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Transcript of Ian Galton, Ph.D.

Date: February 28, 2025

Case: Texas Instruments Incorporated -v- Parkervision, Inc. (PTAB)

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

- - - - - x
TEXAS INSTRUMENTS :
INCORPORATED, :
Petitioner, : IPR2024-00934
v. : U.S. Patent 7,496,342 B2
PARKERVISION, INC., :
Patent Owner. :
- - - - - X

Videotaped Deposition of IAN GALTON, Ph.D.
Conducted Virtually
Friday, February 28, 2025
12:04 p.m. EST

Job No.: 572861
Pages 1 - 108
Reported by: Debra A. Whitehead

1 Videotaped Deposition of IAN GALTON, Ph.D.,
2 conducted virtually.

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4
5 Pursuant to notice, before Debra Ann Whitehead,
6 E-Notary Public in and for the Commonwealth of
7 Virginia.

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ALSO PRESENT:

PARKER SIMPSON, Video Specialist

C O N T E N T S

EXAMINATION OF IAN GALTON, Ph.D.	PAGE
By Ms. Mandir	7
By Mr. Magee	101

EXHIBITS MARKED IN TODAY'S SESSION

(Attached to the Transcript)

GALTON EXHIBIT	PAGE
Exhibit 1 Patent Owner's Notice of Deposition of Dr. Ian Galton	10

EXHIBITS MARKED IN PRIOR SESSIONS

(Not attached)

TI EXHIBIT	PAGE
Exhibit 1001	14
Exhibit 1003	13
Exhibit 1016	23
Exhibit 1021	67

Transcript of Ian Galton, Ph.D.
Conducted on February 28, 2025

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1	P R O C E E D I N G S	12:03:26
2	VIDEO SPECIALIST: Here begins the	12:03:26
3	videotaped deposition of Dr. Ian Galton in the	12:03:28
4	matter of Texas Instruments Incorporated, versus	12:03:32
5	ParkerVision, Incorporated; in the United States	12:03:38
6	Patent and Trademark Office, before the Patent	12:03:43
7	Trial and Appeals Board; Case Number	12:03:44
8	IPR2024-00934.	12:03:53
9	Today's date is 2/28/2025. The time on	12:03:55
10	the video monitor is 12:04 eastern time. The	12:04:01
11	remote videographer for today is Parker Simpson,	12:04:06
12	representing Planet Depos. All parties of this	12:04:09
13	deposition are attending remotely.	12:04:12
14	Would counsel please voice-identify	12:04:14
15	themselves and state whom they represent.	12:04:16
16	MS. MANDIR: This is Stephanie Mandir	12:04:16
17	from Daignault Iyer, on behalf of ParkerVision.	12:04:18
18	MR. MAGEE: This is Bobby Magee of Blue	12:04:21
19	Peak Law Group, on behalf of Texas Instruments.	12:04:26
20	Also with me today are Mr. Josh Griswold and	12:04:29
21	Mr. Rishi Gupta, of Fish & Richardson.	12:04:32
22	VIDEO SPECIALIST: The court reporter	12:04:36

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1	today is Debbie Whitehead, representing Planet	12:04:36
2	Depos.	12:04:36
3	The witness will now be sworn.	12:04:41
4	IAN GALTON, Ph.D.,	12:04:41
5	having been duly sworn, testified as follows:	12:04:50
6	EXAMINATION BY COUNSEL FOR PATENT OWNER	12:04:50
7	BY MS. MANDIR:	12:04:50
8	Q Good morning, Dr. Galton.	12:04:53
9	A Good morning.	12:04:55
10	Q Can you please state your full name, for	12:04:56
11	the record.	12:04:59
12	A Ian Andrew Galton.	12:05:00
13	Q And where are you currently located for	12:05:02
14	today's deposition?	12:05:05
15	A I'm at the Fish & Richardson office in	12:05:06
16	Del Mar, California.	12:05:10
17	Q Is there anyone else with you today in	12:05:11
18	the room --	12:05:14
19	A No.	12:05:15
20	Q -- that you're currently in?	12:05:16
21	And do you agree not to communicate with	12:05:18
22	anyone else while questions are being asked during	12:05:19

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1	today's deposition?	12:05:22
2	A I do. I mean, except for the people on	12:05:23
3	the Zoom call. I mean, I'll have to communicate	12:05:25
4	with you, for instance.	12:05:29
5	Q That's fair enough.	12:05:29
6	Are you using any notes today?	12:05:32
7	A I'm not. But I have a binder that has	12:05:35
8	all of the documents that are relevant to the '342	12:05:38
9	you have also, the expert declaration and the '342	12:05:44
10	patent and so forth.	12:05:46
11	Q That's fine, as long as they're just put	12:05:48
12	to the side. And I ask that you don't look at	12:05:53
13	them. I'll put documents into the record.	12:05:57
14	A Okay.	12:06:00
15	Q So just what we're looking at is on the	12:06:00
16	record and what we're looking at, I would like you	12:06:05
17	to put that binder off to the side.	12:06:08
18	A Okay. I just put it way off to the side.	12:06:10
19	Q Have you been deposed before?	12:06:12
20	A I have.	12:06:14
21	Q Okay. So you're familiar with how this	12:06:14
22	process works. I'll be showing you some documents	12:06:17

1 today. And if you have any difficulties 12:06:19
2 downloading or obtaining the documents, please 12:06:22
3 just let me know so we can get you all set up. 12:06:24
4 It's possible during today's deposition that 12:06:28
5 you'll hear an objection from one of your 12:06:30
6 attorneys. If that's the case, please let them 12:06:32
7 state their objection and then you can go ahead 12:06:37
8 and answer my question unless they tell you not to 12:06:39
9 answer. 12:06:42

10 Does that make sense? 12:06:43

11 A Yes. 12:06:44

12 Q And if at any time you need a break, 12:06:44
13 please just let me know. You can have as many 12:06:48
14 breaks as you want. I just ask that if a question 12:06:51
15 is pending that you give an answer to that 12:06:53
16 question before we take a break. 12:06:56

17 Is that okay? 12:06:58

18 A Sure. 12:06:59

19 Q Is there any reason today that you can't 12:06:59
20 give truthful and accurate testimony? 12:07:02

21 A No. 12:07:05

22 Q Okay. Let's start looking at some 12:07:05

Transcript of Ian Galton, Ph.D.
Conducted on February 28, 2025

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1	documents, then.	12:07:09
2	I already put into the chat Exhibit 1.	12:07:10
3	(Galton Deposition Exhibit 1 marked for	12:07:10
4	identification and is attached to the transcript.)	12:07:15
5	Q So, Dr. Galton, Exhibit 1 to your	12:07:15
6	deposition is entitled Patent Owner's Notice of	12:07:18
7	Deposition of Dr. Ian Galton. Please just let me	12:07:23
8	know when you have that up in front of you.	12:07:27
9	A I have it up in front of me.	12:07:29
10	Q Have you seen this document before?	12:07:30
11	A I don't believe I have.	12:07:34
12	Q This is the patent owner's notice of	12:07:35
13	deposition that we submitted in this case. And	12:07:40
14	you understand that you're here to testify on	12:07:43
15	behalf of TI as an expert with regard to	12:07:45
16	IPR2024-00934. Correct?	12:07:52
17	A Yes.	12:07:53
18	Q And you understand that this IPR relates	12:07:54
19	to U.S. Patent Number 7,496,342. Correct?	12:07:59
20	A Yes.	12:08:03
21	Q And today we're going to be talking about	12:08:03
22	specific issues regarding the '342 patent. So if	12:08:05

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1	I refer to the '342 patent today, you'll know what	12:08:10
2	patent I'm referring to. Right?	12:08:14
3	A I will.	12:08:15
4	Q Dr. Galton, you attached a CV to your	12:08:15
5	declaration in this case. Right?	12:08:23
6	A Yes.	12:08:23
7	Q Is that a reasonably up-to-date summary	12:08:24
8	of your experience?	12:08:27
9	A Yes.	12:08:29
10	Q And you're currently a professor of	12:08:29
11	electrical engineering at the University of	12:08:32
12	California at San Diego?	12:08:35
13	A Yes.	12:08:37
14	Q What kind of courses do you teach there?	12:08:37
15	A I teach circuits on -- integrated	12:08:40
16	circuits classes. So analog and mixed signal	12:08:44
17	integrated circuits, and focused on components	12:08:49
18	that are used in communication systems,	12:08:51
19	specifically wireless communication systems.	12:08:54
20	Q And do you currently have any other jobs?	12:09:00
21	A I have some consulting jobs, but I don't	12:09:03
22	have any other -- I don't have any other sort of	12:09:05

1	official employee-type jobs, no.	12:09:08
2	Q And from the experience and employment	12:09:12
3	listed in your CV, it appears you've been in the	12:09:17
4	RF circuit design industry for about 40 or so	12:09:20
5	years?	12:09:24
6	Is that accurate?	12:09:24
7	A That's right, yeah.	12:09:26
8	Q So given --	12:09:30
9	A RF, mixed signal, and analog, and it's	12:09:32
10	all sort of one big thing.	12:09:34
11	Q So you consider yourself an expert in the	12:09:35
12	field of RF circuitry design. Correct?	12:09:38
13	A Yes.	12:09:43
14	Q I'm going to provide you with another	12:09:43
15	document.	12:09:49
16	A Okay. Can I close the first one?	12:09:50
17	Q Go ahead and close the first one.	12:09:52
18	So it looks like it's uploading, but I'm	12:10:10
19	providing you with a document entitled Declaration	12:10:12
20	of Ian Galton, Ph.D., which is marked in the	12:10:15
21	right-hand corner as TI 0 -- strike that.	12:10:18
22	The document is marked as TI 1003.	12:10:22

Transcript of Ian Galton, Ph.D.
Conducted on February 28, 2025

13

1	A	Okay.	12:10:28
2	Q	So let me know when you have that	12:10:28
3		document in front of you.	12:10:29
4	A	Yep, I just opened it.	12:10:31
5	Q	And this has previously been marked in	12:10:32
6		this IPR as Exhibit 1003.	12:10:36
7		(TI Exhibit 1003, previously marked, not	12:10:40
8		attached.)	12:10:40
9	Q	So I am going to refer to it as either	12:10:40
10		Exhibit 1003 or simply your declaration.	12:10:42
11		Is that okay?	12:10:45
12	A	That's fine.	12:10:46
13	Q	Before your engagement in this case, were	12:10:46
14		you familiar with the '342 patent?	12:10:54
15	A	I was not.	12:10:57
16	Q	Had you ever heard of ParkerVision	12:10:57
17		before?	12:11:00
18	A	I don't think I had.	12:11:02
19	Q	So this was the first time that you've	12:11:03
20		heard of ParkerVision.	12:11:11
21	A	I believe so. I mean, when I first was	12:11:12
22		contacted about it the name sounded vaguely	12:11:14

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1 familiar, so it's possible I had heard about it in 12:11:17
2 the past, but I had no memory of it. 12:11:20

3 Q I'm going to -- providing you with 12:11:26
4 another document. Hopefully we can get these 12:11:28
5 documents all taken care of and out of the way 12:11:31
6 quickly. 12:11:36

7 The next document I'm providing you with 12:11:44
8 is U.S. Patent Number 7,496,342, which has been 12:11:46
9 previously marked in the right-hand corner as TI 12:11:51
10 Exhibit 1001. 12:11:54

11 (TI Exhibit 1001, previously marked, not 12:11:55
12 attached.) 12:11:56

13 Q So let me know when you have that up in 12:11:56
14 front of you. 12:11:58

15 A I have it. 12:11:59

16 Q And you agree that Exhibit 1001 is the 12:11:59
17 patent at issue in today's deposition. Correct? 12:12:09

18 A I do. 12:12:12

19 Q Okay. I'd like to ask you about your 12:12:12
20 interpretation of some of the claim terms of the 12:12:17
21 '342 patent. If you could turn all the way to the 12:12:19
22 back, or last couple of pages of the patent where 12:12:23

1	the claims are found?	12:12:26
2	A Yes.	12:12:27
3	Q And specifically we're going to look at	12:12:31
4	Claim 18. Let me know when you're there.	12:12:33
5	A I'm there.	12:12:38
6	Q Okay. So Claim 18 recites in Step 4,	12:12:38
7	"Controlling a charging and discharging cycle of	12:12:43
8	the first and second capacitors, with first and	12:12:46
9	second switching devices electrically coupled to	12:12:48
10	the first and second capacitors respectively."	12:12:51
11	Do you see that?	12:12:53
12	A I do.	12:12:54
13	Q And if you look in your declaration,	12:12:55
14	Paragraphs 21 and 26, you provide a discussion of	12:12:58
15	the term "controlling a charging and discharging	12:13:02
16	cycle."	12:13:05
17	A Well, no. Let me get to it. So in my	12:13:06
18	declaration, Paragraphs 21 through 26, you said?	12:13:08
19	Q Yep, I believe it starts on Page 21. Or	12:13:12
20	sorry, Paragraph 21.	12:13:14
21	A Okay, I'm there.	12:13:21
22	Q Your declaration does not indicate which	12:13:22

1 construction of "controlling a charging and 12:13:30
2 discharging cycle" you used when analyzing the 12:13:33
3 prior art. Correct? 12:13:36

4 MR. MAGEE: Objection. 12:13:39

5 A I don't think that's correct. I think -- 12:13:40
6 I mean, I'd have to go back and look at it. And 12:13:42
7 maybe we should do that. 12:13:45

8 But I believe when I was pointing it out, 12:13:46
9 it said -- and this is my memory, so I believe I 12:13:48
10 said it worked with both definitions. But we can 12:13:52
11 go look at that specific part of the declaration, 12:13:56
12 if you have questions about that. 12:13:59

13 Q Okay. Yeah, well, I would like to know 12:14:00
14 what claim construction you used for a 12:14:05
15 controlling -- controlling a charging and 12:14:08
16 discharging cycle when analyzing the prior art. 12:14:11
17 And you can take a look at your declaration if 12:14:13
18 that will help you jog your memory. 12:14:16

