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Transcript of Asad Abidi, Ph.D.

Date: March 11, 2025
Case: Apple, Inc.-v- Theta, IP, LLC (PTAB)

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WORLDWIDE COURT REPORTING & LITIGATION TECHNOLOGY

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.,

Petitioner,

v.

THETA IP, LLC,

Patent Owner.

Case IPR2024-00816

U.S. Patent No. 7,010,330

Case IPR2024-00817

U.S. Patent No. 10,129,825

Case IPR2024-00818

U.S. Patent No. 10,524,202

Case IPR2024-00819

U.S. Patent No. 11,564,164

Case IPR2024-00820

U.S. Patent No. 11,638,210

DEPOSITION OF DR. ASAD ABIDI

VOLUME I

DENVER, COLORADO

TUESDAY, MARCH 11, 2025

REPORTED BY: NATALIE PARVIZI-AZAD, CSR, RPR, RSR
CSR NO. 14125
JOB NO.: 575262

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC, Petitioner,	CASE NUMBERS: IPR2024-00816, -00817, -00818, -00819, and -00820
v.	
THETA IP, LLC, Patent Owner.	

DEPOSITION OF DR. ASAD ABIDI, VOLUME I

TAKEN ON BEHALF OF THE PATENT OWNER

REMOTELY VIA ZOOM VIDEOCONFERENCING, IN

DENVER, COLORADO, BEGINNING AT

10:14 A.M. AND ENDING AT 1:03 P.M., ON

TUESDAY, MARCH 11, 2025, BEFORE

NATALIE PARVIZI-AZAD, CERTIFIED SHORTHAND

REPORTER NUMBER 14125.

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A P P E A R A N C E S

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ALSO PRESENT:

PARKER SIMPSON, VIDEOGRAPHER

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(RETAINED BY COUNSEL.)

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EXHIBIT NO.	DESCRIPTION	PAGE
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REMOTELY IN DENVER, COLORADO
TUESDAY, MARCH 11, 2025, 10:14 A.M.

THE VIDEOGRAPHER: Here begins the videotaped deposition of Dr. Asad Abidi in the matter of Apple Incorporated versus Theta, IP, LLC in the United States District Court and -- Trademark Office before the patent and -- Patent Trial and Appeal Board, case number IPR2024-00816, '00817, '00818, '00819, and '00820. Today's date is 3/11/2025. The time on the video monitor is 10:14 Mountain Time.

The remote videographer today is Parker Simpson, representing Planet Depos. All parties to this deposition are attending remotely.

Would counsel please voice identify themselves and state whom they represent.

MR. JOHANNINGMEIER: Yes. This is Corey Johanningmeier of Bunsow De Mory, representing Theta, IP.

MR. HART: Paul Hart with Erise IP representing petitioner, Apple.

THE VIDEOGRAPHER: The court reporter today is Natalie Parvizi representing Planet Depos. The witness will now be sworn.

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THE CERTIFIED STENOGRAPHER: Good morning. My name is Natalie Parvizi-Azad. I'm a certified shorthand reporter with the State of California, CSR number 14125.

Will you please raise your right hand to be sworn.

DR. ASAD ABIDI,
having declared under penalty of perjury to tell the truth, was examined and testified as follows:

EXAMINATION

BY MR. JOHANNINGMEIER:

Q. Okay. Good morning. Thanks for being here today. I'll start with an easy question.

Can you just state your full name for the record?

A. Asad Abidi.

Q. Abidi, okay. And you are a -- currently a professor at UCLA; is that right?

A. Yes.

Q. And have been there for 40-plus years; is that right?

A. 40.

Q. Yeah, okay. All right. I was a USC

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person myself, but I won't get into college rivalries because those are long ago.

So, again, thanks for being here today. Now, have you been deposed before?

A. Yes.

Q. About how many times?

A. One that I remember. Maybe a long time ago a second one, but one in the past several years.

Q. Okay. And was that also in the context of an IPR or patent case?

A. It was an IPR, yes.

Q. All right. Well, so I'll trust that your counsel has talked to you about all of the logistics and won't go through all of that. The one thing I always say to everyone is, I'm not interested in finding out about conversations you've had with lawyers. So if I ask you a question that seems like it's calling for details about conversations you've had with lawyers, it's not intentional. Those would be privileged.

If you ever have any question during the depo about whether something will be privileged, we can stop and you can talk to your counsel there and make sure we're clear on that. Otherwise, you know, he may or may not object, but, you know, we'll just

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1 go through the questions and answers.
2 If you need any kind of break, just let me
3 know and we'll take one.
4 So now I have -- I understand that you
5 have in front of you -- so you understand that we're
6 here today on five different IPR proceedings that
7 you filed declarations in; right?
8 **A. Yes.**
9 MR. JOHANNINGMEIER: Okay. And so, I
10 will -- and we're treating these all together and I
11 really -- there's a lot of similarities between the
12 declarations so it makes it efficient to do so. I
13 have gone ahead and put in the Zoom chat what I've
14 labeled as Exhibits 1 through 5.
15 (Exhibit 1 marked.)
16 (Exhibit 2 marked.)
17 (Exhibit 3 marked.)
18 (Exhibit 4 marked.)
19 (Exhibit 5 marked.)
20 BY MR. JOHANNINGMEIER:
21 Q. I understand that -- and those are
22 basically copies of your declarations in those
23 proceedings. I understand you also have paper
24 copies in front of you; right?
25 **A. Yes.**

10

1 Q. Okay. So I will refer to paragraph
2 numbers and page numbers, and feel free to use the
3 paper copies. And we'll just follow along. If
4 you -- you know, if we need to put something up on
5 the screen we can, but it probably will work to just
6 follow along on the paper.
7 To be clear, Exhibit 1 goes with the '330
8 patent. Proceeding Exhibit 2 goes with the '825
9 patent. This is just for the record.
10 Exhibit 3 goes with the '202 patent,
11 Exhibit 4 goes with the '164 patent, and Exhibit 5
12 goes with the '210 patent. And we'll likely spend
13 most of our time talking about the '330 and
14 Exhibit 1 to the extent there's commonalities.
15 Now, so let's just start with Exhibit 1.
16 Can you open up your declaration from the
17 IPR2024-00816 for the '330 patent?
18 **A. Yes.**
19 Q. Okay. And I want you to go to the end on
20 page 100 and just confirm for me that that's your
21 digital signature and that you signed this on
22 April 30th of last year; is that right?
23 **A. Yes.**
24 Q. Okay. Now, since you signed this, have
25 you discovered any errors or corrections that you

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1 wish to make to this declaration?
2 **A. Nothing substantial. There might be some**
3 **typographical errors, but, yeah, nothing**
4 **substantial.**
5 Q. Okay. I just wanted to give you a chance
6 since, you know, obviously it's been a while since
7 these have been signed, if anything has been
8 discovered in the meantime.
9 What about the other declarations? Are
10 you aware of any things with the other four
11 declarations that you want to correct on the record
12 or clarify?
13 **A. Yes. This is the declaration on the**
14 **patent '210, which is Exhibit 5.**
15 Q. Okay. Okay.
16 **A. And this is page 90.**
17 Q. Okay.
18 **A. Paragraph 161.**
19 Q. All right.
20 **A. Item Number 2.**
21 Q. So what needs to change about that?
22 **A. It should read "decreases a DC bias**
23 **current which increases the noise floor."**
24 Q. Okay. Right. All right. Okay. Now, are
25 there any others like that that you found, like in

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1 prep or in reviewing this since they were written?
2 **A. No.**
3 Q. Okay. All right. Well, thanks for that.
4 I'm glad to ask. I don't want to -- I always hate
5 having those fights around typos so it's good to fix
6 them.
7 So now, these were signed in April of
8 2024. About when did you start work on this case?
9 **A. Probably at the beginning of 2024,**
10 **sometime then. Sorry, I don't have those dates**
11 **handy.**
12 Q. I understand, and an approximate is fine.
13 Now, on page 3 of your declaration -- and we'll just
14 use Exhibit 1 again -- in the first paragraph, you
15 mention your compensation not being based on the
16 substance of opinions, of course, or the outcome. I
17 take it you're being paid at your hourly consulting
18 rate for work on this case?
19 **A. Correct.**
20 Q. What is that rate?
21 **A. $1,000 an hour.**
22 Q. Okay. And roughly how many hours did you
23 spend working on these declarations before they were
24 signed? Roughly?
25 **A. Altogether, probably around 20 hours.**

13

1 Q. Okay. And so that was primarily reviewing
2 and editing the declarations before they were
3 signed; is that -- is that right?
4 **A. Of course. And then reading the patents,**
5 **searching for prior art, all of that.**
6 Q. Okay. Now, so I take it -- and of course,
7 I'm not casting aspersions by saying this, but I
8 take it that you didn't personally draft every word
9 of this declaration; right?
10 **A. It was done jointly between Erise and**
11 **myself.**
12 Q. Right. Okay. So there were -- there's at
13 least some sections that were written maybe in the
14 first draft by counsel there, and then you reviewed
15 and edited as necessary; is that fair?
16 **A. Yes. And there was a fair bit of editing**
17 **that went on.**
18 Q. Sure. Sure. Of course. Okay. And now,
19 since these declarations were filed, have you
20 reviewed -- well, did you review Theta's preliminary
21 responses in the IPR proceedings?
22 **A. No.**
23 Q. Okay. And do you understand that
24 Professor Larry Larsen submitted a declaration in --
25 with those responses?

14

1 **A. Yes, I do know that.**
2 Q. Did you read Professor Larsen's
3 declaration?
4 **A. No.**
5 Q. Okay. So I was going to ask you if
6 anything about that changed your opinion, but I
7 won't.
8 So have you read anything else since you
9 submitted these declarations that has caused you to
10 want to change or modify any of your opinions?
11 **A. No.**
12 Q. Okay. Now, preparing for this deposition,
13 I take it you met with Counsel there in Denver; is
14 that right?
15 **A. Correct.**
16 Q. Okay. And now in preparing for this
17 deposition, did you talk to anybody who wasn't a
18 lawyer?
19 **A. No.**
20 Q. Okay. And in preparing your declaration,
21 did you talk to anybody who wasn't a lawyer?
22 **A. No.**
23 Q. So, for instance, you didn't talk to
24 Mr. Behbahani; right?
25 **A. No.**

15

1 Q. Okay. Or Mr. Leete or Mr. Tan?
2 **A. No.**
3 Q. Okay. Are you still in touch with them?
4 **A. Not really. It's been a long time. They**
5 **were my students 20-plus years ago, so, you know,**
6 **they've gone on to their own lives. Yeah.**
7 Q. Okay. All right. And so, now, do you
8 know Professor Savidis (phonetic)?
9 **A. Yes.**
10 Q. And so, I was looking at your relative's
11 CVs and it looks like you might have overlapped in
12 your undergraduate or graduate studies at Berkley;
13 is that right?
14 **A. No, we did not overlap.**
15 Q. No?
16 **A. No.**
17 Q. Did you overlap at Bell Labs?
18 **A. He was a consultant but I never saw him**
19 **come there. He was busy writing a textbook at the**
20 **time, so...**
21 Q. Okay. So I take it, then, you just know
22 him from being in the same field and going to
23 conferences and all that?
24 **A. Exactly.**
25 Q. Okay. Have you ever worked together on

