

1 UNITED STATES PATENT AND TRADEMARK OFFICE

2
3 BEFORE THE PATENT TRIAL AND APPEAL BOARD

4 TEXAS INSTRUMENTS, INC.,
5 And NXP USA, INC.,
6 Petitioners,

7 V.

8 PARKERVISION, INC.,
9 Patent Owner,

10 IPR2024-00935
11 IPR2024-00936
12 Patent 7,865,177 B2

13 -----
14 ORAL AND VIDEOTAPED DEPOSITION OF

15 IAN GALTON, PH.D.

16 JULY 16, 2025

17 TAKEN VIA ZOOM VIDEOCONFERENCE
18 -----

19 JOB NO.: 592284

20 PAGES: 1 - 103
21 REPORTED STENOGRAPHICALLY BY:
22 ANNETTE PELTIER, CSR, CRR

1 ORAL AND VIDEOTAPED DEPOSITION OF DR. IAN
2 GALTON, produced as a witness at the instance of
3 the ParkerVision, Inc., and duly sworn, was
4 taken in the above-styled and numbered cause on
5 July 16, 2025, from 10:57 a.m. to 1:17 p.m.
6 Central Standard time, before Annette Peltier,
7 CSR, Texas Certified Realtime Reporter, in and
8 for the State of Texas, reported by machine
9 shorthand pursuant to the PTAB Rules of Civil
10 Procedure and the provisions stated on the
11 record or attached hereto.

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Transcript of Ian Galton, Ph.D.
Conducted on July 16, 2025

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ParkerVision Exhibit 2040

TI and NXP v. ParkerVision - IPR2024-00935

1 Exhibit 10 US Patent 7,065,327..... 91

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Transcript of Ian Galton, Ph.D.
Conducted on July 16, 2025

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1	THE COURT REPORTER: Do you want a	10:57:53
2	copy of today's deposition?	10:57:54
3	MR. MAGEE: Yes, we do.	10:57:56
4	THE COURT REPORTER: Okay. Do you	10:57:58
5	want realtime today?	10:58:06
6	MR. MAGEE: Yeah, that would be	10:58:07
7	great.	10:58:09
8	* * * * *	11:08:02
9	THE VIDEOGRAPHER: Here begins	11:08:02
10	Media Number 1 in the videotaped deposition of	11:08:13
11	Dr. Ian Galton, Ph.D., in the matter of Texas	11:08:17
12	Instruments Incorporated versus ParkerVision,	11:08:22
13	Inc., in the United States Patent and Trademark	11:08:23
14	Office, before the Patent Trial and Appeal Board	11:08:25
15	for IPR Number 2024-00935, and 2024-00936.	11:08:28
16	Today's date is July 16th, 2025,	11:08:37
17	and the time on the video monitor is 11:08 a.m.,	11:08:42
18	Central.	11:08:45
19	The remote videographer today is	11:08:45
20	Lucas Shaker, representing Planet Depos.	11:08:48
21	All parties of this video	11:08:50
22	deposition are attending remotely.	11:08:51

Transcript of Ian Galton, Ph.D.
Conducted on July 16, 2025

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1	Would counsel please	11:08:54
2	voice-identify themselves for the record and	11:08:54
3	state whom they represent, starting with the	11:08:54
4	taking attorney.	11:08:58
5	MR. CHARKOW: Jason Charkow, on	11:08:58
6	behalf of the Daignault Iyer firm, on behalf of	11:09:01
7	ParkerVision.	11:09:05
8	MR. MAGEE: Robert Magee of Blue	11:09:06
9	Peak Law Group on behalf of Texas Instruments.	11:09:10
10	Also attending today are Josh Griswold, Rishi	11:09:11
11	Gupta, Yao Wang, and Celia Lewis.	11:09:15
12	THE VIDEOGRAPHER: Thank you,	11:09:18
13	counsel.	11:09:19
14	The court reporter today is	11:09:19
15	Annette Peltier, representing Planet Depos.	11:09:21
16	The witness will now be sworn.	11:09:22
17	IAN GALTON, PH.D.,	11:09:25
18	Having been first duly sworn, testified upon his	11:09:25
19	oath as follows:	11:09:26
20	EXAMINATION	11:09:26
21	BY MR. CHARKOW:	11:09:27
22	Q. Can you please state your name for the	11:09:27

1	record?	11:09:41
2	A. Ian Galton.	11:09:41
3	Q. Okay. And is there any reason that you	11:09:44
4	can't give truthful and accurate testimony	11:09:45
5	sitting here today?	11:09:47
6	A. No.	11:09:48
7	Q. Okay. So are you aware that -- strike	11:09:49
8	that.	11:09:54
9	Do you know a Dr. James Dickens?	11:09:54
10	A. No.	11:09:58
11	Q. You never heard of him?	11:09:58
12	A. Not that I recall.	11:10:02
13	Q. All right. Are you aware that Dr. Dickens	11:10:03
14	provided an expert declaration in the 935 IPR?	11:10:06
15	A. The -- 935? No.	11:10:11
16	Q. Are you aware that anybody other than	11:10:16
17	yourself provided a declaration in the 935 IPR?	11:10:19
18	A. I'm sorry, the -- sorry to be confused.	11:10:23
19	What is the 935 IPR?	11:10:30
20	Q. It's the IPR in the '177 patent.	11:10:32
21	A. Oh, oh. Yeah, there was another expert,	11:10:35
22	because I didn't want to sign the protective	11:10:38

1 order. I -- I'm not -- I don't know him and --
2 and I -- I didn't even know what his name was,
3 or I didn't remember.

4 Q. Okay. So are you aware that another
5 expert provided an expert declaration in the IPR
6 related to the '528 patent?

7 A. I -- I assume he did, but I -- I was not
8 involved in any part of it, so -- so I don't
9 know much about it.

10 Q. Okay. And you didn't list -- strike that.

11 You didn't review Dr. Dickens'
12 declaration, correct?

13 A. No, never seen it.

14 Q. So you have no idea what it says, right?

15 A. That's correct.

16 Q. Okay. Are you aware that ParkerVision had
17 a chip known as "Eddie"?

18 MR. MAGEE: Objection to form.

19 A. No.

20 Q. (BY MR. CHARKOW) Okay. And do you -- did
21 you look at any documents related to
22 ParkerVision's Eddie chip?

1	A. No.	11:11:29
2	Q. Okay. And were you asked to look at	11:11:29
3	documents related to ParkerVision's conception	11:11:33
4	and reduction to practice of the claims of the	11:11:35
5	'177 patent?	11:11:39
6	A. No.	11:11:40
7	Q. Were you asked to look at documents	11:11:40
8	related to ParkerVision's conception and	11:11:43
9	reduction to practice of the claims of the '528	11:11:45
10	patent?	11:11:50
11	A. No.	11:11:50
12	Q. Okay. So if you could open up the '177	11:11:50
13	patent, please. That would have been in the	11:11:57
14	chat. That's going to be Exhibit 1 to your	11:11:59
15	deposition, and is Exhibit 1001 in the IPR.	11:12:01
16	A. It's open.	11:12:06
17	Q. Great.	11:12:06
18	(Whereupon Exhibit Number 1 was	11:12:07
19	marked for identification.)	11:12:09
20	Q. (BY MR. CHARKOW) And if you could turn to	11:12:09
21	figure 83E, which is on PDF Page 118.	11:12:10
22	A. Hold on. 83E, you say?	11:12:16

1	Q. 83E. Correct.	11:12:31
2	A. Okay.	11:12:32
3	Q. On Page 118, PDF.	11:12:32
4	A. I'm there.	11:12:37
5	Q. All right. So 83E, you've seen that	11:12:37
6	diagram before, right?	11:12:42
7	A. Yeah.	11:12:45
8	Q. Okay. And your understanding, that that's	11:12:45
9	showing the charging and discharging of the	11:12:48
10	capacitor in ParkerVision's receiver technology?	11:12:53
11	A. Probably.	11:12:56
12	I mean, I'd have to go back and	11:12:57
13	refresh my memory of -- of what the text that	11:12:59
14	points to it says. I can do that if you want.	11:13:02
15	Q. Yeah.	11:13:04
16	There's a -- I -- fortunately, I made	11:13:04
17	it searchable; so if you put "83E," you may be	11:13:06
18	able to find it pretty quickly.	11:13:10
19	A. Okay. And I'm just wondering, what figure	11:13:42
20	does it refer to? What -- what embodiment, do	11:13:45
21	you know?	11:13:48
22	Q. I -- I don't know.	11:13:48

1	A. Because without that, I'm not going to be	11:13:53
2	able to comment to --	11:13:55
3	Q. Well, it refers to the -- it's in the	11:14:00
4	energy transfer embodiment section.	11:14:02
5	A. Okay. Yeah.	11:14:07
6	Oh, well, why don't you ask your	11:14:08
7	question; and if I have to figure out what	11:14:10
8	figure it -- it refers to, I'll -- I'll ask for	11:14:12
9	a pause to do that.	11:14:16
10	Q. Well, let me ask you this: 83E shows	11:14:18
11	charging and discharging.	11:14:21
12	Do you see that?	11:14:23
13	A. I do.	11:14:23
14	Q. Right. And charging and dis- --	11:14:24
15	MR. MAGEE: Object to form.	11:14:26
16	Q. (BY MR. CHARKOW) -- charging -- strike	11:14:27
17	that.	11:14:28
18	Charging and discharging indicates the	11:14:28
19	presence of a load, correct?	11:14:30
20	MR. MAGEE: Objection to form.	11:14:33
21	A. We'd have to look at a particular	11:14:35
22	embodiment, but generally, yes.	11:14:37

1	Q. (BY MR. CHARKOW) Okay. And -- all right.	11:14:39
2	So you could put that -- oh, let's look at the	11:14:44
3	'528 patent. So that would be Exhibit 2 to your	11:14:50
4	deposition.	11:14:52
5	(Whereupon Exhibit Number 2 was	11:14:52
6	marked for identification.)	11:14:53
7	A. Okay. I'm there.	11:14:53
8	Q. (BY MR. CHARKOW) And let's see. So	11:14:53
9	Exhibit 2 to your deposition is the '528 patent,	11:14:59
10	and that's also Exhibit 1001 but for the 936	11:15:02
11	IPR.	11:15:07
12	You have that in front of you?	11:15:07
13	A. I do.	11:15:10
14	Q. Okay. And if you could turn to PDF	11:15:10
15	Page 105, also figure 83E.	11:15:15
16	A. Hold on. Yes, I'm there.	11:15:19
17	Q. Okay. And that's the same 83E that you	11:15:31
18	saw in the '177 patent, correct?	11:15:35
19	A. Yeah. It looks very similar, yes.	11:15:37
20	Q. Okay. All right. You could put those	11:15:39
21	aside.	11:15:44
22	A. Okay.	11:15:46

1	Q. All right. So let me give you another	11:15:46
2	exhibit.	11:15:52
3	(Whereupon Exhibit Number 3 was	11:15:53
4	marked for identification.)	11:15:53
5	Q. (BY MR. CHARKOW) And let me know when you	11:16:08
6	have that open.	11:16:09
7	A. It's downloading, one second.	11:16:10
8	Q. Okay.	11:16:12
9	A. Okay. It's open.	11:16:14
10	Q. Okay. So Exhibit 3 to your deposition is	11:16:14
11	Petitioner's Reply to Patent Owner's Response.	11:16:18
12	Do you see that?	11:16:24
13	A. I do.	11:16:24
14	Q. All right. And if you could go to Page 38	11:16:25
15	of the document -- 38, like, on the bottom of	11:16:27
16	the page of the document.	11:16:29
17	A. Okay, hold on. Okay.	11:16:32
18	Q. And you could see that diagram came from a	11:16:41
19	book. Well, you had it in your declaration, but	11:16:43
20	it -- also from a book called Sedra Smith.	11:16:46
21	You're aware of that, right?	11:16:48
22	A. I am.	11:16:49

1	Q. Okay. And on Page 38 of the -- of	11:16:50
2	Exhibit 3, we see a figure 2.4.	11:16:53
3	Do you see that?	11:16:57
4	A. I do.	11:16:57
5	Q. All right. And that figure 2.4 is from	11:16:58
6	the Sedra Smith textbook, correct?	11:17:00
7	A. Yes.	11:17:04
8	Q. All right. And in figure 2.4 of Sedra,	11:17:04
9	the plus terminal of the Op-amp circuit is	11:17:08
10	connected to ground, correct?	11:17:12
11	A. Yes.	11:17:14
12	Q. Okay. I'm going to give you another	11:17:14
13	exhibit.	11:17:16
14	(Whereupon Exhibit Number 4 was	11:17:17
15	marked for identification.)	11:17:31
16	Q. (BY MR. CHARKOW) You should have another	11:17:31
17	exhibit. Let me know when you have that.	11:17:32
18	A. It's downloading. Okay. I have it.	11:17:33
19	Q. Okay. And so figure 4 is in the IPR as	11:17:39
20	Exhibit 1004. And you've seen this. This is	11:17:45
21	the Tayloe patent, correct?	11:17:47
22	A. Figure 4 -- you're talking about the	11:17:50

1	document?	11:17:52
2	Q. Exhibit -- exhibit -- sorry, strike that.	11:17:52
3	Let me do this again.	11:17:55
4	Exhibit 4 is the Tayloe patent. Do	11:17:56
5	you see that, yes? Okay.	11:18:00
6	MR. CHARKOW: Sorry, the audio	11:18:03
7	didn't come in for that. I don't know if any --	11:18:04
8	was that just me? He said "yes"?	11:18:05
9	MR. MAGEE: I didn't get it	11:18:08
10	either.	11:18:09
11	A. Yes.	11:18:09
12	Q. (BY MR. CHARKOW) Okay. All right. And	11:18:10
13	Exhibit 4 to your deposition is Exhibit 1004 in	11:18:17
14	the IPR.	11:18:21
15	You've seen Tayloe before, correct?	11:18:26
16	A. Yes.	11:18:28
17	Q. Okay. Can you go to Figure 3, please?	11:18:28
18	A. Yeah. Give me one second to rotate it.	11:18:35
19	Q. Sure.	11:18:37
20	A. Yes, I'm there.	11:18:39
21	Q. Okay. And Figure 3 of Tayloe shows an	11:18:40
22	op-amp circuit's -- well, shows two op-amp	11:18:44

