A. It's the frequency at which you transmit your signal. It -- it -- I just want to make sure that we're on the same page. 04:47:29 04:47:31 04:47:37 04:47:39

Just like the polling frequency sampling frequency, it just tells you how frequently you transmit the signal from inside the body to outside the body. 04:47:39 04:47:42 04:47:45 04:47:48

Q. Okay. So just to be clear, make sure we're on the same page, polling frequency is between the processor and the sensor, correct? 04:47:50 04:47:52 04:47:55 04:47:58

A. I don't -- I need to read the thing to confirm, but polling frequency tells me that something is polling the sensor data, right? It could be between the processor and 04:48:02 04:48:06 04:48:09 04:48:14

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the sensor. It could be between something else. You know, I don't want to just jump in and say yeah, it's between the processor and the sensor, nothing else. May -- that may not be correct. 04:48:16 04:48:18 04:48:20 04:48:21 04:48:22

Q. Okay. I understand. 04:48:23

And transmission frequency is the frequency at which the data is transmitted out of the bolus and into the system at large? 04:48:25 04:48:27 04:48:30 04:48:34

A. The transmission frequency indicates how frequently the sensor data is transmit out of the bolus to an outside receiver. 04:48:34 04:48:37 04:48:41 04:48:46

Q. Okay. Also in paragraph 48, Riskey provides another example where the processor can increase the polling and/or transmission frequency when the animal is in the vicinity of a cabin pen and/or hospital pen? 04:49:10 04:49:14 04:49:18 04:49:22 04:49:26 04:49:31

MR. FISHER: Object to the form. Document speaks for itself. 04:49:31 04:49:34

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A. You know, we talk about the same, you know, passage, paragraph 48, right? And as I said to you before, this is just one of many nonlimiting embodiments, and in this embodiment Riskey described that scenario as you just described. 04:49:37 04:49:39 04:49:41 04:49:43 04:49:50 04:49:53

(BY MS. MAHONEY) 04:50:11

Q. So in this one example, based on the location of the animal, the processor may increase the transmission frequency, correct? 04:50:12 04:50:15 04:50:18

MR. FISHER: Same objections. 04:50:22

A. I mean, in these nonlimiting examples, it talks about you can increase or decrease the transmission frequency. 04:51:13 04:51:16 04:51:19

MR. FISHER: Counsel, we have been going for a little bit over an hour. Perhaps now would be a good time to take a break? 04:51:26 04:51:27 04:51:30 04:51:32

(BY MS. MAHONEY) 04:51:32

Q. Are you okay if we go through just a few more questions, and then we'll take our break? 04:51:46 04:51:48 04:51:51

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A. Sure. 04:51:54

Q. When the processor in Riskey 04:52:25

executes the machine readable instructions, 04:52:29

that consumes power, right? 04:52:33

A. I think that's fair to say, 04:52:42

right? Every time you execute some 04:52:43

instructions, there will be a certain amount 04:52:47

of power consumed. 04:52:50

Q. And you would agree that the 04:52:51

power source for the processor is the battery 04:52:56

that's within the bolus in Riskey, right? 04:53:00

A. I think that's fair to say. 04:53:08

Q. And would it be fair to say that 04:53:11

an increase in transmission frequency 04:53:16

increases power consumption? 04:53:20

MR. FISHER: Object to the 04:53:25

form. 04:53:27

A. It's a very general question, you 04:53:34

know. 04:53:36

It depends on the design, it 04:53:37

depends on how you do it, right? And the -- 04:53:41

I -- I would have to look at a -- I would 04:53:44

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have to look at a specific design scenario, 04:53:49
situations before I can give you a more -- 04:53:53
more concrete answer. 04:53:58
(BY MS. MAHONEY) 04:54:02
Q. And would it be fair to say that 04:54:12
a processor executing instructions that 04:54:15
varies the transmission frequency based on 04:54:19
location would consume more power than 04:54:21
executing instructions that only has one 04:54:24
transmission frequency specified? 04:54:27
MR. FISHER: Object to the 04:54:29
form. 04:54:41
A. I mean, it depends, right? You 04:54:41
know, if you -- if you ask the system not to 04:54:43
transmit frequently, probably will not 04:54:50
consume that much power. So it really 04:54:53
depends on your design. 04:54:55
I have to look at your specific 04:54:56
design in order to give you a better sense 04:54:58
what happened to the power dissipation. 04:55:01
MS. MAHONEY: Okay. I think we 04:55:20
can go for a break now. 04:55:22