19 MR. MAGEE: Objection. Form. 12:14:18

20 A Did someone else say something? 12:14:21

21 MR. MAGEE: I said, "objection, form." 12:14:23

22 You can go ahead and answer, if you can. 12:14:24

1	THE WITNESS: Okay. Say objection a	12:14:28
2	little more slowly, because my Zoom thing is	12:14:30
3	cutting you out. I just -- I just heard -- it	12:14:33
4	almost sounded like someone coughed.	12:14:36
5	MR. MAGEE: Understood. I will be a	12:14:38
6	little bit more patient.	12:14:40
7	A Okay. Hold on. So let me go to -- well,	12:14:42
8	let me back up. So certainly plain and ordinary	12:14:48
9	meaning makes sense. And also controlling a cycle	12:14:51
10	of charging and then discharging.	12:14:56
11	So before looking at what I wrote, you	12:14:59
12	know, I think either one is satisfied. But let me	12:15:04
13	see if I can search this document and find what I	12:15:08
14	wrote.	12:15:11
15	Okay. So, for example, in Paragraph 109	12:16:02
16	I said, DeMaw's circuit structure already	12:16:04
17	satisfies ParkerVision's constructions because,	12:16:09
18	quote, a first switching device (J1) controls a	12:16:11
19	charging/discharging cycle of a first capacitor	12:16:15
20	(C4), unquote, and, quote, a second switching	12:16:19
21	device (J2) controls a charging/discharging cycle	12:16:20
22	of a second capacitor (C5).	12:16:24

1 And so -- yeah, so either one is 12:16:26

2 satisfied. 12:16:32

3 Q How did you determine that DeMaw 12:16:35

4 satisfied the controlling charging and discharging 12:16:50

5 language? 12:16:54

6 A Okay. Can we -- to sort of tighten this 12:16:54

7 question down, can we -- can we point to a 12:16:57

8 specific circuit diagram so I can respond in a 12:17:00

9 more meaningful way for you? 12:17:05

10 Q Sure. Why don't we go to, like, Page 41 12:17:07

11 of your declaration has a figure of DeMaw. 12:17:28

12 A Give me a second to get there. Almost 12:17:33

13 there. One second. 12:17:46

14 Okay. I'm there. 12:17:47

15 Q So I'll ask the question again. 12:17:49

16 How did you determine that DeMaw 12:17:51

17 satisfied the controlling and charging and 12:17:54

18 discharging change? 12:17:58

19 A Okay. Well, for example, if those 12:17:59

20 switches weren't there, the capacitors would never 12:18:03

21 charge. And if they never charge, they don't 12:18:06

22 discharge either. 12:18:09

1	So the JFETs that we've denoted as	12:18:10
2	switches open and close. And in doing so they	12:18:17
3	enable charging and discharging.	12:18:24
4	Q You said if the switches weren't there	12:18:29
5	the capacitors would never charge. Correct?	12:18:38
6	A Yeah. So if -- if you simply ripped out	12:18:41
7	those -- those switches -- well, let me back up.	12:18:47
8	They would charge one time. Because there is a	12:18:53
9	12-volt power supply that, you know, when you	12:18:57
10	first turn it on, would charge those capacitors.	12:18:59
11	But then they would -- they would not	12:19:05
12	subsequently discharge.	12:19:07
13	So it's really the switches that are	12:19:11
14	ultimately responsible for the, you know, repeated	12:19:14
15	charging and discharging of those capacitors.	12:19:18
16	Q Okay. Let's turn back to some of the	12:19:22
17	claim language. The claim language includes --	12:19:33
18	strike that.	12:19:45
19	Claim 18, 19, 20, and 21 include the term	12:19:46
20	"switching device." Correct?	12:19:56
21	A Yeah, let me go to it. Can you point me	12:19:58
22	to where you would like me to look?	12:20:01

1	Q	You can look in the claims themselves if	12:20:03
2		you'd like.	12:20:04
3	A	Okay, I'm there. So do you want me to	12:20:05
4		look at Claim 18?	12:20:08
5	Q	Let me ask the question again. Strike	12:20:10
6		that.	12:20:11
7		Claims 18, 19, 20, and 21 include the	12:20:12
8		term "switching device." Correct?	12:20:15
9	A	Let me just -- I mean, I believe so. But	12:20:19
10		let me just read it really quickly to make sure I	12:20:21
11		don't mess anything up.	12:20:24
12		So Claim 18 certainly does. Claim 19	12:20:29
13		does. And then 20 does, and Claim 21 does, yes.	12:20:38
14	Q	If you want to turn back to Paragraph 27	12:20:51
15		of your declaration?	12:21:05
16	A	Twenty-seven. Okay. One second.	12:21:09
17		Twenty-seven you said?	12:21:26
18	Q	I'm sorry, strike that. If you could	12:21:27
19		turn to Paragraph 26 of your declaration.	12:21:28
20	A	Okay, I'm there.	12:21:33
21	Q	TI proposes an electronic device which	12:21:34
22		opens and closes to break or complete an	12:21:41

1	electrical path in a circuit.	12:21:43
2	Do you see that?	12:21:46
3	A I do.	12:21:47
4	Q Is that the construction that you used in	12:21:48
5	analyzing a switching device in the prior art	12:21:57
6	references?	12:22:00
7	A I think I've already answered this	12:22:01
8	question. I believe that both constructions	12:22:02
9	apply.	12:22:04
10	Q So previously we were looking at	12:22:06
11	controlling a charging and discharging. Right?	12:22:08
12	A Okay. So we're talking about a -- so	12:22:12
13	maybe I'm misunderstanding the question.	12:22:15
14	So we're now talking about switching	12:22:18
15	device?	12:22:21
16	Q Correct.	12:22:22
17	A Okay. And I certainly agree that it's an	12:22:23
18	electronic device which opens and closes to break	12:22:28
19	or complete an electrical path in a circuit. But	12:22:30
20	I should check to be sure my memory is correct.	12:22:34
21	But I believe that ParkerVision also had a	12:22:36
22	definition. And again, I think both -- both are	12:22:40

1	satisfied.	12:22:43
2	Q Okay. We can keep going.	12:22:45
3	I would just like you to look at one more	12:22:56
4	term, Paragraph 27. And you've identified the	12:22:58
5	term "electrically coupling" as a term that the	12:23:04
6	PTAB had previously construed. And you provide	12:23:07
7	the PTAB's previous construction of electrically	12:23:10
8	coupling as being "indirectly or directly	12:23:13
9	connecting such that an electrical signal" can	12:23:16
10	flow through -- "can flow between."	12:23:19
11	Do you see that?	12:23:23
12	A I do.	12:23:24
13	Q Is that the construction that you used	12:23:24
14	when analyzing the prior art relative to the claim	12:23:26
15	language?	12:23:32
16	A It's -- yes. But -- yes. The answer is	12:23:32
17	yes.	12:23:38
18	What I was going to say is, there are --	12:23:43
19	there are also other ways of saying the same	12:23:47
20	thing. But I certainly agree with this	12:23:54
21	construction.	12:23:57
22	Q Okay. And Claim 18 -- sorry to keep	12:23:59

1	jumping around on you. But if you look at Claim	12:24:05
2	18.	12:24:07
3	A I'm there. Go ahead.	12:24:10
4	Q Specifies that the electrical coupling of	12:24:11
5	the -- is of an information signal to a first	12:24:18
6	capacitor and the inverted information signal to a	12:24:21
7	second capacitor. Right?	12:24:23
8	A Yes.	12:24:26
9	Q Okay. One more document.	12:24:26
10	Dr. Galton, I'm providing you with a	12:24:45
11	document that has been marked in the right-hand	12:24:48
12	corner as TI 1016.	12:24:50
13	(TI Exhibit 1016, previously marked, not	12:24:53
14	attached.)	12:24:54
15	Q This was previously marked in the IPR.	12:24:54
16	And I will be referring to this exhibit as Exhibit	12:25:00
17	1016 or DeMaw.	12:25:03
18	Please let me know when you have that up	12:25:08
19	in front of you.	12:25:10
20	A I have it. Although everything is	12:25:11
21	sideways. By any chance, you have a version of	12:25:12
22	this where I don't have to turn my head 90	12:25:17

1	degrees, do you?	12:25:21
2	Q Can you rotate it 90 degrees on your end?	12:25:22
3	A On a page-by-page basis, yes. So I'll	12:25:25
4	rotate it. Point me to where you want me to go,	12:25:28
5	and I'll rotate it on my end.	12:25:30
6	Q Okay. Thanks. So let's see. Let's turn	12:25:31
7	to -- it's going to be PDF Page 7 and 8.	12:25:34
8	A Okay. Give me a second to rotate	12:26:00
9	everything. Okay. Seven and eight are rotated.	12:26:02
10	Q And do you see at the bottom right-hand	12:26:21
11	column of PDF Page 7 the subtitle 6.1.2, Balanced	12:26:26
12	Mixers?	12:26:33
13	A I do.	12:26:33
14	Q And what is a balanced mixer?	12:26:33
15	A It's a mixer where the -- it has two	12:26:36
16	outputs where the information-bearing portion of	12:26:43
17	the signal is differential.	12:26:45
18	Q And if you turn to the next page in	12:26:52
19	DeMaw, you'll see Figure 6.7.	12:26:56
20	A I see it.	12:27:01
21	Q And Figure 6.7 of DeMaw depicts a dual	12:27:01
22	FET balanced mixer using a Siliconix U430 device.	12:27:05

1	Correct?	12:27:13
2	A Siliconix, yes.	12:27:13
3	Q Siliconix.	12:27:14
4	And DeMaw also describes Figure 6.7 as an	12:27:16
5	example of a JFET singly balanced mixer. Correct?	12:27:19
6	A Yes.	12:27:25
7	Q So the transistors Q1 and Q2 in Figure	12:27:25
8	6.7 are JFETs. Correct?	12:27:29
9	A Yes.	12:27:32
10	Q What is a JFET?	12:27:32
11	A It stands for junction field effect	12:27:34
12	transistor. It's a type of transistor.	12:27:36
13	Q And a JFET has three terminals. Correct?	12:27:38
14	A Typically, yes.	12:27:44
15	Q The JFETs in DeMaw have three terminals.	12:27:44
16	Correct?	12:27:53
17	A Yes.	12:27:53
18	Q And those terminals are a source, a	12:27:54
19	drain, and a gate. Correct?	12:27:58
20	A Yes.	12:27:59
21	Q The gate source voltage of a JFET is the	12:27:59
22	voltage applied between the gate and the source.	12:28:07

1	Correct?	12:28:08
2	A Yes. That is correct.	12:28:09
3	Q And the gate source voltage is calculated	12:28:10
4	as the voltage of the gate minus the voltage of	12:28:19
5	the source. Correct?	12:28:21
6	A Yes.	12:28:22
7	Q If the gate of the JFET is connected to	12:28:22
8	ground, then the voltage at the gate is zero	12:28:27
9	volts. Correct?	12:28:30
10	A That is correct, yes.	12:28:32
11	Q And the gate source voltage controls the	12:28:33
12	JFET's conduction by determining the width of the	12:28:39
13	depletion region. Correct?	12:28:42
14	A Say that one more time? I'm sorry.	12:28:44
15	Q The gate source voltage controls the	12:28:46
16	JFET's conduction by determining the width of the	12:28:49
17	depletion region. Correct?	12:28:52
18	MR. MAGEE: Objection. Form.	12:28:54
19	A Yeah, I mean, it's a little more	12:28:55
20	complicated than that. But under many	12:28:57
21	circumstances that's true.	12:29:00
22	Q The pinchoff voltage of a JFET is the	12:29:01

1	threshold voltage at which the conductive channel	12:29:12
2	is fully depleted. Correct?	12:29:15
3	A Well, there's some ambiguity in the	12:29:18
4	literature, but -- but in the case where DeMaw is	12:29:21
5	using it, the pinchoff voltage is the voltage, the	12:29:26
6	Vgs, at which conduction doesn't -- doesn't occur.	12:29:29
7	Q And for the JFETs in DeMaw, the pinchoff	12:29:33
8	voltage is negative, meaning that as the gate	12:29:44
9	source voltage approaches pinch off, the channel	12:29:48
10	narrows until it completely pinches off. Correct?	12:29:51
11	A Yes.	12:29:54
12	Q When the gate source voltage of the JFETs	12:29:54
13	in DeMaw equal zero volts, the channel is fully	12:30:00
14	open along for maximum current. Correct?	12:30:04
15	MR. MAGEE: Objection. Form.	12:30:08
16	A Yeah, I don't quite understand your	12:30:09
17	question. Can you -- can you repeat it?	12:30:10
18	Q When the gate source voltage of the JFETs	12:30:12
19	in DeMaw equals zero volts, the channel is open,	12:30:15
20	allowing for conduction of current. Correct?	12:30:19
21	MR. MAGEE: Same objection.	12:30:22
22	A That is not correct. Open -- open	12:30:24

1 means -- means it doesn't conduct. Closed means
2 conduct. Like when you -- when you open a switch,
3 the lights turn off. When you close a switch, the
4 lights turn on.

5 Q All right. Let me rephrase that
6 question, then.

7 When the gate source voltage of the JFETs
8 in DeMaw equals zero volts, the channel is on,
9 allowing maximum current. Correct?

10 MR. MAGEE: Objection. Form.

11 A Not allowing maximum current, but -- but
12 it is -- it -- in general it will -- it will be
13 closed.

14 (Discussion off the record with the court
15 reporter.)

16 Q When the gate source voltage of the JFETs
17 in DeMaw equals zero volts, the channel is on,
18 allowing current to flow. Correct?