1	circuits, which Tayloe refers to as summing --	11:18:48
2	amplifiers as 50 and 52, correct?	11:18:51
3	A. Yes.	11:18:53
4	Q. Okay. And neither of those op-amp	11:18:54
5	circuits the -- the positive terminal are	11:18:56
6	connected -- well, strike that.	11:18:58
7	In Figure 3 of Tayloe, the positive	11:18:59
8	terminal of the op-amp circuits are not	11:19:01
9	connected to ground, correct?	11:19:05
10	A. That is correct; but from a analysis point	11:19:06
11	of view, as long as that voltage is held	11:19:09
12	constant, it's equivalent to being connected to	11:19:13
13	ground, as far as the -- the impedance goes and	11:19:16
14	as far as the -- the small signal behavior of	11:19:18
15	the circuit goes.	11:19:25
16	THE COURT REPORTER: I'm sorry, as far	11:19:25
17	as the impedance goes, and as far as what?	11:19:25
18	THE WITNESS: The small signal	11:19:25
19	behavior of the circuit goes.	11:19:25
20	THE COURT REPORTER: Thank you.	11:19:28
21	Q. (BY MR. CHARKOW) Okay. There is a --	11:19:28
22	there are times where there is a signal that is	11:19:31

1	being received at the positive terminal of the	11:19:34
2	op-amp circuit, correct?	11:19:38
3	MR. MAGEE: Objection, form.	11:19:39
4	A. That is correct. Sorry, that is correct.	11:19:41
5	But at those times, the top inputs to 50 and 52,	11:19:43
6	are held constant.	11:19:48
7	Q. (BY MR. CHARKOW) Okay.	11:19:50
8	A. Actually, could I just amend that?	11:19:58
9	It's not held constant, but -- but	11:20:00
10	it's not connected to the input signal is what I	11:20:02
11	meant to say.	11:20:07
12	Q. All right. You've heard of the term	11:20:08
13	"conventional current," correct?	11:20:13
14	A. Yes.	11:20:14
15	Q. Okay. And conventional current is taught	11:20:15
16	in engineering classes throughout this country	11:20:18
17	and throughout the world, right?	11:20:20
18	A. Yes.	11:20:21
19	Q. Okay. And conventional current is a	11:20:22
20	concept that is discussed in a -- in the	11:20:24
21	electronics industry, correct?	11:20:26
22	A. Yes.	11:20:27

1	Q. And with regards to conventional current,	11:20:28
2	current flows from positive to negative,	11:20:32
3	correct?	11:20:35
4	A. Yes.	11:20:35
5	Q. With regards to conventional current,	11:20:36
6	charge flows from a higher potential to a lower	11:20:38
7	potential, correct?	11:20:40
8	A. No.	11:20:42
9	Q. For a conventional current -- let me ask	11:20:46
10	the question again -- strike that.	11:20:52
11	With regards to conventional current,	11:20:53
12	if we're talking about conventional current,	11:20:55
13	charge flows from a higher potential to a lower	11:20:59
14	potential, correct?	11:21:01
15	A. No.	11:21:02
16	Q. In circuits, "I" -- the letter I, capital	11:21:02
17	I, stands for current, correct?	11:21:10
18	A. Often, yes.	11:21:12
19	Q. Okay. And "I" refers to conventional	11:21:13
20	current, correct?	11:21:17
21	A. It -- it often --	11:21:19
22	MR. MAGEE: Objection to form.	11:21:20

1	A. Sorry. It often does.	11:21:21
2	Q. (BY MR. CHARKOW) In a circuit diagram, if	11:21:23
3	you see the symbol "I" with an arrow, the arrow	11:21:27
4	is pointing to the direction of conventional	11:21:30
5	current flow, correct?	11:21:33
6	A. No.	11:21:34
7	MR. MAGEE: Objection to form.	11:21:35
8	Q. (BY MR. CHARKOW) If you see an "I" with	11:21:37
9	an arrow, what -- what is it -- what's the arrow	11:21:38
10	pointing to?	11:21:40
11	A. The arrow points in the opposite direction	11:21:41
12	of electron flow when "I" is positive, and it	11:21:45
13	flows in the direction -- it points in the	11:21:49
14	direction of electron flow when "I" is negative.	11:21:51
15	Q. Okay. So does the -- you're talking in	11:21:56
16	the concept of electrons, and I'm not asking	11:22:17
17	about electrons. I'm asking about conventional	11:22:20
18	current -- strike that.	11:22:23
19	In a circuit diagram, if you see the	11:22:24
20	symbol "I" with an arrow, the arrow is pointing	11:22:28
21	to the direction of conventional current flow.	11:22:31
22	Is that a correct or incorrect	11:22:34

1	statement?	11:22:36
2	A. It's incorrect.	11:22:36
3	MR. MAGEE: Objection to form.	11:22:37
4	Q. (BY MR. CHARKOW) It's never -- so the	11:22:38
5	arrow is never pointing in the direction of	11:22:39
6	conventional current flow?	11:22:42
7	A. It depends whether "I" is positive or	11:22:43
8	negative.	11:22:45
9	If it's positive, then conventional	11:22:46
10	current flows in the direction of the arrow. If	11:22:49
11	it's negative, it flows in the other direction.	11:22:53
12	Q. Okay. In a circuit diagram, if you see	11:22:55
13	the symbol "I" with an arrow and -- strike that.	11:23:03
14	Okay. In a circuit diagram, if you	11:23:13
15	see the symbol "I" and it's positive and that	11:23:20
16	"I" has an arrow, the arrow is pointing to the	11:23:22
17	direction of conventional current flow, correct?	11:23:26
18	A. Yes.	11:23:28
19	Q. Okay. You're familiar with Ohm's Law,	11:23:28
20	correct?	11:23:33
21	A. Yes.	11:23:33
22	Q. And Ohm's Law is a fundamental principle	11:23:34

1	of circuit analysis, correct?	11:23:36
2	A. Yes.	11:23:38
3	Q. Okay. Current I through a conductor	11:23:38
4	between two points is -- well, strike that.	11:23:42
5	Ohm's Law states that current I	11:23:45
6	through a conductor between two points is	11:23:47
7	directly proportional to the voltage across the	11:23:49
8	two points, correct?	11:23:52
9	MR. MAGEE: Objection to form.	11:23:55
10	A. Well, define what you mean by a	11:23:56
11	"conductor."	11:23:58
12	Q. (BY MR. CHARKOW) Anything that conducts.	11:23:59
13	A. So if it's a conductance with resistance,	11:24:03
14	then the current flow is proportional to the	11:24:05
15	voltage difference across what you're calling a	11:24:11
16	conductor divided by the resistance.	11:24:13
17	Q. Okay. The formula for Ohm's Law is	11:24:17
18	voltage V equals current I times resistance R ,	11:24:20
19	correct?	11:24:24
20	A. Yes.	11:24:24
21	Q. Okay. And the current I through a	11:24:25
22	conductor which has resistance between two	11:24:28

1	points is directly proportional to the voltage	11:24:32
2	across the two points, correct?	11:24:35
3	A. Yes.	11:24:36
4	Q. Okay. You're familiar with also -- strike	11:24:37
5	that.	11:24:40
6	You're also familiar with Kirchoff's	11:24:40
7	Current Law, correct?	11:24:44
8	A. Yes.	11:24:45
9	Q. Okay. And Kirchoff's Current Law states	11:24:45
10	that the sum of currents entering a node equals	11:24:48
11	the sum of currents leaving it, correct?	11:24:53
12	A. Yes.	11:24:55
13	Q. And the formula -- strike that.	11:24:55
14	The formula for power is voltage V	11:24:59
15	times current I, correct?	11:25:03
16	A. So voltage -- we have to put some	11:25:06
17	qualifiers in there.	11:25:10
18	So if you have a component that you're	11:25:10
19	putting current through, then the power	11:25:13
20	dissipated by that -- or -- or sorry, the power	11:25:18
21	going through that component is the voltage	11:25:25
22	across it times the current through it.	11:25:29

1	Q. All right. So -- so power is equal to	11:25:33
2	voltage times current, V times I, correct?	11:25:37
3	A. With the qualifier --	11:25:39
4	MR. MAGEE: Objection to form.	11:25:41
5	A. -- I said.	11:25:41
6	Q. (BY MR. CHARKOW) Okay. Power is energy	11:25:43
7	per unit time, correct?	11:25:46
8	A. Yes.	11:25:48
9	Q. Okay. And power is the rate of energy	11:25:48
10	transfer, correct?	11:25:51
11	A. Well, not really. I mean, what -- what	11:25:53
12	are you -- you have to define "energy transfer."	11:25:58
13	I mean, that's not a standard term.	11:26:01
14	Q. Well, you have no concept of the word	11:26:02
15	"energy transfer" in your work for decades in	11:26:06
16	the field of electronics?	11:26:08
17	A. I'm just saying, if you -- if you want	11:26:09
18	to -- I mean, you're making a general statement.	11:26:11
19	An energy transfer can mean different things,	11:26:14
20	so -- so ask me a specific question, I'll give	11:26:16
21	you a specific answer.	11:26:19
22	Q. However you understand energy transfer --	11:26:20

1	strike that.	11:26:23
2	Power is the rate of energy transfer.	11:26:24
3	Is that correct or incorrect in any way you	11:26:26
4	understand energy transfer?	11:26:30
5	A. I can't answer --	11:26:31
6	MR. MAGEE: Objection to form.	
7	THE COURT REPORTER: Okay, guys,	
8	hold on, hold on.	
9	(Reporter clarification about	
10	talking over one another.)	
11	THE COURT REPORTER: There was an	
12	objection to the last question, but I didn't get	
13	the objection or the answer.	
14	MR. CHARKOW: My apologies.	11:26:47
15	MR. MAGEE: It was just objection	11:26:47
16	to form.	11:26:48
17	THE COURT REPORTER: And,	11:26:48
18	Dr. Galton, if you want to answer that question,	11:26:48
19	I didn't get it.	11:26:53
20	A. Yeah, so "energy transfer" doesn't have a	11:26:53
21	specific meaning in our field. So if you define	11:26:57
22	for me what you mean by "energy transfer," I	11:27:00

1	will -- I will answer "yes" or "no" to your	11:27:03
2	question.	11:27:04
3	Q. (BY MR. CHARKOW) Okay. What is your	11:27:04
4	understanding of the various ways energy	11:27:05
5	transfer is used in your field?	11:27:08
6	A. Well, you can have energy transfer from --	11:27:10
7	you know, through radiation; you can have energy	11:27:15
8	transfer through electromagnetics; you can have	11:27:19
9	energy transfer through heat, and -- and -- and	11:27:23
10	then as far as the energy that is transferred,	11:27:27
11	some of that energy may be dissipated in the	11:27:31
12	point of origin and some may be received in the	11:27:36
13	point of reception.	11:27:39
14	So it's -- it's just a vague question.	11:27:40
15	I -- I don't have an answer for you.	11:27:41
16	Q. Okay. With regards to electromagnetic	11:27:42
17	signals, power is -- power is the rate of energy	11:27:46
18	transfer, correct?	11:27:48
19	MR. MAGEE: Objection to form.	11:27:49
20	A. No, that's not correct.	11:27:52
21	Q. (BY MR. CHARKOW) Okay. With regards	11:27:53
22	to -- so why is that not correct?	11:27:57

1 A. For the same reason I've -- I've just been 11:27:59
2 saying, I -- I -- even -- you need to define 11:28:01
3 what you mean by "energy transfer." 11:28:03

4 An electromagnetic signal is just -- 11:28:04
5 is -- is just a -- a signal that carries energy 11:28:07
6 with it, but it doesn't necessarily transfer 11:28:16
7 energy from one point to another, so I -- I just 11:28:20
8 don't have an answer for you. 11:28:23

9 Q. Okay. Do you have -- is there any energy 11:28:24
10 transfer that you're aware of where power is -- 11:28:29
11 is the rate of energy transfer? 11:28:34

12 A. Well, it comes down to -- define "energy 11:28:43
13 transfer," and I'll -- I'll give you an answer, 11:28:46
14 but without that, I can't -- I just don't have 11:28:48
15 an answer for you. 11:28:52

16 Q. Sir, I'm asking you to -- any -- anything 11:28:53
17 I could ask in the world about energy transfer, 11:28:55
18 energy -- I'm asking you for energy -- any 11:28:57
19 energy transfer that you could think of, any 11:28:59
20 one. 11:28:59

21 Power is the rate of energy transfer. 11:29:02
22 Can you -- can you identify one case where 11:29:05

1 energy transfer power is the rate of energy
2 transfer?

11:29:07

11:29:09

3 A. Okay. So if we have a -- a battery and we
4 put a -- and we put a resistor across it, then
5 the amount of energy dissipated per unit time by
6 the resistor is power.

11:29:10

11:29:14

11:29:21

11:29:28

7 Q. Okay. And in the context of an RF signal
8 that's coming into a receiver of a wireless
9 chip, power is a rate of energy transferred from
10 that RF signal, correct?