THE VIDEOGRAPHER: Okay. Everybody please stand by. We're going off the record. The time is 4:55. (Break taken from 4:55 p.m. to 5:07 p.m.) THE VIDEOGRAPHER: We are now back on the record. The time is 5:07. (BY MS. MAHONEY)

Q. Dr. Young, the court reporter is going to hand you what's been marked as Exhibit 1004 in this IPR proceeding, which is International Publication Number WO 2008-108816.

(Whereupon Exhibit Number 1004 was marked for identification.)

(BY MS. MAHONEY)

Q. Dr. Young, do you recognize this exhibit as a copy of the Harvey reference that you cite in your declaration?

A. I think that's correct.

Q. And have you reviewed Harvey in

its entirety? 05:08:58

A. Yes, I have. 05:08:58

Q. Can you please turn to paragraph 61 to 63 in your declaration? 05:08:59 05:09:10

A. (Complying.) 05:09:14

Yes, I am at, I guess, paragraph 61 of my declaration. 05:09:33 05:09:39

Q. Okay. And paragraph 61 to 63 contain your opinion regarding how you believe Harvey discloses element 5C; is that correct? 05:09:41 05:09:45 05:09:48 05:09:48

A. Can I take a look at it? 05:09:52

Q. Of course. 05:09:53

A. Yes, I'm done with reading. 05:13:24

Q. Okay. So you agree that paragraph 61 to 63 contain your opinion regarding how you believe Harvey discloses element 5C, right? 05:13:25 05:13:27 05:13:30 05:13:33

A. That's correct. 05:13:34

Q. And do you stand by that testimony? 05:13:34 05:13:37

A. Yes, I do. 05:13:37

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Q. Okay. Let's start with paragraph 61 in your declaration. 05:13:38 05:13:41

You state that, "The specification implicitly discloses that said sensor signal from said one or more sensors are digital representation of an analog signal produced by the said sensor." 05:13:43 05:13:46 05:13:51 05:13:54 05:13:58

What do you mean by "implicitly discloses" in this sentence? 05:14:03 05:14:06

A. When I say something that is implicitly disclosed -- in that particular sentence, it means that the specification may not explicitly talk about using an analog-digital converter to convert the analog signal from the sensor into the digital representation, but that analog-to-digital converter as a -- as a way to encode analog signal must be there. 05:14:09 05:14:15 05:14:22 05:14:26 05:14:30 05:14:33 05:14:35 05:14:42 05:14:44

Q. Okay. Moving on to paragraph 62, you list out the various types of sensors that are described in Harvey, right? 05:14:51 05:15:11 05:15:15

A. That's correct. 05:15:18

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Q. And you would agree that these sensors produce signals in an analog form? 05:15:19 05:15:22

A. That's correct. 05:15:26

Q. Okay. Can you please turn to Page 39 of Harvey? 05:15:27 05:17:04

A. (Complying.) 05:17:05

I am at Page 39 of Harvey. 05:17:20

Q. Okay. And do you see where starting on line 4 of Page 39, Harvey says, "Sensor 5140 can be configured to selectively cause one or more of SENSOR #1, 5310, SENSOR #2, 5320, or SENSOR #N 5330, to sense preselected subject parameter to provide sensed data to Uc5110"? 05:17:23 05:17:25 05:17:31 05:17:35 05:17:42 05:17:47 05:17:50

A. I see that. Let me just read that again. 05:17:56 05:17:58

Okay. So, yeah, I'm okay with the -- with the sentence. 05:18:29 05:18:32

Q. Okay. And -- and just so we're on the same page, "Uc" here is referring to microcontroller; is that right? 05:18:33 05:18:36 05:18:40

