

Texas Instruments Incorporated
(Petitioner)

v.

ParkerVision, Inc.
(Patent Owner)

Petitioner's Demonstratives

IPR2024-00934

U.S. Patent No. 7,496,342

Before Hon. Michael R. Zecher, Bart. A. Gerstenblith,
and Iftikhar Ahmed

Administrative Patent Judges

FISH.

Demonstrative Exhibit – Not Evidence

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Galton's Simulations Are Admissible

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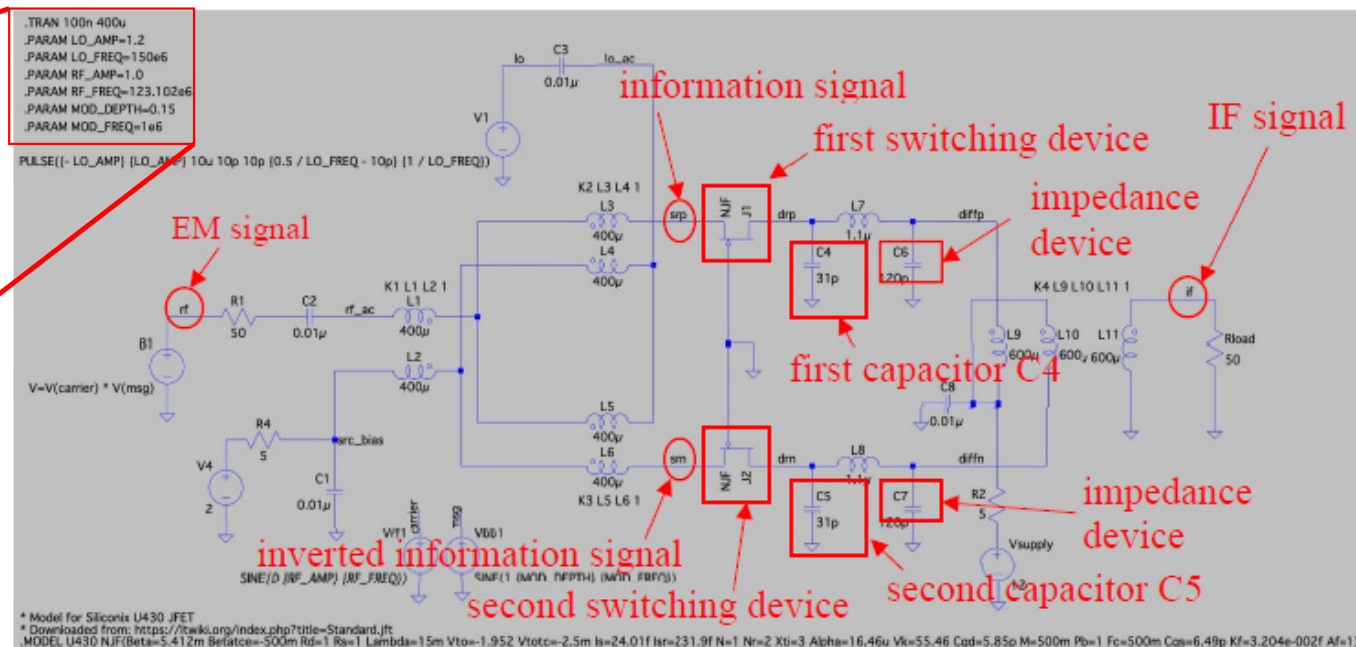
Event Overview

Date	TI (Petitioner)	PV (Patent Owner)
5/18/2024	Petition filed with Galton model and simulations results	
8/29/2024		PV filed POPR attacked the models and accused Galton of cherry-picking, without addressing the specific simulation selection of JFET type
11/26/2024	Petition instituted	
2/26/2025	Galton discovered JFET issue; reran simulation using U430 JFET	
2/28/2025	Deposition of Galton (During deposition, Galton identified JFET selection unprompted, and offered updated simulations	
2/28/2025	TI reiterated offer of new U430 JFET simulations to PV	
2/28/2025		PV rejected offer, but quickly reconsidered
3/5/2025	Board call	
3/6/2025		PV served discovery for simulations and related information
3/20/2025	TI stipulated to accommodate an extension of POR deadline, and to second Galton deposition; TI timely served discovery	
4/21/2025		PV filed POR and Ricketts declaraiton, each addressing Galton second declaration and updated simulations , and exhibits including Galton deposition transcript (EX2039, attaching the second Galton declaration and updated simulation code)
7/7/2025	TI filed Pet Repy, including refiling of Galton second declaration as an independent exhibit (EX1046)	

Galton Declaration (TI-1003)

Provided Detailed Model of DeMaw

```
.TRAN 100n 400u  
.PARAM LO_AMP=1.2  
.PARAM LO_FREQ=150e6  
.PARAM RF_AMP=1.0  
.PARAM RF_FREQ=123.102e6  
.PARAM MOD_DEPTH=0.15  
.PARAM MOD_FREQ=1e6
```



DEMAW-SIM-FIG. 1, DeMaw Balanced Mixer

E.g., TI-1003, ¶¶ 73-74

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Galton Declaration (TI-1003) Explained Initial Circuit Simulations

73. For the DeMaw circuit simulations, parameter values that were described in DeMaw were used, with minor adjustments. For example, the exact parameters of the transformers were not provided; only the physical description was given. Reasonable values were calculated based on the expected circuit operating conditions. In particular, the transformer coupling ratio is ideal, however using a realistic (non-ideal) coupling ratio would not affect the presented results. A SPICE model was found for the exact JFET specified in the book, the Siliconix U430.

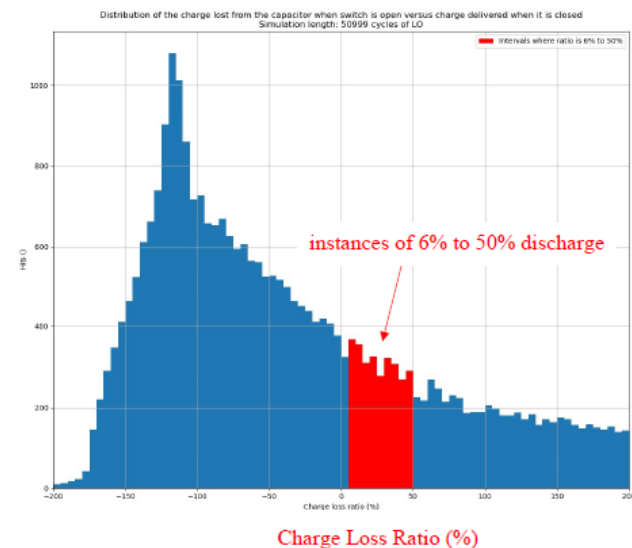
74. The DeMaw circuit was simulated for 400 μ s. The LO signal used is a square wave of 150MHz and amplitude of 1.2V peak. While using a square wave for the LO of this circuit is an idealization, it does not alter the circuit behavior in any way relevant to the presented results. It was chosen to be able to clearly see the transition between switch ON and OFF states.

E.g., TI-1003, ¶¶ 73-74

FISH.

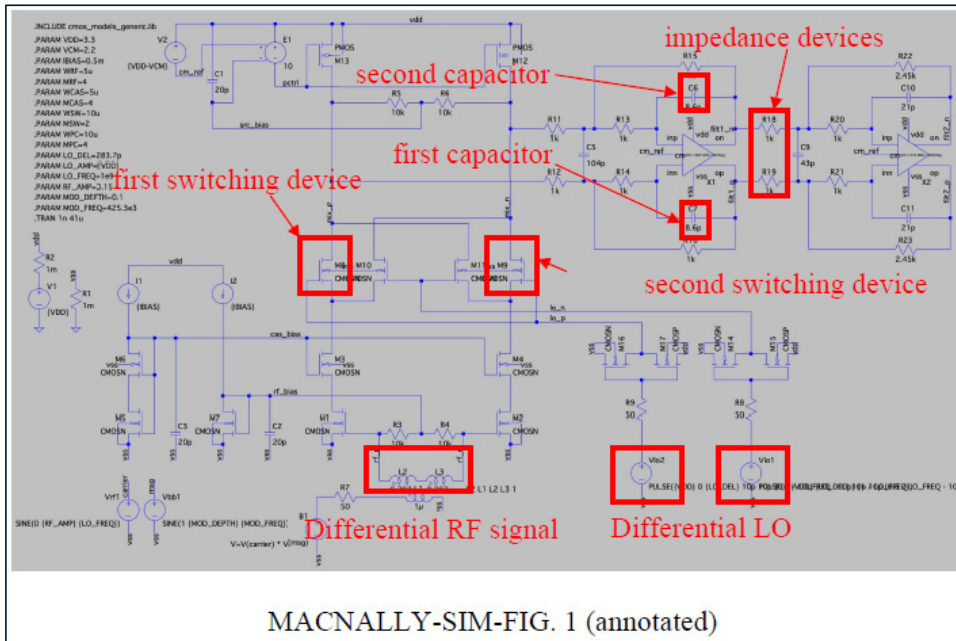
Demonstrative Exhibit – Not Evidence

114. DeMaw teaches claim 19. Specifically, using the transition edges of the LO signal, and the knowledge that the switch opening and closing is dictated by the LO signal amplitude, we can compute on a cycle-by-cycle basis the charge ratio described in claim 19. This ratio is collected for 50,999 simulation cycles and plotted as a histogram, shown in DEMAW-SIM-FIG. 7.



E.g., TI-1003, ¶¶ 114

Galton Declaration (TI-1003) Explained Initial Circuit Simulations



E.g., TI-1003, ¶¶ 93-94 (cited by Pet. at 53)

94. The circuit was operated with a 1.0GHz LO clock, performing direct down-conversion on an RF signal comprised of a 1.0GHz sinusoidal carrier amplitude-modulated (AM) 10% by a 425.3 kHz sinusoidal message signal. This simulation deviates from the original patent's intended modulation of BFSK. The use of AM modulation instead of BFSK modulation was simply to make the plots easier to interpret. However, this choice does not alter the mixer's functionality or behavior in any way relevant to the presented results.