19 A Yes.

20 Q A CMOS is another type of transistor.

21 Correct?

22 A Yes.

1	Q	And a CMOS FET also has three terminals.	12:31:47
2		Correct?	12:31:52
3	A	Typically it has four.	12:31:53
4	Q	What are the four terminals of a CMOS	12:31:55
5		FET?	12:31:59
6	A	The gate, source, drain, and body.	12:31:59
7	Q	And the -- strike that.	12:32:04
8		When the CMOS FET is on, a signal flows	12:32:10
9		from the source terminal to the drain terminal.	12:32:14
10		Correct?	12:32:16
11	A	Not necessarily. It could flow in the	12:32:17
12		other direction, too. It just depends on the --	12:32:19
13		on the biasing.	12:32:22
14	Q	So when a CMOS FET is on, a signal flows	12:32:23
15		between the source terminal and the drain	12:32:29
16		terminal. Correct?	12:32:32
17		MR. MAGEE: Objection. Form.	12:32:32
18	A	No; it's not correct. It's what I said	12:32:35
19		before. You can have current flowing from the	12:32:38
20		source to the drain or from the drain to the	12:32:40
21		source. It just depends on how you bias the	12:32:42
22		terminals.	12:32:45

1	Q	Right. So let me repeat this question	12:32:47
2		again. When a CMOS FET is on, a signal flows	12:32:49
3		between a source terminal and a drain terminal.	12:32:52
4		Correct?	12:32:56
5	A	It would --	12:32:56
6		MR. MAGEE: Objection. Form. Asked and	12:32:56
7		answered.	12:32:58
8	A	I'm so sorry. I can't mean to cut you	12:33:00
9		off. Can you repeat that, Bobby?	12:33:02
10		MR. MAGEE: I said, "objection. Form.	12:33:04
11		Asked and answered."	12:33:05
12		You can still answer if you're able.	12:33:12
13	A	I'm able, but I -- but I do believe I	12:33:14
14		have answered the question.	12:33:17
15	Q	Yeah, please go ahead and answer the	12:33:19
16		question, Dr. Galton.	12:33:21
17	A	Okay. Then restate it, please, just so I	12:33:22
18		make I'm --	12:33:26
19	Q	Sure. When --	12:33:27
20	A	-- answering the right question.	12:33:30
21	Q	Strike that.	12:33:31
22		When a CMOS FET is on, a signal flows	12:33:32

1	between the source terminal and the drain	12:33:36
2	terminal. Correct?	12:33:39
3	A Correct.	12:33:41
4	MR. MAGEE: Objection. Form.	12:33:42
5	THE WITNESS: I'm sorry, Bobby. Go	12:33:43
6	ahead.	12:33:46
7	MR. MAGEE: You can answer. It's okay.	12:33:46
8	THE WITNESS: So, Bobby, for some reason	12:33:49
9	when you object, it still isn't coming through	12:33:51
10	clearly on my -- on my side. I don't know what's	12:33:54
11	going on. But I apologize for cutting you off.	12:33:56
12	A So it's still not correct what -- what	12:34:01
13	you asked. It's not that a signal flows,	12:34:03
14	necessarily; that current flows. And that current	12:34:05
15	may have superimposed on it a signal. But it	12:34:11
16	is -- it is not necessarily the signal itself.	12:34:14
17	So current flows or has the potential to	12:34:17
18	flow between the source and the drain when the Vgs	12:34:21
19	is large enough that a channel forms in the -- in	12:34:27
20	the MOS transistor or CMOS transistor.	12:34:31
21	You don't have to say "CMOS transistor."	12:34:33
22	MOS transistor is -- means the same thing.	12:34:36

1	Q	By applying a voltage to the gate of a	12:34:40
2		CMOS transistor, the transistor's channel between	12:34:46
3		the source and the drain either allows or blocks	12:34:50
4		current flow. Correct?	12:34:53
5	A	Depending on the value of V_{gs} , that is	12:34:54
6		correct.	12:34:57
7	Q	Okay. Let's turn back to Figure 6.7 of	12:34:57
8		DeMaw.	12:35:04
9	A	Okay, I have it in front of me.	12:35:08
10	Q	So the VRF in Figure 6.7 of DeMaw	12:35:10
11		represents an RF signal. Correct?	12:35:18
12	A	Yes.	12:35:20
13	Q	And the VLO in Figure 6.7 of DeMaw	12:35:20
14		represents the LO signal. Correct?	12:35:25
15	A	Yes.	12:35:27
16	Q	And the T1, T2, and T3 are transformers.	12:35:27
17		Correct?	12:35:37
18	A	Yes.	12:35:38
19	Q	The transformer symbols used for T1, T2,	12:35:38
20		and T3 in DeMaw represent a magnetic core	12:35:44
21		transformer. Correct?	12:35:49
22	A	It -- well, it has a ferrite toroid core.	12:35:52

1 So, you know, so that's the precise way to say it,
2 yes.

3 Q So let me ask that again.

4 The transformer symbol used for T1, T2,
5 and T3 represents a magnetic core transformer.

6 Correct?

7 MR. MAGEE: Objection. Form. Asked and
8 answered.

9 A Yeah, I stand by my answer.

10 Q DeMaw does not provide the exact
11 parameters of Transformers T1, T2, and T3.

12 Correct?

13 A It doesn't provide the exact form, but it
14 does tell us that it's got a ferrite toroid core,
15 and that they're wound -- yeah, they have a
16 certain number of windings with Number 620 -- with
17 Number 26 NM with wires.

18 So they do provide some information, but
19 they don't, for example, provide a brand name.
20 You know, like with the JFETs they provided the
21 actual model numbers. For the transistors they
22 don't do that. But they do provide information.

1 Q So DeMaw doesn't provide the exact
2 perimeters for the transformers, but it does
3 provide a physical description of the
4 transformers. Correct?

12:37:13

12:37:17

12:37:21

12:37:23

5 A Yes.

12:37:23

6 Q And DeMaw also says that these
7 transformer dimensions are suitable for use from 3
8 to 30 megahertz. Correct?

12:37:23

12:37:28

12:37:32

9 A Yes.

12:37:35

10 Q There is a label to the right of
11 Transistors Q1 and Q2 that says Z equals 1700 ohm.

12:37:36

12:37:45

12 Do you see that?

12:37:50

13 A I do.

12:37:51

14 Q What does the Z equals 1700 ohm mean in
15 Figure 6.7?

12:37:51

12:37:58

16 A So the capacitor right below that 1700
17 ohms label, and the inductor connected to that
18 capacitor, and then the capacitor connected to the
19 other side of that inductor together perform what
20 a so-called impedance match. And the idea is at
21 the IF frequency, the intermediate frequency, the
22 components are chosen such that the impedance

12:37:59

12:38:06

12:38:10

12:38:12

12:38:17

12:38:22

12:38:26

1 looking into the -- well, the impedance seen 12:38:30
2 looking out of the drain of the JFET has a -- it 12:38:36
3 is 1700 ohms purely real. And on the other side 12:38:40
4 where -- where it says Z equals 100, the impedance 12:38:46
5 looking in to that node from the other side at the 12:38:50
6 IF frequency has an impedance which is 100 ohms 12:38:56
7 and is real. 12:39:00

8 Q So the low-pass matching networks provide 12:39:02
9 a 1700-ohm impedance at the drain of the JFET and 12:39:13
10 a 100-ohm impedance at the transistor -- excuse 12:39:22
11 me, Transformer T4? 12:39:28

12 MR. MAGEE: Objection. Form. 12:39:30

13 A Yeah, could you tighten that question a 12:39:33
14 bit? 12:39:34

15 Q Sure. The low-pass matching networks 12:39:41
16 provide a 17-ohm impedance at the drain of the 12:39:46
17 JFETs. Correct? 12:39:50

18 A No. It's 1700 ohms, and it's the 12:39:51
19 impedance looking into that network from the drain 12:39:54
20 of the JFET. 12:39:58

21 Q So the low-pass matching networks provide 12:40:03
22 a 1700-ohm impedance looking into the network from 12:40:09

1	the drain of the JFETs. Correct?	12:40:12
2	A At the intermediate frequency. And if	12:40:14
3	you add at the intermediate frequency, then the	12:40:19
4	answer is correct.	12:40:21
5	Q Okay. We'll get there.	12:40:24
6	A I'm sorry.	12:40:29
7	Q DeMaw does not provide the actual	12:40:30
8	component values of the two capacitors and	12:40:32
9	inductor in the low-pass matching network.	12:40:36
10	Correct?	12:40:39
11	A That is correct.	12:40:39
12	Q And you included a simulation of DeMaw's	12:40:42
13	Figure 6.7 in your declaration. Right?	12:40:47
14	A I did.	12:40:50
15	Q Did you, personally, set up that	12:40:51
16	simulation?	12:40:54
17	A No. I worked with a -- with a colleague.	12:40:55
18	So I -- you know, these -- these are very long	12:40:57
19	patents. And, you know, I have a day job. And so	12:41:01
20	I -- I supervised a colleague who did much of the	12:41:05
21	simulations, although I was very heavily involved	12:41:11
22	in it. But -- and he's somebody that I've worked	12:41:14

1 with for years. And we've done this in the past 12:41:18
2 as far as -- not -- we haven't worked on legal 12:41:20
3 cases in the past, but we've worked together on 12:41:24
4 projects where he'll do some of the simulations 12:41:27
5 and I'll do some. And I'm very used to working 12:41:31
6 with him. 12:41:34

7 Q So who is the person that assisted you 12:41:35
8 with setting up the simulations? 12:41:38

9 A His name is Dr. Colin Weltin-Wu. And he 12:41:39
10 used to be a postdoc, postdoctoral fellow in my 12:41:47
11 lab. And he got his Ph.D. from Columbia. 12:41:51

12 Q And what specific assistance did he 12:42:02
13 provide you in setting up the simulations? 12:42:06

14 A We discussed the circuits in detail and 12:42:12
15 discussed what needed to be simulated. You know, 12:42:16
16 what plots we needed and, you know, how to go 12:42:22
17 about it. 12:42:27

18 And then he ran the initial simulations. 12:42:29
19 And he also wrote a Python script to extract from 12:42:34
20 the simulation output the various waveforms that 12:42:39
21 we wanted to plot, and plotted those waveforms. 12:42:44
22 And also the histograms. 12:42:48

1	Q	So -- I'm sorry, you said his name was	12:42:55
2		Colin?	12:42:59
3	A	Yes.	12:42:59
4	Q	So Colin wrote a Python script to extract	12:42:59
5		the simulation outputs of the various waveforms.	12:43:04
6		Is that correct?	12:43:07
7	A	Yes.	12:43:08
8	Q	And he also wrote a Python script to plot	12:43:08
9		the histograms in your declaration. Correct?	12:43:16
10	A	Yes.	12:43:20
11	Q	Did you discuss how to set up those	12:43:20
12		scripts or did he set them up on his own?	12:43:29
13	A	We discussed them.	12:43:31
14	Q	How did you determine the values for the	12:43:32
15		capacitor inductor after the JFETs in your	12:43:48
16		simulation?	12:43:52
17	A	Well, we needed to have the impedance	12:43:52
18		match of 1700 ohms on the left and 100 ohms on the	12:44:01
19		right at the intermediate frequency. And then we	12:44:04
20		also wanted to have a fair amount of peaking in	12:44:09
21		the frequency response at the intermediate	12:44:17
22		frequency just to -- just to provide good	12:44:19

1 suppression of unwanted components, such that the 12:44:24
2 final voltage across that second capacitor was a 12:44:28
3 good representation of the -- of the -- you know, 12:44:33
4 of the information signal after being down 12:44:37
5 converted to intermediate frequency. 12:44:41

6 So we just used standard engineering 12:44:43
7 techniques to choose those values. 12:44:46

8 Q So did the values that you chose give you 12:44:53
9 the impedance match of the 1700 ohms on the left 12:44:57
10 and the 100 ohms on the right? 12:45:01

11 MR. MAGEE: Objection. Form. 12:45:03

12 A So they did give us the required 12:45:06
13 impedances at the intermediate frequency, yes. 12:45:09
14 Which is what we intended for them to do. 12:45:12

15 Q And you said you also wanted to have a 12:45:17
16 fair amount of peaking in the intermediate 12:45:20
17 frequency response. 12:45:23

18 How did you adjust the values to get that 12:45:25
19 response? 12:45:28

20 A Well, because it's a capacitor, an 12:45:30
21 inductor and capacitor network, a PI network, that 12:45:34
22 peaking happens naturally. So -- so once we tuned 12:45:38

1 the circuit to give us the required 1700 ohms on
2 one side and the 100 ohms on the other at the IF,
3 we ended up with a peaking I think of about a
4 factor of 10. But that's just the nature of this
5 type of circuit.

6 The -- you know, the CLC, that's what we
7 would call it, circuit, it naturally provides
8 peaking at a -- at a center frequency which in
9 this case was the IF frequency. And it also
10 performs this impedance match. So those are --
11 those are the two purposes of the circuit.

12 Because whenever you -- whenever you
13 down-convert a signal like this through a mixer,
14 there are always unwanted components that need to
15 be filtered out to provide the -- the information
16 signal at the output.

17 Q Were there a choice of many different
18 values that the capacitors and inductor could have
19 been that would still give you the Z equals 1700
20 ohms on the left and Z equals 100 ohms on the
21 right?

22 A Yes.

1 Q And why did you choose the values that 12:47:07
2 you did over other pairs that would give you the 12:47:12
3 same Z values? 12:47:14

4 A We just used sort of good engineering 12:47:20
5 practice. I mean, if you make -- you can make the 12:47:22
6 capacitor -- you can scale the capacitors and 12:47:26
7 inductors up or down, for example. And if the 12:47:28
8 capacitors get too big, then it -- then it kind of 12:47:32
9 loads down the circuit. And if they're too small 12:47:34
10 then you have noise issues. And so we just -- we 12:47:37
11 just chose values that we felt would be reasonable 12:47:40
12 choices from an engineering point of view. 12:47:45

13 Q And if you want -- if you can turn to I 12:47:46
14 believe it's 73 of your declaration, Paragraph 73 12:48:06
15 of your declaration? 12:48:12

16 A Give me a second. You don't happen to 12:48:16
17 know what page it's on, do you? 12:48:18

18 Q I'll tell you in a second. Okay. Strike 12:48:24
19 that. If you can go to Page 44 of your 12:48:33
20 declaration? 12:48:35

21 A Okay. 12:48:44

22 Q And Page 44 of your declaration includes 12:48:44

1	a figure DEMAW-SIM-FIG 1. Correct?	12:48:49
2	A I see it, yes.	12:48:56
3	Q And DEMAW-SIM-FIG-1 represents the	12:48:57
4	circuit you used to simulate DeMaw Figure 6.7.	12:49:02
5	Correct?	12:49:06
6	A Yes.	12:49:07
7	Q The -- strike that.	12:49:07
8	Your colleague is the one who set up the	12:49:14
9	circuitry in this figure. Correct?	12:49:18
10	MR. MAGEE: Objection. Form.	12:49:21
11	A We worked together, but he was the one	12:49:23
12	who actually, you know, drew the -- you know,	12:49:26
13	entered the circuit into the simulator and, you	12:49:32
14	know -- and ran the -- ran the simulation. But we	12:49:34
15	were involved in it together in terms of setting	12:49:38
16	everything up.	12:49:43
17	Q And the transformers in the circuit	12:49:48
18	simulation use an IDL transformer model. Correct?	12:49:52
19	A Yes.	12:49:57
20	Q And the LO used in your simulation is a	12:49:59
21	square wave. Correct?	12:50:05
22	A Yes. Although we have also simulated it	12:50:06

1	with sine wave.	12:50:09
2	Q You have not provided any simulations of	12:50:10
3	the DeMaw circuit with sine wave, have you?	12:50:14
4	A No. But I'm happy to provide them, if	12:50:17
5	you'd like.	12:50:19
6	Q No simulations of DeMaw within LO sine	12:50:20
7	wave were presented in your declaration. Correct?	12:50:25
8	A As I said, the answer is that it's	12:50:28
9	correct. But I'm happy to provide them, if you'd	12:50:30
10	like.	12:50:34
11	Q The simulation -- strike that.	12:50:34
12	The LO used in your simulation has a	12:50:42
13	frequency of 150 megahertz. Correct?	12:50:45
14	A I believe so. I'd have to check. But	12:50:49
15	that sounds -- that sounds about right. I can	12:50:52
16	check if you want, but it does sound about right.	12:50:56
17	Or actually, I see it on the plot. It is	12:51:10
18	correct.	12:51:13
19	Q Okay. So the LO used in your simulation	12:51:18
20	of Figure 6.7 of DeMaw uses a square wave having a	12:51:21
21	150-megahertz frequency. Correct?	12:51:31
22	A That is correct.	12:51:34