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1 any research?
2 **A. No.**
3 Q. What's your -- I sort of have to ask
4 because of the context. What's your general view of
5 Professor Savidis?
6 **A. He's very highly regarded.**
7 Q. His textbooks have been used quite a bit;
8 right?
9 **A. Yes.**
10 Q. As far as I understand?
11 **A. Yes.**
12 Q. Okay. Now -- so you don't have any issues
13 or negative opinions or anything about
14 Professor Savidis; right?
15 **A. No.**
16 (Exhibit 6 marked.)
17 BY MR. JOHANNINGMEIER:
18 Q. Okay. Now -- so I want to ask about the
19 prior art references that you relied on. So I'm
20 going to go ahead and put in the chat what's going
21 to be marked as Exhibit 6, and that's going to be
22 the paper that I think you referred to as the Leetes
23 paper?
24 **A. Yes.**
25 Q. The "2.4-Gigahertz Low IF Receiver For

17

1 Wide Band WLAN." I take it you have a paper copy of
2 that there?
3 **A. Yes, I do.**
4 Q. Okay. So there's basically three prior
5 art references that you refer to in your deposition
6 as the "Behbahani reference," the "Leete reference,"
7 and the "Tan reference;" right?
8 **A. Right.**
9 Q. And now these are all students of yours at
10 the time; is that right?
11 **A. Yes.**
12 Q. Okay. And so -- and some of the -- like,
13 for instance, Behbahani is an author in all of these
14 papers, including the one that we're calling the
15 Behbahani reference; right?
16 **A. Yes.**
17 Q. Okay. And so -- and you are listed as the
18 sort of last author on these papers as well; right?
19 **A. Yes.**
20 Q. So can you just describe for me what was
21 your role in this research at the time?
22 **A. I conceived of this project. I was a**
23 **coprincipal investigator on a research contract we**
24 **had to develop this. This is very early work on**
25 **wide band wireless receivers. And I was involved in**

18

1 **directing this group of students in developing these**
2 **circuits. So I was involved in the conception**
3 **stages of the circuits and troubleshooting and**
4 **development of circuits as they evolved. The**
5 **students then, you know, broke up the work amongst**
6 **themselves and dug deep into them in their design**
7 **simulation, and the students did the IC layout and,**
8 **eventually, they were responsible for the testing.**
9 **So I knew what was going on at the circuit**
10 **level and I was responsible for conceiving this**
11 **entire wide band receiver project and roughly**
12 **architecting it and so on. So it was --**
13 Q. Okay.
14 **A. -- a pretty typical advisor-advisee**
15 **relationship in a university environment.**
16 Q. Right, right. And you said it was under
17 contract. Was that an industry contract or
18 government, or --
19 **A. I think it was a DARPA contract, if I**
20 **remember correctly.**
21 Q. And so this was for, basically,
22 2.4-gigahertz Wi-Fi; is that right?
23 **A. No. This -- Wi-Fi was just coming on**
24 **board at that time. This was -- we were ahead of**
25 **industry at UCLA, we sort of pioneered this RFC MOSS**

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1 **technology. And our first work was for relatively**
2 **narrow band transmissions, but we were ambitious and**
3 **we could foresee the day when mobile users would**
4 **need very high data rates, where they could transmit**
5 **video and so on wirelessly or large data transfers,**
6 **like big files. So we were interested in using wide**
7 **band modulation schemes like QAM and so on. And**
8 **we're talking now the year 2000, way ahead of**
9 **industry. So the question was, how do you build a**
10 **receiver for these things? And that's what we were**
11 **tackling.**
12 Q. Okay.
13 **A. Wi-Fi was in its very, very, very early**
14 **stages. I think it was just -- I think the term had**
15 **been coined around -- around that time.**
16 Q. Okay. So -- and I noticed there was --
17 sort of looking to see what happened to some of
18 these authors. A couple of them went to Broadcom;
19 is that right?
20 **A. John Leete went to Broadcom, and I think**
21 **some of them went to Broadcom for a little while and**
22 **then struck out on their own, yeah, but John Leete**
23 **is still there. He's the one I know who is still**
24 **there.**
25 Q. Well, so I guess my question is: Did this

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1 research ultimately get commercialized at Broadcom
2 or somewhere else?
3 **A. Not directly. But, indirectly, I think it**
4 **influenced many people -- many companies. But not**
5 **directly. No one took this and say, "Okay, let's**
6 **take it the way it stands and make a product."**
7 **Because there were no standards for this stuff, you**
8 **know, this -- advanced modulation schemes like QAM.**
9 **Only became standardized many years later after we**
10 **had done this work.**
11 **So without a standard you can't make a**
12 **product, and that was kind of showing the**
13 **feasibility of using those modulation schemes.**
14 Q. Okay. So like a proof of concept sort of
15 thing?
16 **A. Yes, right. Right.**
17 Q. All right. And so it looks to me like
18 each of these three papers sort of covers a
19 different section of the receiver chain roughly; is
20 that fair?
21 **A. That's right.**
22 Q. Okay. Now -- and so you did -- obviously
23 you supervised and you said you had some -- a big
24 role in developing the architecture. Did you do
25 actual circuit design on this or was it more --

21

A. No, it was a large issue. So the way it works in the circuit areas is that we sketch out the concepts and then ask the students to develop them, to investigate them, and they do the circuit simulations which is our tool to -- to investigate circuit ideas.
Q. Right. So there was simulation and then at some point there was a -- there were some built circuits; right?
A. Yes.
Q. Okay. Was the whole receiver chain built or just portions of it?
A. Well, there's a chip photograph here. That's what got built.
Q. Okay.
A. Yeah. So chip photo of integrated receiver, that's in the Leete paper, Figure 15.
Q. Right. So what got built was the LNA mixers, filters, basically the -- the whole analog front end; right?
A. Yes, correct.
Q. Okay. And then, did you build the analog to digital converter and digital filtering in that as well, or no?
A. No. No, I did not.

22

Q. Okay. So -- so then if we looked at the receiver chain on Figure 1 on page 2.
Do you see that?
A. Are we referring to the Leete paper?
Q. Yes. Yes, the Leete paper.
A. Yes.
Q. Okay. So what's shown here, this is a receiver block diagram. Basically everything that's inside that dotted line was what got built in the chip; is that right?
A. Yes, yes.
Q. Okay. So there's an LNA and then it looks like a mixer in the RF portion; right?
A. Yes.
Q. An then you got some polyphase filters in another mixer stage; is that right?
A. Yes.
Q. Okay. And then it looks like there's some amps in -- so in the IF2 portion of this, what's labeled here is polyphase times one and polyphase times 4. There was a chain of polyphase filters that were used for image rejection; right?
A. Yes, yes.
Q. Okay. And then those drove a programable gain amplifier; right?

23

A. Right.
Q. And then that's driving the -- that's here shown as a BPF, or bandpass filter block; right?
A. Yes.
Q. All right. And then I understand from other papers that that bandpass filter is actually one of two low-pass filters feeding a high-pass filter; is that right?
A. Yes, yes.
Q. Okay. And then there is a final voltage control gain amplifier; right?
A. Yes. Variable gain amplifier, yes.
Q. Sorry, variable gain amplifier. And then that would have been the edge of the chip that you built, and that would have been intended, in a real system, to drive an A to D converter and then a digital base-band; right?
A. Yes, correct.
Q. Okay. So -- now, were you involved in the testing of the built chip?
A. From a distance.
Q. You looked at the results, for instance?
A. Of course, of course, yeah. Lots of things, yeah.
Q. And then what was your involvement in

24

actually writing these papers? Was it still supervisory and review, or --
A. I more or less wrote all of them myself, more or less.
Q. Okay. Yeah, I just -- I was curious. Some people have the students do most of the writing and some people do it themselves. So I take it you were the primary author on these; is that fair?
A. In reality, yes.
Q. Yeah, okay. Now, the other thing I wanted to ask you while we were looking at that block diagram, it says here, "All paths are differential." So I take it this entire received chain was differential signals; right?
A. Yes, yes.
Q. Okay. So the -- the inputs and outputs of each of these blocks were differential INQ signals, basically?
A. No, INQ is -- "I" was differential and "Q" is differential, so --
Q. Exactly, right.
A. -- two separate signals. Yeah, each one differential.
Q. Sorry. Thanks for clarifying. So -- but -- so each input and output on each of these

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1 blocks, I mean, they would have been differential
2 signals; right?
3 **A. Yes, yes, yes.**
4 Q. Okay. And so, there is some amount of
5 impedance matching, I take it, that goes on in --
6 in -- in the phases between these blocks; right?
7 **A. No. On chip, we don't worry about**
8 **impedance matching. That's only done when you build**
9 **discreet circuits on printed circuit boards.**
10 Q. Okay.
11 **A. But on chip, things are so closely packed**
12 **together there's no fear of reflections or --**
13 **usually, yeah.**
14 Q. Okay. Okay. All right. So -- so it
15 looks like a large portion of this particular paper,
16 the Leete paper, is talking about the mixer and --
17 with integrated polyphase filters; is that right?
18 **A. Yes.**
19 Q. Okay. So if you look at page 7 at the
20 top, there's a Figure 14.
21 Do you see that?
22 **A. Yes.**
23 Q. So that's basically showing the image
24 reject chain that I mentioned before; right?
25 **A. Yes.**

26

1 Q. And then, the output of that figure would
2 have fed into the programmable gain amplifier;
3 right?
4 **A. Yes, yes.**
5 Q. Okay. And then that's basically the last
6 thing that's talked about in this paper; right?
7 **A. Yes.**
8 Q. Okay. So if we wanted to know about
9 the -- the next block, which is the low-pass filter,
10 then we'd have to go to a different paper; right?
11 **A. That's right.**
12 MR. JOHANNINGMEIER: Okay. So let's do
13 that. I'm going to go ahead and put in as Exhibit 7
14 what's Exhibit 1004 in the IPRs. This is the paper
15 titled "Adaptive Analog IF Signal Processer" and
16 this is the one that your declarations refer to as
17 "the Behbahani paper."
18 (Exhibit 7 marked.)
19 BY MR. JOHANNINGMEIER:
20 Q. Do you have that?
21 **A. Yes.**
22 Q. Okay. And so -- now this paper covers
23 a -- sort of another subset of the same receiver
24 chain; right?
25 **A. Yes.**

27

1 Q. And so, looking at -- well, start with --
2 on Figure 2, at the top of page 2. This is covering
3 the -- well, it's showing the image rejection down
4 to the programmable gain amplifier, right, and then
5 the variable band with adaptive DR bandpass filter
6 block; right?
7 **A. Right.**
8 Q. Okay. And so, that bandpass filter block,
9 that's the one we talked about where it's basically
10 one of two low-pass filters and then a high-pass
11 filter; right?
12 **A. Yes.**
13 Q. Okay. Now -- so going back a page to the
14 very first page of the article on -- so Figure 1;
15 right? So this is showing, basically, just kind of
16 a rough diagram of an analog bandpass filter
17 response over the top of a frequency spectrum;
18 right?
19 **A. Yes.**
20 Q. And so the idea here is that you want to
21 use this thing to pick one of QAM channels; is that
22 right?
23 **A. Yes.**
24 Q. Okay. And so -- now this also shows a
25 digital FIR filter that would have in the receiver