11:29:47

11:29:52

11:30:00

11:30:07

11 A. Transferred --

11:30:10

12 MR. MAGEE: Objection, form.

11:30:10

13 A. Sorry. I --

11:30:10

14 THE WITNESS: Annette, I'll do my
15 best to -- to take a breath, sorry.

11:30:13

11:30:14

16 A. Do you want to say it again, Robert?

11:30:18

17 MR. MAGEE: I said "objection,
18 form." She has it.

11:30:20

11:30:22

19 A. Okay. So transferred to what?

11:30:22

20 So, for example, you could have an LNA
21 and then there would be a certain amount of
22 energy transferred to the LNA, but then that LNA

11:30:28

11:30:34

11:30:36

1 would have its own energy that gets transferred 11:30:39
2 somewhere else. 11:30:42

3 So again, you have to define -- you 11:30:42
4 have to define what's doing the -- what's 11:30:44
5 providing the energy and what's receiving the 11:30:46
6 energy for this to be a question that I can 11:30:49
7 answer definitively. 11:30:51

8 Q. (BY MR. CHARKOW) In the context of an RF 11:30:53
9 signal that's coming into a receiver of a 11:30:55
10 wireless chip, in particular an RF signal that's 11:30:57
11 going to a capacitor, power is a rate of energy 11:31:02
12 transferred from the RF signal, correct? 11:31:07

13 MR. MAGEE: Objection to form. 11:31:10

14 A. Okay. So the -- so the -- the RF signal 11:31:12
15 is -- is what you're considering to be the 11:31:20
16 supplier of the energy or -- or power, and the 11:31:21
17 capacitor is what you're considering to be the 11:31:25
18 receiver of the power; is that correct? 11:31:29

19 Q. (BY MR. CHARKOW) Yes. 11:31:31

20 A. And what's in between the RF signal and 11:31:32
21 the capacitor? 11:31:35

22 Q. A switch. 11:31:36

1 A. Okay. Well, that switch will have a 11:31:38
2 certain amount of resistance, so it will 11:31:40
3 dissipate some of the power also. It will -- it 11:31:42
4 will -- so some of the power gets transferred to 11:31:44
5 heating up the switch and some of it goes 11:31:47
6 into -- goes into the capacitor. 11:31:51

7 But most receivers have a low noise 11:31:52
8 amplifier, and so the -- the signal received 11:31:56
9 into the chip actually, you know, will get -- 11:31:59
10 will get transferred to the LNA, and the LNA 11:32:03
11 will transfer its own energy to the capacitor. 11:32:06

12 So again, there's just -- it's -- it's 11:32:08
13 the problem you and I always run into, you're 11:32:10
14 asking me these -- these questions that are -- 11:32:13
15 that are just not completely pinned down, so 11:32:14
16 it's hard to give you a definitive answer. 11:32:17

17 Q. Okay. I just want to understand so I get 11:32:20
18 this clear. 11:32:24

19 You understand in textbooks and -- and 11:32:25
20 pretty standard in the industry, power is -- 11:32:28
21 power is considered the rate at which energy is 11:32:31
22 transferred, period, or converted per unit of 11:32:34

1	time.	11:32:38
2	MR. MAGEE: Objection to form.	11:32:39
3	Q. (BY MR. CHARKOW) You don't teach that in	11:32:40
4	your classes, you haven't seen that in any books	11:32:41
5	that you've ever read in your whole career,	11:32:44
6	you're not aware of that?	11:32:46
7	A. You've asked me this question before, and	11:32:47
8	the problem with it is that energy transfer is	11:32:49
9	ambiguous.	11:32:52
10	So -- so I've given -- you asked me	11:32:53
11	for an example, and I gave you one; and in that	11:32:53
12	case, the answer is yes, but there are other	11:32:57
13	cases where the answer is no. Energy transfer	11:32:59
14	is not a standard term in my field. It can mean	11:33:01
15	a lot of different things.	11:33:04
16	Q. Okay. So if I say power is the rate at	11:33:06
17	which energy is transferred, so I'm not saying	11:33:08
18	energy transfer, I'm saying -- so let me strike	11:33:11
19	that. Let me say it again.	11:33:14
20	Power is the rate at which energy is	11:33:16
21	transferred. Is that a correct statement?	11:33:18
22	A. No, for the same reason.	11:33:20

1	Q. So you're saying, in your field, you've	11:33:24
2	never heard, never read a book, ever in your	11:33:26
3	whole career, in decades you've been in this	11:33:28
4	field, that power is the rate at which energy is	11:33:31
5	transferred? Is that your testimony?	11:33:34
6	A. No, that's not my testimony.	11:33:34
7	MR. MAGEE: Objection to form.	11:33:36
8	Q. (BY MR. CHARKOW) Okay. So then -- then	11:33:37
9	you have -- okay. Strike that.	11:33:38
10	Have you ever read in any textbook	11:33:40
11	anywhere in your whole career that power is the	11:33:42
12	rate at which energy is transferred, yes or no?	11:33:45
13	MR. MAGEE: Objection to form.	11:33:49
14	A. The question is ambiguous, and you have to	11:33:50
15	tell me what's -- what's providing the energy,	11:33:53
16	what's -- what it's being transferred through,	11:33:55
17	and what's receiving the energy. So the answer	11:33:58
18	is, it depends.	11:34:00
19	Q. (BY MR. CHARKOW) Okay. You don't	11:34:01
20	understand that to be a fundamental tenet of,	11:34:03
21	like, electrical engineering, that power is the	11:34:05
22	rate at which energy is transferred? You don't	11:34:07

1	recognize that as a thing, right?	11:34:10
2	A. It depends on the context, so -- so the --	11:34:13
3	the answer is sometimes the answer is yes, but	11:34:18
4	-- but sometimes the answer is no. You have	11:34:21
5	to -- you know, you have to -- power is -- is	11:34:22
6	delivered to a component; and if you're talking	11:34:29
7	about the transfer of power to that component,	11:34:32
8	then the power dissipated or stored by that	11:34:35
9	component -- component is in the form of energy	11:34:43
10	per unit time; but when you start saying --	11:34:47
11	well, you know, the way you worded it, it's just	11:34:50
12	ambiguous.	11:34:52
13	Q. Okay. So if the source of the power is an	11:34:52
14	RF signal and the receiver of power is a	11:34:56
15	capacitor and then power -- in a RF receiver	11:35:01
16	chip, power is the rate at which energy is	11:35:05
17	transferred, correct or incorrect?	11:35:08
18	A. Power of what? Because, as I said before,	11:35:11
19	you asked me this question before, and my answer	11:35:14
20	was, in this case, we have to, first of all,	11:35:16
21	assume that the RF signal is connected to the	11:35:19
22	capacitor through a switch.	11:35:24

1 And some of -- some of the power 11:35:26
2 transferred by the RF signal gets dissipated in 11:35:31
3 the switch, and some of it ends up getting 11:35:37
4 stored on the capacitor. 11:35:39

5 Q. Okay. And then if the capacitor is the 11:35:40
6 source of the power and the receiver is a load 11:35:44
7 after a capacitor in an RF chip, power is the 11:35:49
8 rate at which energy is transferred, correct? 11:35:53

9 MR. MAGEE: Objection to form. 11:35:56

10 A. My same answer is, is that it -- it 11:35:57
11 depends on -- on other factors. 11:36:00

12 So, for example, if there's a switch, 11:36:03
13 some of that -- some of that power will get 11:36:05
14 dissipated by the switch and -- but the -- to 11:36:07
15 the extent that no power gets dissipated by the 11:36:10
16 switch, whatever power gets transferred to 11:36:14
17 whatever the load is, then that power is the 11:36:16
18 rate of change of energy. 11:36:22

19 Q. (BY MR. CHARKOW) Right. From the 11:36:25
20 capacitor? 11:36:27

21 A. Under those circumstances, yes. 11:36:28

22 Q. Okay. When calculating power in a 11:36:29

1	circuit, the current used is conventional	11:36:34
2	current, correct, "I"?	11:36:37
3	A. Not necessarily.	11:36:38
4	MR. MAGEE: Objection to form.	11:36:39
5	Q. (BY MR. CHARKOW) Okay.	11:36:41
6	A. I mean, most often that is the case, but	11:36:42
7	it's -- it -- not necessarily.	11:36:45
8	Q. Okay. When one applies Ohm's Law in	11:36:47
9	circuit analysis, the current "I" refers to	11:36:52
10	conventional current, correct?	11:36:54
11	MR. MAGEE: Objection to form.	11:36:55
12	A. You -- I mean, usually that's the case,	11:36:58
13	but it doesn't need to be.	11:37:01
14	Q. (BY MR. CHARKOW) Okay. You would tell	11:37:03
15	your colleagues that?	11:37:05
16	A. Yeah.	11:37:06
17	Q. I -- yeah? Okay.	11:37:06
18	When one applies Kirchhoff's Current	11:37:08
19	Law in circuit analysis, the current is	11:37:12
20	understood to mean conventional current,	11:37:12
21	correct, the "I"?	11:37:15
22	A. Generally, but -- but it doesn't matter.	11:37:18

1	It's just a sign difference.	11:37:20
2	And so in Kirchhoff's Current Law --	11:37:21
3	Kirchhoff's Current Law, you -- you just have to	11:37:24
4	make sure that whatever current goes in, the	11:37:27
5	same amount of current goes out, and whether	11:37:29
6	it's -- whether you consider the current to be	11:37:31
7	positive or negative, it doesn't matter.	11:37:33
8	Q. Okay. Textbooks in the field talk about	11:37:35
9	conventional current, correct?	11:37:39
10	A. Usually, but -- but with a caveat; and	11:37:41
11	that caveat is what I wrote in my declaration --	11:37:44
12	namely that conventional current is based on a	11:37:48
13	mistake that Benjamin Franklin made. He guessed	11:37:51
14	the direction of current flow, and he got it	11:37:56
15	wrong.	11:37:58
16	Q. Sure.	11:37:58
17	A. And so historically we used that, but	11:37:58
18	it's -- it's -- it's just a sign difference.	11:38:00
19	MR. CHARKOW: So strike as	11:38:03
20	nonresponsive.	11:38:03
21	Q. (BY MR. CHARKOW) Just please listen to	11:38:04
22	the question and answer the question asked, and	11:38:04

1	stop trying to pepper the record with	11:38:06
2	information that I'm not asking. Okay? Strike	11:38:06
3	that.	11:38:09
4	MR. CHARKOW: Strike -- strike	11:38:11
5	your previous answer as nonresponsive.	11:38:11
6	Q. (BY MR. CHARKOW) I just need a "yes" or	11:38:14
7	"no" question [sic]. It's a very simple	11:38:15
8	question.	11:38:17
9	Textbooks in the field talk about	11:38:17
10	conventional current, yes or no?	11:38:19
11	MR. MAGEE: Objection to form,	11:38:22
12	asked and answered.	11:38:23
13	A. They talk about both conventional current	11:38:24
14	and electron current.	11:38:26
15	Q. (BY MR. CHARKOW) Okay. You know who	11:38:28
16	Dr. Razavi is, correct?	11:38:33
17	A. I do.	11:38:34
18	Q. And Dr. Razavi is the author of a prior	11:38:35
19	art reference that you relied on, correct?	11:38:37
20	A. Yes.	11:38:39
21	Q. Okay. And he's a well-known professor of	11:38:39
22	electrical engineering, correct?	11:38:43

1	A. Yes.	11:38:44
2	Q. And you're aware that Dr. Razavi wrote	11:38:44
3	textbooks that is used to teach electronic --	11:38:50
4	electrical engineering classes, correct?	11:38:53
5	A. Yes.	11:38:54
6	Q. And have you --	11:38:54
7	MR. MAGEE: Objection, form.	11:38:56
8	Q. (BY MR. CHARKOW) Have you used any of his	11:38:57
9	books in your teachings?	11:38:58
10	A. Yes.	11:39:01
11	Q. Okay. Which book have you used?	11:39:01
12	A. I don't remember because it -- the last	11:39:05
13	time I used it was probably 20 years ago, but it	11:39:07
14	was -- it was when it -- I don't remember the	11:39:10
15	exact title, but it was his book, one of his	11:39:12
16	books on CMOS, circuit -- integrated circuit	11:39:14
17	design.	11:39:18
18	Q. Okay. Do you remember if it was called	11:39:18
19	the "Fundamentals of Microelectronics"?	11:39:20
20	A. It might have been. I just don't	11:39:24
21	remember.	11:39:24
22	Like I said, it was, like, 20 years	11:39:26

1	ago.	11:39:27
2	These days, in my -- in my courses, I	11:39:27
3	don't -- I don't use textbooks.	11:39:29
4	Q. Okay. I -- I just dropped another exhibit	11:39:30
5	into the chat.	11:39:34
6	(Whereupon Exhibit Number 5 was	11:39:36
7	marked for identification.)	11:39:38
8	Q. (BY MR. CHARKOW) Exhibit 5 to your	11:39:38
9	deposition is an excerpt from the Razavi	11:39:39
10	textbook.	11:39:52
11	A. Okay. Got it.	11:39:52
12	Q. Got that open? All right.	11:39:52
13	If you go down to the PDF Page 3,	11:39:53
14	there's a section called "Large-Signal Model."	11:39:56
15	Do you see that?	11:39:58
16	A. Hold on, just -- structure -- you're --	11:40:02
17	oh, yeah, I see it.	11:40:05
18	Q. Okay. And you could look through that.	11:40:06
19	And you see Dr. Razavi's discussion of	11:40:08
20	conventional current flows?	11:40:10
21	A. I do.	11:40:12
22	Q. Okay. So you understand that Dr. Razavi	11:40:12

1	teaches conventional current in his textbooks,	11:40:17
2	correct?	11:40:19
3	A. I do.	11:40:19
4	MR. MAGEE: Objection to form.	11:40:20
5	A. Sorry, I do, but notice that he explicitly	11:40:21
6	mentions "conventional" because he's aware --	11:40:26
7	and as is a POSITA -- that conventional current	11:40:29
8	is the negative of -- of electron current.	11:40:32
9	Q. Okay. And you know what's in Dr. Razavi's	11:40:35
10	head and you know why he wrote what he wrote? I	11:40:38
11	just want to -- I just want to understand.	11:40:41
12	You know why Dr. Razavi did what he	11:40:41
13	did? You talked to him?	11:40:45
14	A. Well, actually, I -- he's a good friend.	11:40:46
15	I know him well, but apart from that --	11:40:49
16	Q. You talked about this?	11:40:51
17	A. I'm sorry?	11:40:51
18	Q. You talked about this?	11:40:52
19	So you said, Hey, in this section, you	11:40:52
20	talked about conventional current and you put	11:40:55
21	"conventional" in brackets; and the reason why	11:40:57
22	you put parentheses and the reason why you put	11:40:59

1	it there is because of "X." You guys had that	11:41:02
2	discussion?	11:41:05
3	A. If you let me talk, I'll answer the	11:41:05
4	question.	11:41:05
5	No, we did not have that discussion;	11:41:07
6	but there would be no other reason to put	11:41:09
7	"conventional" in parentheses if -- if Behzad	11:41:11
8	Razavi thought that conventional current was the	11:41:16
9	only type of current and that -- and that he'd	11:41:19
10	never heard of electron current, so it just	11:41:21
11	stands to reason.	11:41:23
12	Q. Okay. And how many picofarads are	11:41:24
13	typical -- are typical capacitors in an IC --	11:41:30
14	strike that.	11:41:30
15	How many picofarads are used for a	11:41:31
16	typical capacitor in an integrated circuit?	11:41:34
17	A. It can range -- it can range from a few	11:41:37
18	femtofarads up to hundreds of picofarads.	11:41:42
19	Q. Okay. A .3 microfarad capacitor is too	11:41:45
20	large for feasible integration into an	11:41:51
21	integrated circuit, correct?	11:41:55
22	A. Yes.	11:41:56