1	Q	And the LO used in the circuit simulation	12:51:35
2		has a frequency -- strike that.	12:51:37
3		The LO signal used in your simulation has	12:51:39
4		an amplitude of 1.2 volts. Correct?	12:51:41
5	A	Yes, that is correct.	12:51:46
6	Q	Does your model use the Siliconix U430	12:51:48
7		JFET model?	12:51:55
8	A	So that was what we intended, but we	12:51:56
9		discovered after submitting the declaration that	12:51:59
10		we had a typo in our -- in our file here.	12:52:01
11		So if you look where it says first	12:52:07
12		switching device, there -- there's the letters	12:52:08
13		N -- NJF. So we had downloaded -- we had	12:52:14
14		downloaded code -- a SPICE model for those	12:52:20
15		specific Siliconix transistors. And when we -- we	12:52:23
16		had intended to point the simulation to those	12:52:29
17		models, and we accidentally had this NJF which	12:52:31
18		caused the JFETs to be used to be generic JFETs	12:52:36
19		provided by the simulator. So that was a mistake	12:52:41
20		on our part.	12:52:44
21		We have since resimulated with the	12:52:45
22		Siliconix models correctly inserted, and the	12:52:49

1 qualitative behavior of the circuit is the same in 12:52:56
2 the sense that it still functions correctly as a 12:53:00
3 mixer. And, also, the histograms still show the 12:53:03
4 discharge ratios between 6 and 50 percent at all 12:53:11
5 possible levels. 12:53:17

6 So -- so, yeah, that was a mistake that 12:53:18
7 we discovered later, but it didn't -- it didn't 12:53:20
8 materially change the results. 12:53:24

9 Q All of the simulation results and graphs 12:53:28
10 in your declaration, though, rely on a JFET model 12:53:34
11 that is not the Siliconix U430 JFET. Correct? 12:53:38

12 MR. MAGEE: Objection. Form. 12:53:43

13 THE WITNESS: Sorry. Go ahead. 12:53:45

14 MR. MAGEE: Objection. Form. 12:53:47

15 A All of the simulations related to DeMaw 12:53:49
16 that are in the declaration use -- do not use the 12:53:51
17 Siliconix JFETs. But like I said, we have since 12:53:58
18 simulated with the Siliconix JFETs and got 12:54:05
19 comparable results. And it doesn't change any of 12:54:11
20 our conclusions, or any of my conclusions. 12:54:14

21 Q But I don't have any of the results from 12:54:21
22 the Siliconix U430 -- 12:54:23

1	A	That is correct. But I have them with	12:54:29
2		me. I'd be happy to share them with you.	12:54:30
3	Q	Keep them. Thank you.	12:54:33
4		The RF signal that you used in the	12:54:42
5		circuit simulation was generated with a 1-volt	12:54:44
6		123.102 megahertz sinusoidal carrier AM-modulated	12:54:59
7		signal with a 0.15 volt 1-megahertz sinusoidal	12:55:09
8		message signal. Correct?	12:55:14
9	A	Yes.	12:55:16
10	Q	And why did you choose these specific	12:55:18
11		parameters for the RF signal?	12:55:22
12	A	So we expect -- you know, based on our	12:55:26
13		knowledge of this circuit, you know, a mixer is a	12:55:32
14		very general device and can down convert, you	12:55:35
15		know, any piece of a spectrum at RF to, in this	12:55:40
16		case, IF provided it's within the, you know,	12:55:45
17		frequency range of the circuit.	12:55:50
18		And so this circuit, you know, for the	12:55:52
19		types of devices used, you know, can handle	12:55:57
20		signals, you know, below a few hundred megahertz.	12:56:04
21		So we just chose a signal frequency that	12:56:08
22		was well within its capability. And one -- you	12:56:11

1 know, could have been 124, it could have been 127,
2 it could have been, you know, 123.05976.

3 What we typically do when we design
4 circuits, though, is we pick somewhat arbitrary
5 frequencies, like this .102 for example, just so
6 that we don't accidentally end up in a -- in a
7 situation where -- where the LO and the RF signal
8 are so commensurate that we might miss features of
9 the circuit.

10 But we've simulated this with numerous
11 other inputs, and again get comparable results in
12 the same -- in the sense that none of our
13 conclusions differ.

14 Q Why did you choose an AM-modulated signal
15 for the RF signal?

16 A Only because it was -- it's easy to show
17 on plots. But, you know, the mixers are agnostic
18 in the sense that they don't care what the
19 modulation signal is, as long as you -- as long as
20 you're within the bandwidth constraints of the
21 circuit, it can have any modulation. So AM was
22 just something that's easy to -- to see on plots,

1 and it just made the explanation simpler.

12:57:35

2 But everything we said would apply
3 equally to other types of modulations, provided
4 they're -- they have -- you know, they're not too
5 wide band for the circuit.

12:57:38

12:57:43

12:57:45

12:57:47

6 Q Did you consider -- consider alternative
7 RF signal configurations when you were running
8 these simulations?

12:57:49

12:57:53

12:57:56

9 A Can you specify -- specify what you mean
10 by "RF signal configurations"?

12:57:59

12:58:01

11 Q Were -- strike that.

12:58:04

12 Did you consider different RF signal
13 frequencies when running the simulations?

12:58:08

12:58:10

14 A We did. And we not only considered them,
15 but we actually simulated them.

12:58:13

12:58:16

16 Q But you did not provide any simulations
17 of the circuit with a signal other than the RF
18 signal of 123.102 megahertz sinusoidal carrier
19 AM-modulated. Correct?

12:58:18

12:58:20

12:58:27

12:58:35

20 A No; but I would be happy to share them
21 with you, if you'd like. We just chose one
22 representative set of values, but we have lots of

12:58:37

12:58:39

12:58:47

1	others to share if you -- if you wish.	12:58:51
2	Q You stated in your declaration at	12:58:53
3	Paragraph 73 --	12:58:58
4	A Let me go to 73. One second.	12:59:02
5	Okay.	12:59:09
6	Q -- that parameter values that were	12:59:10
7	described in DeMaw were used, with minor	12:59:21
8	adjustments.	12:59:24
9	Do you see that?	12:59:24
10	A Yes.	12:59:25
11	Q What were the minor adjustments that you	12:59:25
12	used to set up your DeMaw simulation?	12:59:32
13	A Okay. Can we go back to the figure so I	12:59:36
14	can point them to you?	12:59:39
15	Q Go ahead.	12:59:40
16	A Point you to them, I mean.	12:59:41
17	So, for example, do you see in the bottom	12:59:43
18	left corner there is a voltage source V4?	12:59:46
19	Q Hold on, let's -- I'm going back to the	12:59:51
20	second simulation on Page 44 of your declaration.	13:00:00
21	A DEMAW-SIM-FIG Figure 4 -- FIG 1, I mean.	13:00:07
22	Q Yeah.	13:00:14

1	A	So look at the bottom left of the	13:00:15
2		circuit, and you'll see a voltage source that's	13:00:16
3		labeled V4.	13:00:19
4	Q	Yep.	13:00:21
5	A	So in DeMaw R4 -- I mean, they call it R1	13:00:22
6		in the -- in the DeMaw diagram, but there's -- in	13:00:29
7		DeMaw R4 would just be R1 and the voltage source	13:00:34
8		would be zero. And it's stated in DeMaw that you	13:00:38
9		need to choose the value of R1, in this case it	13:00:42
10		would be R4, to get the right voltage at that	13:00:46
11		point.	13:00:49
12		And so what we did in this simulation	13:00:50
13		was, instead of doing that, we just had R4 and a	13:00:55
14		voltage source because it's easier in simulation	13:00:59
15		to adjust the voltage to get it -- you know, for	13:01:02
16		expediency, than to sit there and constantly be	13:01:05
17		changing the -- the resistor value.	13:01:08
18		So we made that as a slight difference,	13:01:12
19		but it has -- it has no effect on the steady-state	13:01:16
20		behavior of the circuit.	13:01:20
21	Q	Did you change anything else in the	13:01:23
22		circuit from DeMaw's Figure 6.7?	13:01:26

1 A Yeah. The -- there -- so if you look on 13:01:30
2 the right side of the circuit you see Vsupply there. 13:01:34
3 And you see R2 and C8. We -- that R2 and C8 is 13:01:37
4 just to provide some filtering on the supply. So 13:01:46
5 if you have supply noise, it contributes -- you 13:01:51
6 know, some of it gets filtered out. And it has no 13:01:55
7 real bearing because the supply in this case is 13:01:58
8 noiseless. But -- but we chose -- we ended up 13:02:00
9 choosing different values. And it was just, you 13:02:04
10 know, they were values that we thought would be 13:02:11
11 reasonable. But we have since simulated with the 13:02:13
12 DeMaw values. And again, there's -- has no -- no 13:02:16
13 significant effect on performance whatsoever. 13:02:21
14 Q Is there anything else in the circuit 13:02:23
15 that you've changed in relation to Figure 6.7 of 13:02:28
16 DeMaw? 13:02:33
17 A Well, unfortunately we -- we 13:02:33
18 accidentally, as I mentioned, used the wrong 13:02:37
19 models for the -- for the devices. They still 13:02:41
20 work and the circuit still works, but -- and 13:02:43
21 again, the conclusions don't change. But we 13:02:47
22 accidentally didn't point the simulator to the -- 13:02:49

1 to the Siliconix models. And so we ended up using

13:02:54

2 generic JFETs models supplied by the simulator.

13:02:59

3 And so that was an inadvertent change.

13:03:07

4 Q Are there any other changes in your
5 circuit from DeMaw?

13:03:09

13:03:14

6 A I don't recall any others, no.

13:03:17

7 Q Okay.

13:03:18

8 MS. MANDIR: It's been about an hour.

13:03:22

9 Why don't we go off the record for a break.

13:03:23

10 MR. MAGEE: Okay.

13:03:26

11 VIDEO SPECIALIST: We are going off the
12 record. The time is 13:30.

13:03:27

13:03:28

13 (A recess was taken.)

13:03:31

14 VIDEO SPECIALIST: We are back on the
15 record. The time is 13:13.

13:13:01

13:13:07

16 BY MS. MANDIR:

13:13:12

17 Q Dr. Galton, did you speak with anyone
18 about the substance of your deposition during our
19 break?

13:13:12

13:13:14

13:13:17

20 A Not about the substance, but I ran into

13:13:19

21 Rishi on our way to the bathroom, and he just

13:13:22

22 reminded me that I should pause after questions to

13:13:26

1 allow Bobby a chance to object. 13:13:29

2 THE WITNESS: And so Bobby and also 13:13:32
3 Debbie, I apologize for not doing that 13:13:34
4 sufficiently before. 13:13:36

5 Q But other than that, you didn't talk 13:13:44
6 about the substance of your testimony today. 13:13:47

7 Correct? 13:13:48

8 A No. I mean, correct. 13:13:49

9 Q If we can turn back to your declaration, 13:13:50
10 paragraph I believe 144. 13:14:00

11 A Okay. Can you give me a page number? 13:14:09

12 Q Strike that. If you could turn to Page 13:14:29
13 71 of your declaration and let me know when you're 13:14:31
14 there. 13:14:33

15 A I'm there. 13:14:33

16 Q So you include DeMaw-SIM-Figure 7 on Page 13:14:34
17 71 of your declaration. Correct? 13:14:48

18 A Correct. 13:14:51

19 Q And in Paragraph 114 you specifically say 13:14:52
20 that "Using the transition edges of the LO signal 13:14:54
21 and the knowledge that the switch opening and 13:14:57
22 closing as dictated by the LO amplitude, we can 13:14:58

1	compute on a cycle-by-cycle basis the charge ratio	13:15:02
2	described in Claim 19."	13:15:05
3	Correct?	13:15:06
4	A Correct.	13:15:08
5	Q What is the charge ratio?	13:15:12
6	A So it's when the switch is closed, a	13:15:14
7	certain amount of charge is accumulated on the	13:15:20
8	capacitor. And then when the switch is open, a	13:15:27
9	portion of that charge that was accumulated in the	13:15:32
10	prior closure is -- is discharged. And -- or even	13:15:33
11	charged, it just depends.	13:15:44
12	But anyway, it's the -- it's the ratio of	13:15:45
13	the amount of charge that was discharged when the	13:15:48
14	switch was open relative to the amount that was	13:15:54
15	charged when the switch was closed.	13:15:57
16	Q And how did you compute the charge ratio?	13:16:03
17	MR. MAGEE: Objection. Form.	13:16:11
18	A So we monitored the current flowing into	13:16:17
19	and out of the capacitor, and we -- you know, we	13:16:22
20	stored those traces from the simulator. And then	13:16:27
21	the Python script calculated the ratio I just	13:16:31
22	described and created a standard histogram of the	13:16:39

1 results.

13:16:42

2 Q So you monitored the current flowing in
3 and out of the capacitor per every cycle of the
4 capacitor to get the charge ratio?

13:16:46

13:16:57

13:17:01

5 Is that correct?

13:17:04

6 MR. MAGEE: Objection. Form.

13:17:06

7 A Can you tighten that question, because I
8 don't -- it doesn't quite make sense to me.

13:17:08

13:17:09

9 Q To calculate the charge ratio, did you
10 monitor the current flowing into the capacitor and
11 out of the capacitor on a per-cycle basis?

13:17:12

13:17:16

13:17:22

12 MR. MAGEE: Objection. Form.

13:17:27

13 A We had a record of the current flowing
14 into and out of the capacitor for the entire
15 simulation. And we used -- and we extracted the
16 information from that waveform and our knowledge
17 of the capacitor size.

13:17:29

13:17:34

13:17:38

13:17:41

13:17:45

18 Q You did not provide the underlying source
19 code of the Python post-processing script used to
20 generate this histogram. Correct?