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1 chain in the real product, but that wasn't actually
2 built; right?
3 **A. Yes.**
4 Q. Okay. So essentially, the low-pass filter
5 gives you the initial up slope of this analog BPF
6 curve; right?
7 **A. That's the high-pass filter.**
8 Q. Oh. Yeah, sorry. Right. And then the
9 down slope on the other side is sort of the low-pass
10 filter portion; right?
11 **A. Yes.**
12 Q. And why does the low-pass filter circuit
13 come first?
14 **A. Why does it come first? Yeah, these are**
15 **engineering tradeoffs, and it has to do with signal**
16 **handling capabilities and all of that. So we have**
17 **decided that the interferers, which would lie to**
18 **the -- you know, the picture, Figure 1, starts from**
19 **DC, the interferers would lie at positive**
20 **frequencies. And there could be many of them. So**
21 **if we could suppress them first it will make the**
22 **design of the high-pass filter a lot easier.**
23 Q. Okay.
24 **A. So these are -- you know, the order in**
25 **which you cascade things is based on considerations**

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like that.
Q. Right. Right. And so -- so ultimately, it ends up being a lower power or easier configuration to do the low-pass filter first?
A. Right. Correct. For the high-pass filter, it simplifies that.
Q. Okay. Right. Right. Now -- so, you built in this circuit, basically, two completely separate low-pass filter blocks; right?
A. Yes.
MR. HART: Object to form.
Q. And that was because one -- one filter block wasn't going to give you sufficient dynamic range to cover the worst case, basically; right?
A. That's the idea, yes.
Q. Okay. And so here on page 2, it talks a little bit about the adjustments that can be made. And so in Figure 4, there's what's shown as -- it's basically a substitution of a scaled circuit block; right?
A. That's the worst case condition, yes.
Q. Yeah. So when -- when the worst case condition -- and that -- that's Exhibit 3-C; right? That's the worst case condition?
A. Yes.

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Q. Figure 23C?
A. Yes.
Q. Okay. So when that is detected, the circuit would swap to the -- the higher power or low-pass filter; right?
A. Yes.
Q. To get additional linearity, basically?
A. Yes. Well, dynamic range, lower noise.
Q. Right. I'm sorry.
A. Lower noise. Same maximum signal handling, but lower noise.
Q. But that circuit was basically 10X of the power consumption of the -- the other low-pass filter; right?
A. Yes.
Q. Okay. So the idea was only switch to that when you need it; right?
A. That's right.
Q. Okay. Now -- so this is describing that as a substitution. So I take it when that occurred, the low-power low-pass filter would be turned off and the high-power low-pass filter would be turned on, basically; right?
MR. HART: Object to form.
A. They would both be turned on, because ten

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times higher, it wouldn't make much of a difference if the low-pass filter was left on. But, yeah, you can think of it roughly like that.
Q. So -- and then, when you did that switch, basically, the signal pass was routed to run through the other filter, essentially; right?
MR. HART: Object to form.
A. Yeah. The signal path, I'm not sure if I would say it was "routed," because these two together comprise a single functional block, which is in Figure 2 labeled "Variable Bandwidth Adaptive Dynamic Range Bandpass Filter."
So the adaptive dynamic range is achieved by Figure 4B and the nominal operating conditions are Figure 4A, and all of that is bundled into this one block, which is the adaptive dynamic range bandpass filter.
Q. I understand -- I'm sorry.
A. So -- so the signal path, as far as the signal is concerned, it's flowing through what we call the "filter." And that filter has, inside it, circuits that can adapt dynamic range as needed. So I would consider this as not switching the signal path, but just offering the signal a variable dynamic range on demand.

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Q. Okay. But -- now, just as a matter of actual wiring, I understand that we can draw a box around any portion of the circuit and call it a filter or call it a chip or call it whatever, but what I'm asking about is the actual connections that were in the chip.
Can you look, with me, at Figure 9 on page 6 of this -- this -- what, Exhibit 7?
A. Yes.
Q. Okay. So just to get how this was wired, right, this seems to show the polyphase output, and then, basically, it's going to, basically, one of two paths through different amplifier stages, and there are switches on each of these paths.
Do you see that?
A. Yes.
Q. So essentially, when the higher power filter is off, I take it these switches are open and you're not jamming signal into it; right?
MR. HART: Object to form.
A. Well, it -- so in principle, if it's off, you could give it a signal or not, it wouldn't make any difference.
Q. Right, right.
A. But, yes, the intention is to route the

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signal to the low-pass power filter, but that doesn't necessarily exclude having a signal present at the high-power filter, because it's off so it's not going to respond.

Q. Right. I understand. So I just wanted to be clear that the actual -- I mean, what's disclosed here is fairly clear. You turn one on and then -- then it's used -- the higher power filter is used. But I wanted to just clarify that's how this actually worked.

When you did the swap, the signal was, as you said, rerouted to the other filter, and that filter is turned on and used. And then, when you're not using it, you turn it off to save power; right?

A. Correct. That's right.

Q. Okay. So now, so just looking at this, it appears to me like this is set up to essentially not drive the small -- to switch the signal, you know, away from or not drive -- wait, sorry. Strike that question.

So there's amplification shown here in this Figure 9; right?

A. Uh-huh.

Q. So you have an amplifier that's basically driving the high-power filter at the top; right?

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A. Yes.

Q. And then there's a different -- well, it looks like two driving -- oh, I'm sorry. There's one that -- so there's an amplifier that's only driving the high-power filter, right, the HPW step one; right?

A. But it also can drive the low-power filter. If you look at the dashed line --

Q. Oh, I see.

A. Yeah. So we use -- we basically got amplifier, we use them in different ways. We try to reuse stuff, so use them in different ways. We can route things kind of all over the place as is needed.

Q. Right. Okay. So this is -- this is basically showing the programmable gain amplifier block of the chain; is that -- is that right?

A. It's the pre-filter gain that came before the filter, because it was, again, after the filter as well.

Q. Right. So in the -- in the diagram, the Figure 2, it's what's labeled as PGA1; is that right?

A. Yes, yes.

Q. Okay. All right. And so, basically, you can switch in and out one or more of these amplifiers, depending on how much amplification you want to drive into the filter, basically; right?

A. Right.

Q. Okay. Now, this -- this paper describes the programmable gain driving the filter, but doesn't actually describe the filter either; right? That's the next one?

A. Yes.

MR. JOHANNINGMEIER: Okay. So let's look at what I'll go ahead and put in the chat as Exhibit 8, and this is Exhibit 1006.

(Exhibit 8 marked.)

BY MR. JOHANNINGMEIER:

Q. And it's what's been -- I think in your declarations you refer to this as the Tan paper; right?

A. Yes.

Q. Okay. So was it the case that Mr. Tan worked on the filter part?

A. He had -- yes, he had major contribution to the filter, yes.

Q. Okay. All right. And so this paper is -- it's about the channel select filter portion; right?

A. Yes.

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Q. Okay. So here, if you turn to the page 2, there is another block diagram up at the top in Figure 1; right? It's the same one, basically; right?

A. Yes.

Q. And so, again, here the -- what's shown is the analog chip from the image reject down converter through to the -- to where the A/D would be -- where it was actually built; right?

A. We did not build the HD, but yes.

Q. Okay. Yes. Okay. So the -- the -- basically, there was an analog output to this chip; right?

A. Yes, yes.

Q. All right. And so the block, then, that we've been calling the filter is what's labeled here as the variable bandwidth or BW, BPF.

(Reporter seeks clarification.)

Q. Variable bandwidth or BW, BPF. That's what you referred to as, sort of, the filter block; right?

A. Yes.

Q. Okay. Now, on the next page, Figure 3 up at the top, there's a -- what's basically described as a simplified diagram of the variable

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1 transconductor core of this filter; is that fair?
2 **A. Yes.**
3 Q. Okay. And so the inputs here are
4 differential and they're driving the gate of a
5 couple transistors; right?
6 **A. Uh-huh, yes.**
7 Q. All right. So now, does this diagram sort
8 of apply to both the high power and the low power
9 version? They were -- they have the same
10 architecture; right?
11 **A. Yes. I -- I can't say that -- roughly,**
12 **yes. I can't say in every detail, but yes. This is**
13 **describing a -- a variable transconductor that's**
14 **using transistors and resistors.**
15 Q. Right. And it's using the resistors, RS,
16 and then, I guess, to some extent, NM 3 and 4, it's
17 using that for degeneration; right?
18 **A. Yes, yes.**
19 Q. Okay. And so, basically, the resistor is
20 what's influencing the bias turn of this thing. Is
21 that a fair way to describe this?
22 **A. Yeah, it's a combination of RS and the**
23 **transistors NM3 and NM4, which is nonradio**
24 **resistors. They're operating in their triode region**
25 **and that's what gives us controllability. So by**

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1 **changing the voltage AFC, we can vary that**
2 **resistance.**
3 Q. Right. So NM3 and NM4 are basically --
4 can be thought of as a variable voltage variable
5 resistor; right?
6 **A. Yes. In series with a fixed resistor,**
7 **yes.**
8 Q. Sure. And again, this is basically what's
9 determining the -- the, sort of, bias current
10 through this circuit; right?
11 **A. Yes. In the simplified circuit, yes. So**
12 **you would have a bias voltage applied at the input,**
13 **and then this would determine the resulting current.**
14 Q. Right. Okay. Correct, correct. That's
15 clear. Yes. And so, again, the input of this is
16 differential; right? INP and INN; right?
17 **A. Yes.**
18 Q. Okay. And then the output of this, it's
19 basically not really shown, but it's a load
20 across -- well, there's a load connected between the
21 drains of these -- MN1 and MN2; right?
22 **A. Yes.**
23 Q. Okay. So, now -- so the signal passed
24 through this circuit is essentially into the input
25 and then out through the load; right?

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1 **A. Yes.**
2 Q. Okay. The -- the drain -- sorry, the --
3 the resistors, the bias -- what we call the bias
4 resistors, RS and NM3 and 4, doesn't actually carry
5 signal, right, that's not part of the signal path?
6 **A. No, they do. The signal flows from the**
7 **drain, through the transistor, into the source. So**
8 **just like this arrow indicates, there is a bias**
9 **current that flows through the transistor all the**
10 **way to ground. But simply, signal currents flow**
11 **through transistor to ground. So the signal can**
12 **flow in the load, through the transistor, through**
13 **RS, all the way down to ground.**
14 Q. Sure, I understand. But I mean, I
15 guess -- you know, fundamentally, this is how
16 transistors work. But I guess what I'm getting at
17 is, sort of, the idea of the signal path. So when I
18 think about signal path, I don't typically talk
19 about the, you know, currents that go straight to
20 the ground as being the path of the signal.
21 The signal through this -- through this
22 transconducting core is basically coming in the
23 input and out through the load; right?
24 **A. And --**
25 MR. HART: Object to form.