1	MR. MAGEE: Objection, form.	11:41:56
2	Q. (BY MR. CHARKOW) Okay. And one way to	11:41:57
3	reduce capacitor size is to increase the	11:41:58
4	circuit's operating frequency, correct?	11:42:01
5	A. One way to reduce capacitor size is to --	11:42:06
6	I -- that -- that question -- I mean, we'd have	11:42:10
7	to look at specific circuits. That's not	11:42:15
8	generally necessary -- that's not necessarily	11:42:17
9	true.	11:42:18
10	Q. Well, I'm just saying one way.	11:42:19
11	So if you have a capacitor and an	11:42:22
12	integrated circuit, one way to reduce the	11:42:24
13	capacitor size into -- is to increase the	11:42:26
14	circuit's operating frequency, correct?	11:42:28
15	A. The question just doesn't make sense.	11:42:30
16	I mean, one way to reduce its size --	11:42:32
17	what does the circuit do, and -- and what --	11:42:35
18	where is the capacitor being used? I mean,	11:42:39
19	there's just not enough information in that	11:42:41
20	question for me to answer it definitively.	11:42:43
21	Q. Okay. In a filter of a RF chip that has a	11:42:45
22	capacitor, one way to reduce that capacitor size	11:42:49

1	is to increase the circuit's operating	11:42:53
2	frequency, correct?	11:42:55
3	A. Can you define "operating frequency"? I	11:42:58
4	mean, what are -- are we talking about clock	11:43:01
5	rate? Are we talking about bandwidth? Are we	11:43:02
6	talking about the -- the center frequency of the	11:43:06
7	signal?	11:43:09
8	Q. Bandwidth.	11:43:10
9	A. I'm sorry?	11:43:11
10	Q. Bandwidth.	11:43:11
11	A. So if you want to -- okay. So if you're	11:43:13
12	building a low-pass analog filter, then	11:43:19
13	generally you need smaller capacitors if you	11:43:23
14	want to widen the bandwidth.	11:43:26
15	Q. So one way to reduce the capacitor size in	11:43:29
16	the case where a capacitor is used in an RF	11:43:33
17	filter is to increase the circuit's operating	11:43:37
18	frequency, to increase the baseband, correct?	11:43:39
19	A. You're kind of saying it backwards.	11:43:42
20	I mean, in the -- in the sense that	11:43:44
21	usually you have a -- a certain bandwidth of a	11:43:46
22	signal that you're trying to receive in the case	11:43:50

1 of a wireless receiver and -- and depending on 11:43:52
2 the bandwidth that you're trying to create a 11:43:55
3 low-pass -- depending on the bandwidth of the 11:44:01
4 signal, your low-pass filter bandwidth will be 11:44:05
5 larger or smaller; and the larger the bandwidth 11:44:09
6 is, generally the smaller your capacitors can 11:44:11
7 be. 11:44:11

8 But it's not like you choose -- you 11:44:14
9 have -- you're -- it's not like, for instance, 11:44:16
10 you're building a bluetooth receiver and you're 11:44:18
11 like, oh, my capacitors are too big, let me 11:44:21
12 increase the bandwidth of the bluetooth signal; 11:44:25
13 it just doesn't work that way. 11:44:28

14 Q. Okay. If you decrease the -- the baseband 11:44:29
15 signal in an RF chip, you can reduce the 11:44:34
16 capacitor size where that capacitor is used in a 11:44:39
17 filter, correct? 11:44:42

18 A. When you say "reduce the baseband signal," 11:44:43
19 what do you mean by that? Reduce its amplitude, 11:44:47
20 reduce its bandwidth, what? 11:44:50

21 Q. Its bandwidth. 11:44:52

22 A. Okay. So now, can you ask me the question 11:44:53

1	again so that I -- I can hear the whole thing	11:44:56
2	again?	11:45:00
3	Q. If you reduce the bandwidth of a baseband	11:45:00
4	signal in an RF chip, can you reduce the	11:45:05
5	capacitor size where the capacitor is used in a	11:45:08
6	filter?	11:45:11
7	A. So if the -- if the filter you're talking	11:45:11
8	about is the channel select filter, then the	11:45:14
9	answer is yes, typically. I mean, it's not	11:45:18
10	always the case, but usually the answer to --	11:45:22
11	would be yes.	11:45:24
12	Q. If you reduce -- strike that.	11:45:26
13	All right. Providing capacitors	11:45:38
14	off-chip rather than on-chip increases	11:45:47
15	an integrated circuit's -- well, strike that.	11:45:50
16	Providing capacitors off-chip rather	11:45:51
17	than on-chip increases a chip size, correct?	11:45:54
18	A. No.	11:45:56
19	Q. Okay.	11:45:57
20	A. It actually decreases the chip size.	11:45:58
21	Q. Okay. Let me ask it a different way.	11:46:01
22	Strike that.	11:46:06

1	Providing capacitors off-chip rather	11:46:07
2	than on-chip increases the size of the -- strike	11:46:10
3	that.	11:46:17
4	Providing capacitors off-chip rather	11:46:17
5	than on-chip increases the size of the -- well,	11:46:29
6	strike that.	11:46:34
7	Okay. A chip design that requires	11:46:43
8	large off-chip capacitors is -- is incompatible	11:46:45
9	with a single-chip IC implementation, correct?	11:46:49
10	MR. MAGEE: Objection to form.	11:46:54
11	A. No, because all -- all chips that we --	11:46:57
12	and even chips that we would call single chip	11:47:03
13	implementations have off-chip capacitors, at the	11:47:07
14	very least for decoupling the power supplies;	11:47:10
15	and these capacitors are tiny anyway.	11:47:13
16	So even when you call it a single-chip	11:47:16
17	solution, the -- you know, you will have	11:47:18
18	capacitors off-chip, in general.	11:47:21
19	Q. (BY MR. CHARKOW) Okay. A chip design	11:47:22
20	that requires large off-chip capacitors is	11:47:24
21	incompatible with a single-chip IC	11:47:28
22	implementation, correct?	11:47:31

1	MR. MAGEE: Objection, form.	11:47:32
2	A. Not necessarily --	11:47:32
3	THE WITNESS: I'm sorry, go ahead,	11:47:34
4	Bobby.	11:47:35
5	MR. MAGEE: Objection to form.	11:47:37
6	That's fine.	11:47:38
7	A. So when you're talking about large, I	11:47:39
8	assume you're meaning large value. The physical	11:47:42
9	size of these things are usually pretty small.	11:47:44
10	So -- and -- and decoupling capacitors	11:47:47
11	are generally large-valued, as well. So -- so	11:47:52
12	if you have a -- an off-chip capacitor other	11:47:55
13	than the decoupling capacitors, you know, it --	11:48:00
14	it -- it's definitely an off-chip component, but	11:48:04
15	it doesn't necessarily have -- have a	11:48:06
16	significant impact on size.	11:48:08
17	For instance, sometimes you put those	11:48:09
18	capacitors and they're absolutely tiny; they're	11:48:11
19	like almost like -- like specks of sand. You	11:48:15
20	can put them on the bottom of the board so it	11:48:17
21	doesn't actually increase the board real estate.	11:48:20
22	So it -- we wouldn't necessarily call a chip	11:48:23

1	a -- we -- let me -- let me back that up.	11:48:27
2	We wouldn't necessarily say a chip is	11:48:30
3	not a single-chip solution just because it has	11:48:34
4	off-chip capacitors because, like I said, they	11:48:39
5	always do.	11:48:41
6	Q. (BY MR. CHARKOW) All right. A chip	11:48:41
7	design that requires large off-chip capacitors	11:48:43
8	that are part of a filter is incompatible with a	11:48:46
9	single-chip IC implementation, correct?	11:48:52
10	A. No.	11:48:54
11	Q. So a single-chip IC, the fact that you	11:48:55
12	have fundamental components that are located	11:48:59
13	off-chip, you still say that's a single-chip IC?	11:49:01
14	That's your position?	11:49:05
15	A. Yeah, because there are always off-chip	11:49:05
16	components.	11:49:08
17	MR. MAGEE: Objection -- hang on,	11:49:08
18	sorry.	11:49:10
19	Objection to form.	11:49:10
20	Go ahead.	11:49:11
21	A. There are always off-chip components.	11:49:12
22	For example, you have a crystal	11:49:14

1	oscillator that's off-chip. You -- you -- and	11:49:16
2	like I said, you have decoupling capacitors that	11:49:20
3	are generally large value. Those are off-chip,	11:49:24
4	too, and -- and so the term "single-chip	11:49:26
5	solution" does not preclude having some	11:49:31
6	supporting passives off-chip.	11:49:34
7	Q. (BY MR. CHARKOW) Okay. Putting in	11:49:38
8	another exhibit.	11:49:55
9	A. I haven't received anything.	11:50:10
10	MR. MAGEE: Nor have I.	11:50:13
11	MR. CHARKOW: Okay.	11:50:15
12	Q. (BY MR. CHARKOW) You should have it now.	11:50:23
13	A. Okay. I've got it.	11:50:25
14	Q. Exhibit 6 to your deposition is the	11:50:26
15	petition for IPR 2024-00936. Let me know when	11:50:29
16	you have that open.	11:50:34
17	A. Got it.	11:50:35
18	(Whereupon Exhibit Number 6 was	11:50:37
19	marked for identification.)	11:50:38
20	Q. (BY MR. CHARKOW) Okay. You've seen this	11:50:38
21	petition before, right?	11:50:42
22	A. Yes.	11:50:45

1	Q. Okay. Can you turn to Page 28 of the	11:50:45
2	petition? So let's see. Yeah, actual -- actual	11:50:49
3	Page 28, meaning 28 on the bottom of the page.	11:50:55
4	A. Okay. Hold on. All right. I'm there.	11:51:02
5	Q. Okay. Do you see the first line? It	11:51:07
6	says, "A POSITA would have been motivated to	11:51:10
7	adapt Tayloe's system as a single-chip (i.e.,	11:51:12
8	integrated circuit known as IC.)"	11:51:17
9	You see that?	11:51:19
10	A. Yes.	11:51:19
11	Q. What is meant by "single-chip"?	11:51:20
12	A. Well, okay. So first of all, this isn't	11:51:24
13	my document, but I -- I assume that what it --	11:51:31
14	what it -- what it means is to put, you know,	11:51:36
15	the essential functionality of Tayloe's system	11:51:39
16	on a single IC.	11:51:43
17	Q. Okay.	11:51:46
18	A. But -- but a person in my field would	11:51:47
19	understand that even though they might say it	11:51:49
20	this way, there are definitely going to be	11:51:52
21	off-chip components. There are going to be --	11:51:56
22	there's going to be a crystal oscillator,	11:51:57

1 there's going to be decoupling capacitors, and 11:52:00
2 then in the case of Tayloe's system, it's for a 11:52:03
3 ham radio application, And so there's -- there's 11:52:08
4 going to be usually an external amplifier to 11:52:10
5 drive speakers. 11:52:14

6 And so the -- this single-chip is -- 11:52:15
7 is sort of a -- a -- not a precise term, but -- 11:52:18
8 but it's -- it's -- what it's intended to convey 11:52:25
9 is that the -- the functionality of Tayloe's 11:52:29
10 system is primarily implemented on a 11:52:34
11 single-chip. 11:52:37

12 Q. What's the essential functionality that 11:52:37
13 would be implemented on a single-chip in Tayloe? 11:52:39

14 A. Well, the -- the components -- I mean, 11:52:42
15 the -- the commutator -- I mean, the -- you -- 11:52:47
16 what you're probably getting at is is if we 11:52:50
17 implement Tayloe's system exactly, the 11:52:54
18 capacitors will have to be big, large value, 11:52:57
19 not -- not big size, and they'll have to be 11:52:59
20 off-chip. 11:53:02

21 So there's some -- you know, that -- 11:53:03
22 that's a component that would have to be 11:53:05

1	off-chip.	11:53:07
2	But like I said, the crystal	11:53:07
3	oscillator would have to be off-chip, and that	11:53:10
4	-- that's essential, too, in the sense that	11:53:12
5	Tayloe's system won't work without a clock.	11:53:14
6	And then we have to provide clean	11:53:17
7	power supplies to it, so we need off-chip	11:53:19
8	coupling capacitors; and Tayloe's system won't	11:53:22
9	work without those.	11:53:25
10	So -- so the point is that -- that --	11:53:26
11	this is sort of a sloppy way to -- to say it,	11:53:28
12	but the bottom line is, aside from passives,	11:53:32
13	such as a crystal and such as capacitors, the --	11:53:36
14	you don't need additional chips to implement,	11:53:41
15	for example, Figure 3 of Tayloe.	11:53:44
16	Q. So you mentioned essential functionality,	11:53:46
17	and I want to understand the components that	11:53:49
18	you -- in Tayloe that you believe are essential	11:53:51
19	functionality. That's your language that you	11:53:53
20	used.	11:53:56
21	A. Yeah.	11:53:56
22	Q. So what's the essential functionality that	11:53:56

1	you stated that would be implemented on a	11:53:59
2	single-chip in Tayloe?	11:54:01
3	A. All transistors required to implement	11:54:02
4	Tayloe's system.	11:54:06
5	Q. That's it? Just transistors?	11:54:07
6	A. And resistors.	11:54:09
7	Q. So just transistors and resistors, that's	11:54:12
8	it?	11:54:15
9	A. Yeah, And any passives that are small	11:54:15
10	enough to fit on the chip, but -- but not	11:54:18
11	necessarily all of them.	11:54:19
12	The -- the -- point is by single-chip,	11:54:20
13	the intent is to mean that you don't need	11:54:22
14	multiple chips to do it.	11:54:25
15	Q. I get it. I'm just trying to understand	11:54:26
16	the -- the -- the limits of what you're saying,	11:54:30
17	so -- strike that.	11:54:31
18	The essential functionality that you	11:54:32
19	state that would be implemented on a single-chip	11:54:37
20	for Tayloe would be transistors, the resistors,	11:54:40
21	and any passives that are small enough to fit on	11:54:45
22	the chip?	11:54:50

1	A. Yes.	11:54:51
2	And to add to that, the -- the --	11:54:52
3	where the definition in this context of a	11:54:56
4	single-chip would fail is if you needed multiple	11:54:59
5	chips. So the -- so the point is that you're	11:55:03
6	going to build a board that has one chip on it	11:55:05
7	and a bunch of supporting passives.	11:55:08
8	Q. Okay. What -- when you say "passives,"	11:55:11
9	what do you mean?	11:55:13
10	A. Things that don't contain transistors.	11:55:14
11	Q. Like what?	11:55:16
12	A. Like capacitors, like a crystal, yeah.	11:55:18
13	Q. Anything else?	11:55:24
14	A. A resistor is a passive. Any -- anything	11:55:25
15	that -- that does not have a power supply or	11:55:28
16	does not -- well, any -- any -- it's -- it's	11:55:31
17	essentially anything that doesn't contain	11:55:34
18	transistors.	11:55:38
19	Q. So anything that's not a trans- -- so	11:55:38
20	basically the only thing that you say is a	11:55:41
21	fundamental essential component that needs to be	11:55:43
22	in a single-chip for Tayloe are transistors	11:55:46

1 because everything else -- you say anything

11:55:48

2 without a transistor can be off the chip.