E.g., TI-1003, ¶¶ 93-94 (cited by Pet. at 53)

149. Macnally teaches claim 19. As the mixer switches are driven by the full-swing LO clock signal, it is possible to compute the intervals of time when the switches are open versus closed. The identical post-processing script that was used

E.g., TI-1003, ¶¶ 93-94 (cited by Pet. at 53)

POPR – Criticized Galton’s Simulation Value Selection

DeMaw

TI/Dr. Galton merely assert that “[t]he LO signal used [in DeMaw’s circuit simulation] is a square wave of 150MHz and amplitude of 1.2V peak.” Pet., 18 (citing TI-1003, ¶¶ 72-74) (emphasis added). TI/Dr. Galton simply chose values and a waveform to get to the result that they needed.

Second, TI/Dr. Galton assert that RF signal in the simulation “was generated with a 1.0 volt, 123.102MHz sinusoidal carrier AM modulated with a 0.15 volt, 1 MHz sinusoidal ‘message signal.’” TI-1003, ¶ 96; *see also* Pet., 19. Yet, DeMaw lacks any disclosure regarding the RF signal frequency, modulation, or amplitude.

cannot properly investigate and rebut the analysis. And allowing Petitioners to exploit the prior art’s lack of disclosure to cherry-pick self-serving values without any explanation or rationale undermines the integrity of the proceedings.⁴

Paper 6 at 10-12

Macnally

Notably, Dr. Galton’s simulations, which TI rely upon to support its argument, use a “full-swing LO clock signal” that is neither taught nor suggested by Macnally. Dr. Galton even admits that “[t]he circuit was built using the limited descriptive text available in the patent,” and that “[t]his simulation *deviates* from the original patent’s intended modulation of BFSK.” TI-1003, ¶¶ 92, 94 (emphasis

Paper 6 at 15-16

Institution Decision – Sufficiency of Parameter Selection Acknowledged

that are best resolved upon a complete record. In our view, Dr. Galton provides a sufficient explanation as to how he performs the circuit simulations on a model of DeMaw's circuit diagram illustrated in Figure 6.7 by using routine experimentation, including the selection of parameter values taught by DeMaw together with expected minor adjustments that yield the simulation results. Ex. 1003 ¶¶ 72–74, 114–16. We note that ParkerVision will have an opportunity to cross-examine Dr. Galton regarding how he performed the circuit simulations should ParkerVision choose to pursue this argument further during trial. See 37 C.F.R. § 42.53.

Paper 10 at 24

Just Days Before Deposition – Galton Reran Simulations

21	I believe earlier you testified that you
22	discovered a mistake in your model of DeMaw such
1	that it was not loading the specific JFET models
2	you were looking to use.
3	Is that correct?
4	A Yes.
5	Q When did you discover that mistake?
6	A <u>Just a few days ago.</u>
7	Q And I believe you said you resimulated it
8	to account for using the correct JFETs.
9	Is that correct?
10	A That is correct.
11	Q And when did you do that simulation?
12	A <u>Day before yesterday. And the night</u>
13	<u>before that.</u>

EX.-2036, 101:21-102:13 (cited by Paper 42 at 2-3)

Also, Inspired by POPR Arguments – Galton Reran Simulations With Other Values

14	Q	And I think you also mentioned that you
15		had <u>simulated DeMaw with sine wave LO?</u>
16		Is that correct?
17	A	Yes.
18	Q	When did you perform that simulation?
19	A	I don't remember the exact date, but it
20		was <u>after seeing the patent owner's preliminary</u>
21		<u>response.</u> And it was just because they in that
22		response suggested that we were picking values,
1		<u>cherry-picking values</u> to get the results we
2		wanted. And I wanted -- <u>I knew that wasn't true,</u>
3		and I wanted to be able to say truthfully in the
4		depo that not only did I know that wasn't true,
5		but that we went back and simulated and found it
6		to not be true.

EX.-2036, 102:14-103:6 (cited by Paper 42 at 2-3)

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During First Galton Deposition – Galton Offered the New Simulation Data to PO

21 We have since resimulated with the
22 Siliconix models correctly inserted, and the
1 qualitative behavior of the circuit is the same in
2 the sense that it still functions correctly as a
3 mixer. And, also, the histograms still show the
4 discharge ratios between 6 and 50 percent at all
5 possible levels.
6 So -- so, yeah, that was a mistake that
7 we discovered later, but it didn't -- it didn't
8 materially change the results.

EX.-2036, 44:9-45:8 (cited by Paper 42 at 3, 9)

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9 Q All of the simulation results and graphs
10 in your declaration, though, rely on a JFET model
11 that is not the Siliconix U430 JFET. Correct?
12 MR. MAGEE: Objection. Form.
13 THE WITNESS: Sorry. Go ahead.
14 MR. MAGEE: Objection. Form.
15 A All of the simulations related to DeMaw
16 that are in the declaration use -- do not use the
17 Siliconix JFETs. But like I said, we have since
18 simulated with the Siliconix JFETs and got
19 comparable results. And it doesn't change any of
20 our conclusions, or any of my conclusions.
21 Q But I don't have any of the results from
22 the Siliconix U430 --
1 A That is correct. But I have them with
2 me. I'd be happy to share them with you.
3 Q Keep them. Thank you.

EX.-2036, 45:9-46:3 (cited by Paper 42 at 3, 9)

After First Galton Deposition – TI Counsel Offered the JFET Simulation Data to PO

From: Josh Griswold <griswold@fr.com>
Sent: Friday, February 28, 2025 4:35:31 PM
To: Jason Charkow <jcharkow@daignaultiyr.com>; Stephanie Mandir <smandir@daignaultiyr.com>; Taylor Lepore <tlepore@daignaultiyr.com>; IPR12189-0092IP1 <IPR12189-0092IP1@fr.com>; PTAB Inbound <PTABInbound@fr.com>; Rishi Gupta <rgupta@fr.com>; Yao Wang <ywang@fr.com>; Rick Bisenius <bisenius@fr.com>
Cc: PV <PVLit@daignaultiyr.com>
Subject: RE: Texas Instruments Inc., and NXP USA, Inc. v. ParkerVision, Inc. - Extension Request for Patent Owner Responses

Stephanie,

The error Dr. Galton mentioned in his model was mistake that caused it to not load the intended JFET model. He had just told us of it during our meeting with him Thursday. As he testified, he's run the simulation again and verified the error doesn't change the opinions he's offered.

We would like to provide you simulation outputs, like in his declaration, but using the correct JFET model so you can account for it in your POR. We'd agree to extend your POR date to the 13th and allow you to ask Dr. Galton questions about the updated simulation output, under oath, prior to his '177 and '528 depo. We expect to have the update ready to serve on you Monday.

We'll prepare the stipulation to move the '342 POR deadline and send it over.

Best,
Josh

TI-1061 at 3 (cited by Paper 42 at 3)

Demonstrative Exhibit – Not Evidence

After the Deposition, TI Counsel Offered the JFET Simulation Data to PO

From: Josh Griswold <griswold@fr.com>
Sent: Friday, February 28, 2025 4:35:31 PM
To: Jason Charkow <jcharkow@daignaultiyr.com>; Stephanie Mandir <smandir@daignaultiyr.com>; Taylor Lepore <tlepore@daignaultiyr.com>; IPR12189-0092IP1 <IPR12189-0092IP1@fr.com>; PTAB Inbound <PTABInbound@fr.com>; Rishi Gupta <rgupta@fr.com>; Yao Wang <ywang@fr.com>; Rick Bisenius <bisenius@fr.com>
Cc: PV <PVLit@daignaultiyr.com>
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We'll prepare the stipulation to move the '342 POR deadline and send it over.

Best,
Josh

TI-1061 at 3 (cited by Paper 42 at 3)

TI Offers Rejected By PO

From: Jason Charkow <jcharkow@daignaultiyer.com>
Sent: Friday, February 28, 2025 4:10 PM
To: Josh Griswold <griswold@fr.com>; Stephanie Mandir <smandir@daignaultiyer.com>; Taylor Lepore <tlepore@daignaultiyer.com>; IPR12189-0092IP1 <IPR12189-0092IP1@fr.com>; PTAB Inbound <PTABInbound@fr.com>; Rishi Gupta <rgupta@fr.com>; Yao Wang <ywang@fr.com>; Rick Bisenius <bisenius@fr.com>
Cc: PV <PVLit@daignaultiyer.com>
Subject: Re: Texas Instruments Inc., and NXP USA, Inc. v. ParkerVision, Inc. - Extension Request for Patent Owner Responses

we will not accept that new material. It is new evidence. We will not be addressing it in our por. We will only be addressing what was in the actual petition.

TI-1061 at 3 (cited by Paper 42 at 3)

Board Guidance Requested

From: Jason Charkow <jcharkow@daignaultiyr.com>
Sent: Tuesday, March 4, 2025 5:57 PM
To: Trials <Trials@USPTO.GOV>
Cc: PV <PVLit@daignaultiyr.com>; Josh Griswold <griswold@fr.com>; Konah Duche <kduche@daignaultiyr.com>; Stephanie Mandir <smandir@daignaultiyr.com>; Taylor Lepore <tlepore@daignaultiyr.com>; IPR12189-0092IP1 <IPR12189-0092IP1@fr.com>; PTAB Inbound <PTABInbound@fr.com>; Rishi Gupta <rgupta@fr.com>; Yao Wang <ywang@fr.com>; Rick Bisenius <bisenius@fr.com>
Subject: IPR2024-00934 - Texas Instruments Inc. v. ParkerVision - Requesting Guidance

CAUTION: This email has originated from a source outside of USPTO. PLEASE CONSIDER THE SOURCE before responding, clicking on links, or opening attachments.