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1 **A. Yes. It goes to the load, yes. And then**
2 **on to other stages.**
3 Q. Right. Right. Just the next stage and
4 the next stage. Okay. So now, there's an --
5 additional diagrams of the circuit (indiscernible)
6 simplified in Figure 6 on page 5. Can you turn
7 there?
8 **A. Yes.**
9 Q. Now -- so this is showing, I mean,
10 basically the degeneration network is little bit
11 more complicated for one of these. But this is
12 basically showing the two filters, the low noise
13 low-pass filter and the low power low-pass filter;
14 right?
15 **A. These are the transconductors that**
16 **comprise those filters, so they're a building block.**
17 Q. Right, right. And I'm -- I'm -- you know,
18 I'm talking about the transconductor portion because
19 that's the portion you identified in your
20 declaration as being the variable part. So I
21 understand it's not the whole filter, but -- so
22 what's shown here in 6A is the variable
23 transconductor circuit for the
24 low-noise-high-power-low-pass filter; right?
25 **A. Yes.**

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Q. Okay. And so -- and essentially, it's got a little more detail about the low, but it is basically the circuit we were looking at in its simplified form in 2 to 3; right?
A. Yes.
Q. And then, Figure 6B is showing the -- sort of the low power low-pass filter; right?
A. Yes.
Q. The transconductor portion of it; right?
A. Yes.
Q. And I understand from reading this that for that one you could vary the bias current by basically picking one of the these sets of transistors. So the VAFC1, VAFC2, VAFC3, only -- or VFC4, only one of those is going to be active in a given time; is that right?
A. That's correct, but they do not affect the bias current. So VAFC1 through 3 are bridging resistors. They do not affect the bias current that runs vertically down to ground.
Q. Sure, yes. I'm sorry. But they're selecting a bias current by controlling where you put the bridge, basically; is that right?
A. No. They're selecting a degeneration. They're changing the degeneration without changing

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the bias current.
Q. I see. Okay. All right. Thanks. So I -- I do have an electrical engineering degree, but it's 25 years ago. So I -- you know, I apologize if I'm getting a few of these things slightly wrong.
A. No problem, no problem.
Q. Okay. All right. So, now -- so, again, these are -- within the bandpass filter blocks, these are two separate low-pass filter circuits. Basically, there's two separate low pass circuits in there; right?
MR. HART: Object to form.
A. Yes, two filters.
Q. Right. And then we already talked about how the one that's shown here at the top is basically ten times the power; right?
A. Yes, correct.
Q. And so, it's turned off when not in use; right?
A. Right.
Q. Okay. And so -- and for that matter, the -- the lower one -- lower power one is turned off when not in use too; right?
A. Right. I think that's the way we used it, yes.

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Q. Yeah, okay. Because, I mean, it doesn't save as much power, but it does save power if you turn it off when you're not using it; right?
A. Yes, yes.
Q. Okay. Now, I have a question about the table -- so if we look back at page 4 -- well, I'm sorry, before we go there -- let's just stay on these figures.
So looking at these two circuits, the -- for the transconductors, the -- the input of this -- of this circuit is -- again, it's a gate of -- well, it's a differential to the gates of the two transistors; right?
A. Yes.
Q. So the input impedance -- if you look -- if you're looking into the circuit at the input, the input impedance is very high?
A. Yes.
Q. Okay. And that's -- it's the same for both, basically; right?
A. Yes.
Q. Okay. Now, on page 4 section C in the -- near the top of the first column, there is a -- basically, it says, with the above bias voltages, the GM over I bias of the transconductance is about

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1. What is the GM over I bias figure, what does that represent?
A. It's got to do with current efficiency so, what you look to do is get as powerful a transistor as you can with as low of a bias current so that you save power. So this ratio is somehow an indication of that.
Q. Right. Okay. And now looking at the -- page 5 on -- there's a table, Table 2 at the top.
Do you see that?
A. Yes.
Q. So this is -- it says "characteristics of the filter transconductance." And so, basically, it's got a column here for high and low power. I think this is referring to both filters; is that right?
A. Correct. And it's referring to the transconductance only, so it's referring to the circuits in Figure 6.
Q. Right. Exactly. Okay.
And so -- so, basically, the GM over high diff figure is the same for both; right?
A. Yes.
Q. The ratio is roughly one?
A. Right.

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Q. And -- but the, sort of, nominal gain is -- is obviously a factor of ten higher for one than the other; right?
A. The transconductance, yes.
Q. Oh, I'm sorry. Yes, the transconductance. Upper case G sub M is the transconductance; right?
A. Yes. The effective transconductance of the circuit, yes.
Q. Right, okay. All right. And so, it's the whole thing. And so, that is basically ten times higher for the Figure 6 A circuit than the Figure 6 B circuit; right?
A. Yes.
Q. And now, the other thing here being the input output swing is essentially the same for both; right?
A. Yes.
Q. Okay. So the -- we talked about how the input impedance, looking at this transconductor, is high; right?
A. Yes.
Q. If you're looking at the output impedance, what's the output impedance of this transconductor circuit?
A. It's determined by the parallel

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combination of the NMOS FET, the one that receives the input, degenerated by the resistors in parallel with the PMOS FET output resistance, in parallel with this little block called "Negative Conductance" which is there to boost the output resistance. So three contributors.
Q. Right. And so, then the -- they would obviously -- well, maybe not -- let me start again.
Is it the same or different output impedance between these two circuits, 6A and 6B?
A. They -- they will be different because the transistor sizes are different.
Q. Okay. Right. Okay. So -- now, I had another -- I'm sorry, I'm just trying to ask clarifying questions about this -- you know, looking at Figure 9 on page 7.
A. Yes.
Q. So what is Figure 9 showing?
A. It's showing the architecture of the low-pass filter.
Q. Okay. And so, how does that transconductor circuit that we just looked at fit into that architecture?
A. So each of these triangles is a certain number of these transconductors connected in

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parallel. So at the input, we have five transconductors in parallel. It gives a transconductance with strength five times the unit transconductance, and then there's -- inside the filter, there are these triangles in opposing directions. Those are two transconductors with strength three each, and so on.
Q. Okay. And then what about these triangles with the two in them, what are those?
A. Those are termination resistors. So if we look at the picture on the very top which gives the equivalent circuit, we have what are called termination resistors at the input and the output.
This is called a "doubly terminated filter." So there's a resistor at the input to which you connect a voltage source and a resistor at the output where you sense the output voltage. And these two transconductors, whose output connects back to its input, simulate resistors.
Q. Uh-huh. Right. And so -- and I guess the other thing, then, is that, looking at these pairs of negative feedback transconductors, the triangles with "3" in them, each of those is meant to basically function as an inductor, essentially; is that right?

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A. When -- when connected or when coupled to capacitors. So, strictly speaking, starting from the left side, if we move horizontally, we get one pair of transconductor size 3, a capacitor, 25-unit capacitors, and then another pair of transconductors size 3. And end-to-end which is the terminals of where I started to where I ended, that simulator floating conductor. So four transconductors and one capacitor simulate a floating conductor as shown in the circuit above.
MR. JOHANNINGMEIER: Okay, great. Thanks.
Now -- okay. I think that's -- those are the questions I had on that. We can obviously refer back to these as we need to.
I want to actually ask you some questions about your declaration. Now, we've been going for about an hour, do you want to take a quick break or do you want to keep going?
MR. HART: This is Paul. I could use a break, if you don't mind.
THE WITNESS: I could use one too.
MR. JOHANNINGMEIER: No problem. Let's just take, like, a ten-minute break?
MR. HART: That's great, thanks.
THE VIDEOGRAPHER: Okay. We're going off

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1 the record. The time is 11:16.
2 (Recess.)
3 THE VIDEOGRAPHER: We are back on record.
4 The time is 11:30.
5 BY MR. JOHANNINGMEIER:
6 Q. Okay. Welcome back. Now, I wanted to ask
7 you about your declarations. And so, let's use the
8 one -- Exhibit 1, basically, for the '830 patent.
9 And I understand you have a copy of the '830 patent
10 there as well -- or the '330 patent, sorry, up --
11 **A. Yeah.**
12 Q. -- there as well?
13 **A. Yes, I do.**
14 MR. JOHANNINGMEIER: Okay. So I'm going
15 to go ahead and put that into the chat as Exhibit 9,
16 in case we need to refer to it.
17 (Exhibit 9 marked.)
18 BY MR. JOHANNINGMEIER:
19 Q. So actually, let's look at that right now.
20 And can you turn with me in the '330 patent to -- I
21 guess, it'll be page 23 of the exhibit, the bottom
22 of column 12.
23 **A. Yes.**
24 Q. Okay. So the bottom of column 12,
25 there's -- is where claim 1 is; right?

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1 **A. Yes.**
2 Q. Okay. And claim 1 is one of the claims
3 you analyzed; right?
4 **A. Yes.**
5 Q. Okay. So one of the things that claim 1
6 requires is that the signal path include a low noise
7 amplifier, a mixer, and a low-pass filter having an
8 input coupled to the output mixer; right?
9 **A. Yes.**
10 Q. So let's look at your declaration, then,
11 starting at paragraph 83 of Exhibit 1.
12 **A. Yes.**
13 Q. Okay. So this is the portion of your
14 declaration where you talk about the Behbahani
15 reference and you say that it has an -- a LNA, a
16 mixer, a filter topology; right?
17 **A. Yes.**
18 Q. And now, I understand from your
19 declaration that, you know, the claim when it says,
20 "coupled to," you're not reading "coupled to" as
21 requiring a direction connection with no intervening
22 circuitry; right? You're suggesting that "coupled
23 to" would allow for intervening things to be in
24 between; right?
25 **A. Well, simple things like an amplifier.**

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1 Q. Right. Right. Okay. I just wanted to
2 make sure I understand that was your -- your
3 interpretation. And I'm not saying it's wrong or
4 right. I just want to -- so your -- because the
5 Behbahani reference, for instance, has amplifiers
6 between the mixer and the filter; right?
7 **A. Right. Right.**
8 Q. Okay. But the -- the low-pass filter in
9 Behbahani is downstream from the mixer; right?
10 **A. Through an amplifier, yes.**
11 Q. Okay. And then, so, at the top of
12 page 47, you say -- you have a header that reads,
13 "Behbahani's LNA, Mixer, and Low-Pass Filter are
14 Components of an Integrated Circuit That Receives a
15 Signal"; right?
16 **A. Yes.**
17 Q. Okay. And so then, in paragraph 85, you
18 point to Figure 2, which depicts an analog chip that
19 includes the components, including a LNA, a mixer,
20 and a low-pass filter; right?
21 **A. Yes.**
22 Q. Okay. And so, here, you've referring to
23 the green box in Figure 2 as a low-pass filter;
24 right?
25 **A. Yes.**

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1 Q. But actually, we already talked about how
2 that box includes low-pass filter components and
3 high-pass filter components; right?
4 **A. Yes.**
5 Q. Okay. But the claim here requires a
6 low-pass filter; right?
7 **A. Yes.**
8 Q. But you're referring to the low-pass
9 filter component of that block; right?
10 **A. Yes, which --**
11 MR. HART: Object to form.
12 **A. Which actually appears first, so the PGA**
13 **feeds into a low-pass filter.**
14 Q. Right. Right. Understood.
15 Now, looking at page 49. At the top,
16 there's a figure. This is basically a layout of the
17 chip that we talked about earlier that your group
18 built; right?
19 **A. Yes.**
20 Q. Okay. And so, just so I understand,
21 there's -- basically, there's a purple section here
22 labeled, "Channel Select Filter" and "Auxiliary
23 Channel Select Filter."
24 **A. Yes.**
25 Q. Do you see that?