A. That's correct. 05:18:42

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Q. Okay. And Harvey does not explicitly state that the sensor signal data is encoded, right? 05:18:42 05:18:45 05:18:48

MR. FISHER: Object to the form; the document speaks for itself. 05:18:50 05:18:52

A. If this data going to the microprocessor, the data must be in a digital form, and that digital representation of the data is the encoded version of the sensor data that is -- that is analog in the original form. 05:18:59 05:19:03 05:19:11 05:19:15 05:19:19 05:19:24

(BY MS. MAHONEY) 05:19:27

Q. But Harvey does not explicitly state that the sensor signal data is encoded, right? 05:19:27 05:19:30 05:19:33

MR. FISHER: Same objections. 05:19:33

A. It does not explicitly say that, but it's inherent. 05:19:39 05:19:42

(BY MS. MAHONEY) 05:19:46

Q. Okay. Can you please turn to Page 10 of Harvey? 05:20:04 05:20:05

A. (Complying.) 05:20:06

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Yeah, I am at Page 10. 05:20:21

Q. Okay. And can you review 05:20:24

paragraphs 36 and 37, please? 05:20:25

A. (Complying.) 05:20:27

Yeah, I'm done with that, two 05:22:54

paragraphs. 05:22:56

Q. Okay. So in paragraphs 36 and 05:22:56

37, Harvey is providing a list of 05:23:00

communication protocols, right? 05:23:03

A. That's correct. 05:23:05

Q. And Harvey further states in 05:23:05

paragraph 36 that he is providing 05:23:14

"nonlimiting examples of wireless protocols," 05:23:18

right? 05:23:21

A. I believe that's correct. 05:23:22

Q. And paragraph 37 also states that 05:23:22

Harvey's list of wireless protocols includes 05:23:38

"nonlimiting examples," right? 05:23:42

A. Yeah. In that paragraph it talks 05:23:46

about nonlimiting examples of, you know, 05:23:48

WAN-based communication protocol. That's 05:23:52

what the passage is -- says. 05:23:55

Q. So a POSA would understand that Harvey's list of wireless protocols in paragraphs 36 and 37 are nonexhaustive, right? 05:23:57 05:24:02 05:24:05 05:24:08

MR. FISHER: Object to the form. 05:24:09 05:24:22

A. I mean, these are examples, right, embodiments, you know. 05:24:22 05:24:24

At the end of the paragraph, 37, it says, of course, right, the foregoing are nonlimiting, nonexhaustive examples of communication protocols illustrated in the teachings here. 05:24:26 05:24:30 05:24:33 05:24:37 05:24:39

So these are examples the teaching provides, right, you know, the wireless, the IEEE standards, or vary -- different -- various type of communication standards/protocols Harvey teach that could be used for wireless data communication. 05:24:41 05:24:44 05:24:45 05:24:49 05:24:51 05:24:53

(BY MS. MAHONEY) 05:24:58

Q. Okay. So in other words, Harvey leaves open the possibility of using other 05:25:00 05:25:02

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wireless protocols besides the specific ones that are listed in paragraphs 36 and 37? 05:25:04 05:25:08

MR. FISHER: Same objection. 05:25:10

A. Would that be fair to say that at least these are -- these communication protocols are disclosed by Harvey on Page 10, paragraph 36 and 37. 05:25:15 05:25:17 05:25:20 05:25:24

(BY MS. MAHONEY) 05:25:35

Q. But Harvey leaves open the possibility of using other wireless communication protocols, right? 05:25:35 05:25:37 05:25:39

MR. FISHER: Same objection. 05:25:40

A. Yeah, you can have other steps, what Harvey says, but I want to make sure that we're on the same page. 05:25:49 05:25:51 05:25:54

These are the communication protocols specifically taught by Harvey as embodiments. 05:25:56 05:25:57 05:26:00

(BY MS. MAHONEY) 05:26:01

Q. Okay. And just to confirm, you testified earlier today that there are nondigital wireless communication protocols, 05:26:19 05:26:20 05:26:25