Dear Honorable Board,

The parties require your guidance on an issue that arose on Friday 2/28. The parties request a call with the Board and are available at the following dates/times:

- Wednesday 3/5 - after 2 PM EST
- Thursday 3/6 - 2-3 PM EST

On August 29, 2024, ParkerVision (Patent Owner) filed and served its POPR in which ParkerVision identified deficiencies with circuit simulations prepared by Petitioner's expert,

EX.-3002

Dr. Galton, in his declaration accompanying the Petition. These simulations provide the basis for TI's invalidity positions and these deficiencies go directly to the heart of the issue in this IPR.

On November 26, 2024, the Board instituted the IPR. The parties agreed to extend the date for the POR until March 6, 2025.

On Friday 2/28, ParkerVision took to the deposition of Dr. Galton. During that deposition, Dr. Galton stated he was aware of a mistake that he made in his simulations. For the first time, Dr. Galton/TI sought to provide corrected simulations at the deposition to correct this mistake. Dr. Galton also referenced undisclosed simulations (not included in his Declaration) that he ran after receiving the POPR and offered to provide these simulations as well. ParkerVision refused to accept any corrected or undisclosed simulations during the deposition because they were not part of the record and ParkerVision had no time to consider them in the middle of the deposition.

On Friday 2/28 night, TI offered to provide corrected simulations to address the mistake by Monday 3/3 as well as a 10-day extension for ParkerVision to file its POR and address these simulations and depose Dr. Galton on the new corrected simulations.

Now, instead of having nine months to have its expert consider TI's simulations as it should have, ParkerVision and its expert are being asked to address the corrected simulations in its POR in 10 days. ParkerVision's expert (who had already prepared his own simulations based on what was in the Petition) is also busy during this time.

Also hanging out there are TI's undisclosed simulations (referenced by Dr. Galton at his deposition) that Dr. Ricketts will never have an opportunity to address.

The late disclosure of the corrected and undisclosed simulations is highly prejudicial to ParkerVision, because ParkerVision and its expert do not have ample time to consider any of these simulations and prepare a response (including simulations to counter TI's simulations). There is also no more time left in the schedule to give ParkerVision the months that it is entitled to review the simulations under the IPR rules.

ParkerVision does not believe that TI's corrected or undisclosed simulations should be allowed, and seeks the Board's guidance.

TI responds that, as Dr. Galton testified during the deposition, the mistake was a typo that resulted in the simulations calling a generic JFET instead of specific JFET model identified in the prior art. Dr. Galton testified that the mistake was discovered "just a few days ago" and it "didn't material change the results." TI has offered to provide ParkerVision the corrected simulations (with the mistake corrected) and opportunity to depose Dr. Galton on the corrected simulations. TI does not seek to file the corrected simulations at this time, but TI does not oppose ParkerVision entering them into the record. TI does not seek to file the additional simulations performed by Dr. Galton since the POPR at this time. And because TI has not received ParkerVision's POR, TI takes no position on whether the additional simulations performed by Dr. Galton since the POPR will be filed in reply to the POR.

Sincerely,
Jason

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Demonstrative Exhibit – Not Evidence

PO Discovery Request – Served

From: Stephanie Mandir <smandir@daignaultier.com>
Sent: Thursday, March 6, 2025 10:42 AM
To: Josh Griswold <griswold@fr.com>; jcharkow@daignaultier.com; kduche@daignaultier.com; Taylor Lepore <tlepore@daignaultier.com>; IPR12189-0092IP1 <IPR12189-0092IP1@fr.com>; PTAB Inbound <PTABInbound@fr.com>; Rishi Gupta <rgupta@fr.com>; Yao Wang <ywang@fr.com>; Rick Bisenius <bisenius@fr.com>
Cc: PV <PVlit@daignaultier.com>
Subject: RE: Texas Instruments Inc., and NXP USA, Inc. v. ParkerVision, Inc. - Extension Request for Patent Owner Responses

Counsel,

Following our conversation with the Board yesterday, and after conferring with our client, we have decided to move forward by requesting production of all of Dr. Galton's additional simulations now.

During his deposition, Dr. Galton stated that he re-ran simulations to correct the mistake of using a generic JFET model instead of the specific Siliconix U430 model disclosed in DeMaw. He also indicated that he ran other simulations with various modifications based on waveforms and values from the prior art references. Dr. Galton confirmed he is willing to share all of these new simulations with us now. Accordingly, we request the following:

1. Simulations run by Dr. Galton where he fixed the mistake of using the generic JFET model and implemented the specific Siliconix U430 model;
2. All other simulations run by Dr. Galton after reviewing the Patent Owner's Preliminary Response, including any variations or iterations;
3. All related Python code used to generate or analyze the simulations, including any model libraries, native LTSpice files, and additional generic or supporting files necessary to replicate the simulations; and
4. Any instructions or scripts used for running the simulations, including Python-based instructions.

Please confirm when you can produce these materials so that we have sufficient time to review them before re-deposing Dr. Galton in IPR2024-00934. We do not believe we will have enough time to prepare to depose Dr. Galton on these issues on March 12. We will need to discuss another date for Dr. Galton to be deposed on the new simulations.

We also believe a one-month extension of the Patent Owner's Response deadline from the date we receive the full production is appropriate. The Board confirmed during our call that they are willing to adjust the schedule on the backend to accommodate this.

Please confirm when you can produce these materials and your position on a corresponding extension of the POR deadline.

Best,
Stephanie



Stephanie R. Mandir
Counsel

FISH.

TI-1052 at 3 (cited by Paper 42 at 4)

PO Discovery Request – Served

Do you think you can definitely provide materials on March 17? We don't want to propose a schedule if we are only going to have to rework it again because TI cannot meet that date.



Jason S. Charkow

From: Josh Griswold <griswold@fr.com>
Sent: Tuesday, March 11, 2025 10:43 AM
To: jcharkow@daignaultiyer.com; Stephanie Mandir <smandir@daignaultiyer.com>; kduche@daignaultiyer.com; Taylor Lepore <tlepore@daignaultiyer.com>; IPR12189-0092IP1 <IPR12189-0092IP1@fr.com>; PTAB Inbound <PTABInbound@fr.com>; Rishi Gupta <rgupta@fr.com>; Yao Wang <ywang@fr.com>; Rick Bisenius <bisenius@fr.com>
Cc: PV <PVLit@daignaultiyer.com>
Subject: RE: Texas Instruments Inc., and NXP USA, Inc. v. ParkerVision, Inc. - Extension Request for Patent Owner Responses

Yes, we will get you to the materials by the 17th, so you can schedule based on that.

TI-1052 (cited by Paper 42 at 4)

TI Complied With Discovery Request – Furnished Requested Information Timely

From: Josh Griswold
Sent: Monday, March 17, 2025 3:17 PM
To: jcharkow@daignaultiier.com; Stephanie Mandir; kduche@daignaultiier.com; Taylor Lepore; IPR12189-0092IP1; PTAB Inbound; Rishi Gupta; Yao Wang; Rick Bisenius
Cc: PV
Subject: RE: Texas Instruments Inc., and NXP USA, Inc. v. ParkerVision, Inc. - Extension Request for Patent Owner Responses

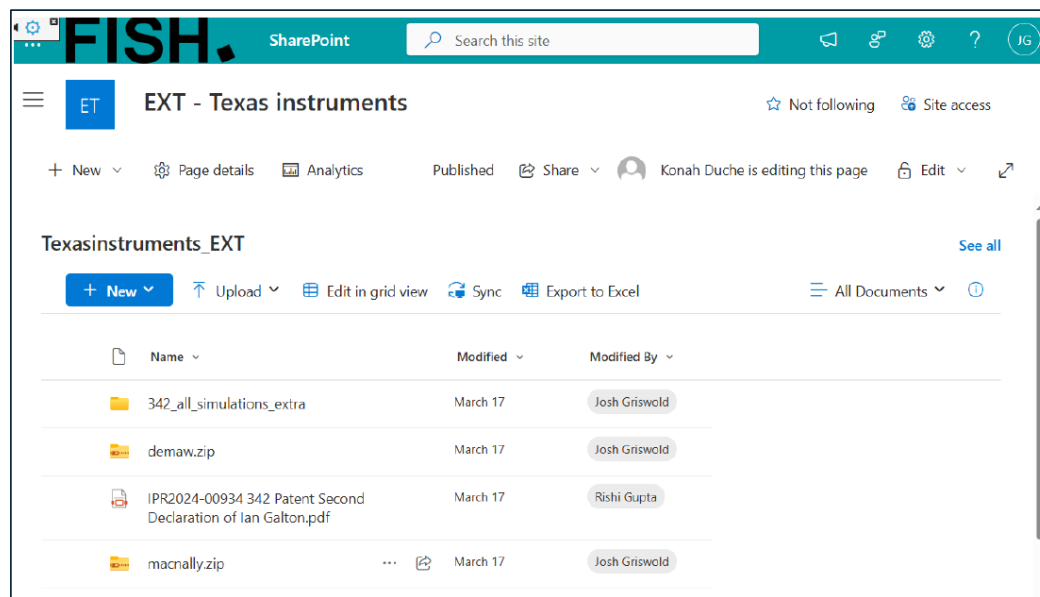
Jason,

We're setting up a Sharepoint site where you can download the additional materials from Dr. Galton. I believe you should be receiving login details shortly. We sent it to you, Stephanie, Konah, and Taylor, so anyone who wants can access the data.