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A. Yes.
Q. So is that the entirety of the bandpass filter or is that just the two low-pass filters?
A. I am not sure, but it would seem... It would -- yeah, I am not sure. I mean, the high-pass filter might be on that box. Sorry. I don't remember.
Q. Okay. Would you look with me at Exhibit 8, which is the Tan paper. It might help.
On Figure 16, there's another micrograph of a chip.
A. Yes.
Q. Okay. And I would -- now, is that the same chip as what's in Figure 15 of Leetes or is it -- is it something different?
A. It's a standalone chip that just tests the filters. And you can tell that because the pads surround the chip and that defines the periphery of the chip.
Q. Okay.
A. So you see there's little white squares? They -- they run on three sides, so that means that's a standalone chip.
Q. Okay. So -- so there was a standalone chip built with just the filters; is that right?

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A. Yes.
Q. Okay. All right.
And then, those filters were also built in an integrated chip?
A. Right.
Q. Okay. To test the whole analog portion of the chain; is that right?
A. Yes.
Q. Okay. So here, looking at Figure 16 in the Tan paper, basically the signal through the chip is going to go through either what's labeled APF or low-power LPF; right? And then, into -- from either of those into the HPF block; right?
A. Yes.
Q. Okay. Now, let's look at -- go back to your declaration. I wanted to ask you about starting at paragraph 102.
So let me know when you're there.
A. Yes, I'm there.
Q. Okay. So this is part of a discussion about the dynamically changing and impedance element; right?
A. Yes.
Q. Okay. Now, so here in 102, you say, basically, "Transconductance is a well-known concept

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that is distinct from resistance," but basically that they're both electrical characteristics of current; right?
A. Yes.
Q. Now, how does -- well, okay. So then you say that "a person of ordinary skill would have understood that there's typically an inverse relationship between transconductance and resistance"; right?
A. Yes.
Q. Okay. But typically means not always; right?
A. It will -- no. It would be -- okay. So there's always an inverse relationship between transconductance and resistance because they are two separate concepts, but they are intimately related. So resistance --
Q. Right. Okay. Yeah.
A. Yeah. So resistance --
Q. Sorry. My question was going be, basically, because it says "typically." Like, what the -- is there a circumstance where they're not related, in your view, but it sounds like maybe not?
A. Yeah, there wouldn't be any such thing. Transconductance is just a generalized conductance.

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Conductance is the inverse of resistance, so a generalized conductance is where you apply a voltage on two terminals and you see the current in response at another two terminals. That's called a transconductance.
Whereas a conductance is where you only have two terminals. You apply a voltage across them and you see a current flow between the same two terminals.
So, transconductance simply separates the terminals where you apply the voltage and the terminals where you receive the current, whereas conductance unites those pair of terminals into one pair. Otherwise, both obey what you might say is Ohm's law. So in that sense, they are totally related.
Q. Now, is it your understanding that people use transconductance when referring to AC signals and small signals as opposed to DC?
A. You can apply transconductance to anything. It's nothing to with AC or DC. The concept of transconductance is completely general.
Q. Right. But like, for instance, so impedance has a real and a complex component; right?
A. Yes.

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1 Q. And so, in a resistor there's no complex
2 component to an impedance, so it can be said that a
3 resistor has an impedance; right?
4 **A. You can say it's got an impedance, but the**
5 **imaginary part is zero.**
6 Q. Right. So how is the -- the -- does
7 conductance also have a real and imaginary part?
8 **A. Of course. Conductance is simply the**
9 **inverse of resistance.**
10 Q. Right. Right. Okay. But basically, the
11 conductance of a resistor is going to basically just
12 the resistance?
13 **A. One over the resistance, yes. So a --**
14 Q. (Indiscernible).
15 **A. Right. So a 10 ohm resistor is .1 siemens**
16 **of conductance.**
17 Q. Mh-hmm. Right. Right. Okay.
18 So, but then, when you're -- okay.
19 So, now -- so you're essentially treating,
20 in this declaration, transconductance as an
21 impedance; is that fair?
22 **A. No, I'm not saying that. I'm saying that**
23 **there is a relationship. So an impedance has a very**
24 **specific meaning. It applies only to two terminals.**
25 **A transconductance is four terminals, two pair of**

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1 **terminals.**
2 **So you can't -- I can't treat them**
3 **equivalently, but they are in -- they are total**
4 **analogs of each other. They are -- transconductance**
5 **is a generalization of conductance. That's the way**
6 **I'm treating it.**
7 Q. Okay. Well, so now, the claim of the --
8 claim 1, for instance, of the '330 patent requires
9 dynamically varying impedance; right?
10 **A. Yes.**
11 Q. Now, you're pointing to a circuit where
12 you're saying the transconductance changes; right?
13 **A. Yes.**
14 Q. So how is changing the transconductance
15 changing an impedance?
16 **A. So there's -- I would like to refer to one**
17 **of the figures that you had brought up in the papers**
18 **earlier. Let me just find it.**
19 **So this is the Tan paper, Figure 3.**
20 Q. Okay. Right. This is the simplified
21 transconductor diagrams that we talked about
22 earlier?
23 **A. Yes. Yes.**
24 Q. Okay.
25 **A. So this is a variable transconductor, and**

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1 **the way I vary it is by clanging the resistance of**
2 **NM3 and NM4 with a voltage AFC.**
3 Q. Okay. So then that -- now, if you change
4 the voltage AFC, then you're basically -- you're
5 effectively changing the resistance of NM3 and NM4;
6 right?
7 **A. That's right. And they degenerate these**
8 **two transistors on the top, NM1 and NM2. So if you**
9 **change the degeneration, you change the effective**
10 **transconductance.**
11 Q. Okay.
12 **A. So associated with the transconductance,**
13 **there is -- inside the transconductance circuit,**
14 **there is a resistor somewhere. And the two**
15 **resistances that are not fixed, but which change**
16 **with bias current and so on, and with voltages, are**
17 **the channel resistance.**
18 **Channel means the conducting path between**
19 **the drain and the source of NM3 and NM4, as well as**
20 **NM1 and NM2. So as we change the transconductance,**
21 **we are actually changing the resistance of those**
22 **channels.**
23 **The channels are a conducting layer, and**
24 **we are putting more carriers or fewer carriers into**
25 **them. And that's what changes the transconductance**

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1 **of this circuit.**
2 Q. Okay. So -- and just to be clear, the
3 thing that you're pointing to is changing the
4 transconductance is variation of the voltage at
5 AFC --
6 **A. Yes.**
7 Q. -- right?
8 Which then causes to the variable resistor
9 trans -- well, the transistor NM3, which is
10 operating as a variable resistor, it causes that to
11 change its resistance and, therefore, the flow of
12 current through it; right?
13 **A. And therefore, the effective**
14 **transconductance presented by this entire circuit**
15 **where the transconductance is measured from the**
16 **input voltage NP and NN to the -- to the switching**
17 **or AC current going into the load. That's the**
18 **transconductance.**
19 **So that effective transconductance changes**
20 **as a consequence of the changing resistance in NM3**
21 **and NM4.**
22 Q. Right. So this would be true of any --
23 sort of any generic degeneration resistor used with
24 a transistor; right? If you change the degeneration
25 resistance, you're going to change the current

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1 through the signal varying transistor; right?
2 **A. Yes. Yes.**
3 Q. And so, then, you would be varying its
4 transconductance; right?
5 **A. Yes.**
6 Q. But the actual impedance that is changed
7 in -- in your -- what you're talking about here is
8 the impedance of NM3 and NM4; right?
9 **A. Yes. And also as a -- as a result, if**
10 **there's a change in bias current, there would be a**
11 **change in NM1 and NM2, but only if the bias current**
12 **also changes.**
13 Q. Right. Okay. So there's -- basically,
14 there is a change in the resistance value which,
15 then, causes a change in the bias current which,
16 then, obviously, changes the behavior of NM1 and
17 NM2; right?
18 MR. HART: Object to form.
19 **A. Yes. In this case, yes. But in Figure 6**
20 **of the same paper, there are transistors used which**
21 **do not affect the bias current. And so, in**
22 **Figure 6(a), if I change the voltages VAFC1 through**
23 **VAFC3, the bias currents aren't changed, but the**
24 **degeneration does change.**
25 Q. Okay.

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1 **A. So now, I'm counting on the resistance of**
2 **these pairs of transistors associated with VAFC1,**
3 **VAFC2, VAFC3. That resistance is changing up the**
4 **transistors and that's changing the degeneration,**
5 **and that's changing the overall transconductance of**
6 **the entire circuit.**
7 Q. Okay. So in -- in Figure 6(b), then, by
8 changing VAFC1, 2, or 3, you're effectively changing
9 the resistance that's on the -- sorry -- is it the
10 drain of the -- of INP2 and IN and -- is that right?
11 Sorry. I think I butchered that.
12 So what you're basically saying is by
13 changing VAFV1 through 3, you're affecting the
14 amount of degeneration resistance that's present?
15 **A. Yes, that's right. When -- differently**
16 **between two transistors, yes.**
17 Q. Okay. And then, so that will -- the
18 change in the amount of resistance that's there
19 going to ground will -- will cause -- well, does it
20 or does it not cause a change in the bias to
21 transistor INP?
22 **A. No, it doesn't change the bias current.**
23 Q. Okay. Now, what about AFC4 here?
24 **A. AFC4 is used for slight changes in the**
25 **bias current, but yeah. So all of these are used to**

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1 **give a variable transconductor that gives**
2 **different -- you know, this is a pretty wide ranging**
3 **transconductance. The GM variation in the low power**
4 **given in Table 2 is 50 percent. It's a very large**
5 **change of transconductance. So that change is kind**
6 **of divided up in these changes and various**
7 **resistance, VAFC1 through VAFC4.**
8 Q. Right. Right. Okay. Understood.
9 So then, going back to the declaration,
10 paragraph 103. I mean, you have this diagram there
11 as well.
12 So, do you see paragraph 103?
13 **A. Yes, I do.**
14 Q. So, I mean, it looks like it has been
15 slightly rearranged, but this is basically a
16 reproduction of Figures 6(a) and 6(b) from the Tan
17 paper; right?
18 **A. Yes.**
19 Q. Okay. And it's been highlighted with blue
20 and -- and red; right?
21 **A. I have a black and white print, so...**
22 Q. Oh, okay.
23 **A. Yeah.**
24 Q. All right. So the -- the ratios here --
25 **A. Yes.**

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1 Q. -- like, 190 over 3, 122 over 3, that's
2 the transistor with the length ratio, so that's the
3 size of the transistors; is that right?
4 **A. Yes.**
5 Q. Okay. And then, the -- the values that
6 are highlighted in red on mine, like 740 and 6K,
7 those are the resistor values; right?
8 **A. In ohms, yes.**
9 Q. Ohms. Okay.
10 And so, in the Figure 6(a), what you're
11 pointing to as the, sort of, lever that changes the
12 transconductance is VAFC; is that right?
13 **A. Yes.**
14 MR. HART: Object to form.
15 Q. So then that would basically, as we
16 discussed, changes the effective resistance of
17 the -- of the degeneration transceivers there and
18 changes the bias current; right?
19 MR. HART: Object to form.
20 **A. Yes. Although, it's in series with a**
21 **fixed resistor, so its effect is kind of dampened by**
22 **that. Yes.**
23 Q. Sure. Sure. Sure. But, I mean, that it
24 will affect the changes to the bias current, you
25 know, to the extent it's -- correct. Okay.