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right? 05:26:27

MR. FISHER: Object to the 05:26:28

form; mischaracterizes. 05:26:28

A. We talk about something like 05:26:36

that, right, you know, but I don't remember 05:26:37

exactly what I said. But to be fair, that's 05:26:41

something that you and I discussed in the 05:26:45

early part of the deposition. 05:26:47

(BY MS. MAHONEY) 05:26:49

Q. But you would agree that 05:26:51

nondigital wireless communication protocols 05:26:52

exist? 05:26:54

MR. FISHER: Same objections. 05:26:55

A. Yeah, I think it's fair to say 05:27:11

that. 05:27:13

(BY MS. MAHONEY) 05:27:13

Q. And nothing in paragraphs 36 or 05:27:21

37 of Harvey require that the wireless 05:27:23

communication protocol be digital, right? 05:27:26

MR. FISHER: Object to the 05:27:28

form; document speaks for itself. 05:27:30

A. I think that's right. The 05:27:34

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document speaks for itself. 05:27:36
If you look at those protocols, 05:27:37
for example, Bluetooth, ZigBees, you know, 05:27:39
wireless link communication protocols, these 05:27:44
are digital-based communication protocols. 05:27:46
(BY MS. MAHONEY) 05:27:51
Q. But Harvey does not require that 05:27:51
the communication protocols are digital, 05:27:53
right? 05:27:55
MR. FISHER: Same objections; 05:27:56
asked and answered. 05:27:58
A. Harvey discloses these 05:28:05
communication protocols in paragraph 36 and 05:28:08
37 on Page 10, and that these communication 05:28:11
protocols are digital-based, the 05:28:16
communication protocols. 05:28:18
(BY MS. MAHONEY) 05:28:19
Q. But Harvey does not require using 05:28:19
these communication protocols, correct? 05:28:22
MR. FISHER: Same objections; 05:28:24
asked and answered. 05:28:27
A. I do not recall whether Harvey 05:28:29

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used the word requires or not, but when I look at these communication protocols in paragraph 36 and the 37 on Page 10 of Harvey, through the lens of ordinary skill in the art, I think a POSA would understand these are digital-based communication protocols. 05:28:32 05:28:35 05:28:36 05:28:42 05:28:47 05:28:49

(BY MS. MAHONEY) 05:28:51

Q. Okay. And -- and just to be clear, paragraphs 36 and 37 are nonlimiting, nonexhaustive examples of communication protocols, right? 05:28:52 05:28:53 05:29:03 05:29:05

MR. FISHER: Same objections. 05:29:07

A. I think we talked about that earlier on, you know. Even the documents somewhere mentions that nonlimiting, nonexhaustive examples; but these are the ones they list here on that page. 05:29:08 05:29:09 05:29:12 05:29:16 05:29:20

(BY MS. MAHONEY) 05:29:38

Q. And a POSA would also agree that the examples provided in paragraphs 36 and 37 of Harvey are nonlimiting, nonexhaustive examples? 05:29:38 05:29:40 05:29:43 05:29:47

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MR. FISHER: Object to the form. 05:29:49 05:30:01

A. I guess, you know, the document speaks for itself, right? 05:30:01 05:30:03

If paragraph 36, paragraph 37 use the word "nonlimiting examples," that's what it says. 05:30:04 05:30:07 05:30:09

(BY MS. MAHONEY) 05:30:11

Q. And a POSA would understand that, too? 05:30:11 05:30:13

MR. FISHER: Object to the form; asked and answered. 05:30:13 05:30:14

A. If I put myself as a POSA, I would understand that. 05:30:28 05:30:32

(BY MS. MAHONEY) 05:31:09

Q. Dr. Young, the court reporter is going to hand you what has been marked Exhibit 1006 in this IPR proceeding, which is U.S. Patent Application Publication Number 2013/0197323. 05:31:09 05:31:10 05:31:15 05:31:17 05:31:20

(Whereupon Exhibit Number 1006 was marked for identification.) 05:31:44 05:31:47

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(BY MS. MAHONEY) 05:31:47

Q. Dr. Young, do you recognize this exhibit as a copy of the Rettedal reference that you cite in your declaration? 05:32:14 05:32:15 05:32:18