11:55:50

3 A. It can be, but -- but it would be silly to

11:55:54

4 put things off-chip if -- if you can

11:55:57

5 conveniently put them on-chip. So it just --

11:56:00

6 Q. Okay.

11:56:00

7 A. -- depends.

11:56:02

8 But the bottom line is, by

11:56:02

9 "single-chip" in this context, it means that

11:56:04

10 when you build the final system on a -- on a

11:56:06

11 circuit board, there's one chip.

11:56:09

12 Q. Okay.

11:56:10

13 A. And there may or may not be other

11:56:11

14 passives, but in general, there will be

11:56:13

15 passives.

11:56:16

16 Q. Okay. So I want you to look at Tayloe on

11:56:17

17 Figure 3 and tell me the components that are

11:56:19

18 shown in Figure 3 that are fundamental,

11:56:21

19 essential components that needs to be on a

11:56:25

20 single-chip for Tayloe.

11:56:27

21 A. Hold on.

11:56:29

22 MR. MAGEE: Objection, form.

11:56:30

1 A. Okay. Figure 3.

11:56:32

2 So if you're going to implement all of
3 Figure 3, the bios network will generally be on
4 the chip, the commutator will be on the chip,
5 the components within the amplifiers 50 and 52
6 will be on-chip, the 90-degrees phase delay may
7 or may not be on a chip. It just depends how
8 that's implemented, and the details aren't
9 presented in Tayloe; and the amplifier 60 would
10 typically be on the chip.

11:56:33

11:56:37

11:56:43

11:56:48

11:56:55

11:56:58

11:57:02

11:57:04

11:57:08

11 Q. (BY MR. CHARKOW) What about the
12 capacitors?

11:57:11

11:57:13

13 A. The capacitors, if -- if they're small
14 enough, would be implemented on-chip. If
15 they're implemented off-chip, what -- what we
16 would often do is implement a portion of those
17 capacitors on-chip and then -- and then have the
18 rest of the capacitance be off-chip and
19 connected in parallel.

11:57:15

11:57:19

11:57:22

11:57:25

11:57:28

11:57:32

11:57:36

20 Q. You're aware that Tayloe's experimental
21 results describe using a 0.3 microfarad
22 capacitor, correct?

11:57:36

11:57:40

11:57:45

1	A. Yes.	11:57:46
2	Q. Okay. And based on Tayloe's disclosure, a	11:57:46
3	0.3 microfarad capacitor would be provided	11:57:50
4	off-chip, correct?	11:57:54
5	A. Most of it would be, yes.	11:57:54
6	Q. Well, do you -- have you cited anything	11:57:56
7	anywhere in any of the documents that you've	11:57:59
8	provided in this case that show that you would	11:58:01
9	split the capacitor between on and off-chip for	11:58:03
10	Tayloe?	11:58:06
11	A. No, because it wasn't -- wasn't relevant,	11:58:07
12	but I'm just telling you that's what I would do.	11:58:10
13	Q. But you have no support, no documentation	11:58:13
14	to show that that would be done or could be	11:58:15
15	done; that's just your unsupported view, right?	11:58:18
16	MR. MAGEE: Objection to form.	11:58:21
17	A. Well, it's my view as a chip designer and	11:58:22
18	it's my view as having -- having done things	11:58:24
19	like that, the -- the problem with -- with going	11:58:27
20	just off to a chip, off to a large capacitor	11:58:30
21	through a bond wire without any kind of	11:58:33
22	capacitance on-chip is you -- you -- you create	11:58:37

1 an opportunity for ringing to occur, so it -- so 11:58:40
2 it would -- wouldn't be a particularly good 11:58:43
3 design practice. 11:58:45

4 So I'm just telling you based on my 11:58:47
5 knowledge of the field; but it wasn't relevant 11:58:48
6 to what I wrote, so I didn't bother to include 11:58:50
7 any references. 11:58:52

8 Q. (BY MR. CHARKOW) Okay. 11:58:53

9 Combining Tayloe with Macnally does 11:58:54
10 not eliminate or reduce Tayloe's capacitor 11:58:59
11 requirements, correct? 11:59:03

12 A. That is correct. 11:59:04

13 Q. So if you combine Tayloe and Macnally, the 11:59:05
14 capacitors still have to be, certainly, 11:59:10
15 off-chip, correct? 11:59:13

16 A. To a large extent, yes. 11:59:15

17 Q. Okay. The '177 patent describes that when 11:59:17
18 a switch is closed, the capacitor after the 11:59:22
19 switch charges and current flows into the 11:59:24
20 capacitor, correct? 11:59:27

21 A. It's a 477-page patent. I mean, in -- in 11:59:30
22 general terms, yes, but it -- but it -- there 11:59:34

1 are probably embodiments for which that isn't 11:59:36
2 quite true. 11:59:39

3 If we -- if you want, we can look at 11:59:40
4 specific embodiments. 11:59:41

5 Q. The '177 patent describes that when a 11:59:42
6 switch is open, the capacitor after the switch 11:59:45
7 discharges and current flows out of the 11:59:47
8 capacitor, correct? 11:59:50

9 MR. MAGEE: Objection to form. 11:59:51

10 A. Not necessarily. 11:59:52

11 Q. (BY MR. CHARKOW) But it does disclose 11:59:54
12 that, right, the '177 patent? 11:59:55

13 A. There -- it disclosed it as an optional 11:59:57
14 feature. It doesn't disclose it as a 12:00:01
15 requirement. 12:00:02

16 Q. Okay. So -- but it does describe it, 12:00:02
17 correct? 12:00:05

18 A. As an optional -- 12:00:05

19 MR. MAGEE: Objection to form. 12:00:07

20 A. It describes it as an option. 12:00:08

21 Q. (BY MR. CHARKOW) Okay. The '528 patent 12:00:10
22 describes that when a switch is closed, the 12:00:12

1 capacitor after the switch charges and current 12:00:15
2 flows into the capacitor, correct? 12:00:17

3 A. It -- it -- yes, I mean, it -- it -- it -- 12:00:21
4 that won't always be the case because -- because 12:00:25
5 sometimes when -- when the -- you know, when the 12:00:31
6 input signal increases, conventional current 12:00:33
7 flows into the capacitor; and when the -- when 12:00:37
8 the RF signal decreases, conventional current 12:00:41
9 flows out. 12:00:43

10 But, in general, there will be roughly 12:00:44
11 50 percent of the time that what you're saying 12:00:47
12 is true. 12:00:49

13 Q. Okay. So the '528 patent -- I'm just 12:00:49
14 asking if it describes -- whether or not it's on 12:00:53
15 an embodiment, I'm just saying it describes; so 12:00:55
16 that's what I'm saying -- strike that. 12:00:58

17 The '528 patent describes that when a 12:00:59
18 switch is open, the capacitor after the switch 12:01:01
19 discharges and current flows out of the 12:01:03
20 capacitor, correct? 12:01:06

21 A. It does mention -- 12:01:06

22 MR. MAGEE: Objection to form. 12:01:07

1	A. Sorry. It does mention that, but for the	12:01:08
2	same reasons I just described, it can flow the	12:01:11
3	other way too, but, yes.	12:01:13
4	Q. (BY MR. CHARKOW) Okay. And -- and you	12:01:14
5	understand that conventional current is the	12:01:18
6	current -- well, strike that.	12:01:20
7	You mentioned conventional current now	12:01:22
8	when you were talking about charging and	12:01:24
9	discharging.	12:01:26
10	Do you recall that?	12:01:27
11	A. Yeah. I did it because you liked that, so	12:01:27
12	I was trying to make you happy.	12:01:29
13	Q. Okay. Great.	12:01:31
14	So with regards to conventional --	12:01:32
15	well, strike that.	12:01:35
16	So the ParkerVision patents refer to	12:01:36
17	conventional current. You know, when you're	12:01:40
18	talking about charging and discharging, it's	12:01:43
19	talking about conventional current or it's	12:01:45
20	discussing conventional current, correct?	12:01:47
21	A. We'd have to look at --	12:01:49
22	MR. MAGEE: Objection to form.	12:01:50

1	A. We'd have to look at specific cases, but	12:01:51
2	that's probably true.	12:01:53
3	Q. (BY MR. CHARKOW) Okay. In saturation, an	12:01:55
4	NMOS transistor conducts current from drain to	12:02:02
5	source, correct?	12:02:05
6	A. In --	12:02:08
7	MR. MAGEE: Objection to form.	12:02:08
8	A. In saturation, a -- an NMOS transistor	12:02:09
9	conducts current -- conventional current from	12:02:15
10	drain to source, yes.	12:02:18
11	Q. (BY MR. CHARKOW) Okay. So let's go to	12:02:19
12	another -- oh, you know what? Let's take a	12:02:21
13	break. It's been an hour. Take a break, quick	12:02:24
14	break.	12:02:27
15	THE VIDEOGRAPHER: Stand by.	12:02:28
16	We're going off the record. The time is	12:02:30
17	12:02 p.m.	12:02:33
18	(Break taken from 12:02 p.m. to	12:02:34
19	12:15 p.m.)	12:15:12
20	(Whereupon Exhibit Number 7 was	12:15:16
21	marked for identification.)	12:15:18
22	THE VIDEOGRAPHER: And we are back	12:15:18

1	on the record. The time is 12:15 p.m.	12:15:25
2	Q. (BY MR. CHARKOW) During the break, did	12:15:27
3	you talk to any attorneys?	12:15:29
4	A. Nope.	12:15:30
5	Q. Okay. So I've just dropped another	12:15:31
6	exhibit into the chat. If you could just take a	12:15:34
7	look at it when you have that -- strike that.	12:15:37
8	You've been provided with Exhibit 7 to	12:15:39
9	your deposition, which is the Razavi reference,	12:15:41
10	which is Exhibit 1017 in the IPRs.	12:15:44
11	A. Hold on. Okay. I got it.	12:15:47
12	Q. All right. And you've seen this reference	12:15:52
13	before, right?	12:15:55
14	A. Yes.	12:15:56
15	Q. Okay. And if you could turn to Figure 2,	12:15:56
16	which has the LNA/mixer implementation.	12:15:59
17	A. Yes, I've got it.	12:16:02
18	Q. Okay. M5 and M6 are NMOS transistors,	12:16:03
19	correct?	12:16:09
20	A. Correct.	12:16:09
21	Q. Okay. And for that matter, in the	12:16:09
22	baseband amplifier circuit, M1 and M2 are also	12:16:15

1	NMOS transistors, correct? Figure 5.	12:16:19
2	A. Yes.	12:16:22
3	Q. And let's just -- let me -- let me just do	12:16:22
4	it all while we're here, sorry. Going back to	12:16:28
5	Figure 2 -- sorry, yeah, so back to Figure 2	12:16:31
6	of -- strike that.	12:16:36
7	Back in figure -- strike that.	12:16:37
8	In Figure 2 of the Razavi reference,	12:16:39
9	all of the transistors, M1, 2, 3, 4, M5, M6, M7,	12:16:46
10	M8, those are all NMOS transistors, correct?	12:16:54
11	A. Yes.	12:16:58
12	Q. And in the Figure 5, the baseband	12:16:59
13	amplifier of Razavi, M1, M2, M3, M4 are all NMOS	12:17:02
14	transistors, correct?	12:17:08
15	A. No.	12:17:08
16	Q. M3 and 4 are not NMOS transistors?	12:17:12
17	A. They are not.	12:17:29
18	Q. What type of transistors are they?	12:17:30
19	A. PMOS.	12:17:33
20	Q. Sorry, CMOS?	12:17:35
21	A. PMOS, P as in Peter.	12:17:37
22	Q. PMOS, okay. Oh, I see.	12:17:39

1	Okay. You can put that aside.	12:17:53
2	I'm providing you with another exhibit	12:17:59
3	to your deposition.	12:18:01
4	(Whereupon Exhibit Number 8 was	12:18:03
5	marked for identification.)	12:18:03
6	Q. (BY MR. CHARKOW) Strike that.	12:18:10
7	You're provided with Exhibit 8 to your	12:18:13
8	deposition. This is a -- a paper by Abidi.	12:18:15
9	Do you have that in front of you?	12:18:20
10	A. I do.	12:18:21
11	Q. All right. And this is Exhibit TI-1059 or	12:18:22
12	Exhibit 1059 to the IPR.	12:18:29
13	You've seen that before, correct?	12:18:31
14	A. Yes.	12:18:33
15	Q. Okay. And you read this whole document	12:18:33
16	before you provided your declaration, correct?	12:18:37
17	A. Yeah, but it was quite a while ago, but	12:18:41
18	yes.	12:18:44
19	Q. Okay. So let's go to Page 1. The first	12:18:44
20	page, which is Page 18 of the -- which is	12:18:49
21	labeled as Page 18 in the left-hand corner,	12:18:52
22	okay?	12:18:55

1	A. Uh-huh. Yes.	12:18:56
2	Q. All right. So there is a discussion --	12:18:56
3	starting on the left-hand side, there's a	12:18:59
4	section titled "ICs in Broadcast Radio	12:19:02
5	Receivers."	12:19:07
6	Do you see that?	12:19:07
7	A. I do.	12:19:08
8	Q. Okay. And in there -- in that section,	12:19:09
9	there is a -- a discussion of on-chip	12:19:12
10	components.	12:19:15
11	Do you see that?	12:19:16
12	So look to the second column on the	12:19:16
13	first page. You'll see discussions of on-chip	12:19:19
14	components. You could -- feel free to read that	12:19:23
15	section if you would like.	12:19:26
16	A. Hold on.	12:19:30
17	Which -- the second paragraph, you	12:19:31
18	said, or the first?	12:19:32
19	Q. Sorry, it's the -- strike that.	12:19:33
20	So Exhibit 8, Page 1, on the	12:19:35
21	right-hand column in the section entitled "ICs	12:19:39
22	in Broadcast Radio Receivers," there is a	12:19:43