13:17:51

13:17:53

13:17:57

21 A I did not. But I have it with me. I'd
22 be happy to share it with you now, if you'd like.

13:17:59

13:18:02

1 Q Why was that not included in your 13:18:05
2 declaration previously? 13:18:10

3 A Because a histogram is a pretty 13:18:16
4 standard -- you know, it's a known technique. We 13:18:21
5 certainly could have, but it seemed like the 13:18:23
6 declaration was already very long and, you know, 13:18:26
7 it just seemed -- didn't seem necessary. 13:18:30

8 But like I said, I'm happy to provide it 13:18:32
9 if you'd like. 13:18:36

10 Q Well, how could someone independently 13:18:36
11 verify your results without access to the source 13:18:40
12 code? 13:18:46

13 A Well, we provide, you know, the exact 13:18:46
14 information on what and how -- you know, what we 13:18:51
15 simulated and how we simulated it. And so a 13:18:54
16 person wanting to duplicate our results could use 13:18:59
17 LTspice, just like we did, could type in the 13:19:02
18 circuit just like we did, could use the same 13:19:06
19 values just like we did. And then they could -- 13:19:08
20 they could take the current waveforms through that 13:19:11
21 capacitor and calculate the histogram. 13:19:18

22 And a histogram is a known thing. And 13:19:24

1	so, you know, you could even do it with pencil and	13:19:27
2	paper if you wanted to, but it's just more	13:19:29
3	convenient to do it with a computer.	13:19:31
4	Q Did you use any mathematical calculations	13:19:37
5	in the Python post script?	13:19:41
6	MR. MAGEE: Objection. Form.	13:19:47
7	A Yeah, I mean, it's kind of a vague	13:19:50
8	question.	13:19:52
9	But, you know, in order to calculate --	13:19:54
10	in order to calculate a histogram, you know, you	13:19:55
11	have to, you know, tally up the number of times	13:20:01
12	that each one of those occurrences occur. So that	13:20:06
13	tallying process you could say is a mathematical	13:20:09
14	operation.	13:20:12
15	And any time you take a ratio you divide	13:20:12
16	two numbers. Division is a -- is a mathematical	13:20:15
17	operation. So -- so in those senses, yes.	13:20:19
18	Q Did you preprocess the data before	13:20:22
19	running it through the Python script?	13:20:26
20	A We did not.	13:20:29
21	MR. MAGEE: Objection. Form.	13:20:33
22	THE WITNESS: Sorry, Bobby.	13:20:35

1	Q	Did you use any specific Python libraries	13:20:36
2		or functions to generate this histogram?	13:20:39
3	A	Yes. We used -- to actually make our	13:20:44
4		plots we used a library called Matplotlib. And to	13:20:51
5		do some of the arithmetic operations in order to	13:20:59
6		calculate the values for the histograms, we used a	13:21:04
7		library called NumPy.	13:21:12
8	Q	Does your script perform any statistical	13:21:25
9		adjustments or normalizations?	13:21:31
10	A	No.	13:21:36
11	Q	Did you write the script?	13:21:36
12		MR. MAGEE: Objection. Form.	13:21:41
13	A	I did not write the script. Colin wrote	13:21:45
14		the script. But we discussed its functionality	13:21:47
15		at -- in-depth. And like I said, I have a copy of	13:21:51
16		it, and I'm familiar with it.	13:21:54
17	Q	Did you review the Python script prior to	13:21:57
18		submitting your declaration?	13:22:08
19	A	I did.	13:22:11
20	Q	And did you have to do any corrections to	13:22:11
21		the Python script before submitting your	13:22:21
22		declaration?	13:22:24

1	A	No.	13:22:24
2	Q	Did you validate the results of your	13:22:24
3		Python script against another method or	13:22:33
4		independent source?	13:22:36
5	A	Can you be more specific?	13:22:40
6	Q	Did you perform other tests that verified	13:22:42
7		the results of your Python script?	13:22:45
8	A	So together Colin and I looked at the	13:22:49
9		current waveforms going into the capacitors and	13:22:55
10		verified that we did, indeed, see, just by hand	13:23:00
11		checking, the instances in the range of 6 to 50	13:23:05
12		percent.	13:23:11
13		So we spot checked in that sense to make	13:23:11
14		sure that, you know -- as just a sanity check on	13:23:13
15		the histogram.	13:23:18
16		And, also, based on my knowledge of the	13:23:20
17		circuit and my understanding of how the circuit	13:23:22
18		works, these results are completely in line with	13:23:25
19		what I expected.	13:23:33
20	Q	Can an individual verify the results of	13:23:36
21		your histogram without the Python script?	13:23:51
22	A	I believe I've already answered that. I	13:23:56

1 actually -- I actually described the methodology
2 that they would -- would be able to do to use it,
3 to do so.

4 Q How many times did you run your Python
5 script?

6 MR. MAGEE: Objection. Form.

7 A I mean, it's -- I don't have an answer
8 for you. I mean, we've done this numerous times
9 because we've -- we've -- I guess I should have
10 mentioned before that another sanity check we did
11 was we tried many different input signals and, you
12 know, many different variations of amplitudes and
13 so forth and got comparable results.

14 So every time we run another simulation,
15 we run a Python script to get the -- or run the
16 Python script not only to get the histograms, but
17 also just to plot the results in general.

18 So -- so I don't have a specific number
19 for you. You know, it's like saying when you
20 write a document, how many times did you open
21 Word, you know, it's just not something you
22 remember, but I'm sure you would -- in most cases

1	it would be many, many times, and in this case it	13:25:17
2	was many, many times.	13:25:20
3	Q How can we be certain that your Python	13:25:21
4	script doesn't contain any errors or biases	13:25:28
5	affecting the results?	13:25:31
6	A Well, earlier in response to -- you know,	13:25:34
7	to a question I described -- you asked me how	13:25:37
8	could somebody verify our results. And I gave you	13:25:41
9	a detailed description of how you could do it.	13:25:45
10	That's one way.	13:25:48
11	Another way would simply be to take our	13:25:49
12	Python code, which I'll be happy to give you, and	13:25:52
13	have someone look at it.	13:25:55
14	Q It says that this ratio was collected for	13:26:00
15	50,999 simulation cycles. Correct?	13:26:18
16	A Yes.	13:26:22
17	Q So it's probably not possible to manually	13:26:22
18	check if your histogram is correct. Right?	13:26:28
19	MR. MAGEE: Objection. Form.	13:26:32
20	A It's not correct.	13:26:34
21	Q So are you saying someone would have to	13:26:38
22	check 50,999 simulation cycles?	13:26:40

1	A	No, I'm not saying that.	13:26:46
2	Q	How would someone check if your histogram	13:26:48
3		is correct without checking the 50,999 simulation	13:26:51
4		cycles?	13:26:57
5	A	Well, first, the -- it is only necessary	13:27:01
6		to have, you know, one occurrence of this -- you	13:27:08
7		know, of a discharge ratio in the 6 percent to 50	13:27:12
8		percent range or correspondingly in the other	13:27:16
9		ranges. So you only have to run it until you see	13:27:23
10		one.	13:27:26
11		You know, the histogram is just a simple	13:27:27
12		means of showing that it happens many, many times.	13:27:28
13		But by monitoring the current in and out of the --	13:27:32
14		those capacitors, you can -- you can easily zero	13:27:39
15		in on cases where the discharge ratio is any value	13:27:44
16		in this -- in this histogram.	13:27:49
17		So, and not only that, but this histogram	13:27:52
18		uses 50,999 cycles, but you get a rougher looking	13:27:55
19		but comparable histogram with far fewer cycles.	13:28:00
20	Q	This histogram was the result of the	13:28:06
21		outputs from your simulation Figure 1. Correct?	13:28:20
22	A	You say "simulation Figure 1." Could you	13:28:29

1	direct me to what figure you're talking about?	13:28:30
2	Q On Page 44 of your declaration, you have	13:28:37
3	DEMAW-SIM-FIG 1.	13:28:45
4	A Uh-huh.	13:28:49
5	Q The histogram is a product of running	13:28:49
6	that circuit. Correct?	13:28:59
7	A Correct.	13:29:05
8	MR. MAGEE: Objection. Form.	13:29:05
9	THE WITNESS: I'm sorry, Bobby.	13:29:07
10	And Bobby, one quick thing, if you could	13:29:09
11	maybe get closer to your microphone? Because I	13:29:11
12	don't hear the object. All I heard on my -- on my	13:29:13
13	side was "form."	13:29:17
14	MR. MAGEE: Yeah, I think -- I think the	13:29:18
15	problem is if we talk over each other. I will do	13:29:20
16	my best.	13:29:23
17	THE WITNESS: Okay. And I'll pause more.	13:29:25
18	I apologize.	13:29:27
19	Q So because there were certain mistakes in	13:29:29
20	your simulation, this probably is not an accurate	13:29:35
21	histogram of the DeMaw circuit. Correct?	13:29:38
22	MR. MAGEE: Objection. Form.	13:29:42

1	A	No, it's not correct.	13:29:43
2		So first of all, like I said, there is	13:29:47
3		only one mistake, and it was -- it was using a	13:29:49
4		different set of JFET models. But that doesn't	13:29:53
5		change the nature -- you know, the fundamental	13:29:56
6		nature of this circuit. And, in fact, when	13:30:00
7		circuits are shown in textbooks or patents or	13:30:06
8		papers, very rarely are any components given.	13:30:09
9		So, for example, the preferred	13:30:14
10		embodiments in the '342 patent, I'm not sure that	13:30:16
11		any of them have component values. So it's very	13:30:19
12		common for engineers to expect to have to	13:30:24
13		calculate their own component values and use good	13:30:28
14		engineering judgment, you know, sort of standard	13:30:31
15		optimization techniques, to choose values.	13:30:33
16		So while it's true that for the	13:30:36
17		simulation we put in the declaration it didn't --	13:30:39
18		you know, some of the component values were --	13:30:43
19		were a little different than what DeMaw disclosed,	13:30:46
20		the -- it didn't change the fundamental nature of	13:30:52
21		the circuit.	13:30:55
22	Q	Was the input to the histogram data	13:30:56

1	directly from the simulation output, or was it	13:31:07
2	modified before being processed?	13:31:10
3	MR. MAGEE: Objection. Form. Compound.	13:31:12
4	A And previously asked.	13:31:15
5	You asked that question, and I -- and I	13:31:17
6	answered it already.	13:31:19
7	Q So there is no modifications to the	13:31:23
8	simulation outputs to create this histogram.	13:31:26
9	Correct?	13:31:30
10	A We didn't change the data in any way.	13:31:33
11	But the process of making a histogram means that	13:31:38
12	you have to extract the data and count up the	13:31:40
13	number of discharge percentage ratios and plot	13:31:46
14	them.	13:31:48
15	So -- so we did not change the data in	13:31:49
16	any way, but we -- in order to create a histogram,	13:31:52
17	you have to do -- you have to do some processing,	13:31:55
18	you know, as I said, counting up the various	13:31:58
19	occurrences. So that's what we did.	13:32:01
20	Q And the histogram represents the	13:32:03
21	distribution of charge loss from the capacitor	13:32:27
22	when one switch is open versus closed.	13:32:31

1	Is that correct?	13:32:36
2	A No.	13:32:39
3	MR. MAGEE: Objection. Form.	13:32:40
4	A It's what I said previously when you	13:32:41
5	asked that question.	13:32:42
6	Q Remind me. I don't believe I asked that	13:32:44
7	question.	13:32:49
8	Let me strike that. Let me ask again.	13:32:50
9	Strike that.	13:32:53
10	The histogram represents the distribution	13:32:54
11	of the charge lost from one capacitor when one	13:32:56
12	switch is open versus charge delivered when it is	13:33:00
13	closed. Correct?	13:33:03
14	MR. MAGEE: Objection. Form.	13:33:04
15	A So the histogram shows the number of	13:33:07
16	occurrences of the various percentages of charge	13:33:13
17	lost from that capacitor when the switch is open	13:33:23
18	ratioed against the charge that was delivered to	13:33:30
19	that capacitor when the switch was previously	13:33:31
20	closed in the -- in the most recent period.	13:33:36
21	Q Okay. Let's turn to -- or I'm going to	13:33:40
22	provide you with another exhibit.	13:33:46

1	So, Dr. Galton, I am now providing you	13:34:03
2	with document that is marked on the right-hand	13:34:06
3	corner as TI 1021.	13:34:09
4	(TI Exhibit 1021, previously marked, not	13:34:11
5	attached.)	13:34:12
6	Q And this document has been previously	13:34:12
7	marked in the IPR as Exhibit 1021. And I will be	13:34:14
8	referring to this document as Macnally. Okay?	13:34:19
9	A Okay.	13:34:22
10	Q Do you have the document in front of you?	13:34:30
11	Sorry?	13:34:32
12	A I do.	13:34:32
13	Q So Macnally refers to U.S. Patent Number.	13:34:33
14	Correct?	13:34:40
15	A Correct.	13:34:41
16	Q And let's turn to Figure 3 of Macnally,	13:34:41
17	which should be on PDF Page 5. You'll probably	13:34:43
18	have to flip it again.	13:34:50
19	A I'm there. Let me flip it. One second.	13:34:51
20	It's flipped.	13:35:00
21	Q Figure 3 of Macnally is a diagram of the	13:35:00
22	mixer and anti-alias filter. Correct?	13:35:10

1	A	Yes.	13:35:15
2	Q	And there are no component values for the	13:35:15
3		individual components provided in Figure 3 of	13:35:19
4		Macnally. Correct?	13:35:22
5	A	Correct.	13:35:23
6	Q	And RFP represents an input signal.	13:35:23
7		Correct?	13:35:36
8	A	Yes.	13:35:37
9	Q	And RFN represents an inverted signal.	13:35:37
10		Correct?	13:35:45
11		MR. MAGEE: Objection.	13:35:46
12	A	Yes.	13:35:47
13		THE WITNESS: Sorry, Bobby.	13:35:48
14		MR. MAGEE: Objection. Form.	13:35:49
15		Go ahead.	13:35:50
16	Q	The transistors shown in Figure 3 of	13:35:51
17		Macnally are CMOS FETs. Correct?	13:35:55
18	A	Yes.	13:36:00
19	Q	And Signals RFP and RFN are fed into the	13:36:00
20		gates of the CMOS FETs. Correct?	13:36:09
21		MR. MAGEE: Objection. Form.	13:36:12
22	A	Into the gates of M1 and M2.	13:36:16

1	Q	And if you look at the teachings of	13:36:18
2		Macnally, specifically Column 7, Line 8, Macnally	13:36:25
3		teaches that the mixer's conversion gain is	13:36:32
4		14.3dB?	13:36:38
5	A	Can you direct me to where you're	13:36:38
6		looking?	13:36:40
7	Q	Yeah. Sorry. That is Column 7 of the	13:36:40
8		patent, Line 8.	13:36:44
9	A	Okay. Give me a second.	13:36:47
10		The mixer's conversion gain is 14.3dB,	13:37:03
11		yes.	13:37:12
12	Q	And how does the mixer generate a 14.3dB	13:37:12
13		gain?	13:37:18
14	A	Okay. Let us go back to the figure. I'm	13:37:20
15		trying to find it again.	13:37:33
16		Okay. So the RFP and RFN are a	13:37:37
17		differential version of the information signal.	13:37:44
18		It's an amplified version of the RF signal.	13:37:48
19		And when RFP increases, RFP decreases.	13:37:53
20		And so when that means is that in that case more	13:37:58
21		current will flow through the -- you know, from	13:38:00
22		drain to source of M1, and correspondingly less	13:38:02

1 current will flow through M2.