A. Yeah, I do recognize that. 05:32:20

Q. And have you reviewed Rettedal in your -- in its entirety? 05:32:21 05:32:24

A. Yes, I -- yes, I have. 05:32:25

Q. Dr. Young, you rely on Rettedal for its description of matching elements, right? 05:32:27 05:33:37 05:33:39

MR. FISHER: Object to the form. 05:33:41 05:33:48

A. Yeah, I cite to Rettedal as a reference, as a prior reference for one of the claim limitations requiring matching -- matching elements. 05:33:48 05:33:49 05:33:54 05:33:59

(BY MS. MAHONEY) 05:34:00

Q. Okay. Can you please turn to Figure 6 in Rettedal? 05:35:26 05:35:28

A. (Complying.) 05:35:29

I am at Figure 6. 05:35:37

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Q. Okay. And Figure 6 includes a block that is titled "Matching Network"; is that correct? 05:35:40 05:36:07 05:36:07

A. That is correct. 05:36:12

Q. Okay. And Figure 6 does not provide any details on the components that are in this matching network, correct? 05:36:42 05:36:44 05:36:46

MR. FISHER: Object to the form. 05:36:48 05:36:54

A. You know, if you look at Figure 6, this is just a high-level building block diagram, right? You know, a person -- you know, I would look at the specifications to gain a better understanding what is taught in the patent with respect to that figure. 05:36:54 05:36:56 05:36:58 05:37:01 05:37:03 05:37:07

(BY MS. MAHONEY) 05:37:55

Q. Dr. Young, the court reporter is going to hand you what's been marked as Exhibit 1007 in this IPR proceeding, which is Japanese Patent Publication Number 2004-215061 and its accompanying English translation. 05:37:55 05:37:56 05:37:59 05:38:03 05:38:08 05:38:12

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(Whereupon Exhibit Number 1007 was marked for identification.) 05:38:13 05:38:41

(BY MS. MAHONEY) 05:38:41

Q. Dr. Young, do you recognize this exhibit as a copy of the Kunda reference that you cite in your declaration? 05:38:42 05:38:44 05:38:46

A. Yes, I do. 05:38:48

Q. And have you reviewed Kunda in its entirety? 05:38:48 05:38:51

A. For the English version. 05:38:51

Q. Okay. And Kunda describes the use of a double loop antenna in a mobile phone, right? 05:38:53 05:38:57 05:39:01

MR. FISHER: Object to the form; document speaks for itself. 05:39:03 05:39:10

A. You know, again, based upon my recollection, Kunda talks about something related to a mobile phone. 05:39:15 05:39:17 05:39:19

(BY MS. MAHONEY) 05:39:33

Q. And Kunda never states that his wireless antenna could be used in a bolus configuration within an animal, right? 05:39:33 05:39:37 05:39:40

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MR. FISHER: Same objections. 05:39:42

A. I didn't recall language like 05:39:51

that in Kunda, but Kunda talks about the 05:39:53

small size antenna, right, that can be -- 05:39:56

that can be used for wireless communication 05:39:59

in general. 05:40:01

(BY MS. MAHONEY) 05:40:05

Q. But Kunda specifically does not 05:40:05

talk about the application of his antenna in 05:40:07

a bolus for use in an animal? 05:40:10

MR. FISHER: Same objections. 05:40:13

A. I think I said that to you 05:40:15

earlier. 05:40:17

I do not recall language like 05:40:17

what you described, you know, in Kunda, but 05:40:19

Kunda talks about the small antenna, right, 05:40:22

small form factor that can be used for 05:40:27

wireless communication in general. 05:40:31

(BY MS. MAHONEY) 05:40:34

Q. And Kunda's primary application 05:40:35

here is for a mobile phone, right? 05:40:37

MR. FISHER: Same objections; 05:40:39

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asked and answered. 05:40:41