Best,
Josh

TI-1052 (cited by Paper 42 at 4)

TI Complied With Discovery Request – Provided Sims, Data, Python Code, 2nd Declaration



TI-1053

TI Accommodated Other Requests Also – Agreed to Extend the POR Date by > 2 Months

DUE DATE 1 February 18, 2025
 Patent Owner's response to the petition
 Patent Owner's motion to amend the patent

Scheduling Order, Paper 11 at 11

DUE DATE	Original Date	Modified Date
DUE DATE 1	<u>February 18, 2025</u>	March 3, 2025

Joint Stipulation, February 14, 2025

DUE DATE	Original Date	Modified Date
DUE DATE 1	March 3, 2025	March 6, 2025

Joint Stipulation, March 3, 2025

DUE DATE	Original Date	Modified Date
DUE DATE 1	March 6, 2025	March 13, 2025

Joint Stipulation, March 6, 2025

DUE DATE	Original Date	Modified Date
DUE DATE 1	March 13, 2025	March 20, 2025

Joint Stipulation, March 13, 2025

DUE DATE	Original Date	Modified Date
DUE DATE 1	March 20, 2025	April 17, 2025

Joint Stipulation, March 20, 2025

DUE DATE	Original Date	Modified Date
DUE DATE 1	April 17, 2025	<u>April 21, 2025</u>

Joint Stipulation, April 16, 2025

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Demonstrative Exhibit – Not Evidence

POR and Ricketts Declaration – Each Address Galton 2nd Declaration, Python Script

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POR – Filed Galton 2nd Declaration, Python Script

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2	EXAMINATION OF IAN GALTON, Ph.D.	PAGE
3	By Ms. Mandir	7
4		
5	E X H I B I T S	
6	(Attached to the Transcript)	
7	GALTON EXHIBIT	PAGE
8	Exhibit 1 Second Declaration of Ian Galton,	9
9	Ph.D.	
10	Exhibit 2 Word Formatted Version of the	22
11	Python script Comp.PY	
12	Exhibit 3 DEMA-W-SIM-FIG. 1 (Revised, Clean)	41
13	and DEMA-W-SIM-FIG. 1.2	

EX.-2039, Exhibit List

Demonstrative Exhibit – Not Evidence

POR

simulation output, as well as the raw data from each simulation. *Id.* TI also agreed to multiple extensions of the POR deadline (originally due February 18, 2025 extended to April 21, 2025 – over 2 months) and made Dr. Galton available for a second deposition on his Second Declaration and the other provided materials, which PO took on April 14, 2025.

PO filed their POR citing and fully addressing Dr. Galton's Second Declaration and Dr. Galton's second deposition. E.g., POR at 48-65. PO failed to provide Dr. Galton's Second Declaration its own exhibit number. Paper 18 at 3. Rather, PO included it as an exhibit to Dr. Galton's second deposition transcript. EX-2026, EX. 1. Thus, TI provided Dr. Galton's Second Declaration as EX-1042 with its Petitioner's Reply.

Paper 42 at 4-5

Demonstrative Exhibit – Not Evidence

342 Patent and Claims

- Claim 18 – invalidated by DeMaw, disclaimed
- Claims 22-23 – disclaimed
- Claims 19-21 – remaining claims to discharge percentage ranges

The 342 Patent and Representative Figure

(12) **United States Patent**
Sorrrells et al.

(10) Patent No.: **US 7,496,342 B2**
(45) Date of Patent: **Feb. 24, 2009**

(54) **DOWN-CONVERTING ELECTROMAGNETIC SIGNALS, INCLUDING CONTROLLED DISCHARGE OF CAPACITORS**

(58) **Field of Classification Search** 455/313, 455/323, 334, 318; 327/356, 357, 358, 359; 327/360
See application file for complete search history.

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(73) Assignee: **Parkvision, Inc.**, Jacksonville, FL (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 868 days.

(21) Appl. No.: **10/972,133**

(22) Filed: **Oct. 25, 2004**

(65) **Prior Publication Data**
US 2005/0085208 A1 Apr. 21, 2005

Related U.S. Application Data

(60) Division of application No. 09/855,851, filed on May 16, 2001, now Pat. No. 7,010,286, which is a continuation-in-part of application No. 09/550,644, filed on Apr. 14, 2000.

(60) Provisional application No. 60/272,043, filed on Mar. 1, 2001, provisional application No. 60/213,363, filed on Jun. 21, 2000, provisional application No. 60/204,796, filed on May 16, 2000.

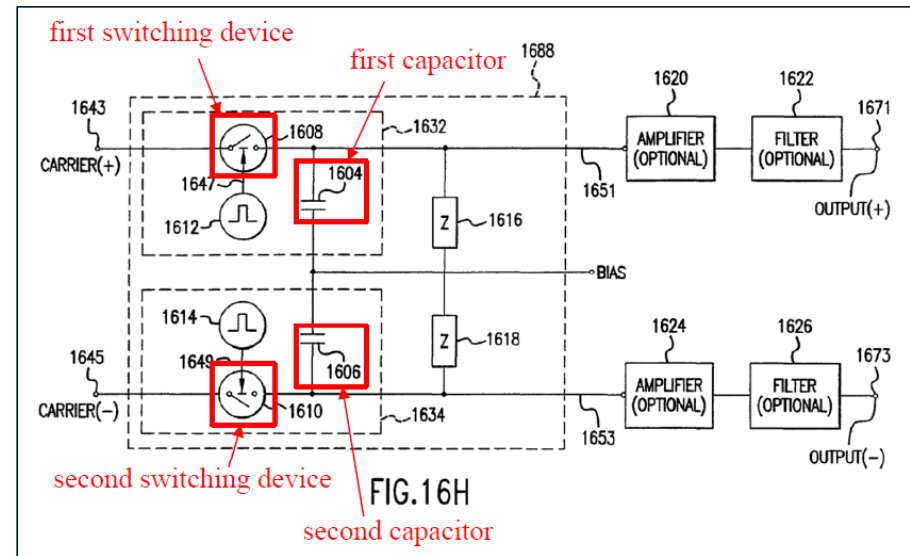
(51) **Int. Cl.**
H04B 1/26 (2006.01)

(52) **U.S. Cl.**
455/313; 455/323; 455/334; 455/318; 327/356; 327/357; 327/358; 327/359; 327/360

(56) **References Cited**
U.S. PATENT DOCUMENTS
2,057,613 A 10/1936 Gardner (Continued)
FOREIGN PATENT DOCUMENTS
DE 1936252 1/1971 (Continued)
OTHER PUBLICATIONS
English-language Abstract of Japanese Patent Publication No. JP 58431622, data supplied by ep.espacenet.com, 1 page (Feb. 24, 1983—Date of publication of application). (Continued)

(57) **ABSTRACT**
Methods, systems, and apparatuses, for down-converting and up-converting an electromagnetic signal. In embodiments the invention operates by receiving an EM signal and recursively operating on approximate half cycles of the carrier signal. The recursive operations can be performed at a sub-harmonic rate of the carrier signal. The invention accumulates the results of the recursive operations and uses the accumulated results to form a down-converted signal. In embodiments, up-conversion is accomplished by controlling a switch with an oscillating signal, the frequency of the oscillating signal being selected as a sub-harmonic of the desired output frequency. When the invention is being used in the frequency modulation or phase modulation implementations, the oscillating signal is modulated by an information signal before it causes the switch to gate the bias signal. The output of the switch is filtered, and the desired harmonic is output.

23 Claims, 94 Drawing Sheets



*TI-1001, 342 Patent, FIG. 16H
cited by Petition at 7; POR at 27*

342 Patent Claim 18 (Invalidated by DeMaw, Disclaimed)

18. A method for down-converting an electromagnetic signal, comprising the steps of:

- (1) receiving an information signal;
- (2) inverting the information signal to generate an inverted information signal;
- (3) electrically coupling the information signal to a first capacitor and the inverted information signal to a second capacitor;
- (4) controlling a charging and discharging cycle of the first and second capacitors with first and second switching devices electrically coupled to the first and second capacitors, respectively; and
- (5) performing a plurality of charging and discharging cycles of the first and second capacitors to generate first and second down-converted information signals across first and second impedance devices, respectively;

wherein the information signal is used to store a charge on the first capacitor when the first switching device is closed and the inverted information signal is used to store a charge on the second capacitor when the second switching device is closed.

342 Patent Claim 19-21

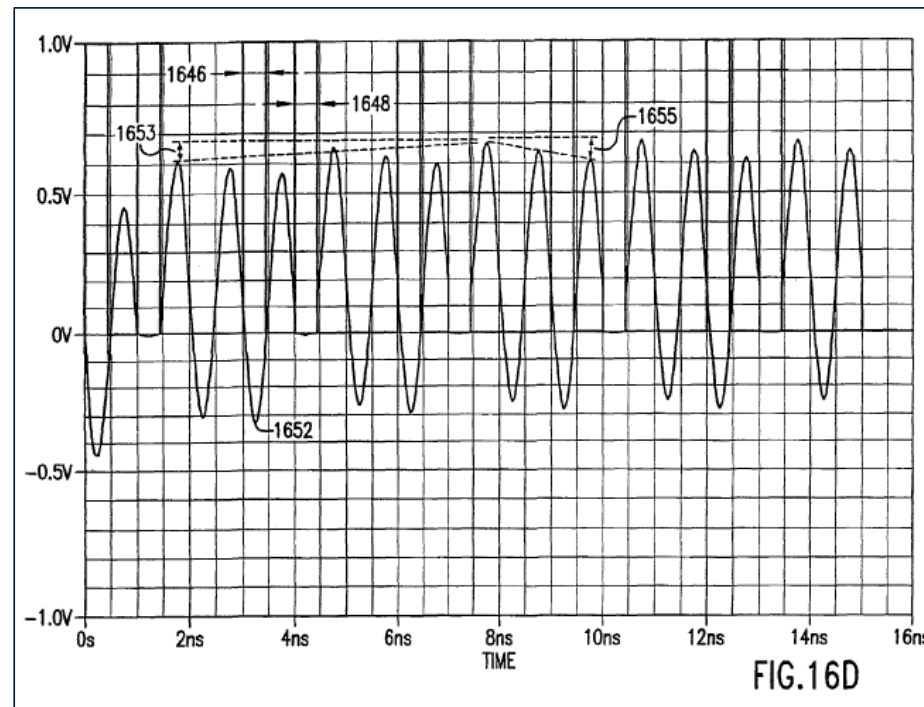
19. The method of claim 18, wherein the first capacitor discharges between six percent to fifty percent of the total charge stored therein during a period of time that the first switching device is open, and wherein the second capacitor discharges between six percent to fifty percent of the total charge stored therein during a period of time that the second switching device is open.