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1 Understood.
2 Now --
3 **A. And I do want to point out that these**
4 **transistors didn't -- that connect to ground are**
5 **always acting as resistors. They are in their trial**
6 **region of operation.**
7 Q. Right.
8 **A. So they act like resistors.**
9 Q. Right. Okay. Right.
10 So it's a way of essentially creating a
11 voltage-controlled resistance, essentially; right?
12 **A. Yes.**
13 Q. Okay. And so that's true of VAFC in
14 Figure 6(a), and then also VAFC4 in Figure 6(b);
15 right?
16 **A. As well as all the other VF -- VAFs because**
17 **they're all changing resistance.**
18 Q. Right. Right. Okay. I see. Right.
19 But as we discussed, changing VAFC1
20 through 3 is basically affecting the degeneration
21 without changing the bias current; right?
22 **A. That's correct, yes.**
23 Q. And changing VAFC4 would have -- would
24 have -- maybe relatively small, but would have an
25 effect on the bias current; right?

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1 **A. Yes.**
2 Q. Okay. All right. Now -- so, can you turn
3 with me to paragraph 124?
4 **A. Yes.**
5 Q. All right. So this is still talking about
6 the claim elements requiring -- sorry. One second.
7 Hold on.
8 Going back to the beginning of the
9 section, this is claim element 1(b), "reducing a
10 switching current in the single path by dynamically
11 changing an impedance of a component in the signal
12 path"; right?
13 **A. Yes.**
14 Q. Okay. And so here, you're kind of summing
15 up and basically talking about the switch between
16 the two filters. One of which has, essentially, a
17 higher transconductance by a factor of ten; right?
18 **A. Yes.**
19 Q. So then, therefore, a higher capacitance
20 and higher bias current; right?
21 **A. Yes.**
22 Q. So then, at the very end here, you say,
23 basically, if "a POSITA," a person of ordinary
24 skill, "would have understood, consistent with the
25 '330 patent and Dr. Tsividis' 2003 paper, that Tan's

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1 teachings confirm Behbahani's switch from high-power
2 to low-pass filter does in fact increase the signal
3 path impedance"; right?
4 **A. Yes.**
5 Q. So when the signal path is going through
6 the low-pass filter, it has a certain impedance;
7 right?
8 MR. HART: Object to form.
9 **A. It flows to a certain impedance; correct.**
10 **Yes, signal current flows through a certain**
11 **impedance.**
12 Q. Correct. And then, when the signal path
13 is flowing through to the high-power filter, it has
14 what you're saying is a different impedance; right?
15 MR. HART: Object to form.
16 **A. Yes.**
17 Q. Okay. Now, the actual claim language here
18 says, "Changing -- you have to dynamically change an
19 impedance of a component in the signal path"; right?
20 That's what the claim requires?
21 MR. HART: Object to form.
22 Q. If you look at the '330 patent with me at
23 the bottom of column 12.
24 **A. Yes.**
25 Q. Okay. So, "Dynamically changing an

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1 impedance of a component in the signal path."
2 So, in your opinion, what component in the
3 signal path has its impedance dynamically changed?
4 **A. The transconductors.**
5 Q. Of the low-pass filter?
6 MR. HART: Object to form.
7 **A. Yes.**
8 Q. Okay. Now, you're saying this occurs upon
9 the switch from the low- to the high-power filter;
10 right?
11 **A. Yes.**
12 Q. Now, when you do that switch, one set of
13 conductors is turned on and another set is turned
14 off; right?
15 MR. HART: Object to form.
16 **A. Another set is turned on, yes.**
17 Q. And the set that's turned on has a
18 different transconductance than the set that's
19 turned off; right?
20 **A. Yes.**
21 Q. Okay. Now, in that operation, the
22 transconductance of set one does not change; right?
23 **A. Set one being the low-pass filter?**
24 Q. Yeah. Let's just say the low-pass filter.
25 So we're running through the low-pass filter. We

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1 have a transconductance. We turn it off. We
2 haven't changed the transconductance of the low-pass
3 filter; right?
4 MR. HART: Object to form.
5 **A. Yes. Okay.**
6 Q. Okay.
7 **A. And we substitute the high-power filter,**
8 **yes.**
9 Q. Right. So then, if you look at the
10 high-power filter, it's sitting there off. It has a
11 certain theoretical transconductance. You turn it
12 on and now, you're using that transconductance;
13 right?
14 **A. Yes.**
15 Q. But by turning it on, you haven't changed
16 its transconductance; right?
17 **A. But you have changed the transconductance**
18 **of the filter functional block.**
19 Q. Okay. So -- but this is why I asked you
20 the question: What component in the signal path are
21 you alleging is -- has its impedance changed; right?
22 Because you'll agree with me that the
23 low-pass filter, the impedance doesn't change by
24 virtue of it being turned on or off; right?
25 MR. HART: Object to form.

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1 **A. Well, if you turn it off, its impedance**
2 **changes.**
3 Q. It's not working, so I guess -- well,
4 the -- the -- okay. So that's interesting.
5 Sorry. I didn't mean to interrupt you.
6 What were you going to say?
7 **A. Nothing. I was just responding to what**
8 **you were just pointing out.**
9 Q. All right. Well, so I guess what -- the
10 claim requires that something in the signal path
11 have its impedance changed; right?
12 **A. Yes.**
13 Q. Okay. And so, what I'm pointing out is
14 that there isn't a change to the impedance of either
15 the low-pass filter or the high-pass filter by
16 virtue of the swap; right?
17 **A. No. The signal encounters a totally**
18 **different impedance.**
19 Q. Oh, I -- I understand. But neither of --
20 the impedance of those transconductors don't change
21 by virtue of the swap; right?
22 **A. But the impedance experienced by the**
23 **signal does change.**
24 Q. Uh-huh.
25 **A. We're talking about what the signal does;**

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1 **right? It's -- it's irrelevant what a circuit**
2 **that's off may be doing. It's -- the important**
3 **thing is what does the signal experience. And it's**
4 **experiencing a high impedance when it's flowing**
5 **through the low -- low-power transconductor. And**
6 **then, it experiences a ten-times lower impedance**
7 **when it flows through the high-power transconductor.**
8 **So the signal is --**
9 Q. I understand.
10 **A. Yeah.**
11 Q. So, the -- but what it says in the claim
12 is that what matters is that a component in the
13 signal path changes impedance?
14 **A. The transconductance changes impedance.**
15 Q. But no component in the signal path
16 changes. What you're talking about is a rerouting
17 of the signal path; right, to a different component?
18 MR. HART: Objection to form.
19 **A. The signal experiences a filter. It**
20 **doesn't know that you're using switching or any**
21 **other means to, you know, to -- to alter the**
22 **properties of that filter.**
23 **The filter preserves its shape, but lowers**
24 **its noise, and the signal is unaware of that. So it**
25 **enters a transconductor, and the high-power**

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1 **transconductor, it encounters lower noise.**
2 **So if we look at it from the point of view**
3 **of the signal processing, the signal is seeing the**
4 **same filter -- the same filtering action, the same**
5 **frequency response of the filter, but just**
6 **experiencing lower noise when the power is ten times**
7 **higher.**
8 Q. Well, so I guess what -- I mean, you
9 understand that what has to be disclosed is the
10 actual claim language; right?
11 I mean, what we're talking about here is
12 whether or not the actual language of the claim is
13 what is -- was done in the -- these references or
14 not; right?
15 **A. To me, the component is a transconductor.**
16 **And how I modify its values is a matter of**
17 **engineering design. There are numerous ways to**
18 **modify its values. And what we have chosen to do is**
19 **for convenience, for actually good performance, we**
20 **simply substitute a bigger transconductor for a**
21 **smaller one.**
22 **These kind of substitutions are**
23 **commonplace in analog CMOS technology, and all**
24 **modern analog circuits use these kind of switches**
25 **to -- because MOSFETs make very good switches, so we**

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1 **can exploit that property to preserve many good, you**
2 **know, aspects of a particular circuit design and**
3 **scale it, in this case, by ten times.**
4 **So the signal is flowing and it is unaware**
5 **of how we've changed the transconductor that**
6 **comprises the filter, but it encounters a**
7 **transconductor of lower noise, and the component in**
8 **question is the transconductor.**
9 **It's a function. That transconductor**
10 **makes up a filter. That filter is an affixed**
11 **function. It gives the same frequency response.**
12 **So the signal is unaware that we have done**
13 **these switching things, and it just sees a**
14 **transconductor of lower noise and -- and higher**
15 **transconductance.**
16 Q. I understand. But I mean, the -- the way
17 that your -- your circuit worked was, basically, it
18 was to switch a different filter into the path;
19 right?
20 I mean, we can agree on that much; right?
21 The way that it worked was the switch from going
22 through one filter to going through another filter;
23 right?
24 MR. HART: Objection to form.
25 **A. When the filter has the identical**

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1 **frequency response.**
2 Q. Yes.
3 **A. So the -- the filtering function is**
4 **unaltered.**
5 Q. Uh-huh. Right.
6 **A. The detail of the filter might change, but**
7 **the filtering function is unaltered. It's still the**
8 **same filter as appears in the receiver block**
9 **diagram.**
10 Q. But the signal is traveling through
11 different components?
12 MR. HART: Object to form.
13 Q. Right?
14 **A. Yeah, but it's traveling -- that's true**
15 **for, you know, other parts of the circuit as well.**
16 **So yes, it's traveling through different components,**
17 **but it's seeing the same function.**
18 Q. Understood. I mean -- so I guess you
19 understand -- well, just to use a simple analogy, I
20 guess.
21 A light bulb. You can have a 10-watt
22 light bulb, a 50-watt light bulb; right? Those have
23 different impedances; right?
24 So I mean, just to use the analogy. If I
25 unscrew a 10-watt bulb and screw in a 50-watt bulb,

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1 I've changed the impedance of the bulb that's in use
2 and I've changed the amount of light in the room;
3 right?
4 **A. Yes.**
5 Q. Okay. Now, what if I just have one bulb
6 that's dimmable and adjust a dimmer switch? I can
7 change the impedance of a dimmable bulb with a
8 variable resistor dimmer switch; right? But I
9 haven't swapped the bulb.
10 **A. Yes. But you have done something to the**
11 **dimmer switch.**
12 Q. I understand. But, I mean, so what I'm
13 getting at is there is a difference, potentially,
14 between swapping one circuit for another and
15 changing the internal architecture of a particular
16 circuit; right?
17 **A. So in the case of a dimmer, there may be**
18 **switching of elements that's going on that enables**
19 **that same light bulb to put out a different amount**
20 **of light. What you've done is simply shifted the**
21 **switching action from the light bulb itself to the**
22 **dimmer.**
23 Q. Uh-huh. Right. Well, what I'm saying
24 is -- what I'm suggesting is that these are
25 different approaches. So to apply to it to your

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1 circuit, instead of having two filters, you could
2 have had one filter with a variable attenuator in
3 front of it and used the attenuator to vary the
4 amount of signal going in; right?
5 MR. HART: Object to form.
6 **A. Yes, but that would not have been a good**
7 **solution to the problem of a receiver.**
8 Q. I'm not suggesting that it would. I'm
9 saying that that's a possible approach; right? Just
10 to vary, you know, use a variable impedance in front
11 of one filter in order to adjust the level of signal
12 going in is something that could be done; right?
13 MR. HART: Object to -- object to form.
14 **A. It's hypothetical and does not serve our**
15 **purposes.**
16 Q. Right. Okay. So I guess then -- so to go
17 back to the original question here. If the claim
18 requires an impedance of a component in the signal
19 path to change, what, in your view, is the component
20 that changes?
21 **A. The transconductor and the capacitors.**
22 Q. Okay. And when you say the
23 "transconductor," you mean a particular
24 transconductor, or you mean you've swapped in a new
25 transconductor?