13:38:05

2 And that current change times the
3 resistances seen at the -- seen at the nodes to
4 which R3 and R4 connect, that represents the
5 amplified signal. And if you measure the -- the
6 voltage at the two nodes I just described -- the
7 differential voltage at the two nodes I just
8 described divided by the differential voltage at
9 the input, then you will get a gain which, when
10 you take 20 log of that number, you will get the
11 14 point whatever dB number we described, or
12 described by Macnally.

13:38:09

13:38:17

13:38:24

13:38:29

13:38:34

13:38:38

13:38:40

13:38:42

13:38:48

13:38:50

13:38:57

13 Q And the LOP -- strike that.

13:38:58

14 Let's turn back to your declaration.

13:39:19

15 Sorry to keep making you jump around. But --

13:39:20

16 A I'm there. Where would you like me to
17 go?

13:39:24

13:39:26

18 Q If you could go to Page 55 of your
19 declaration, please.

13:39:26

13:39:43

20 A Okay, I'm there.

13:39:51

21 Q Page 55 of your declaration includes a
22 figure MACNALLY-SIM-FIG 1. Correct?

13:39:51

13:39:56

1	A	Correct.	13:40:03
2	Q	And this -- strike that.	13:40:03
3		Is this the circuit used to model	13:40:10
4		Macnally in your simulations?	13:40:12
5	A	Yes.	13:40:18
6	Q	And did you set up the simulation	13:40:18
7		personally?	13:40:20
8	A	No; I was -- I was involved in it, and I	13:40:21
9		calculated many of the component values. But as I	13:40:25
10		mentioned before, my colleague called Dr. Colin	13:40:28
11		Weltin-Wu was more involved in the actual running	13:40:31
12		of the simulation and collecting the data than I	13:40:38
13		was. But I was -- I was involved in it also.	13:40:41
14	Q	And what discussions did you have with	13:40:55
15		Colin with regards to setting up the specific	13:40:56
16		circuit of Macnally?	13:41:00
17	A	Can you be more specific? I mean, we	13:41:04
18		spent hours and hours on this whole thing. And,	13:41:06
19		you know, some of those conversations involved,	13:41:09
20		Hey, let's go get coffee.	13:41:11
21		I mean, if you can be more specific on	13:41:14
22		the nature of what you're asking, I'd be happy to	13:41:16

1	answer it.	13:41:19
2	Q Sure. Let me clarify.	13:41:19
3	How did you and Colin come up with the	13:41:26
4	values of each of the components in the simulated	13:41:29
5	Macnally circuit?	13:41:33
6	MR. MAGEE: Objection. Form.	13:41:34
7	A So I've described in detail in my	13:41:37
8	declaration how we -- how I came up with the	13:41:40
9	values of the components in the anti-aliasing	13:41:45
10	filter, anti-alias filter, which is a synonym.	13:41:50
11	And for the other components because Macnally	13:41:55
12	didn't specify them, we used MOS, CMOS models that	13:41:59
13	are consistent with a 0.6 micron process, which is	13:42:06
14	what Macnally used. And we -- and we used the	13:42:08
15	supply voltage specified in Macnally, which is 3.3	13:42:16
16	volts.	13:42:20
17	Q There is a voltage or biasing circuit at	13:42:30
18	the top of the Macnally simulation circuit.	13:42:38
19	Correct?	13:42:40
20	A Correct.	13:42:41
21	Q And that is not -- the biasing -- strike	13:42:41
22	that.	13:42:46

1	The biasing circuit in your simulated	13:42:46
2	Macnally circuit is not actually disclosed in	13:42:49
3	Macnally. Correct?	13:42:52
4	A That is correct.	13:42:54
5	Q Why did you include the biasing circuit	13:43:01
6	in your Macnally simulated circuit?	13:43:08
7	A Because -- well, for a few reasons.	13:43:12
8	One is that usually when circuits are	13:43:15
9	shown in papers -- and this -- the Macnally patent	13:43:21
10	is -- came straight out of a -- of a conference	13:43:30
11	paper where they presented it, with the exact same	13:43:34
12	results.	13:43:37
13	But when they present the schematics,	13:43:38
14	they're usually simplified versions of the	13:43:42
15	schematics. And so we just used the current	13:43:45
16	sources to provide a controlled bias current, you	13:43:51
17	know, to implement the circuit in a way we felt	13:44:04
18	they probably would have implemented it.	13:44:07
19	That said, the bias current doesn't	13:44:09
20	change -- I mean, the use of bias current sources	13:44:11
21	doesn't change the behavior of the circuit. So we	13:44:17
22	could have used resistors directly to VDD. But	13:44:21

1 the problem is, for the -- for the gain that they
2 were -- they were saying they had, the voltage
3 drop across those resistors would have been very
4 high. And so we suspected they did it this way.

5 But we could have -- we could have done
6 it the other way, too. This is a very, very
7 standard technique in circuit design.

8 Q The LO signal used in your simulated
9 Macnally circuit was a square wave. Correct?

10 A That is correct.

11 Q And the LO signal used in your Macnally
12 circuit simulation operated at a 1-gigahertz LO
13 clock. Correct?

14 A That is correct.

15 Q And the RF signal used in your Macnally
16 circuit simulation operated at a - sinusoidal
17 carrier amplitude -- strike that.

18 The RF signal used in your Macnally
19 circuit simulation included a 1-gigahertz
20 sinusoidal carrier amplitude modulated 10 percent
21 by a 425.3 kilohertz sinusoidal message signal?

22 A Correct.

1	Q	And in Paragraph 94 of your declaration,	13:45:45
2		which is just the paragraph down from this figure,	13:45:51
3		you state that, The simulation deviates from the	13:45:55
4		patent's intended modulation of BFSK modulation.	13:45:59
5		Correct?	13:46:06
6	A	Correct.	13:46:06
7	Q	And why did you choose to alter the	13:46:07
8		disclosed modulation of Macnally?	13:46:15
9	A	Well, we also simulated it with BFSK and	13:46:19
10		got materially the same results.	13:46:23
11		But the answer to your question is that	13:46:25
12		it's the same as the corresponding question that	13:46:30
13		you asked me in DeMaw. Which is that it just --	13:46:32
14		using an AM signal, an amplitude-modulated RF	13:46:37
15		signal, it just makes it easier to explain the	13:46:42
16		behavior because the waveforms are less	13:46:45
17		complicated, but they don't materially change the	13:46:49
18		results.	13:46:51
19	Q	You said you simulated the BFSK	13:46:57
20		modulation with your Macnally circuit.	13:47:00
21	A	Yes.	13:47:03
22	Q	Correct?	13:47:03

1	But those results were not provided in	13:47:04
2	your declaration. Correct?	13:47:06
3	A Correct. But I have them with me. I'd	13:47:09
4	be happy to share them with you, if you'd like.	13:47:11
5	Q The transistor M8 in your simulation and	13:47:14
6	the transistor M9 in your simulation have the same	13:47:26
7	output path. Correct?	13:47:36
8	MR. MAGEE: Objection. Form.	13:47:39
9	A Can you -- can you define what you mean	13:47:43
10	by "output path"?	13:47:45
11	Q Transistor M8 and Transistor M9 meet at a	13:47:47
12	node before entering the anti-alias -- strike	13:47:51
13	that.	13:48:00
14	Transistor M8 and Transistor M9 meet at a	13:48:02
15	node before the anti-alias filter circuit.	13:48:08
16	Correct?	13:48:14
17	MR. MAGEE: Objection. Form.	13:48:16
18	A What do you mean, "meet at a node"?	13:48:22
19	Q The -- strike that.	13:48:24
20	The drains of M8 and M9 are connected.	13:48:25
21	Correct?	13:48:29
22	A Incorrect.	13:48:31

1	Q	Can you explain how I'm incorrect?	13:48:31
2	A	Well, they -- one of the -- hold on a	13:48:35
3		second. One of the -- so if you look at the drain	13:48:41
4		of M9, it's -- it's connected to the top input of	13:48:48
5		a anti-alias filter. And if you look at the drain	13:48:56
6		of M8, it's connected to the bottom input of the	13:48:59
7		anti-alias filter. So they're not the same node.	13:49:02
8		They're not -- they're not wired together.	13:49:05
9		Maybe I could offer just one bit of	13:49:28
10		information that might be helpful to you?	13:49:30
11	Q	Okay.	13:49:35
12	A	Are you -- are you there?	13:49:38
13	Q	Go ahead. Yeah.	13:49:39
14	A	Okay. So see how there are those little	13:49:40
15		blue circles, or little blue dots where wires	13:49:44
16		meet?	13:49:50
17	Q	Yeah.	13:49:50
18	A	That means that they're -- they're	13:49:51
19		connected. Whereas if a -- if two wires cross and	13:49:54
20		there's no blue dot, that means that that -- that	13:49:57
21		they don't connect.	13:50:01
22		So I think perhaps what might have caused	13:50:03

1	your confusion is -- is that there is a blue wire	13:50:05
2	going from the drain of M8 into the bottom input	13:50:11
3	of the anti-alias filter. And it crosses the	13:50:15
4	drain of M9. But because there's no blue dot	13:50:18
5	there, they're not actually connected. And that's	13:50:21
6	a -- that's a pretty standard notation for	13:50:30
7	circuits.	13:50:33
8	Q You're looking at the MACNALLY-SIM-FIG 1	13:50:34
9	annotated on Page 55 of your report. Correct?	13:50:43
10	A Correct.	13:50:46
11	Q After the drain of M8, there's a blue dot	13:50:46
12	that's labeled P mix. Correct?	13:50:52
13	A Yes.	13:50:57
14	Q And after the drain of M9, there is a	13:50:57
15	blue dot labeled Mix M9. Correct?	13:51:01
16	A Yes.	13:51:07
17	Q Okay. Let me try this again. Strike	13:51:07
18	that.	13:51:24
19	The drain of M8 and the drain of M11 are	13:51:25
20	connected?	13:51:32
21	A Yes.	13:51:34
22	Q The -- strike that.	13:51:35

1	The M8 transistor and the M11 transistor	13:51:43
2	operate on 180-degree differential. Correct?	13:51:53
3	MR. MAGEE: Objection. Form.	13:52:01
4	A What do you mean by a "180-degree	13:52:04
5	differential"?	13:52:07
6	Q When M8 is conducting current, M11 is not	13:52:08
7	conducting current. And when M11 is conducting	13:52:19
8	current, M8 is not conducting current. Correct?	13:52:23
9	MR. MAGEE: Objection. Form.	13:52:25
10	A That's correct in an ideal sense, yes.	13:52:31
11	Q And both of the drain outputs follow the	13:52:33
12	same path. Correct?	13:52:38
13	A When you say "both," we've talked a lot	13:52:41
14	about -- we've talked about a lot of drain	13:52:43
15	outputs. So which -- which drains are we talking	13:52:46
16	about?	13:52:50
17	Q The drains of M8 and M11 follow the same	13:52:50
18	path. Correct?	13:52:56
19	A Well, they're connected together, so in	13:52:57
20	that sense yes.	13:52:59
21	Q The drains of M10 and M9 are connected	13:53:07
22	together. Correct?	13:53:09

1	A	Correct.	13:53:10
2	Q	When M10 is conducting, M9 is not	13:53:10
3		conducting. And when M9 is conducting, M10 is not	13:53:15
4		conducting. Correct?	13:53:18
5		MR. MAGEE: Objection. Form.	13:53:19
6	A	You --	13:53:20
7		THE WITNESS: I'm sorry, Bobby.	13:53:21
8		MR. MAGEE: Objection. Form.	13:53:23
9		Go ahead.	13:53:25
10	A	Ideally, that is the case.	13:53:25
11	Q	Are there any modifications that you made	13:53:29
12		to this Macnally circuit other than the top	13:53:37
13		biasing circuitry?	13:53:43
14	A	No. Not that I'm aware of. Or not that	13:53:51
15		I know of.	13:53:55
16		The only -- the only thing that might	13:53:56
17		look like a modification is we use a transformer	13:53:58
18		just to convert the -- or actually a vaillant,	13:54:03
19		just to convert the single-ended RF signal to a	13:54:10
20		differential form. And you can see us, where we	13:54:14
21		insert that into RFP and RFN.	13:54:17
22		So -- so that's not really part of the	13:54:21

1 circuit. So I -- so it's not -- it's not really a 13:54:24
2 modification, but I just thought I would mention 13:54:28
3 it. 13:54:31

4 Q How did you choose the frequency values 13:54:31
5 of the RF signals? 13:54:43

6 A So the -- the application was -- it's a 13:54:48
7 direct conversion receiver, meaning that the LO 13:54:56
8 and the RF frequencies have to be the same. And 13:54:58
9 the -- the original application of the Macnally 13:55:02
10 circuit is a cordless telephone, which has a -- an 13:55:09
11 RF frequency of between 900 megahertz and a 13:55:14
12 gigahertz. So we just chose, you know, the higher 13:55:19
13 end of the range. But we've simulated, you 13:55:22
14 know -- we've simulated down as low as 900 13:55:27
15 megahertz and up as high as a gigahertz. 13:55:31

16 Q If you turn to Page 65 of your 13:55:36
17 declaration, there is a Figure DEMA-W-SIM-FIG 4 13:55:53
18 annotated. 13:56:01