20. The method of claim 18, wherein the first capacitor discharges between ten percent to twenty-five percent of the total charge stored therein during a period of time that the first switching device is open, and wherein the second capacitor discharges between ten percent to twenty-five percent of the total charge stored therein during a period of time that the second switching device is open.

21. The method of claim 18, wherein the first capacitor discharges between fifteen percent to thirty percent of the total charge stored therein during a period of time that the first switching device is open, and wherein the second capacitor discharges between fifteen percent to thirty percent of the total charge stored therein during a period of time that the second switching device is open.

342 Patent Representative Figure FIG. 16D

FIG. 16D the slope 1655 represents the rate of discharge of capacitor 1606 between apertures.
TI-1001, 19:1-8, cited by Reply at 20.

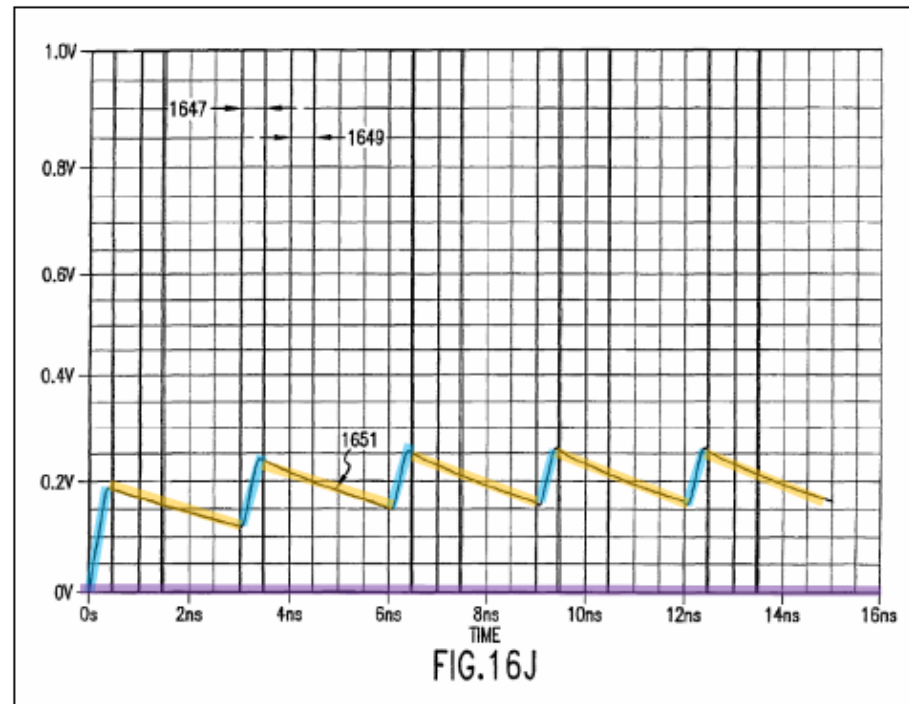


TI-1001, 342 Patent, FIG. 16D, cited by Reply at 20.

Demonstrative Exhibit – Not Evidence

342 Patent Representative Figure 16J

FIG. 16J illustrates a **down-converted** signal 1651, for input signal 1643. *TI-1001*, 20:5-51.



Undisputed Topics

- DeMaw renders claim 18 invalid (Pet. at 12)
- The claimed discharge percentages are non-critical (Institution Decision; Reply at 3-4)
- Electrical charge flows from low voltage to high voltage (Reply at 27)

DeMaw Invalidated Claim 18

- Federal Circuit Confirmed DeMaw Anticipates Claim 18 Based on Structure AND Function

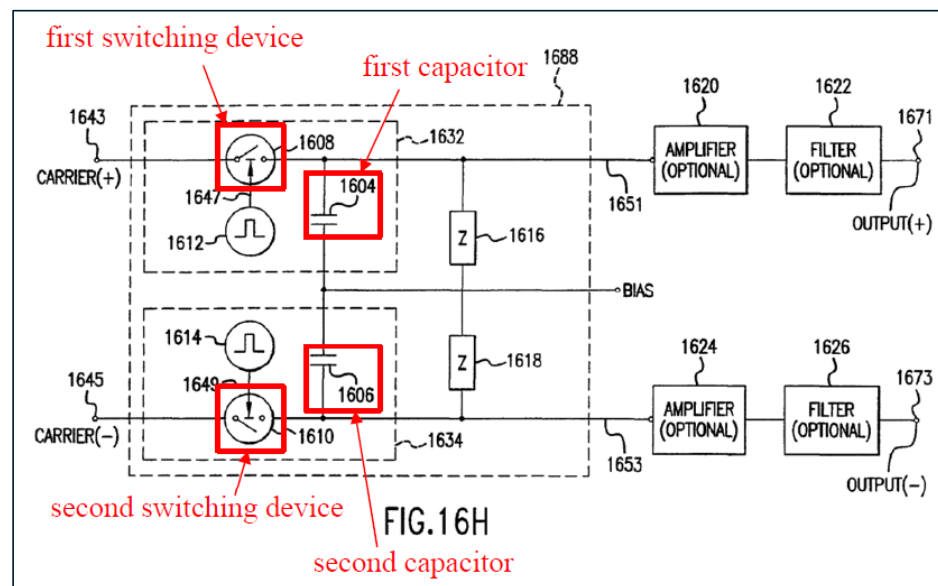
Federal Circuit Confirmed that DeMaw's Circuit Corresponds to FIG. 16H

The Federal

Circuit noted that Patent Owner had not undermined the expert's explanations of "the operation of the DeMaw circuit and how Figure 6.7 of DeMaw corresponds to Figure 16H of the '342 patent." *Id.* Furthermore, the Federal Circuit rejected Patent Owner's arguments concerning the expert's component values used to model DeMaw's operation. *See, id.*

Petition at 12 (citing TI-1031: ParkerVision v. Qualcomm, 621 F.App'x 1009 (Fed. Cir. 2015))
(**annotated**)

Structural Correspondance Between DeMaw and FIG. 16H



342 Patent, FIG. 16H (TI-1003), cited by Petition at 7 TI-1031, at 28

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DeMaw, FIG. 6.7 (TI-1016), cited by Petition at 14

DeMaw Performs Each Step of Claim 18

claim 18 was previously invalidated,

Sur-reply at 5

18. A method for down-converting an electromagnetic signal, comprising the steps of:

- (1) receiving an information signal; ☒
- (2) inverting the information signal to generate an inverted information signal; ☒
- (3) electrically coupling the information signal to a first capacitor and the inverted information signal to a second capacitor; ☒
- (4) controlling a charging and discharging cycle of the first and second capacitors with first and second switching devices electrically coupled to the first and second capacitors, respectively; ☒
- and
- (5) performing a plurality of charging and discharging cycles of the first and second capacitors to generate first and second down-converted information signals across first and second impedance devices, respectively; ☒

wherein the information signal is used to store a charge on the first capacitor when the first switching device is closed and the inverted information signal is used to store a charge on the second capacitor when the second switching device is closed. ☒

PO Recognizes that Claim 18 Was Invalidated

Because claim 18 was previously invalidated, Petitioner implies that the challenged dependent claims are nothing more than the discovery of optimal/workable percentage ranges for capacitor discharge. Reply,3 (citing *Sur-reply, Paper 38, at 5 (annotated)*)

Discharge Percentages Are Not New and Unexpected or a “critical” Range

- PO has provided no evidence or argumentation that the first and second capacitors discharge at rates that demonstrate “new and unexpected results” such that each claimed discharging range can be deemed “a ‘critical’ range.” See *Institution Decision*, at 23.
- Petitioner’s histograms show that DeMaw performs the claimed discharge percentages under several different operating conditions.

PO Offers Nothing to Show Claimed Ranges Are New and Unexpected or a “Critical” Range

(CCPA 1955)). Here, as set forth above, TI has shown that the general conditions of dependent claims 19–21 are disclosed in DeMaw. The burden now shifts to ParkerVision to come forward with sufficient evidence to rebut TI’s “prima facie case of obviousness” by showing, for example, the first and second capacitors required by dependent claims 19–21 discharge at rates that demonstrate new and unexpected results such that each claimed discharging range can be deemed “a ‘critical’ range.” *Id.* (identifying categories of effective rebuttal evidence and making clear that the burden of producing such evidence falls on the patent owner in an IPR). Apart from

Institution Decision at 23 (annotated)

PO Offers Nothing to Show Claimed Ranges Are New and Unexpected or a “Critical” Range

Claims 19-21 do not merely recite percentages; rather, they specifically require that discharge occur at a specific time—when a switch is *open*. Claim 18 contains no such limitation/requirement regarding the timing of discharge in relation to the state of the switch.