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A. I mean, the transconductor through which the signal flows to experience filtering.
Q. Okay. Right. Right. So if the -- the transconductor that the signal is flowing through has changed; right?
A. The --
MR. HART: Object to form.
A. The impedance of that transconductor has changed.
Q. Well, I guess I -- I -- I -- maybe we're running in circles, but the actual -- when I say "changed," I didn't mean that it has -- the particular transconductance circuit that the signal is going through has been substituted for a different one; right?
A. But the signal can't tell the difference.
Q. I -- that may be -- that may be true, but -- but actually what had happened in the disclosed circuit is that the -- the transconductance block that the signal is experiencing has been swapped --
A. Yes.
Q. -- for another one; right?
A. Yes, which is a very common technique.
Q. No. Understood. I mean, I'm not -- and

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I'm not -- I'm just basically trying to make sure we agree on what's happening in the circuit and -- and what you're pointing to. I'm just trying to clarify all of that. So -- and I'm not -- okay.
So now, can you pull up the declaration for the '825 patent? It's what I've marked as Exhibit 2. It's the proceeding IPR2024-00817.
A. Yes.
Q. Okay. So now, would you go with me to paragraph -- well, page 50. Right around paragraph 91.
Let me know when you're there.
A. Yes, I'm there.
Q. Okay. So now, these claims -- a slightly different language. And here, you're talking about the claim element that requires a circuit for determining a signal strength of an interferer and a circuit for determining the signal strength of the desire signalled; right?
A. Yes.
Q. And so, what are you saying is the circuit for determining the signal strength of an interferer?
A. Okay. So we have to look at the combined action. I'm now referring to the figure on page 51.

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We are looking at the combined action of sensing signal strength are composite (indiscernible) values or RMS values at four points in this block diagram; AI, A0, DI, D0.
Q. Uh-huh.
A. So the idea is that we can make very, very sharp selective filters, as shown in picture on top of page 50, the adjacent page -- the previous page.
We can make a very sharp digital filter that isolates one channel or the desired signal, and that's what comes out at D0.
Q. Uh-huh.
A. Now, this is a digitized signal, and the HD converter is like a voltage ruler. It measures the height of the signal or the amplitude of the signal with respect to its full-scale reference. Usually, that's one volt.
So the digitized signal that comes out at D0 is telling you the peak values that you can pick up there. Tell you the actual amplitude of the desired signal relative to one volt. It's a fraction of one volt.
So this way we can measure the desired signal. Now, if we also make a measurement at AI which is the entire band that's entered the receiver

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through the band pass filter and -- which is passed through all the mixer and so on, that comprises the desired signal and all the interferers. And we can measure the composite value of everything at AI.
Between these two points, there is a programmable gain amplifier, PGA2, whose gain we know because it is a digital control magnifier, and we know what gain it's going to give for a given digital word.
So we measure the desired signal alone at D0. We then divide that by the gain of known gain of the amplifier of PGA2.
That gives us the desired signal strength before amplification. Then, we compare it with the total measured strength at AI. And when we subtract, D0 divided by the PGA2 gain from AI, what remains is all the interferers.
Q. Okay. So you're identifying, then, the D0 measurement as the desired signal measurement; is that right?
A. Yes.
Q. Okay. And then, the sort of subtraction of -- well, so then, you're basically -- with the known gain, you're taking that back to what's shown in this diagram as A0, basically; right?

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A. Yes.
Q. Okay. And then subtracting A0 from AI to get -- that's what you're saying the interferer --
A. Well, strictly speaking -- right. So strictly speaking, I'm subtracting -- here's the actual operation. I look at AI minus D0 over the gain of PGA2. That's the calculation I'm doing.
Q. Okay. So --
A. And that --
Q. Yes.
A. Yes. Go ahead.
Q. I'm sorry.
A. Yeah.
Q. Sorry. I don't want to talk over you, but I -- I just want to make sure I understand.
The -- so what you are saying is that there was -- or at least contemplated a measurement at AI and a measurement amount D0; right?
A. Yes.
Q. And then, what's shown here is A0 would have been, essentially, a calculation because of the known gains rather than a separate measurement; is that right?
A. A0 is simply the -- so these measurements are used for many purposes, but A0 gives some sense

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of how effective the analog filter was.
So we are going back to the figure on the previous page, labeled Figure 1. The analog filter is somewhat selective, but it can't be anywhere as selective as the digital.
So nearby interferers will make their way through that filter, and A0 gives us a measure of that, as to how effective the filtering has been.
Q. So now, I -- we talked about before the -- how the digital part of this -- the GSG chip part of this was never actually built; right?
A. Yes.
Q. So I mean, you know, and these measurements -- what we're talking about here is, I mean, you -- you've obviously shown them on the diagram, but we're talking about, basically, theoretically, how these could be used; right? You didn't build this full functionality; right?
A. Yes.
MR. HART: Object to form.
Q. Okay. So -- so really, though, because we're talking about what's obvious from the references, we need to look at what the -- like, for instance, the Behbahani paper says about how this is done; is that right?

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MR. HART: Object to form.
A. I'm not sure what you mean. Could you elaborate, please?
Q. Well, would you turn with me to the Behbahani paper, Exhibit 7 or, basically, EX 1004?
A. Yes. Yes.
Q. Okay. And then, on page 3...
A. Yes.
Q. So here, there is the discussion in the first column here about the algorithm to sense the input signal and determine instant dynamic range; right?
A. Yes, yes.
Q. So this is the part of the paper that actually talks about AI and A0, and D0 and DI; right?
A. Yes.
Q. Okay. So now, essentially what's contemplated -- and so here, in the middle of this paragraph, it does talk about the desired signal as measured by power D0 minus the gain; right?
A. Yes.
Q. That's what you were talking about?
A. Yes, yes.
Q. D0 minus -- okay. All right. And then -- so basically this, here, at the end of this

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paragraph is talking about the condition for determining when the worst case shown in Figure 3(c) exists; right?
A. Yes.
Q. Okay. And it says that it's looking at whether the signal levels are significantly different at either pairs AI and A0 or DI and D0; right?
A. Yes, that's one way. There are numerous ways of doing it. Yes.
Q. Uh-huh. Well, so I'm just trying to focus on the way of doing it that's -- that we're -- we're alleging is taught here; right? So you're saying that -- I mean, because this is -- this is a portion of the reference that you are referring to?
A. Yes --
Q. -- teaching; is that right?
A. Yes. So if there is a big difference in the signal levels at D0, adjusting for the amplifier gain compared to AI, that means the entire interferers are very strong compared to the desired channel. That's in plain words. That's what triggers the worst case condition. Sensing the worst case condition.
Q. All right. Now, this doesn't say -- well,

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1 and it also says then -- it goes on to say there has
2 to be a weak signal at D0; right?
3 **A. Yes, that's right.**
4 Q. Because the worst case isn't just high
5 interferers. It's high interferers with low signal;
6 right?
7 **A. That's correct, so that difference has two**
8 **lows.**
9 Q. All right. Now, how did -- or how was
10 this circuit contemplated -- well, okay. Let me put
11 it this way: So this tells us how you detect the
12 worst case scenario; right?
13 **A. Yes.**
14 Q. How do you detect that you've gone out of
15 the worst case scenario?
16 **A. Well, for example, if A0 and AI are**
17 **comparable, then that means that the interferers**
18 **after the analog filtering are -- are -- you know,**
19 **they have been suppressed so much that you can't**
20 **even detect them.**
21 **So that's a case where the input signal**
22 **and the interferers are comparable, but again, you**
23 **can use -- you can use the relative values at D0 and**
24 **AI as well to detect that.**
25 **So if the analog filter suppresses the**

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1 **interferers to the point that, at its output, the**
2 **total signal level is not very different from its**
3 **input, then that means the interferers are benign**
4 **and the analog filter was very effective in**
5 **suppressing them.**
6 **So they would be kind of far away and not**
7 **usually different from the signal itself. So when**
8 **you have access to signal levels at different points**
9 **along the signal change like this, you have a lot of**
10 **information that you can use with various algorithms**
11 **to make these decisions.**
12 Q. Understood. And so, what I'm trying to
13 focus on is what -- which way this thing teaches.
14 And so, I read this sentence -- it says, "If the
15 total signal power is comparable at AI and A0 and DI
16 and D0, the condition is like Figure 3(a) or 3(b)."
17 Do you see that?
18 **A. That's right. Yes, that's correct.**
19 Q. This is basically what, I guess, you
20 started by saying if -- if the signals at AI and A0
21 are close to the same, then that's how you would
22 know that you didn't have significant interferers;
23 is that right?
24 **A. Yes. Yes.**
25 Q. Okay. So basically, this -- what's being

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1 disclosed here would go into a worst case condition
2 based on the -- what we talked about. And then, at
3 some point, when the interferers were determined to
4 be less, it would come out; right?
5 MR. HART: Object to form.
6 **A. Yes. Sorry, I can't follow that one.**
7 **Would you repeat that or rephrase it?**
8 Q. Well, so if you're in -- if you're in the
9 worst case condition, you're using the high-power
10 filter, what I'm asking is: How would you know to
11 come out of that condition? And it looks like what
12 this is saying is you would look for AI and A0 to be
13 comparable, for instance; is that right?
14 MR. HART: Object to form.
15 **A. Or D0 and -- and AI to be kind of in the**
16 **right ballpark, yes. So there are numerous ways of**
17 **doing it.**
18 Q. Right. But what this is talking about
19 looking at is, essentially, that the interferers
20 have gotten -- have decreased. And the way you're
21 look -- looking for that is by looking for AI and A0
22 or DI and D0 to be similar; right?
23 **A. Yeah. DI and D0 measure close interferers**
24 **nearby because the analog filters have already done**
25 **something. AI and A0 look at the whole thing, and**

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1 **so, they really focus on the far away interferers.**
2 **And yes, that's a good starting measure is**
3 **AI and A0 being comparable.**
4 Q. Okay.
5 **A. That would mean interferers are not so**
6 **great, that they'll cause trouble to the filter.**
7 THE CERTIFIED STENOGRAPHER: Counsel,
8 whenever you get to a good point, if we could take a
9 restroom recess.
10 MR. JOHANNINGMEIER: Oh, yes. Let's --
11 let's do that.
12 THE VIDEOGRAPHER: Okay. We are going off
13 the record. The time is 12:30.
14 (Recess.)
15 THE VIDEOGRAPHER: We are back on the
16 record. The time is 12:41.
17 BY MR. JOHANNINGMEIER:
18 Q. Okay. Welcome back. I wanted to ask you
19 about a different part of your declaration for the
20 '825 patent. This is -- would you go with me to
21 paragraph 101 on page 58?
22 **A. Yes.**
23 Q. Okay. So this is a section talking about
24 the circuit for measuring the signal strength;
25 right?