1	discussion of on-chip components.	12:19:46
2	Do you see that?	12:19:48
3	A. Hold on. Yes, I do.	12:19:51
4	Q. Okay. So you see there -- it says, "In	12:19:55
5	designing a low-power, miniature FM receiver,"	12:20:01
6	and then there's a person, "Kasperkovitz at	12:20:06
7	Philips realized that there are many advantages	12:20:12
8	in eliminating the RF and IF filters and	12:20:14
9	implementing the required selectivity on-chip."	12:20:17
10	Do you see that?	12:20:21
11	A. I do.	12:20:21
12	Q. Okay. And then the next sentence says,	12:20:21
13	"As it was impossible to integrate the RF	12:20:27
14	filters on-chip with spiral monolithic inductors	12:20:30
15	or to replace the 10.7 megahertz IF crystal	12:20:35
16	filters with active gyrator filters, the key	12:20:41
17	step in solving this problem was to lower the IF	12:20:45
18	from 10.7 megahertz to 70 kilohertz."	12:20:47
19	Do you see that?	12:20:51
20	A. I do.	12:20:51
21	Q. Okay. So this section about ICs and	12:20:52
22	broadcast radio receivers has discussion about	12:20:58

1	on-chip components, right? And you saw that?	12:21:00
2	A. Yes.	12:21:02
3	Q. Okay. And then -- and it's saying that --	12:21:02
4	well, strike that.	12:21:10
5	And then if you keep reading down, the	12:21:11
6	next sentence says, "Aside from a small off-chip	12:21:16
7	inductor which provides a minimum of RF	12:21:19
8	filtering, the channel bandwidth is mainly	12:21:24
9	defined on-chip by high-order active RC	12:21:27
10	filters."	12:21:31
11	Do you see that?	12:21:31
12	A. I do.	12:21:31
13	Q. Okay. So that's another instance of a	12:21:32
14	discussion on-chip, correct?	12:21:35
15	A. Yes.	12:21:37
16	Q. Okay. Then if you keep reading a few --	12:21:37
17	several lines down -- so it's maybe like seven,	12:21:43
18	eight lines down. It starts with "This	12:21:48
19	single-chip FM mono receiver."	12:21:50
20	Do you see that?	12:21:52
21	A. Yes.	12:21:53
22	Q. Okay. So Abidi, in Exhibit 8 on Page 1,	12:21:54

1 which is -- on the first page of the document,
2 it says, "This single-chip FM mono receiver
3 requires only 15 small capacitors and 2
4 inductors, making it possible to fit the entire
5 system within a wristwatch."

6 Do you see that?

7 A. I do.

8 Q. Okay. And then the 15 small capacitors
9 and the 2 inductors are referring to on-chip
10 components, correct?

11 A. Hold on a second.

12 Q. Sure.

13 A. Honestly, I'm not sure. I'd have to look
14 at the reference.

15 Q. Okay. So -- so you don't know if the --
16 it specifically says the only thing that's
17 off-chip is this one inductor, and then it talks
18 about 15 small capacitors and 2 inductors; and
19 you think that could be anything other than
20 on-chip?

21 A. Well, what you're saying is probably true,
22 but -- but the thing is that, like I told you

1 before, there are always other off-chip 12:23:28
2 components, like a crystal and like bypass 12:23:31
3 capacitors; and so it's kind of sloppy wording 12:23:35
4 in the sense that he's -- he's -- he's talking 12:23:37
5 specifically about some components and neither 12:23:43
6 others. 12:23:46

7 So I think you are probably right, but 12:23:46
8 I'm not sure, but -- but as an -- as an 12:23:49
9 additional point, this is an example of what I 12:23:52
10 was saying before; this is what he's calling a 12:23:54
11 single-chip component, and it has at least -- 12:23:57
12 one component is shown here, off-chip, and maybe 12:24:01
13 -- maybe others, as well. I don't know. 12:24:05

14 But -- but for sure it's going to have 12:24:07
15 a crystal off-chip, and it's going to have 12:24:08
16 decoupling capacitors off-chip, so -- so I'm not 12:24:10
17 exactly sure. I'd have to look at the 12:24:14
18 reference. I can do it. I can look it up right 12:24:16
19 now and tell you, if you want. 12:24:18

20 Q. No, thank you. I don't think it's in the 12:24:20
21 record, so we're not going to do that. 12:24:22

22 The section -- so this section on ICs 12:24:24

1 in broadcast radio receivers relates to using 12:24:33
2 on-chip components to make a chip smaller, 12:24:35
3 correct? 12:24:38

4 MR. MAGEE: Objection, form. 12:24:38

5 Q. (BY MR. CHARKOW) Generally? 12:24:39

6 A. No. 12:24:40

7 When you use on-chip components, it 12:24:40
8 usually doesn't make the chip smaller. What it 12:24:43
9 usually does is it allows you to avoid having 12:24:45
10 expensive off-chip components. 12:24:49

11 So, for example, even -- even 12:24:53
12 nowadays, when you buy a cell phone, it's got a 12:24:55
13 bunch of off-chip components but it has way 12:24:57
14 fewer off-chip components than it had in the 12:25:00
15 past because they've managed to replace some of 12:25:03
16 those off-chip components with on-chip 12:25:07
17 components. 12:25:11

18 And -- and the advantage to doing that 12:25:11
19 is often cost because -- because some types 12:25:12
20 of -- of filters, such as SAW filters, are very 12:25:15
21 expensive; and part of it is -- is just bill of 12:25:19
22 materials, so -- but it rarely makes the chips 12:25:22

1	smaller. It usually actually makes them bigger.	12:25:25
2	Q. Okay. Sir, are we reading the same thing?	12:25:27
3	It says, "This single-chip FM mono receiver,"	12:25:30
4	that's the one that's described above, "Requires	12:25:33
5	only 15 small capacitors and 2 inductors, making	12:25:36
6	it possible to fit the entire system within a	12:25:39
7	wristwatch," meaning making it smaller.	12:25:40
8	Am I missing -- I mean, that's -- if	12:25:42
9	you don't think that this section talks about	12:25:44
10	using on-chip components to make things smaller,	12:25:46
11	that's fine, you could say that. It --	12:25:49
12	A. You asked -- you asked me a specific	12:25:53
13	question, and now you want a general answer.	12:25:54
14	The specific question was does -- does moving	12:25:57
15	components on-chip make the chip smaller? And	12:26:03
16	my answer was, generally that's not the case.	12:26:05
17	It can sometimes be the case, but more often	12:26:07
18	than not, it's not --	12:26:09
19	Q. I said in the context of this section. I	12:26:10
20	didn't say generally.	12:26:13
21	A. Okay. So -- so ask me the question then,	12:26:13
22	again.	12:26:16

1	Q. In the context of the section of Abidi	12:26:16
2	that talks about ICs in broadcast radio	12:26:18
3	receivers, the discussion here is -- talks about	12:26:21
4	using on-chip components to make chips smaller,	12:26:25
5	correct?	12:26:28
6	A. It does.	12:26:31
7	Q. Okay.	12:26:32
8	A. But I mean, it -- it -- it does, but -- I	12:26:35
9	mean, it's a little vague in the sense that we	12:26:41
10	have to compare it to something specifically.	12:26:42
11	So first of all, I -- I don't recall	12:26:44
12	whether those 15 small capacitors and 2	12:26:47
13	inductors are off-chip or on-chip. I -- I --	12:26:50
14	they may be off-chip, but I'm just not sure.	12:26:53
15	And so I just don't have the	12:26:55
16	information at my fingertips with which to	12:26:57
17	answer your question.	12:27:01
18	Q. I just need to understand.	12:27:01
19	You took -- you took a position -- you	12:27:02
20	took a position in this case, and I just need	12:27:03
21	the board to understand whether your position is	12:27:05
22	either A or B. It's two -- it's -- there's no	12:27:07

1 in between. It's -- it's -- either you have a 12:27:09
2 position A or position B. So let's -- I would 12:27:11
3 like the board to understand that. 12:27:13

4 So here's -- here's the question -- 12:27:14
5 strike that. 12:27:16

6 In section -- there's a section 12:27:16
7 entitled "ICs in Broadcast Radio Receivers," 12:27:21
8 okay? 12:27:24

9 Yes or no: This section that I just 12:27:24
10 mentioned from Abidi relates to using on-chip 12:27:29
11 components to make a chip smaller, yes or no? 12:27:33

12 MR. MAGEE: Objection to form. 12:27:35

13 A. You know, it's been a while since I looked 12:27:37
14 at this reference. I just don't remember. I'm 12:27:39
15 happy to look at it, but I just don't recall the 12:27:42
16 details of this reference. 12:27:45

17 Q. (BY MR. CHARKOW) Go read the whole 12:27:46
18 section, sure. Go read the whole section. 12:27:47

19 A. No. The -- what I'm talking about is the 12:27:49
20 reference to which it refers. 12:27:51

21 Q. Well, I just want to know if that's your 12:27:53
22 position. I just want to know what your 12:27:56

1	position is.	12:27:58
2	A. My position is --	12:27:58
3	Q. I just want a clear position, yes or no.	12:27:59
4	A. My clear position is --	12:28:01
5	MR. MAGEE: Object.	12:28:03
6	A. -- I don't know without looking at the	12:28:03
7	reference, the reference to which this -- this	12:28:05
8	paper refers. I'm happy to --	12:28:06
9	Q. (BY MR. CHARKOW) The reference that's not	12:28:07
10	part of the record that I can't give you? I	12:28:08
11	can't give you it. If it's not in the record, I	12:28:11
12	can't give it to you.	12:28:13
13	A. Well --	12:28:13
14	MR. MAGEE: Objection, form. Hang	12:28:15
15	on --	12:28:16
16	(Talking over each other.)	12:28:17
17	MR. MAGEE: Objection to form. Go	12:28:19
18	ahead.	12:28:20
19	A. I -- we can -- I can either look at the	12:28:20
20	reference by -- we can put it in the record and	12:28:23
21	I can look -- look at it quickly.	12:28:25
22	Q. (BY MR. CHARKOW) Can't do it.	12:28:27

1 A. Or I can stick with my answer that is I
2 just don't recall.

3 Q. Okay. So you don't recall one way or
4 another whether the section in Abidi on ICs in
5 broadcast radio receivers, if that relates to
6 using on-chip components to make chips smaller?
7 That's your testimony?

8 A. The objective is to -- is to make the
9 overall system smaller, not necessarily the
10 chips themselves smaller. You -- the idea is,
11 you know, a system is more than just a chip,
12 even if it's a single-chip; and so by putting
13 more of these passive components on-chip, you
14 typically make the overall system smaller and
15 often less expensive but you don't necessarily
16 make the chips smaller.

17 As far as your specific question about
18 this particular circuit, I -- I looked at this
19 reference quite a while ago, and I -- I think,
20 but I'm not 100 percent sure, that those 15
21 small capacitors and 2 inductors are off-chip,
22 but I would have to look at it. I can do it in

1 five -- you know, five minutes, if you want. If

12:29:35

2 you want --

12:29:36

3 Q. I can't -- I can't -- we're not allowed to

12:29:36

4 do that. I can't -- we can't add anything to

12:29:38

5 the record. It's -- that's -- that's the rules.

12:29:40

6 A. Okay. Then my answer stands.

12:29:41

7 Q. Okay. So you realize you looked at this,

12:29:43

8 like, a few weeks ago, right? Like, this isn't,

12:29:46

9 like, a year ago.

12:29:48

10 MR. MAGEE: Objection, form.

12:29:49

11 Q. (BY MR. CHARKOW) This is a more recent

12:29:50

12 reference.

12:29:52

13 MR. MAGEE: Objection, form.

12:29:52

14 A. So I was on a hiking -- well, anyway,

12:29:53

15 the -- the point is, I wrote 300 pages and --

12:29:55

16 and I -- I just would have to refresh my memory

12:29:59

17 on this, so -- on that reference, so --

12:30:02

18 Q. (BY MR. CHARKOW) You wrote 300 pages for

12:30:05

19 what?