A. Yeah, the mobile phone 05:40:46

application is mentioned in Kunda, but I 05:40:47

think Kunda also talk -- Kunda talks about -- 05:40:50

as an example, right? But Kunda also talks 05:40:52

about wireless communication in general. 05:40:55

(BY MS. MAHONEY) 05:41:08

Q. So the antenna in a mobile phone 05:41:08

has to be able to transmit through the air, 05:41:11

right? 05:41:13

A. That's correct. 05:41:16

Q. And if you're holding your phone, 05:41:19

the antenna needs to be able to transmit 05:41:21

through your hand? 05:41:25

A. I heard what you said. 05:41:31

Now, I'm -- but I'm not sure if I 05:41:33

can connect that -- you know, the words 05:41:35

correctly. 05:41:37

Can you maybe characterize it in 05:41:38

a different way? You know, I heard you -- 05:41:41

something about holding that -- what are you 05:41:44

-- what are you asking? 05:41:46

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Q. If you are holding your mobile phone -- 05:41:47 05:41:50

A. Okay. 05:41:50

Q. -- then the antenna in the mobile phone has to be able to transmit through your hand, right? 05:41:50 05:41:53 05:41:55

A. It's a very general question. The antenna radiates electromagnetic wave. If the hand is -- if the hand is holding it, I suppose some of the electromagnetic wave will probably go through the hand, but some would just go around it, right. Your hand just cannot stop the transmission. 05:41:57 05:42:07 05:42:12 05:42:17 05:42:20 05:42:22 05:42:25

Q. And you would agree that mobile phones are not placed inside of an animal, right? 05:42:42 05:42:44 05:42:47

A. I have not encountered situation where a mobile phone is inside an animal's body. 05:42:48 05:42:53 05:42:57

Q. Okay. 05:43:17

MS. MAHONEY: Subject to any redirect, I have no further questions; so at 05:43:19 05:43:20

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this time, I will pass the witness. 05:43:22

THE WITNESS: Okay, thank you. 05:43:24

MR. FISHER: I don't know if 05:43:25

I'm going to have any -- any redirect, so 05:43:26

let's just take a pause and maybe reconvene 05:43:29

in 15 minutes, and then we'll have a decision 05:43:32

at that time. 05:43:37

MS. MAHONEY: Okay. 05:43:37

THE VIDEOGRAPHER: Okay. 05:43:38

Everybody please stand by. 05:43:40

We're going off the record. 05:43:41

The time is 5:43. 05:43:43

(Break taken from 5:43 p.m. to 05:43:46

5:46 p.m.) 05:46:32

THE VIDEOGRAPHER: We are back 05:46:33

on the record. The time is 5:46. 05:46:39

MR. FISHER: All right. 05:46:42

Petitioner's have nothing on redirect, so we 05:46:43

can close out the deposition. 05:46:46

THE VIDEOGRAPHER: Perfect. 05:46:48

Please stand by. 05:46:49

This marks the end of the 05:46:50

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deposition of Dr. Darrin J. Young. We are going off the record. The time is 5:46. 05:46:51 05:46:54

(Deposition concluded at 5:46 p.m.)

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Certificate of Shorthand Reporter

I, Annette Peltier, CSR, Texas Certified Realtime Reporter in and for the State of Texas do hereby certify:

That DR. DARRIN J. YOUNG, the witness whose deposition is herein before set forth, was duly sworn before the commencement of such deposition and that such deposition was taken before me and is a true record of the testimony given by such witness.

I further certify that the adverse party, SMAXTEC INC. and SMAXTEC ANIMAL CARE GMBH, was represented by counsel at the deposition.

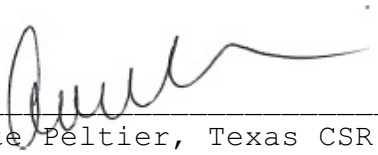
I further certify that the deposition of DR. DARRIN J. YOUNG, occurred at the offices of Dechert LLP, 515 Congress Avenue, Suite 1400, Austin, Texas, 78701, on April 1, 2025, commencing at 9:11 a.m. to 5:46 p.m.

I further certify that I am not related to any of the parties to this action by blood or marriage, I am not employed by or an

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attorney to any of the parties to this action, and that I am in no way interested, financially or otherwise, in the outcome of this matter.

IN WITNESS WHEREOF, I have hereunto set my hand this 7th day of April, 2025.



_____
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a1
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