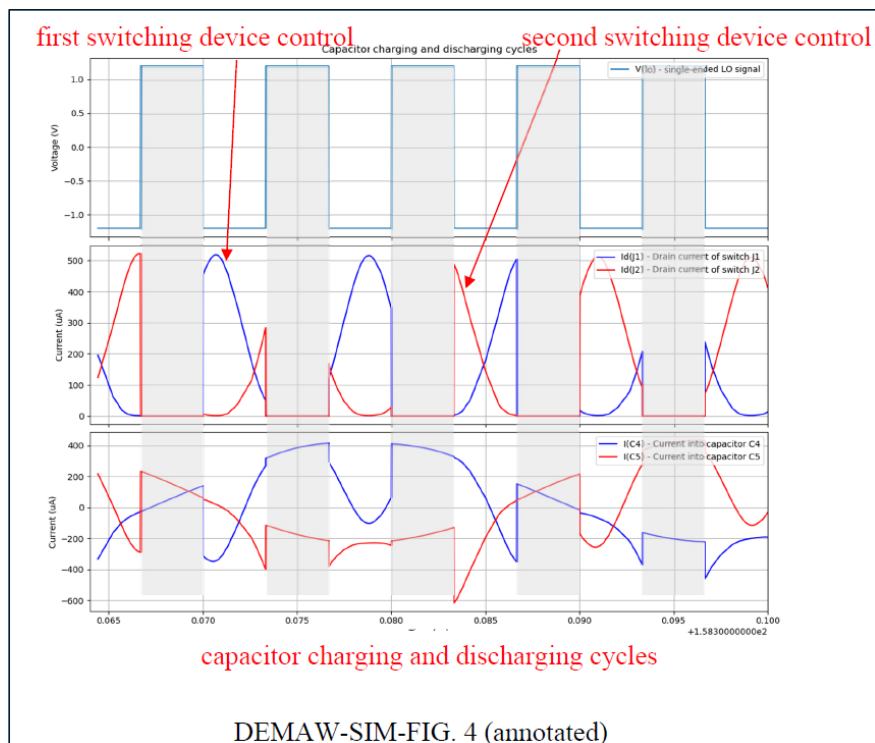
Sur-reply, Paper 38 at 5

(4) controlling a charging and discharging cycle of the first and second capacitors with first and second switching devices electrically coupled to the first and second capacitors, respectively; and

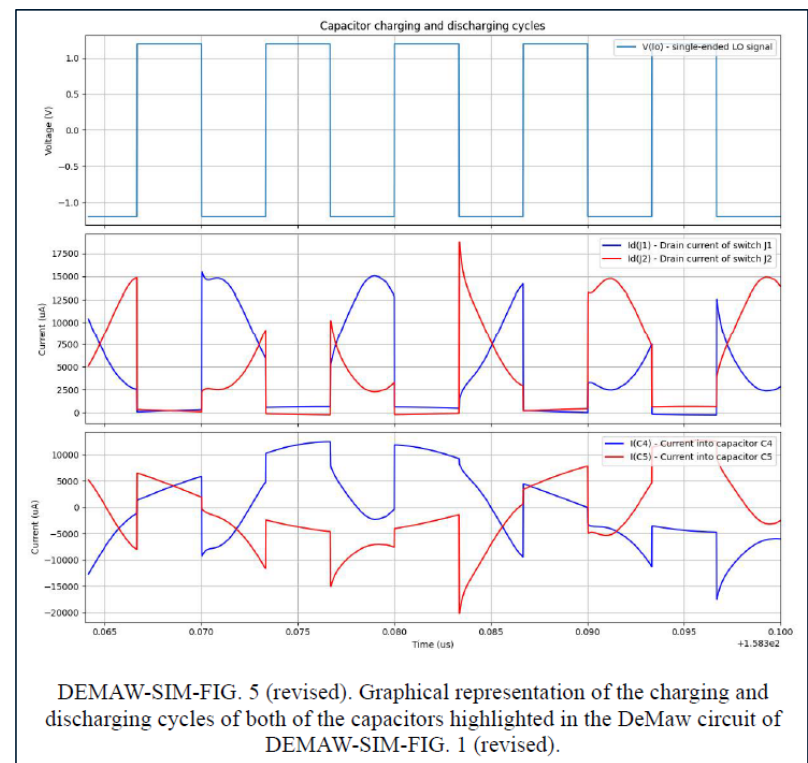
...

wherein the information signal is used to store a charge on the first capacitor when the first switching device is closed and the inverted information signal is used to store a charge on the second capacitor when the second switching device is closed.

DeMaw's Simulations Show Discharging When Switches Are Open



Petition at 29-30 (citing TI-1003, ¶¶ 105-109)



Pet. Reply at 8 (citing TI-1042, ¶¶ 8, 13)

Dr. Galton Explained that the Data Was Collected Using the Transition Edges of the LO

DeMaw teaches claim 19. Specifically, using the transition edges of the LO signal, and the knowledge that the switch opening and closing is dictated by the LO signal amplitude, the charge ratio of in claim 19 can be computed on a cycle-by-cycle basis using a python post-processing script applied to the raw simulation waveforms. This ratio was collected for 50,999 simulation cycles and plotted as a histogram, shown in DEMAW-SIM-FIG. 7. TI-1003, 114.

Petition at 35 (citing TI-1003, ¶¶ 114)

Ricketts Testified that Switches “effectively” Turn Off

1. *Claim Construction of a Switching Device Cannot Render the Claims Inoperable*

Importantly, Dr. Galton clarified the distinction between real and ideal JFET behavior. TI-1060, ¶¶18-32. In the ideal case, a JFET can stop conducting when off. *Id.*, ¶¶19-20. In reality, all JFETs continue conducting when off. *Id.*, ¶¶18-32 (discussing practical switching behavior). Ricketts recognizes this: “the JFET **effectively** turns off.” EX2021, ¶201 (emphasis added). If an absolute “off-state” were imposed onto the claimed switching devices (*i.e.*, active switching devices, like MOSFETs or JFETs), the claims could never be satisfied because no practical switching devices would suffice.¹

Reply at 2-3 (citing: TI-1060, ¶¶ 18-32)

conducting “ON” state, allowing current to flow freely. As V_{GS} becomes more negative, the conducting channel narrows, restricting current flow. If V_{GS} reaches a critical threshold called the pinchoff voltage (V_P or $V_{GS(OFF)}$), the JFET **effectively turns off**, blocking current flow.

EX.-2021, ¶ 201 (Reply at 2-3)

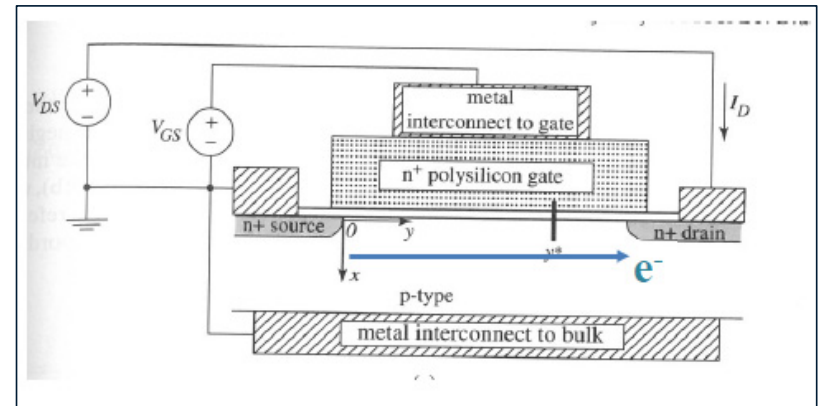
Electrical Charge Flows from Low to High V

- Galton and Ricketts agree that electrical charge flows from low to high voltage

Experts Agree that Electrical Charge Flows from Low Voltage to High Voltage

41. Voltage: Voltage represents the difference in electric potential energy per unit charge between two points in a circuit. It quantifies the amount of potential energy available to move charges. Negative charges (electrons) are naturally attracted to higher voltages, while positive charges (protons) are drawn toward lower voltages.

*Ricketts Declaration, EX.-2021, ¶ 41
(cited by Reply at 27) (annotated)*



Electrons are negatively charged, so they flow toward the positive supply voltage.

Pet. Reply at 27 (citing TI-1060, ¶ 134)

Issue 1 DeMaw

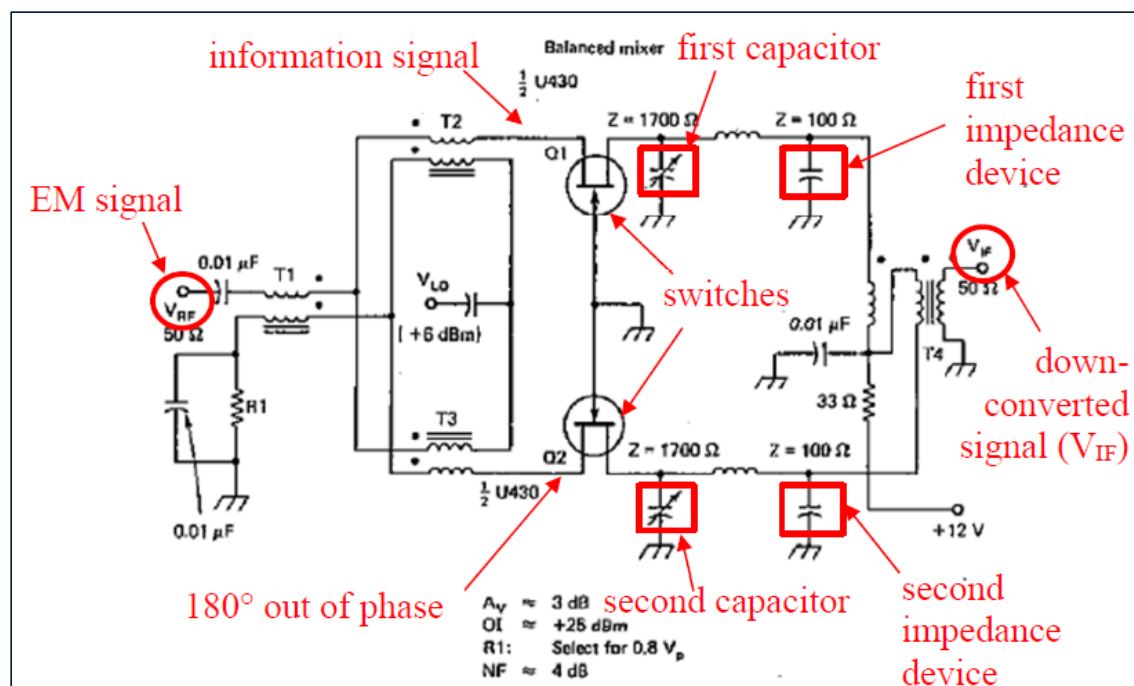
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DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

DeMaw's Mixer Circuit

- DeMaw's Mixer Includes All Elements of Claims 18-21
- DeMaw's Mixer Performs the Method Steps of Claims 18-21

DeMaw's Mixer of Figure 6.7 (TI-1016)