12:30:06

20 A. Well, there are --

12:30:07

21 MR. MAGEE: Objection, form.

12:30:08

22 A. -- there are three declarations I wrote.

12:30:09

1	Each is on the order of 100 pages and -- and --	12:30:12
2	yeah, so...	12:30:16
3	Q. (BY MR. CHARKOW) I'm just talking about	12:30:17
4	the most recent one.	12:30:18
5	A. I can -- let me tell you what I'm	12:30:20
6	100 percent sure of. What I'm 100 percent sure	12:30:23
7	of is the reference to which this refers,	12:30:26
8	reference 4. I looked at it back then, but I	12:30:29
9	just don't remember. That's all I can tell you.	12:30:32
10	I -- I believe those 15 small capacitors and 2	12:30:35
11	inductors are off-chip, but I'm not 100 percent	12:30:38
12	sure. I don't know how to be any clearer than	12:30:41
13	this.	12:30:45
14	Q. So if you can look at -- let's see. All	12:30:46
15	right. So if we go back to the discussion where	12:30:54
16	it talks about -- it says, "As it was impossible	12:30:57
17	to integrate the RF filters on-chip with spiral	12:31:02
18	monolithic inductors" -- do you recall that?	12:31:06
19	A. Uh-huh.	12:31:09
20	Q. It talks about the way to solve that	12:31:09
21	problem was to lower the IF.	12:31:11
22	Do you see that?	12:31:16

1	A. Yes.	12:31:16
2	Q. Okay. So according to this section of	12:31:17
3	Abidi, by lowering the IF, a single-chip IC is	12:31:20
4	achieved by implementing filters and capacitors	12:31:25
5	on chips, correct?	12:31:27
6	A. That is correct.	12:31:29
7	Q. And the section on --	12:31:29
8	A. Can I just add -- add something to that?	12:31:33
9	But that's not the only requirement	12:31:36
10	for inductors.	12:31:37
11	So for instance, you would use	12:31:38
12	inductors as the impedance match and those would	12:31:40
13	be off-chip. So -- so I believe that those two	12:31:44
14	inductors and the 15 capacitors, small	12:31:46
15	capacitors, are -- are off-chip; but again, I'd	12:31:49
16	have to -- I'd have to look at the reference to	12:31:51
17	remind myself of that.	12:31:53
18	Q. Okay. But you don't have any recollection	12:31:54
19	specifically, sitting here today, like, you	12:31:57
20	can't say it definitively?	12:31:59
21	A. I cannot because I -- even though you	12:32:00
22	said, well, I worked on this three weeks ago, I	12:32:03

1 actually worked on it a few months ago. I 12:32:05
2 provided all my documentation to Fish & 12:32:07
3 Richardson before I left on a long trip, or I 12:32:10
4 was out of commission. 12:32:14

5 So -- so it's been a while, and my 12:32:14
6 vague recollection is that those components are 12:32:18
7 off-chip, but I -- I just don't remember for 12:32:21
8 sure; and the only way to verify it is to look 12:32:23
9 at reference 4, which I did at the time, but I 12:32:26
10 just don't recall. 12:32:28

11 Q. Okay. The sections on IC in -- strike 12:32:29
12 that. 12:32:35

13 The section that we've been 12:32:35
14 discussing, which is broadcast radio receivers, 12:32:36
15 refers to creating a single-chip IC receiver, 12:32:40
16 correct? 12:32:43

17 A. You mean, in the Abidi paper? 12:32:45

18 Q. Yeah, in that specific section. 12:32:48

19 A. Yes. 12:32:50

20 Q. So if you go to Page 19 -- 12:32:51

21 A. Nine -- wait, wait, are we in the Abidi? 12:33:00

22 Q. Yeah, yeah, Page 19. It's the bottom 12:33:02

1	left, so it's the second page, but Page 19 of	12:33:04
2	the actual document.	12:33:07
3	A. I'm sorry.	12:33:09
4	Q. The bottom right. So when I say, like,	12:33:09
5	18, 19, the documents --	12:33:13
6	A. Got it.	12:33:14
7	So 19, and where do you want me to	12:33:14
8	look --	12:33:14
9	Q. All right. So -- strike that.	12:33:15
10	So Page 2 of Exhibit 8, which is -- on	12:33:17
11	Page 2 of Exhibit 8.	12:33:25
12	A. I am -- well, I mean, I'm in -- I'm on	12:33:26
13	Page 2 of Abidi's article.	12:33:31
14	Q. Yeah, that's it. Yes, so -- strike that.	12:33:33
15	Page -- you're on Page 2 of Abidi's	12:33:36
16	article, correct?	12:33:39
17	A. Yes.	12:33:39
18	Q. Okay. And in Abidi, there's a separate	12:33:40
19	section discussing ICs in cellular telephone	12:33:45
20	transceivers.	12:33:48
21	Do you see that?	12:33:50
22	A. I do.	12:33:50

1	Q. Okay. And there's discussion -- so you	12:33:51
2	could read that section. I'm going to ask you	12:33:54
3	some questions if you want to read through that	12:33:56
4	section, but the question that I have is on the	12:33:58
5	left side, third paragraph, the discuss- --	12:34:01
6	there's a discussion of a Siemens IC?	12:34:03
7	A. I don't see where it says "Siemens."	12:34:14
8	You're talking about the bottom left paragraph	12:34:16
9	on Page 2?	12:34:18
10	Q. Yes. It starts with, "Circuits to	12:34:19
11	implement the complex modulation," and we read a	12:34:22
12	few lines down, it says, "In a 900 megahertz	12:34:25
13	transmitter."	12:34:29
14	A. Yeah, I see it.	12:34:29
15	Q. You see that from Siemens?	12:34:30
16	A. I do.	12:34:32
17	Q. Okay. So in this section of Abidi, which	12:34:32
18	is related to cellular telephone transceivers,	12:34:36
19	there is a discussion of a Siemens product that	12:34:39
20	had a transmitter IC, a separate receiver IC,	12:34:42
21	and a separate IF off-chip baseband SAW filter,	12:34:46
22	correct?	12:34:51

1	A. No, that's not correct.	12:34:51
2	Q. Okay. Let's go through it.	12:34:53
3	So we see, "In a 900 megahertz	12:34:55
4	transmitter silicon bipolar IC from Siemens," we	12:35:01
5	see, "a precision quadrature-upconversion mixer	12:35:05
6	implements the phase-shift keyed modulation	12:35:08
7	specified in the European GSM system to produce	12:35:12
8	a single-sideband, suppressed-carrier output."	12:35:15
9	Do you see that?	12:35:19
10	A. Yes.	12:35:19
11	Q. It says, "The IC, which includes an output	12:35:20
12	stage to drive a separate power amplifier,	12:35:23
13	drains 40" -- I guess, milliamps?	12:35:26
14	A. Yeah.	12:35:29
15	Q. Okay. Then it says, "The companion	12:35:30
16	receiver IC includes a first mixer," right?	12:35:34
17	Which means that the receiver IC is separate	12:35:37
18	from the transmitter IC, right?	12:35:39
19	A. Yes.	12:35:41
20	Q. Okay. So there is a discussion in this	12:35:41
21	section of Abidi that the Siemens product has a	12:35:43
22	transmitter IC and a separate receiver IC,	12:35:47

1	correct?	12:35:51
2	A. Yes.	12:35:51
3	Q. All right. And then we see it says, "The	12:35:51
4	companion receiver IC includes a first mixer	12:35:59
5	with buffers to drive an IF off-chip baseband	12:36:02
6	SAW filter."	12:36:07
7	Do you see that?	12:36:09
8	A. That's not what it says.	12:36:09
9	Q. I'll read it again.	12:36:13
10	"The companion receiver IC includes a	12:36:14
11	first mixer, comma, with buffers to drive an IF	12:36:18
12	off-chip baseband SAW filter."	12:36:23
13	A. Read it more carefully.	12:36:26
14	Q. I literally read the words on the page.	12:36:35
15	You go -- you go read the words.	12:36:37
16	A. What's the word right before "SAW filter"?	12:36:38
17	Q. Base -- oh, "bandpass."	12:36:41
18	The -- strike that.	12:36:43
19	The companion receiver IC include --	12:36:44
20	strike that.	12:36:48
21	Abidi says, "The companion receiver IC	12:36:48
22	includes a first mixer, with buffers to drive an	12:36:53

1	IF off-chip bandpass SAW filter," correct?	12:36:55
2	A. That's correct.	12:36:59
3	Q. Okay. So there's a discussion in Abidi	12:36:59
4	that the Siemens product has a transmitter IC,	12:37:03
5	and separate from that transmitter IC is an IF	12:37:09
6	off-chip bandpass SAW filter, correct?	12:37:13
7	A. I think you meant "receiver IC," but it	12:37:17
8	says "the companion receiver IC has an off-chip	12:37:22
9	SAW filter."	12:37:25
10	Q. Right. Okay.	12:37:26
11	So there is discussions in Abidi of	12:37:27
12	the Siemens product that has a transmitter IC, a	12:37:30
13	separate receiver IC, and a separate IF off-chip	12:37:34
14	bandpass SAW filter, correct?	12:37:39
15	A. Yes.	12:37:41
16	Q. Okay. Abidi then goes on to describe an	12:37:42
17	Alcatel -- strike that.	12:37:48
18	Abidi then goes on to describe on the	12:37:50
19	right-hand side, the top of the page, an Alcatel	12:37:53
20	product that achieves greater miniaturization	12:37:56
21	than the Siemens product.	12:37:59
22	Do you see that?	12:38:01

1	A. I do.	12:38:01
2	Q. Okay. And the way Alcatel achieved	12:38:01
3	greater miniaturization than the Siemens product	12:38:04
4	was by integrating the transmitter and the	12:38:07
5	receiver sections onto a single bipolar chip,	12:38:11
6	correct?	12:38:14
7	A. Yes.	12:38:14
8	Q. And --	12:38:15
9	A. Can I add a caveat to that?	12:38:17
10	That didn't make the chip smaller,	12:38:19
11	that made the overall system smaller.	12:38:21
12	Q. Okay.	12:38:24
13	A. The chip actually probably grew, but the	12:38:24
14	overall system, including the board and the	12:38:26
15	passive components around it, that all got	12:38:29
16	smaller.	12:38:33
17	So when he talks about	12:38:33
18	miniaturization, he's talking about the system,	12:38:35
19	not necessarily the chip. This is what I was	12:38:38
20	objecting to in what you said before.	12:38:40
21	Q. Okay. And then it says, "The	12:38:42
22	miniaturization was achieved by using the	12:38:44

1	zero-IF architecture," correct? That makes it	12:38:46
2	possible?	12:38:50
3	A. Yes.	12:38:51
4	Q. Okay. In other words, using zero-IF	12:38:51
5	architecture results in a lower frequency that	12:38:55
6	allows integration of the transmitter and	12:38:58
7	receiver sections, correct?	12:39:01
8	A. No. The -- the -- using -- using a -- a	12:39:04
9	zero-IF architecture allowed them to implement	12:39:11
10	the channel filtering using on-chip components	12:39:16
11	as opposed to a SAW filter. It has nothing to	12:39:21
12	do with -- with the transmitter.	12:39:26
13	Q. Okay. The Alcatel product in Abidi is --	12:39:29
14	well, strike that.	12:39:34
15	A. And let me mention one other thing,	12:39:41
16	even -- even this particular chip had a large	12:39:43
17	off-chip capacitor -- actually, probably two of	12:39:50
18	them, but certainly one, because it had a -- it	12:39:52
19	had an integrated phased-lock loop.	12:39:55
20	And for that type of system, the	12:39:58
21	bandwidth of that phased-lock loop had to be so	12:39:59
22	low that the capacitors were required to be	12:40:02

1 off-chip, and yet, they still call it a 12:40:05
2 single-chip re- -- transceiver. 12:40:07

3 And also, like I said, there will be a 12:40:11
4 crystal there. There will be -- there will be a 12:40:14
5 matching network which involves inductors, and 12:40:16
6 there will be -- and capacitors, and there will 12:40:20
7 be bypass capacitors. 12:40:22

8 So even though we call it a 12:40:26
9 single-chip colloquially, it doesn't mean that 12:40:28
10 the whole product is a chip. It means that -- 12:40:31
11 it means that -- that most of the functionality 12:40:34
12 is on the chip except for passives. 12:40:35

13 MR. CHARKOW: Okay. Move to 12:40:38
14 strike as nonresponsive. 12:40:38

15 Q. (BY MR. CHARKOW) All right. So let's go 12:40:45
16 to -- do you recall being deposed a bunch of 12:40:48
17 times? Correct? 12:40:54

18 A. I do. 12:40:55

19 Q. Okay. I'm going to -- I'm going to ask 12:40:55
20 you a question. This is just some confirmation 12:41:01
21 that this is correct. 12:41:04

22 All right. So you've been provided 12:41:07

1 with Exhibit 9 to your deposition, which is an 12:41:11
2 excerpt from a deposition. 12:41:14

3 (Whereupon Exhibit Number 9 was 12:41:14
4 marked for identification.) 12:41:15

5 A. Let me -- I'm opening it. One second, 12:41:17
6 I've -- I've got it. 12:41:20

7 Q. (BY MR. CHARKOW) All right. So this was 12:41:21
8 a deposition that was done on February 28th, 12:41:22
9 2025. 12:41:22

10 Do you recall being at that 12:41:27
11 deposition? 12:41:28

12 A. I do. 12:41:28

13 Q. All right. And you gave truthful and 12:41:28
14 accurate testimony at that deposition, correct? 12:41:30

15 A. I did, yes. 12:41:33

16 Q. Okay. So if you could turn to -- on the 12:41:34
17 second page, I just want to ask you a question. 12:41:37

18 A. Okay. 12:41:41

19 Q. On page -- so it's the second page, and 12:41:41
20 then the -- it's in four quadrants, and one of 12:41:44
21 the quadrants is 69 -- 60 -- Page 69. 12:41:47

22 Do you see that? 12:41:55

1	A. I do.	12:41:55
2	Q. All right. And then you were asked a	12:41:55
3	question. The question was: "And how does the	12:41:59
4	mixer generate a 14.3-dB gain?"	12:42:02
5	Do you see that?	12:42:06
6	A. And how does a mixer -- okay, yes.	12:42:08
7	Q. And you could see further up where you	12:42:11
8	were talking about the Macnally reference.	12:42:13
9	Do you see that?	12:42:15
10	A. Further up?	12:42:17
11	Q. Yeah, just to the top of the page of 69.	12:42:18
12	A. Yeah, okay.	12:42:21
13	Q. Okay. So in your answer, you said --	12:42:22
14	sorry.	12:42:33
15	Sorry, give me a second, I lost it.	12:42:34
16	Okay. So -- strike that.	12:42:42
17	So in your deposition, you testified	12:42:44
18	under oath that "When the RFP increases, the RFP	12:42:47
19	decreases. And so what that means is that in	12:42:52
20	the case more current will flow through the --	12:42:57
21	you know, from drain to source of M1. And	12:43:00
22	correspondingly less current will flow through	12:43:03

1	M2."	12:43:06
2	Do you see that?	12:43:07
3	A. Yeah.	12:43:07
4	Can we -- I'd like to bring up the	12:43:07
5	Macnally circuit just so I can put it in	12:43:10
6	context.	12:43:12
7	Q. Sure. I'll give it to you, just give me a	12:43:13
8	second.	12:43:16
9	All right. So I'm giving you	12:43:22
10	Exhibit 10 to your deposition, which is the	12:43:25
11	Macnally reference, which is Exhibit 1021 in	12:43:26
12	the -- or TI 1021 in the IPRs.	12:43:29
13	A. I've got it. One second.	12:43:32
14	(Whereupon Exhibit Number 10 was	12:43:34
15	marked for identification.)	12:43:35
16	A. So we're referring to figure -- Figure 3.	12:43:35
17	Let me rotate it. One second.	12:43:40
18	All right. Got it.	12:43:43
19	Q. (BY MR. CHARKOW) All right. So you're in	12:43:45
20	Figure 3 of Macnally, correct?	12:43:46
21	A. I am.	12:43:48
22	Q. All right. So in Figure 3, you see M1?	12:43:52