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1 **A. Yes.**
2 Q. Okay.
3 **A. Yes.**
4 Q. And so, this says that the -- the details
5 aren't given in the Behbahani paper, but you point
6 to a circuit that's in Figure 8 of the Tan paper; is
7 that right?
8 **A. Yes.**
9 Q. Okay. And so, this circuit is essentially
10 disclosing it's a peak detector; right?
11 **A. Yes.**
12 Q. So it can detect when a signal goes above
13 a preset threshold, basically; right?
14 **A. Yes.**
15 Q. And so, now, the figure that's actually
16 shown in Figure 8, here, it isn't being used just
17 for raw measurement. It's being used as part of a
18 gain control loop for the PGA block; right?
19 **A. Yes.**
20 Q. Okay. So it's essentially trying to
21 get -- now, why are there multiple peak detectors
22 here?
23 **A. We are trying to address a practical**
24 **problem associated with these active filters, and**
25 **that is that although the filter gain in its**

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1 **passband is one, that is if you apply a sine wave at**
2 **the passband frequency, it flows through the filter**
3 **and emerges on the other side without changing**
4 **amplitude. The transmission gain is one.**
5 **You can could have gains internal to the**
6 **filter which are greater than one, and that only**
7 **happens with active filters. With these things that**
8 **simulate inductors.**
9 **So there is the fear that you could have**
10 **internal saturation of nodes if you have these**
11 **unscaled swings internal to the filter. So the**
12 **purpose of these peak detectors is to monitor every**
13 **node inside the filter and look for that possibility**
14 **of some voltage swing getting to dangerously high**
15 **levels where it could saturate the transconductor**
16 **and -- and thereby ruin everything in the signal**
17 **path.**
18 **And so if the signal levels start to**
19 **approach this VRef, the PGA is turned down to make**
20 **the signal smaller to keep everything under control.**
21 Q. Okay. So here at -- now, looking at
22 paragraph 102, you say, "A person of ordinary skill
23 would have been motivated to utilize these signal
24 strength measurements circuits to measure nodes AI
25 and AO"; right?

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1 **A. Yes.**
2 Q. Now, in actual fact, in the circuit, there
3 wasn't -- there was no such circuit there; right? I
4 mean, the -- the -- these peak detectors weren't
5 actually used. They were used for a different
6 purpose; right?
7 MR. HART: Object to form.
8 **A. You mean at AI and AO?**
9 Q. Well, right. So we just talked about
10 the -- what you're showing is Figure 8 where you're
11 using peak detectors to measure signals within this
12 active filter?
13 **A. Yes.**
14 Q. In order to control the gains; right?
15 **A. Yes.**
16 Q. Okay. And then, you're saying a person
17 would have thought to use those peak detectors to
18 measure AI and AO; right?
19 **A. Yes.**
20 Q. Okay. But there weren't actually peak
21 detectors at AI and A0 in the -- the actual circuit;
22 right?
23 **A. Our prototype, just to contain the amount**
24 **of labor involved, we didn't put them in because we**
25 **had developed -- not peak detectors, but signal**

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1 **strength measurement circuits in the past, and we**
2 **knew how to build them.**
3 Q. Right.
4 **A. And so, we -- we decided, just to cut down**
5 **on the amount of work, not to put them on the chip.**
6 Q. Understood. But there are also -- you
7 know, they're not discussed in the papers either
8 though; right?
9 **A. Correct. Correct.**
10 Q. Okay. So your opinion here, as I
11 understand it, is that basically what is discussed
12 in the peak detectors in the gain and a person of
13 ordinary skill would have used those -- or could
14 have used those to measure the -- the -- the AI and
15 A0, for instance; right?
16 **A. Yes. But also in 103, I go on to say that**
17 **depending on the situation, you can also use a**
18 **different kind of signal strength measurement**
19 **circuit that we had published beforehand, which is**
20 **shown on page 61, which can cover much wider ranges**
21 **of signal strengths.**
22 Q. Okay. Well, so let me ask you, then,
23 about that. Are you saying that this Khorram
24 reference is part of your opinion or necessary to
25 your opinion?

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1 MR. HART: Object to form.
2 **A. It's -- it's just a -- kind of a --**
3 **pointing out that you can use different types of**
4 **circuits depending on the range of signal levels.**
5 **That's all it's saying. So --**
6 Q. So --
7 **A. -- we --**
8 Q. Yeah. What you're saying is --
9 **A. Yeah. The point is that signal detection**
10 **is well known at the time this circuit was**
11 **developed. And I gave an example of a signal**
12 **detection circuit in the filter and, later on, an**
13 **example of a logarithmic signal detection circuit**
14 **that we had used in a previous chip as ways of**
15 **measuring the signal.**
16 Q. Okay. But, to be clear, you're not saying
17 that this -- is it Khorram paper --
18 **A. Yes.**
19 Q. You're not saying that this Khorram paper
20 is somehow referenced by Behbahani or Tan; right?
21 **A. No, no, no. Because we assumed it was**
22 **sort of obvious by then.**
23 Q. Okay. All right. But, if we're just
24 looking at what's taught by Tan, for instance, it
25 doesn't mention this -- this additional paper that

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1 you did; right?
2 **A. Yes, that's right. It does not.**
3 Q. All right. Now -- so if you didn't put
4 the signal detection circuits into the -- the -- the
5 chip, how did you -- or did you measure the signal
6 strength at all in there?
7 **A. Yes, we did. We had analog buffers that**
8 **by bought out to --**
9 Q. Okay.
10 **A. -- so we measured on oscilloscope.**
11 Q. Okay. So you just -- you basically just
12 put in a test point where you could go in with a
13 scope and measure it?
14 **A. Right.**
15 Q. So I take it then that there was no --
16 because there was a test chip, there was no
17 automatic switching based on signal levels --
18 **A. Correct.**
19 MR. JOHANNINGMEIER: Okay. All right.
20 Okay. All right. Well, good news is this being
21 cross-examination, I don't have any additional
22 questions for you now, so unless your counsel wants
23 to do something, in which case I might have some
24 more, but otherwise, that's it for me right now.
25 MR. HART: Give us just a couple minutes.

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1 I may have some redirect.
2 MR. JOHANNINGMEIER: Okay.
3 THE VIDEOGRAPHER: Okay. We're going off
4 the record. The time is 12:50.
5 (Recess.)
6 THE VIDEOGRAPHER: We are back on record.
7 The time is 13:01.
8 EXAMINATION
9 BY MR. HART:
10 Q. Right. Dr. Abidi, I'd like to refer you
11 back to some questions about language in claim 1 of
12 the '330 patent. Counsel for patent owner referred
13 you to the last limitation in claim 1 of the '330
14 patent, which discusses changing an impedance of a
15 component in the signal path.
16 Do you recall that line of questions?
17 **A. Yes.**
18 Q. Now, you talked a lot about changing
19 transconductance and changing capacitances incident
20 to scaling between a low-pass filter branch and a
21 high-power filter branch.
22 Do you recall that?
23 **A. Yes.**
24 Q. What have you mapped to the claimed
25 component in the signal path cited in this last

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1 limitation of claim 1?
2 **A. It's --**
3 MR. JOHANNINGMEIER: Objection.
4 **A. It's the adaptive bandpass filter in the**
5 **receiver.**
6 Q. I see. Is that the block depicted in
7 Behbahani that is a variable bandwidth adaptive
8 bandpass filter?
9 **A. That's correct.**
10 MR. JOHANNINGMEIER: Objection.
11 Q. And -- and can you explain what components
12 within that filter block component cause the
13 impedance seen by the signal to change?
14 **A. Well, this --**
15 MR. JOHANNINGMEIER: Objection.
16 **A. This is an active filter, and it's made**
17 **up, as shown in one of the diagrams we looked at,**
18 **with transconductors and capacitors.**
19 **So the impedance levels are defined by**
20 **both of those quantities. The transconductors can**
21 **be scaled up in size and bias current, and their**
22 **transconductance goes down in inverse proportion.**
23 **The capacitors can be sized up and their reactance**
24 **goes down in inverse proportion. So those are the**
25 **impedances that change.**

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MR. HART: Okay. That's all I have, Corey.

EXAMINATION

BY MR. JOHANNINGMEIER:

Q. Now, when you say "those are the things that change," those are the things that change when you swap the two filters; right?

A. Yes.

MR. JOHANNINGMEIER: Okay. No further questions.

THE VIDEOGRAPHER: All right. If there's nothing further, this concludes the deposition of Dr. Asad Abidi. The time is 13:03.

(Deposition concluded at 1:03 P.M.)

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ERRATA SHEET FOR THE DEPOSITION OF:

CASE NAME: APPLE, INC V THETA, IP, LLC
CASE NUMBERS: IPR2024-00816,-00817, -00818, -00819 and -00820
DEPO DATE: TUESDAY, MARCH 11, 2025
DEPONENT: DR. ASAD ABIDI

CORRECTIONS

PG.	LN.	NOW READS	SHOULD READ	REASONS

SIGNATURE _____ DATE _____

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STATE OF CALIFORNIA)
) SS.
COUNTY OF LOS ANGELES)

I, DR. ASAD ABIDI, HEREBY CERTIFY UNDER PENALTY OF PERJURY UNDER THE LAWS OF THE STATE OF CALIFORNIA THAT THE FOREGOING IS TRUE AND CORRECT.

EXECUTED THIS ____ DAY OF _____, 2025, AT _____, CALIFORNIA.

_____
DR. ASAD ABIDI

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CERTIFICATE OF SHORTHAND REPORTER - NOTARY PUBLIC

I, NATALIE PARVIZI-AZAD, REPORTER AND NOTARY PUBLIC WITHIN AND FOR THE STATE OF CALIFORNIA DO HEREBY CERTIFY:

THAT DR. ASAD ABIDI, THE WITNESS WHOSE DEPOSITION IS HEREINBEFORE SET FORTH, WAS DULY SWORN BY ME BEFORE THE COMMENCEMENT OF SUCH DEPOSITION AND THAT SUCH DEPOSITION WAS TAKEN BEFORE ME AND IS A TRUE RECORD OF THE TESTIMONY GIVEN BY SUCH WITNESS.

I FURTHER CERTIFY THAT THE ADVERSE PARTY, PETITIONER, WAS REPRESENTED BY COUNSEL AT THE DEPOSITION.

I FURTHER CERTIFY THAT THE DEPOSITION OF DR. ASAD ABIDI OCCURRED REMOTELY THROUGH ZOOM VIDEOCONFERENCE ON TUESDAY, MARCH 11, 2025, COMMENCING AT 10:14 A.M. TO 1:03 P.M.

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I FURTHER CERTIFY THAT I AM NOT RELATED TO ANY OF THE PARTIES TO THIS ACTION BY BLOOD OR MARRIAGE, I AM NOT EMPLOYED BY OR AN ATTORNEY TO ANY OF THE PARTIES TO THIS ACTION, AND THAT I AM IN NO WAY INTERESTED, FINANCIALLY OR OTHERWISE, IN THE OUTCOME OF THIS MATTER.

IN WITNESS WHEREOF, I HAVE HEREUNTO SET MY HAND THIS 17TH DAY OF MARCH, 2025.

MY COMMISSION EXPIRES:
NOVEMBER 30, 2025

NOTARY PUBLIC IN AND FOR THE
STATE OF CALIFORNIA