19 Do you see that? 13:56:02

20 A I do. 13:56:03

21 Q And there is no equivalent Macnally 13:56:03
22 figure for DEMA-W-SIM-FIG 4. Correct? 13:56:10

1	MR. MAGEE: Objection. Form.	13:56:17
2	A Wait. We're talking about Macnally or	13:56:21
3	DeMaw? I'm confused.	13:56:23
4	Q I'm asking if you have an equivalent	13:56:25
5	figure for Macnally as the one shown on Page 65 of	13:56:29
6	your report.	13:56:35
7	A I'd have to go look. I don't remember	13:56:36
8	exactly. Do you want me to go look or -- or do	13:56:38
9	you want to just continue with your question?	13:56:46
10	Q Yeah, please, I would like to know if you	13:56:48
11	have an equivalent figure for Macnally to Figure	13:56:51
12	found on 65 of your report.	13:56:55
13	A Okay. Hold on. Let me -- let me scout	13:56:59
14	around in here. One second.	13:57:03
15	Okay. So I can't really look at both	13:58:03
16	pictures at once, so I'm just going to sort of	13:58:06
17	talk out -- think out loud for you.	13:58:09
18	So if we look at DEMAW-SIM-FIG 4 we see	13:58:11
19	the current into Capacitor C4 and C5. Okay? And	13:58:18
20	then remind me where -- what page the Macnally	13:58:22
21	result was on?	13:58:25
22	Hello?	13:58:36

1	Q	Yeah, I'm sorry, you're asking me?	13:58:36
2	A	Yeah.	13:58:38
3	Q	I'm asking you if you can find a figure	13:58:40
4		that's equivalent to the figure shown on 65 of	13:58:42
5		your report for Macnally.	13:58:48
6	A	Oh, oh, I'm sorry. I'm sorry. Give me a	13:58:50
7		second. I was looking in the -- I misunderstood	13:58:51
8		the question. All right. Let me see. Sorry.	13:58:54
9		It's a long document and I don't have all of it	13:59:02
10		memorized in real-time.	13:59:05
11		So if you look at Figure MACNALLY-SIM-FIG	13:59:24
12		2, that shows the current Capacitor C6 and C7.	13:59:30
13	Q	There is no LO signal illustrated in	13:59:42
14		MACNALLY-SIM-FIG 2. Correct?	13:59:48
15	A	Well, the LO -- I mean, the -- see those	13:59:54
16		red squares on -- in the figure? Those -- those	14:00:01
17		show -- those denote different phases, or the same	14:00:07
18		phases of the LO signal.	14:00:16
19		So basically when the switches are turned	14:00:18
20		on, we're in the red -- that means the LO going	14:00:20
21		into that, the corresponding transistor, is high.	14:00:24
22		That corresponds to what's inside one of the red	14:00:27

1	triangles. And when the switch is turned off,	14:00:30
2	corresponding to the phase where the LO is low,	14:00:34
3	that's outside of the red triangle. So the	14:00:38
4	information is, indeed, there.	14:00:41
5	Q How -- strike that.	14:00:42
6	In Paragraph 139 --	14:01:01
7	A Which page?	14:01:06
8	Q It's the page right after.	14:01:06
9	A Oh, right. I see it. Go ahead.	14:01:10
10	Q You said that, "Although it is not	14:01:12
11	possible to see the information signal present in	14:01:15
12	the capacitor current waveforms of Figure	14:01:19
13	MACNALLY-SIM-FIG 2 due to the narrow time plotting	14:01:22
14	range."	14:01:27
15	Do you see that?	14:01:27
16	A Hold on. Let me -- so it's Paragraph	14:01:28
17	139, you said?	14:01:31
18	Q Yes. Strike that. Let me clean that up.	14:01:32
19	In Paragraph 139 of your declaration you	14:01:34
20	write, "It is not possible to see the information	14:01:38
21	signal present in the capacitor current waveforms	14:01:41
22	of figure MACNALLY-SIM-FIG 2 due to the narrow	14:01:43

1	time plotting range." Correct?	14:01:50
2	A Give me one second.	14:01:51
3	Yes.	14:02:01
4	Q So, but is that an accurate statement,	14:02:02
5	that we're not able to see the information signal	14:02:17
6	present in the capacitor current waveforms of	14:02:22
7	MACNALLY-SIM-FIG 2?	14:02:26
8	A Well, the intent of the -- of the comment	14:02:31
9	was to mean that you can't -- you can't zoom out	14:02:36
10	and see the long-term progression of it. Because	14:02:40
11	we're only looking at a small piece.	14:02:43
12	In the same sense that if you -- you	14:02:45
13	know, if you're standing in the middle of a very	14:02:47
14	flat desert, it's hard to realize that you're on	14:02:50
15	a -- you're standing on a spherical planet,	14:02:53
16	because you're only looking at a small piece of	14:02:56
17	it.	14:02:58
18	So in the sense that it's hard to	14:02:58
19	visualize the -- you know, the behavior of the --	14:03:00
20	of the RF signal because you're only looking at a	14:03:03
21	tiny piece of it, that's correct. But the	14:03:06
22	information is there; it's just -- it's just hard	14:03:08

1 from this vantage point to see it sort of

14:03:11

2 long-term behavior. That's what I meant by that

14:03:14

3 sentence.

14:03:16

4 Q Why didn't you provide a graphic that
5 had -- was easier to see the information?

14:03:18

14:03:21

6 MR. MAGEE: Objection. Form.

14:03:25

7 A So if you go down to MACNALLY-SIM-FIG 3
8 annotated on Page 93, you can see this -- this
9 kind of shows the reason for -- or the answer to
10 your question.

14:03:28

14:03:36

14:03:41

14:03:49

11 So tell me when you're there, and I'll
12 continue.

14:03:50

14:03:53

13 Q I'm there.

14:03:54

14 A So in this case the local oscillator
15 signal is so much higher frequency than the
16 message signal, than the -- than the -- or than
17 the bandwidth of the -- of the RF signal, that in
18 this graph we -- we've shown -- we've zoomed back
19 out enough so you can see the behavior of the
20 message signal in the bottom graph. But in doing
21 so, the top graph looks just like a big blob of
22 ink because the -- because the frequencies are so

14:03:55

14:04:01

14:04:04

14:04:07

14:04:13

14:04:19

14:04:23

14:04:25

14:04:30

1	different.	14:04:33
2	And so we would have had the same problem	14:04:33
3	in the previous graph, in that if we were able to	14:04:35
4	zoom out enough to do that, you wouldn't be able	14:04:38
5	to see the individual charging and discharging	14:04:40
6	cycle.	14:04:42
7	So it's simply because the frequencies	14:04:43
8	are so different that we just don't have enough	14:04:46
9	resolution either on the -- in the file or in our	14:04:50
10	eyesight to be able to look at them on the same	14:04:53
11	scale meaningfully, you know, for any -- any value	14:04:56
12	we pick.	14:05:02
13	MS. MANDIR: It's been about an hour.	14:05:13
14	Why don't we take a break. Go off the record.	14:05:15
15	VIDEO SPECIALIST: We are going off the	14:05:18
16	record. The time is 14:05.	14:05:19
17	(A recess was taken.)	14:05:22
18	VIDEO SPECIALIST: Back on the record.	14:19:28
19	The time is 14:19.	14:19:33
20	BY MS. MANDIR:	14:19:36
21	Q Dr. Galton, did you speak with anyone	14:19:37
22	about the substance of your testimony during the	14:19:40

1	break?	14:19:43
2	A No.	14:19:44
3	Q Okay. And before the break we were	14:19:44
4	talking about Macnally. Correct?	14:19:49
5	A Yes.	14:19:52
6	Q And if you could turn back to Macnally,	14:19:52
7	actually, let's see --	14:19:59
8	A I'm sorry, turn back to what?	14:20:06
9	Q Page 96 of your declaration.	14:20:08
10	A Okay. Hold on.	14:20:11
11	Okay.	14:20:19
12	Q And on Page 96 of your declaration you	14:20:20
13	include a figure, MACNALLY-SIM-FIG 4. Correct?	14:20:25
14	A Correct.	14:20:30
15	Q And MACNALLY-SIM-FIG 4 is a -- strike	14:20:30
16	that.	14:20:40
17	To generate MACNALLY-SIM-FIG 4, you used	14:20:43
18	the identical Python post script as you did for	14:20:48
19	the histogram of DeMaw that we looked at earlier.	14:20:53
20	Correct?	14:20:57
21	A Yes.	14:20:58
22	MR. MAGEE: Objection. Form.	14:20:58

1	THE WITNESS: Sorry, Bobby.	14:21:02
2	Q And in Figure -- strike that.	14:21:03
3	In Paragraph 149 of Macnally you state	14:21:05
4	that, "As the mixer switches are driven by the	14:21:09
5	full-swing LO clock analyze, it is possible to	14:21:13
6	compute the intervals of time when the switches	14:21:16
7	are open versus closed."	14:21:17
8	Correct?	14:21:19
9	A Yes.	14:21:19
10	Q Macnally does not teach square wave LO	14:21:25
11	signals. Correct?	14:21:34
12	MR. MAGEE: Objection. Form.	14:21:35
13	A Not -- it's not really correct. So it's	14:21:39
14	for the -- in most mixers it's understood that	14:21:43
15	square wave LOs are far superior to sine wave LOs	14:21:49
16	in terms of reducing noise. And for the type of	14:21:55
17	mixer that Macnally uses, it would be -- it's	14:21:59
18	just, it's known by, you know, by -- it would have	14:22:05
19	been known by a POSITA, and is certainly known by	14:22:09
20	a POSITA today, that you would only use it with	14:22:12
21	local oscillator signals that are intended to be	14:22:16
22	square waves.	14:22:19

1 And in fact, the patent owner's 14:22:23
2 preliminary response is incorrect when it says 14:22:25
3 that Macnally specifically teaches sinusoidal LOs. 14:22:28

4 That's absolutely not true. 14:22:33

5 Q Macnally does not disclose square wave LO 14:22:35
6 signals, though. Correct? 14:22:40

7 MR. MAGEE: Objection. Form. 14:22:41

8 A No, but it -- 14:22:42

9 THE WITNESS: Sorry. Bobby, go ahead. 14:22:43

10 MR. MAGEE: Objection. Form. 14:22:45

11 You can answer. 14:22:46

12 THE WITNESS: I'll do my best to pause. 14:22:48
13 It's not my nature, but I'll work on it. 14:22:50

14 A The teaching is implicit in that -- in 14:22:54
15 that a POSITA would understand that you absolutely 14:22:57
16 would use a square wave LO, or an LO that as 14:23:01
17 closely as possible approximates a square wave. 14:23:09

18 Q And for the MACNALLY-SIM-FIG 4 histogram, 14:23:12
19 you said you used the identical post-processing 14:23:16
20 script that was used to generate Figure 14:23:20
21 DEMAW-SIM-FIG 7. Correct? 14:23:23

22 MR. MAGEE: Objection. Form. 14:23:26

1	A	Yes.	14:23:27
2	Q	Does the Python post script include the	14:23:28
3		number of cycles that the histogram is run?	14:23:30
4	A	In this case it's 10,999 cycles.	14:23:37
5	Q	So the Macnally histogram differs in at	14:23:43
6		least simulation length from the DeMaw simulation	14:23:48
7		histogram. Correct?	14:23:52
8	A	It is correct. But the reason is that	14:23:54
9		we -- we ran the simulations for the same amount	14:23:56
10		of actual time. And so that ended up giving us	14:23:59
11		different numbers of cycles.	14:24:05
12		But after reading the patent owner	14:24:06
13		preliminary response, where we were called out for	14:24:08
14		using different numbers, we just went back and	14:24:12
15		generated histograms for just 10,000 period for	14:24:16
16		both. And they didn't materially change the	14:24:20
17		results or conclusions.	14:24:26
18	Q	Sorry to switch gears on you, but if you	14:24:28
19		could turn back to DeMaw.	14:24:40
20	A	Can you be more specific?	14:24:44
21	Q	Exhibit 1016. Could you turn to Exhibit	14:24:45
22		1016, PDF Page 8?	14:24:50

1	A	DeMaw. You're in Exhibit 1016. Okay.	14:24:57
2		And where am I looking? I'm sorry?	14:25:00
3	Q	PDF Page 8.	14:25:03
4	A	Okay. I'm there.	14:25:05
5	Q	And on the right-hand column of DeMaw,	14:25:06
6		the third sentence of the second paragraph says,	14:25:15
7		The four, colon 1 impedance ratio of T4 matches	14:25:20
8		the mixer to a 50-ohm load. Correct?	14:25:24
9	A	Hold on. The third -- you said the third	14:25:29
10		sentence of the second paragraph?	14:25:34
11	Q	On the right -- strike that.	14:25:35
12		If you look at the second paragraph,	14:25:38
13		third sentence on the right-hand column of PDF	14:25:42
14		Page 8.	14:25:47
15	A	Wait, I'm so sorry. So it's the third	14:25:53
16		sentence of the second paragraph?	14:25:56
17		Is that what you said?	14:25:57
18	Q	Yeah.	14:25:58
19	A	That's Performance results when VLO is .8	14:26:00
20		peak to peak times Vgs off?	14:26:03
21	Q	No. One sentence up.	14:26:07
22	A	Second sentence.	14:26:12

1	Q	So DeMaw states that the 4:1 impedance	14:26:12
2		ratio of T4 matches the mixer to a 50-ohm load.	14:26:16
3		Correct?	14:26:19
4	A	Oh, yes. I'm sorry, that is the third	14:26:19
5		sentence. I didn't -- the period on my -- on my	14:26:21
6		screen is very faint.	14:26:24
7		So the 4:1 impedance ratio of T4 matches	14:26:26
8		the mixer to a 50-ohm load, yes.	14:26:29
9	Q	Your DeMaw simulation did not use a 4:1	14:26:32
10		impedance ratio of T4. Correct?	14:26:35
11	A	I think we did. I believe we did. I'd	14:26:38
12		have to double-check. But as far as I know, we	14:26:43
13		did.	14:26:46
14	Q	Well, let's look at your simulation for	14:26:46
15		DeMaw. If you can go to your declaration?	14:26:51
16	A	Okay.	14:27:01
17	Q	Page 55 of your declaration.	14:27:01
18		Oh, I'm sorry, that's the wrong page.	14:27:03
19		Strike that. Page 44 of your declaration is your	14:27:04
20		simulation circuit of DeMaw.	14:27:18
21	A	Hold on a second. Page 44, you said?	14:27:23
22	Q	Yeah.	14:27:26

1	A	Okay.	14:27:35
2	Q	So let me ask the question again.	14:27:35
3		Your DeMaw simulation did not use a 4:1	14:27:37
4		impedance ratio of T4. Correct?	14:27:40
5	A	I believe we did. I'd have to	14:27:47
6		double-check, but I believe -- I believe we did.	14:27:51
7	Q	Well, you see the values of T4, 600?	14:27:55
8	A	Yeah. But I think that K4 is -- I need	14:28:06
9		to double-check. I am -- I'm not certain at this	14:28:16
10		point. But I believe we did. And, but that said,	14:28:19
11		even if we didn't, even if -- even if the turns	14:28:26
12		ratios were the same, this comes after the	14:28:31
13		impedance device and would not materially change	14:28:34
14		the results. But I -- like I said, I believe we	14:28:37
15		did, but I'm not a hundred percent sure. I need	14:28:41
16		to -- I need to check.	14:28:44
17	Q	Can you not tell by looking at this	14:28:47
18		figure right now whether you used a 4:1 ratio?	14:28:53
19	A	I cannot, so I need to check.	14:28:57
20	Q	If you did not use a 4:1 ratio, would	14:29:03
21		that have been a mistake?	14:29:09
22	A	It would have been a difference. And --	14:29:11