1	A. I do.	12:43:54
2	Q. And in Macnally, current flows from the	12:43:54
3	drain to the source of M1, correct?	12:44:01
4	A. Conventional current --	12:44:04
5	MR. MAGEE: Objection to form.	12:44:05
6	A. Sorry. Conventional current flows that	12:44:05
7	way.	12:44:05
8	MR. CHARKOW: Can we take a break?	12:44:09
9	THE WITNESS: Sure.	12:44:13
10	THE VIDEOGRAPHER: Stand by.	12:44:14
11	We are going off the record. The	12:44:15
12	time is 12:44 p.m.	12:44:16
13	(Break taken from 12:44 p.m. to	12:44:19
14	1:05 p.m.)	13:05:53
15	THE VIDEOGRAPHER: We are back on	13:05:58
16	the record. The time is 1:06 p.m.	13:06:02
17	Q. (BY MR. CHARKOW) Circuits that receive	13:06:07
18	higher frequency signals can use smaller	13:06:09
19	capacitors, correct?	13:06:11
20	A. What do you mean by "higher frequency	13:06:14
21	signals"?	13:06:16
22	Q. Higher frequency RF signals.	13:06:17

1 A. It's just an ill-posed question. I mean, 13:06:22
2 circuit -- what does the circuit do? Are we 13:06:25
3 talking about bandwidth? Are we talking about 13:06:27
4 center frequency? You've asked me this 13:06:29
5 question, and I've given you this exact same 13:06:31
6 answer that I just gave you. 13:06:33

7 Q. No, I didn't ask you the same question. I 13:06:35
8 changed the question because you weren't 13:06:37
9 answering it, so I'm trying to -- I'm trying to 13:06:39
10 get a question that will result in an answer, 13:06:40
11 so -- so the RF signal coming -- strike that. 13:06:44

12 With regards to the RF input signal to 13:06:47
13 a -- a receiver of a wireless chip, if -- the 13:06:53
14 higher the frequency of that signal, the smaller 13:07:00
15 capacitors that you can use, correct? 13:07:05

16 MR. MAGEE: Objection to form. 13:07:07

17 A. Used for what? 13:07:08

18 Q. (BY MR. CHARKOW) In a filter. 13:07:09

19 A. No, that's not -- that's not correct, 13:07:14
20 necessarily. 13:07:16

21 Q. Well, what do you mean it's not correct 13:07:18
22 necessarily? When is it correct? 13:07:20

1	MR. MAGEE: Objection to form.	13:07:22
2	A. I mean, it's still a vague question, but	13:07:23
3	I'll give you an example. It's not a definitive	13:07:26
4	example, but it's -- but it's -- it's -- it's	13:07:29
5	rep- -- it's an example.	13:07:31
6	So if we're talking about increasing	13:07:32
7	the frequency -- the center frequency of the RF	13:07:35
8	signal, and -- and the circuit you're talking	13:07:41
9	about performs direct downconversion, then the	13:07:44
10	frequency of the signal has no bearing	13:07:48
11	whatsoever on the capacitors used in the	13:07:50
12	low-pass filter.	13:07:52
13	Q. (BY MR. CHARKOW) Okay. I asked when it	13:07:53
14	does have a bearing, not when it doesn't.	13:07:55
15	A. Well, so when it does -- so there -- if --	13:07:58
16	I mean, so first, you -- the problem is this is	13:08:10
17	such an ill-posed question.	13:08:12
18	So, first of all, are we talking about	13:08:14
19	the capacitors in a low-pass filter? Are we	13:08:15
20	talking about the capacitors in a bandpass	13:08:17
21	filter? Like, give me more details. Like, I	13:08:20
22	can't -- you're -- you're asking such a vague	13:08:23

1	question.	13:08:24
2	And then you're asking me to -- to,	13:08:25
3	like, tighten up your question for you and then	13:08:29
4	give you an answer; and then when I tried that,	13:08:30
5	you're, like, oh, that's not what I asked.	13:08:33
6	So, you know, give me a precise	13:08:34
7	question, and I'll give you a precise answer.	13:08:36
8	Q. Okay. The -- strike that.	13:08:39
9	A receiver, a wireless receiver	13:08:43
10	receiving a higher frequency signal, can use a	13:08:54
11	smaller capacitor in a bandpass filter, correct?	13:08:59
12	A. Not necessarily.	13:09:06
13	Q. Well, when can it?	13:09:08
14	A. Well, first of all, we don't usually	13:09:12
15	use -- we don't usually implement bandpass	13:09:15
16	filters on-chip in wireless receivers. Those	13:09:17
17	are usually off-chip.	13:09:20
18	And -- and -- and the capacitor size,	13:09:22
19	in that case, would not depend on the RF center	13:09:30
20	frequency. So if you increase the frequency of	13:09:33
21	the RF signal, it would not necessarily have any	13:09:36
22	bearing whatsoever on the capacitor sizes in the	13:09:40

1	filters.	13:09:44
2	Q. Okay. A wireless receiver receiving a	13:09:44
3	high frequency signal can use a smaller	13:09:52
4	capacitor in a low-pass filter, correct?	13:09:57
5	A. It depends what you mean by "higher	13:09:58
6	frequency." If we're talking about the	13:10:01
7	frequency at which the RF signal wiggles, then	13:10:03
8	the answer is no.	13:10:06
9	Q. Okay. Well, is there a case where it	13:10:08
10	would affect the size of the capacitor, where	13:10:11
11	using a higher frequency signal would affect the	13:10:13
12	size of the capacitor?	13:10:16
13	A. It depends on your definition of, quote,	13:10:16
14	higher frequency signal, end quote.	13:10:19
15	So, again, you got to ask me a	13:10:21
16	specific question for me to give you a specific	13:10:23
17	answer.	13:10:25
18	Q. Using a higher -- higher megahertz. I	13:10:25
19	don't know -- so you used higher -- like, 100	13:10:28
20	megahertz higher, or, like, a gigahertz as	13:10:33
21	opposed to megahertz higher.	13:10:36
22	A. Okay. The -- that's what we would call	13:10:37

1	the center frequency of the RF signal, and the	13:10:40
2	center frequency of the RF signal has no bearing	13:10:44
3	whatsoever on the low-pass filters used in a --	13:10:47
4	in a wireless receiver.	13:10:50
5	Q. Okay. Lower frequent -- strike that.	13:10:51
6	Lower frequencies need larger	13:10:56
7	capacitance to achieve a desired impedance or a	13:10:59
8	time constant compared to higher frequencies	13:11:02
9	which use smaller capacitors to get the same	13:11:05
10	effect, correct?	13:11:07
11	MR. MAGEE: Objection, form.	13:11:07
12	A. Well, wait.	13:11:08
13	Are we talking about the low-pass	13:11:09
14	filter at -- after downconversion, or are we	13:11:13
15	talking about the capacitors that are used in a	13:11:20
16	matching network?	13:11:21
17	I -- the problem is, this is just such	13:11:22
18	a vague question. I don't have a way to answer	13:11:24
19	it.	13:11:26
20	Q. (BY MR. CHARKOW) After downconversion.	13:11:26
21	A. Okay. So after downconversion, the -- the	13:11:28
22	capacitor size is not impacted in any way by the	13:11:31

1 center frequency of the RF signal. I -- I've

13:11:36

2 answered -- I've answered this now a few times,

13:11:40

3 and that -- that's my answer.

13:11:42

4 Q. Sorry, just give me a minute.

13:11:42

5 All right. Is there any relationship
6 between frequencies and the size of the
7 capacitors used in a low-pass filter in a
8 receiver of an RF chip?

13:12:33

13:12:40

13:12:42

13:12:44

9 MR. MAGEE: Objection to form.

13:12:48

10 A. So if we're talking about RF input
11 frequency, no; but if you want to build a
12 low-pass filter with a wider bandwidth, that
13 will usually reduce the size of the -- of the
14 required capacitors, but that has nothing to do
15 with the center frequency of the R -- receive
16 signal.

13:12:50

13:12:55

13:12:59

13:13:04

13:13:07

13:13:10

13:13:14

17 Q. (BY MR. CHARKOW) Is there any
18 relationship between the LL frequency and the
19 size of the capacitors used in a low-pass filter
20 in a receiver of an RF chip?

13:13:19

13:13:20

13:13:23

13:13:26

21 A. If it's a direct conversion receiver,
22 there is not.

13:13:28

13:13:31

1	Q. What happens if it's not a direct	13:13:31
2	conversion receiver?	13:13:33
3	A. Give me an example.	13:13:34
4	Q. A heterodyne receiver.	13:13:36
5	A. Okay. Well, then it -- it does -- it	13:13:39
6	still does not depend on the RF center	13:13:42
7	frequency, but it does -- it -- it -- well, in	13:13:45
8	that case, if it's heterodyne, you -- you --	13:13:49
9	you're not building a low-pass filter, you're	13:13:52
10	building a bandpass filter, and that's almost	13:13:54
11	always done off-chip.	13:13:54
12	And it's very often done with SAW	13:13:55
13	filters, so -- so it doesn't -- it's not really	13:14:01
14	an issue of capacitance.	13:14:02
15	MR. CHARKOW: Can we just take a	13:14:48
16	break for a minute? Sorry, just nobody go	13:14:49
17	anywhere. I just got to -- I just got to do	13:14:51
18	something, just one minute. I think I'm done.	13:14:53
19	THE VIDEOGRAPHER: Stand by. We	13:14:56
20	are going off the record. The time is 1:14 p.m.	13:14:57
21	(Break taken from 1:15 p.m. to	13:15:00
22	1:16 p.m.)	13:16:43

Transcript of Ian Galton, Ph.D.
Conducted on July 16, 2025

100

1	THE VIDEOGRAPHER: We are back on	13:16:43
2	the record. The time is 1:16 p.m.	13:16:48
3	MR. CHARKOW: For the record,	13:16:51
4	Stephanie Mandir, my colleague at Daignault	13:16:54
5	Iyer, joined for the last couple of minutes.	13:16:58
6	And I have no further questions at	13:16:59
7	this time.	13:17:01
8	MR. MAGEE: We have no questions.	13:17:01
9	We'll read and sign.	13:17:03
10	THE VIDEOGRAPHER: All right.	13:17:06
11	I'll close this down. Stand by.	13:17:06
12	This marks the end of the	13:17:07
13	deposition of Dr. Ian Galton, Ph.D, for the	13:17:08
14	matters of IPR2024-00935 and 036.	13:17:13
15	We are going off the record. The	13:17:16
16	time is 1:17 p.m. Central.	13:17:17
17	MR. MAGEE: All right. Thanks	13:17:21
18	everybody.	13:17:23
19	THE COURT REPORTER: Does anybody	13:17:26
20	need a rough?	13:17:27
21	MR. CHARKOW: Yes.	13:17:29
22	(Deposition concluded.)	

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ParkerVision Exhibit 2040
TI and NXP v. ParkerVision - IPR2024-00935

Transcript of Ian Galton, Ph.D.
Conducted on July 16, 2025

101

1 I, IAN GALTON, PH.D., have read the foregoing
2 deposition and hereby affix my signature that
3 same is true and correct, except as noted above.

4 _____
5 IAN GALTON, PH.D.

6 THE STATE OF _____)

7 COUNTY OF _____)

8 Before me, _____, on

9 this day personally appeared IAN GALTON, PH.D.,

10 known to me (or proved to me under oath or

11 through _____)

12 (description of identity card or other document)

13 to be the person whose name is subscribed to the

14 foregoing instrument and acknowledged to me that

15 they executed the same for the purposes and

16 consideration therein expressed.

17 Given under my hand and seal of office this

18 _____ day of _____,

19 _____.

20 _____
21 NOTARY PUBLIC IN AND FOR

22 THE STATE OF _____

COMMISSION EXPIRES: _____

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ParkerVision Exhibit 2040
TI and NXP v. ParkerVision - IPR2024-00935

1 UNITED STATES PATENT AND TRADEMARK OFFICE

2
3 BEFORE THE PATENT TRIAL AND APPEAL BOARD

4 TEXAS INSTRUMENTS, INC.,
5 And NXP USA, INC.,
6 Petitioners,

7 V.

8 PARKERVISION, INC.,
9 Patent Owner,

10 IPR2024-00935
11 IPR2024-00936
12 Patent 7,865,177 B2

13 Certificate of Shorthand Reporter

14 I, Annette Peltier, CSR, Texas Certified
15 Realtime Reporter in and for the State of Texas
16 do hereby certify:

17 That IAN GALTON, PH.D., the witness whose
18 deposition is herein before set forth, was duly
19 sworn before the commencement of such deposition
20 and that such deposition was taken before me and
21 is a true record of the testimony given by such
22 witness.

23 I further certify that the adverse party,
24 Texas Instruments Inc., and NSP USA, Inc., was

1 represented by counsel at the deposition.

2 I further certify that the deposition of IAN
3 GALTON, PH.D., occurred via Zoom videoconference
4 on July 16, 2025, commencing at 10:57 a.m.
5 Central time to 1:17 p.m. Central time.

6 I further certify that I am not related to
7 any of the parties to this action by blood or
8 marriage, I am not employed by or an attorney to
9 any of the parties to this action, and that I am
10 in no way interested, financially or otherwise,
11 in the outcome of this matter.

12 IN WITNESS WHEREOF, I have hereunto set my
13 hand this 18th day of July, 2025.

14 

15 _____
16 Annette Peltier, Texas CSR 3253
17 Expiration Date: 10/31/25
18 Firm Registration No. 686
19 451 Hungerford Drive
20 Suite 400
21 Rockville, MD 20850
22 Phone: 888.433.3767
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A			
abidi	accurate	59:6, 60:1,	allows
65:8, 68:22,	8:4, 89:14	60:18, 97:14,	71:9, 87:6
73:1, 74:10,	achieve	97:20, 97:21	almost
76:4, 79:3,	97:7	again	47:19, 99:10
80:17, 80:21,	achieved	16:3, 19:10,	also
81:18, 82:17,	79:4, 86:2,	28:16, 29:3,	3:22, 7:10,
83:21, 84:21,	86:22	30:12, 31:19,	13:10, 13:15,
85:3, 85:11,	achieves	45:1, 45:2,	14:20, 23:4,
85:16, 85:18,	85:20	72:22, 79:15,	23:6, 30:3,
87:13	acknowledged	84:9, 96:15	63:22, 88:3
abidi's	101:15	ago	alto
81:13, 81:15	across	38:13, 39:1,	3:9
able	22:7, 22:15,	65:17, 76:19,	always
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