1 but it wouldn't have -- it wouldn't have been a 14:29:16
2 mistake in the sense that the circuit would still 14:29:18
3 have worked as -- you know, as stated in DeMaw. 14:29:21

4 Q Did you check your DeMaw simulation prior 14:29:28
5 to using it in your declaration? 14:29:35

6 A Yes. 14:29:41

7 Q And did you check the Python script used 14:29:41
8 to generate the histograms prior to using them in 14:29:47
9 your declaration? 14:29:53

10 A You asked that question before, and the 14:29:55
11 answer is still yes. 14:29:56

12 Q In DeMaw the R1 -- strike that. 14:29:57

13 If you look at DeMaw, PDF Page 8, the 14:30:26
14 left-hand column, maybe three or four sentences 14:30:35
15 down it says, "R1 is selected to give a Vgs of 0.8 14:30:40
16 the pinchoff voltage, which will be on the order 14:30:46
17 of 2 V, allowing for a published spread of 14:30:49
18 negative 1 to negative 4 V, Vgs (off.)" 14:30:52

19 Do you see that? 14:30:59

20 A Where am I -- where am I looking in the 14:31:00
21 text? I'm sorry? 14:31:02

22 Q This is DeMaw PDF Page 8. Left-hand 14:31:04

1	side.	14:31:08
2	A Yeah, I see it. R1 is selected to give a	14:31:10
3	Vgs of 0.8. There's a misprint. 0.8 times the	14:31:14
4	pinchoff voltage which will be on the order of 2	14:31:19
5	volts, allowing for the published spread of minus	14:31:22
6	1 to minus 4 volts.	14:31:25
7	Q And R1 --	14:31:27
8	A Times Vgs, sorry. Vgs off. I apologize.	14:31:28
9	I didn't mean to interrupt you.	14:31:33
10	Q No. That's okay. Were you finished	14:31:34
11	or --	14:31:36
12	A I am.	14:31:37
13	Q Okay. And R1 -- strike that.	14:31:37
14	Figure 6.7 shows R1 as being grounded.	14:31:44
15	Correct?	14:31:48
16	A It shows the bottom terminal of R1 as	14:31:49
17	being grounded, yes.	14:31:54
18	Q And in your simulation you previously	14:31:55
19	said that you used -- strike that.	14:31:59
20	In your simulation you said that R4 was	14:32:08
21	equivalent to DeMaw's R1. Correct?	14:32:12
22	A No, that's not what I said. What I said	14:32:15

1 is that in DeMaw, he recommends adjusting the 14:32:16
2 value of R1 until you get a voltage at the top 14:32:24
3 terminal of R1 that ends up biasing the local 14:32:29
4 oscillator according to what they described in 14:32:33
5 the -- in the text you just had me read. 14:32:36

6 And that's kind of a hassle to do. 14:32:38
7 Because every time you want to change the input 14:32:43
8 you need to figure out a different resistor to 14:32:45
9 use. 14:32:49

10 So what we did instead, and which was 14:32:49
11 ultimately equivalent, is we used a smaller 14:32:51
12 resistor, but we used a voltage source to set the 14:32:54
13 voltage. 14:32:57

14 So here he's relying on the voltage drop 14:32:58
15 across the resistor. So there's current flowing 14:33:01
16 to the resistor, and he's relying on that average 14:33:03
17 voltage drop to provide the biasing. And we just 14:33:06
18 did what is from a circuit point of view for 14:33:10
19 the -- for practical purposes here equivalent, we 14:33:13
20 just used a voltage source. 14:33:16

21 However, we also simulated it exactly the 14:33:18
22 way DeMaw shows it. And we got materially the 14:33:24

1 same results.

14:33:28

2 Q You did not provide other simulations
3 other than the ones -- strike that.

14:33:32

14:33:40

4 Your declaration doesn't have any other
5 circuit simulations other than the one provided in
6 DEMAW-SIM-FIG 4, the DeMaw circuit. Correct?

14:33:41

14:33:45

14:33:47

7 A That's correct. But I'm happy to provide
8 them. I've got them on my computer. I can share
9 them right now, if you'd like.

14:33:53

14:33:54

14:33:57

10 Q Why didn't you provide the simulation
11 that you said you did that was exactly the circuit
12 of DeMaw?

14:33:58

14:34:05

14:34:07

13 A Well, in that case we did it after the --
14 after seeing the patent owner's preliminary
15 response. Because we weren't expecting -- or I
16 wasn't expecting that the patent owner's
17 preliminary response would sort of accuse me of
18 cooking the component values to get the numbers I
19 want. Because that's absolutely not what I did.
20 And I thought, well, I wanted -- you know, I knew
21 that, you know, making the changes along these
22 lines would not materially affect the results, but

14:34:08

14:34:13

14:34:15

14:34:20

14:34:23

14:34:28

14:34:30

14:34:33

14:34:35

14:34:38

1 I wanted to be able to say in this deposition
2 truthfully that I have looked at it and simulated
3 it and, indeed, there's no material difference as
4 far as, you know, what we're talking about is
5 concerned.

6 Q But sitting here right now, I can't
7 verify what you're saying is true?

8 A I am happy to show it to you. And I'm
9 happy to submit the documents, if you'd like.

10 Q How did you calculate charge in your
11 histogram generation?

12 A Well, I think I've already answered this
13 question.

14 So current -- I'll elaborate on it a bit.
15 Current is charge flow per unit time. And so if
16 you know the current and you know the capacitance,
17 you can calculate the accumulation or the -- or
18 the discharge rate, charging rate or discharging
19 rate of the capacitor as a function of time. So
20 we just used standard, you know, undergraduate
21 electrical engineering equations to do that.

22 Q So are those mathematical equations were

14:34:42

14:34:44

14:34:46

14:34:50

14:34:52

14:34:52

14:34:54

14:34:57

14:34:59

14:35:01

14:35:17

14:35:21

14:35:23

14:35:25

14:35:30

14:35:33

14:35:38

14:35:40

14:35:43

14:35:46

14:35:52

14:35:56

1	used in the Python script to generate the	14:36:06
2	histogram?	14:36:08
3	A Yes.	14:36:09
4	MR. MAGEE: Objection. Form.	14:36:09
5	THE WITNESS: Sorry, Bobby. Go ahead.	14:36:12
6	MR. MAGEE: Objection. Form.	14:36:14
7	A Yes.	14:36:16
8	Q So mathematical equations to calculate	14:36:16
9	charge. Were there any other mathematical	14:36:24
10	calculations included in your Python script?	14:36:27
11	A I think you asked this before too. But,	14:36:30
12	you know, I described -- I described some of the	14:36:32
13	other calculations in -- that we used to -- you	14:36:34
14	know, we took the ratio of, you know, the charging	14:36:39
15	to discharging amounts. We did some calculations	14:36:41
16	to tally up the number of occurrences to create a	14:36:46
17	histogram, things like that.	14:36:51
18	Q Okay. I'm going to --	14:36:54
19	MS. MANDIR: Let's go off the record for	14:37:17
20	a second.	14:37:19
21	VIDEO SPECIALIST: Okay. We are going	14:37:21
22	off the record. The time is 14:37.	14:37:22

Transcript of Ian Galton, Ph.D.
Conducted on February 28, 2025

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1	(A recess was taken.)	14:37:25
2	VIDEO SPECIALIST: We are back on the	14:42:40
3	record. The time is 14:42.	14:42:47
4	MS. MANDIR: Okay. Dr. Galton, I don't	14:42:52
5	have any more questions for you, so thank you.	14:42:54
6	THE WITNESS: Okay. Thank you.	14:42:58
7	MR. MAGEE: Sorry to do this, everyone.	14:43:00
8	Could I take just five minutes to check my notes	14:43:02
9	before doing redirect? It won't be long.	14:43:04
10	MS. MANDIR: Okay. Off the record?	14:43:06
11	MR. MAGEE: Yeah.	14:43:08
12	VIDEO SPECIALIST: We are going off the	14:43:09
13	record. The time is 14:43.	14:43:10
14	(A recess was taken.)	14:43:12
15	VIDEO SPECIALIST: And we're back on the	14:50:32
16	record. The time is 14:50.	14:50:39
17	EXAMINATION BY COUNSEL FOR PETITIONER	14:50:39
18	BY MR. MAGEE:	14:50:39
19	Q Good morning, Mr. Galton. I just have a	14:50:43
20	few quick questions.	14:50:45
21	I believe earlier you testified that you	14:50:47
22	discovered a mistake in your model of DeMaw such	14:50:51

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1	that it was not loading the specific JFET models	14:50:54
2	you were looking to use.	14:50:57
3	Is that correct?	14:50:58
4	A Yes.	14:50:59
5	Q When did you discover that mistake?	14:50:59
6	A Just a few days ago.	14:51:03
7	Q And I believe you said you resimulated it	14:51:06
8	to account for using the correct JFETs.	14:51:10
9	Is that correct?	14:51:13
10	A That is correct.	14:51:14
11	Q And when did you do that simulation?	14:51:14
12	A Day before yesterday. And the night	14:51:16
13	before that.	14:51:23
14	Q And I think you also mentioned that you	14:51:26
15	had simulated DeMaw with sine wave LO?	14:51:28
16	Is that correct?	14:51:33
17	A Yes.	14:51:35
18	Q When did you perform that simulation?	14:51:35
19	A I don't remember the exact date, but it	14:51:41
20	was after seeing the patent owner's preliminary	14:51:42
21	response. And it was just because they in that	14:51:47
22	response suggested that we were picking values,	14:51:50

1 cherry-picking values to get the results we

14:51:53

2 wanted. And I wanted -- I knew that wasn't true,

14:51:57

3 and I wanted to be able to say truthfully in the

14:51:59

4 depo that not only did I know that wasn't true,

14:52:02

5 but that we went back and simulated and found it

14:52:04

6 to not be true.

14:52:07

7 Q And I think you also testified that you

14:52:15

8 had simulated Macnally with a BFSK modulation as

14:52:18

9 well.

14:52:23

10 Do you remember that?

14:52:23

11 A Yes.

14:52:24

12 MS. MANDIR: Objection. Form.

14:52:25

13 Q When did you simulate the Macnally

14:52:26

14 circuit with an input wave using a BFSK

14:52:32

15 modulation?

14:52:37

16 A I don't remember the exact date, but

14:52:37

17 again, it was after receiving the patent owner's

14:52:39

18 preliminary response, and for the same reason as I

14:52:43

19 gave a minute ago.

14:52:47

20 Q And I think earlier you testified

14:52:48

21 regarding the impedance ratio of T4 in the DeMaw

14:52:54

22 simulation?

14:53:01

1	Do you remember that?	14:53:02
2	A I do.	14:53:02
3	Q Do you have any reason to believe that	14:53:03
4	you used an incorrect or different -- let me	14:53:05
5	strike that.	14:53:10
6	Is there any reason to believe that you	14:53:11
7	used an impedance ratio for T4 that differs from	14:53:12
8	what was disclosed in DeMaw?	14:53:16
9	A I have no reason to believe that.	14:53:19
10	Q If you did use an impedance ratio that	14:53:20
11	differs from what was disclosed in DeMaw, would	14:53:24
12	that change any of your conclusions?	14:53:26
13	A No.	14:53:29
14	Q Okay. Why not?	14:53:30
15	A Because it would only affect the	14:53:32
16	impedance looking out of that CLC network that we	14:53:37
17	have been talking about. And so it would have	14:53:42
18	very little effect on the charging and discharging	14:53:43
19	ratios of that first capacitor. It would have a	14:53:46
20	tiny effect, but -- but it would not change the	14:53:51
21	results significantly. Or meaningfully, I should	14:53:57
22	say.	14:54:02

Transcript of Ian Galton, Ph.D.
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1	Q	And when you're referring to "results,"	14:54:04
2		are you speaking about the histogram?	14:54:06
3	A	Yes.	14:54:10
4	Q	Would it qualitatively change the shape	14:54:10
5		of the histogram?	14:54:15
6		MS. MANDIR: Objection. Form.	14:54:17
7	A	It might change the shape slightly, but	14:54:19
8		it would be very marginal.	14:54:22
9	Q	Would you expect that the histogram would	14:54:25
10		still cover the same output ranges?	14:54:27
11	A	Absolutely.	14:54:31
12		MR. MAGEE: Okay. I don't have any other	14:54:35
13		further questions.	14:54:37
14		MS. MANDIR: Neither do I.	14:54:40
15		VIDEO SPECIALIST: If there is nothing	14:54:42
16		further, this concludes the deposition of Dr. Ian	14:54:43
17		Galton. The time is 14:54.	14:54:48
18		(Off the record at 2:54 p.m. EST.)	
19			
20			
21			
22			

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ACKNOWLEDGMENT OF DEPONENT

I, IAN GALTON, Ph.D., do hereby
acknowledge that I have read and examined the
foregoing testimony, and the same is a true,
correct and complete transcription of the
testimony given by me, and any corrections appear
on the attached Errata sheet signed by me.

(DATE)

(SIGNATURE)

C E R T I F I C A T E

I, Debra Ann Whitehead, E-Notary Public in and for
the Commonwealth of Virginia, do hereby certify:

That IAN GALTON, Ph.D., the witness whose
deposition is hereinbefore set forth, was duly sworn
by me before the commencement of such deposition and
that such deposition was taken virtually and is a
true record of the testimony given by such witness.

I further certify that the adverse party,
TEXAS INSTRUMENTS INCORPORATED, was represented by
counsel at the deposition.

I further certify that the deposition of
IAN GALTON, Ph.D., occurred virtually, on Friday,
February 28, 2025, from 12:04 p.m. to 2:24 p.m. EST.

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1 I further certify that I am not related to
2 any of the parties to this action by blood or
3 marriage, I am not employed by or an attorney to any
4 of the parties to this action, and that I am in no
5 way interested, financially or otherwise, in the
6 outcome of this matter.

7
8 IN WITNESS WHEREOF, I have hereunto set my
9 hand this 1st day of March, 2025.

10
11 My commission expires:
12 October 31, 2027

13 **Debra AnnWhitehead**
14 -----

15 E-NOTARY PUBLIC IN AND FOR THE
16 COMMONWEALTH OF VIRGINIA

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