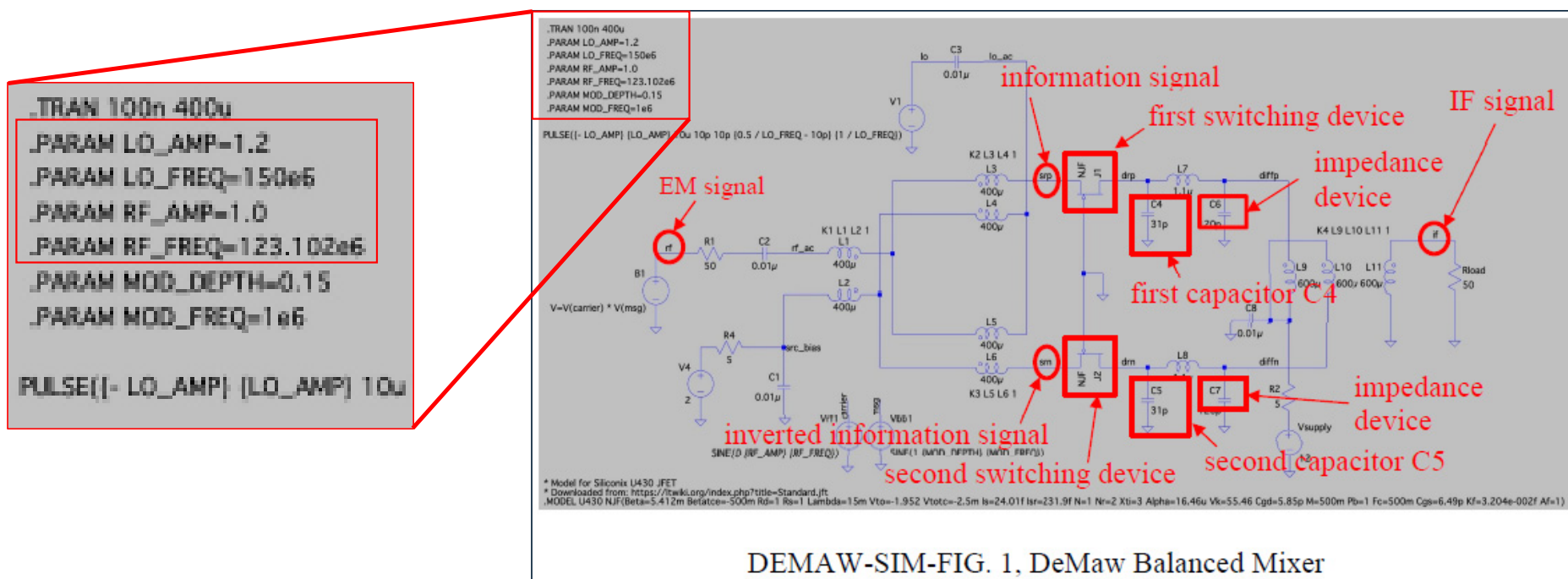


DeMaw, FIG. 6.7 (TI-1016), cited by Petition at 14

Simulations of DeMaw's Mixer Circuit

- Galton's Original Simulations
- Squared up LO at 150 MHz and 1.2 V
- Input signal is 123 MHz at 1 V

Galton's Models of DeMaw's Mixer



FISH.

Demonstrative Exhibit – Not Evidence

Petition at 17 (citing TI-1003, ¶¶ 72-74)

Galton Explained His Simulation Model

73. For the DeMaw circuit simulations, parameter values that were described in DeMaw were used, with minor adjustments. For example, the exact parameters of the transformers were not provided; only the physical description was given. Reasonable values were calculated based on the expected circuit operating conditions. In particular, the transformer coupling ratio is ideal, however using a realistic (non-ideal) coupling ratio would not affect the presented results. A SPICE model was found for the exact JFET specified in the book, the Siliconix U430.

74. The DeMaw circuit was simulated for 400 μ s. The LO signal used is a square wave of 150MHz and amplitude of 1.2V peak. While using a square wave for the LO of this circuit is an idealization, it does not alter the circuit behavior in any way relevant to the presented results. It was chosen to be able to clearly see the transition between switch ON and OFF states.

E.g., TI-1003, ¶¶ 73-74

114. DeMaw teaches claim 19. Specifically, using the transition edges of the LO signal, and the knowledge that the switch opening and closing is dictated by the LO signal amplitude, we can compute on a cycle-by-cycle basis the charge ratio described in claim 19. This ratio is collected for 50,999 simulation cycles and plotted as a histogram, shown in DEMAW-SIM-FIG. 7.

EX.-2036, 38:14-41:12

14	Q	How did you determine the values for the
15		capacitor inductor after the JFETs in your
16		simulation?
17	A	Well, we needed to have the impedance
18		match of 1700 ohms on the left and 100 ohms on the
19		right at the intermediate frequency. And then we
20		also wanted to have a fair amount of peaking in
21		the frequency response at the intermediate
22		frequency just to -- just to provide good

EX.-2036, 38:14-41:12

FISH.

Demonstrative Exhibit – Not Evidence

FISH.

Demonstrative Exhibit – Not Evidence



Galton's Bias Circuit Is Consistent with DeMaw

This bias configuration results in a gate-source voltage (V_{GS}) at or near the JFET's pinch-off voltage. DeMaw, however, teaches that V_{GS} is 0.8 the pinchoff voltage. Ex.-1016, 196. The yellow highlight below shows DeMaw's actual bias configuration including using 0.8Vp. Ex.-2021, ¶¶244-246.

POR at 43

43. Dr. Ricketts criticized my use of a 1.2V peak (2.4V peak-to-peak) LO signal instead of using a 0.8V peak (1.6V peak-to-peak). DeMaw recommended, but did not require, that the LO amplitude should be 80% of $V_{GS(OFF)}$, and Dr. Ricketts assumed a pinch-off voltage of 2V, so he claims the peak should be 0.8V. EX2021, ¶296.

TI-1060, ¶ 43 (cited by Pet. at 11)

Galton's Bias Circuit Is Consistent with DeMaw

An example of properly designed JFET singly balanced mixer is seen in Fig. 6.7. It is similar to a circuit suggested by E. Oxner of Siliconix in *Application Note AN72-1*. Dynamic balance is assured through the use of a U430 dual-FET unit. R1 is selected to give a V_{gs} of 0.8 the pinchoff voltage, which will be on the order of 2 V, allowing for the published spread of -1 to -4 V, $V_{gs(off)}$. Symmetrical feed is used at the mixer input by means of T1, T2, and T3, providing a 180° phase dif-

TI-1016 at 8 (cited by Reply at 10-11)

44. Dr. Ricketts would be correct if the pinch-off voltage were really restricted to 2 volts. However, DeMaw says that the range for the pinchoff of the Siliconix U430 is from -1 to -4 V, $V_{gs(off)}$ —a fact that Dr. Ricketts acknowledged. TI-1016, 8; TI-1051, 17:13-21, 18:8-21. Our design assumed a 3V pinch-off voltage, which is well within this range. Nevertheless, had we assumed a pinch-off voltage of 2 volts, the general behavior of the circuit and our conclusions would not have been different. For context, the pinch-off voltage of a junction field-effect transistor (JFET) varies over a wide range over temperature and across different copies of the JFETs. If it were not true that the general behavior of the circuit and our conclusions would remain unchanged had we chosen a pinch-off voltage of 2 volts, then the circuit would not be practical because its fundamental behavior would change with the operating temperature and across different copies of the circuit.

TI-1060, ¶¶ 44 (cited by Reply at 10-11)

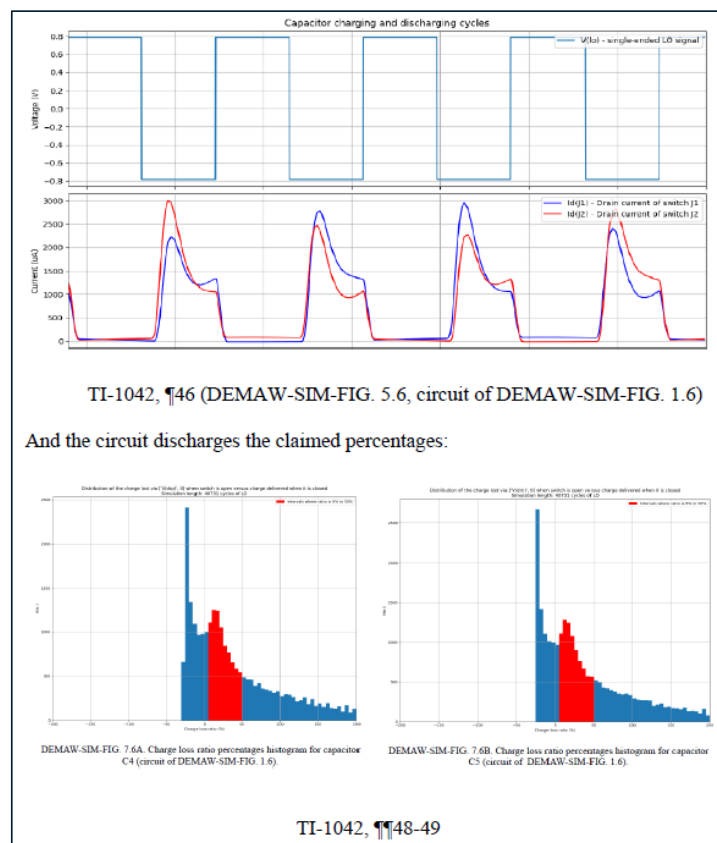
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Demonstrative Exhibit – Not Evidence

Galton Proved that Lowering the Bias Voltage Still Shows Performance of the Claimed Ranges

The additional simulations used a 0.785 V amplitude for the LO at 119.8 MHz, and various different amplitudes for the RF input signal at 150 Mhz. TI-2042, ¶84; TI-1060, ¶¶74-77. The circuit still performed the method of claims 18-21. *Id.* For example, taking the simulation using the smallest input signal (the extreme case), the additional simulations show the claimed charging/discharging cycles:

Reply at 16 (citing by TI-1042, ¶ 84; TI-1060, ¶¶ 74-77)



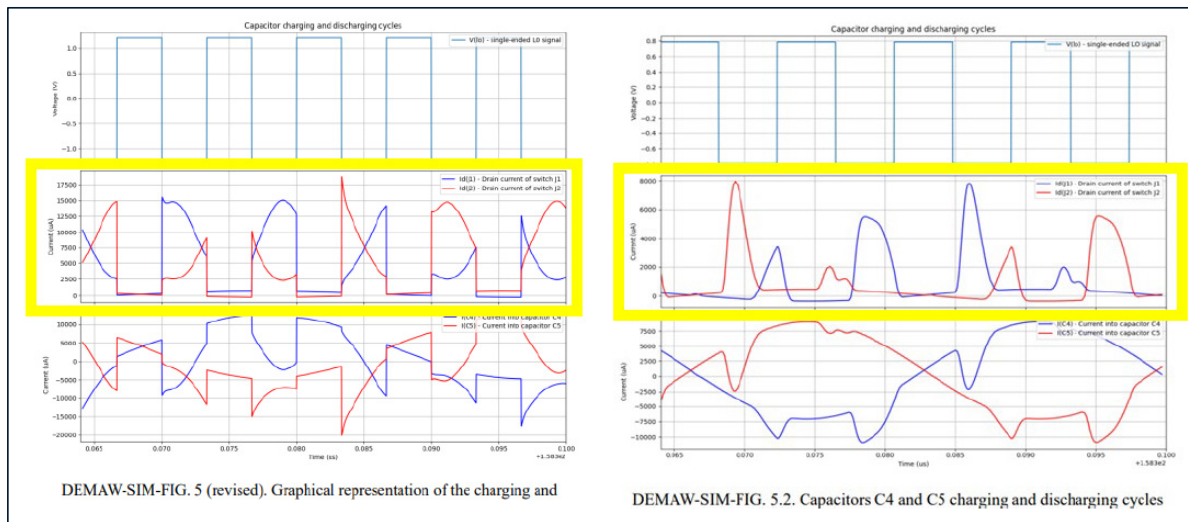
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Demonstrative Exhibit – Not Evidence

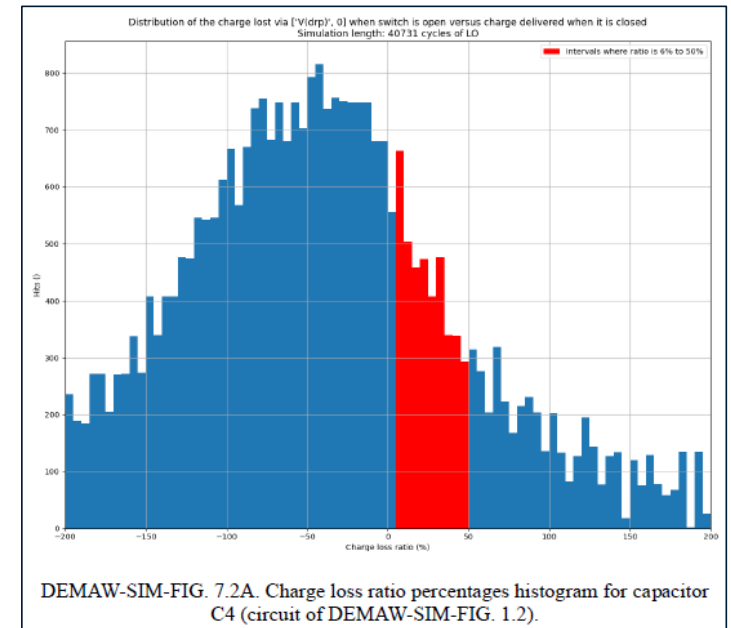
TI-1042, ¶ 48-49 (cited by Reply at 17)

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Galton Proved that Lowering the Bias Voltage Still Shows Performance of the Claimed Ranges



POR at 55



TI-1042, ¶ 24

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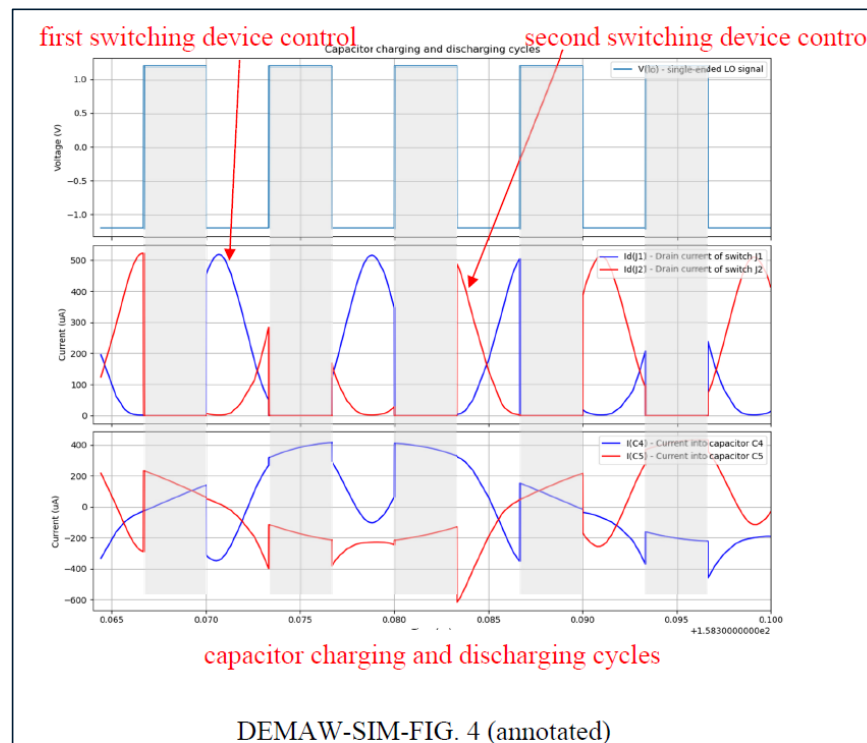
Demonstrative Exhibit – Not Evidence

Galton's Operating Frequencies Are Appropriate for DeMaw

40. Dr. Ricketts states that my simulation is physically unrealistic because I used “out-of-band frequencies” of 123.102 MHz for the RF signal and 150MHz for the LO signal. EX2021, ¶295. The circuit to which Dr. Ricketts refers is shown in Figure 6.7 of the DeMaw textbook, and while the textbook does mention that the transformers are suitable for 3 MHz to 30 MHz operation, 1) this does not mean that they will not operate at higher frequencies, and 2) a POSITA would understand that the fundamental behavior of the circuit would not be affected if transformers with higher frequency operation were used.

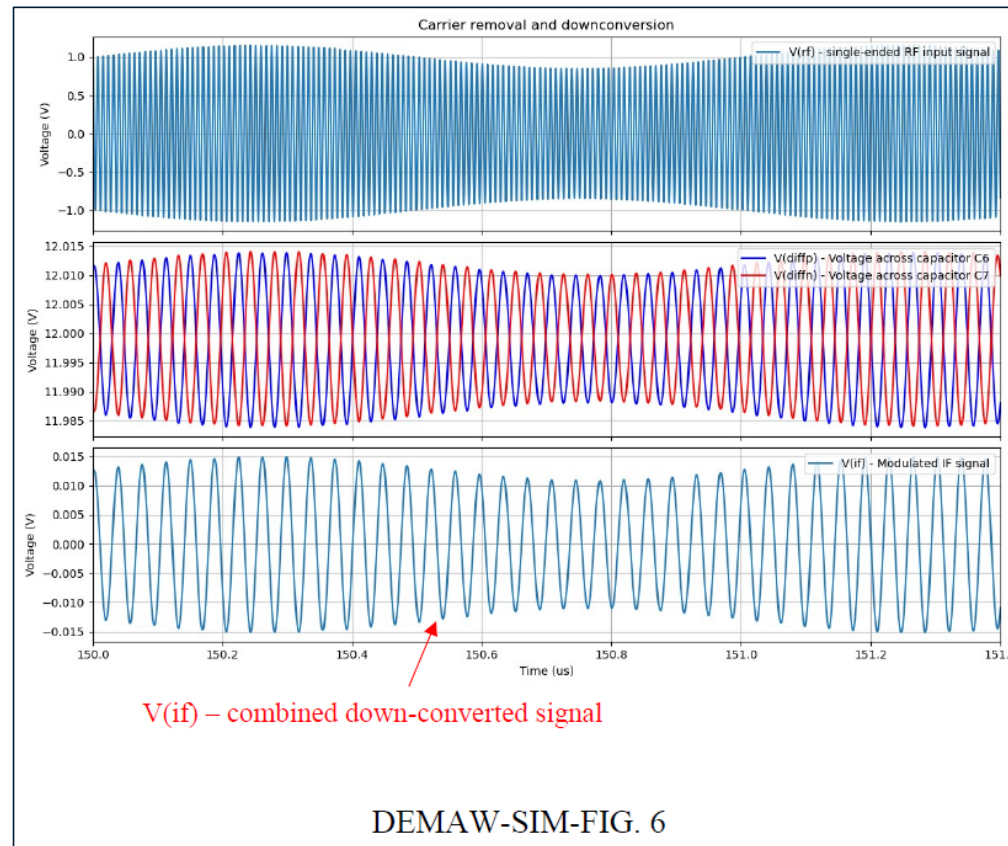
41. Indeed, our simulations used transformers with characteristics that exhibit negligible degradation at frequencies well above 150 MHz, so Dr. Ricketts is not correct in his assertion that the transformers are problematic in our simulations at the frequencies we chose.

DeMaw's Mixer Performs a Plurality of Charging and Discharging



Petition at 29-30 (citing TI-1003, ¶¶ 105-109)

DeMaw's Mixer Performs a Plurality of Charging and Discharging to Produce a Down-Converted Signal



Petition at 33 (citing TI-1003, ¶¶ 112)

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Demonstrative Exhibit – Not Evidence

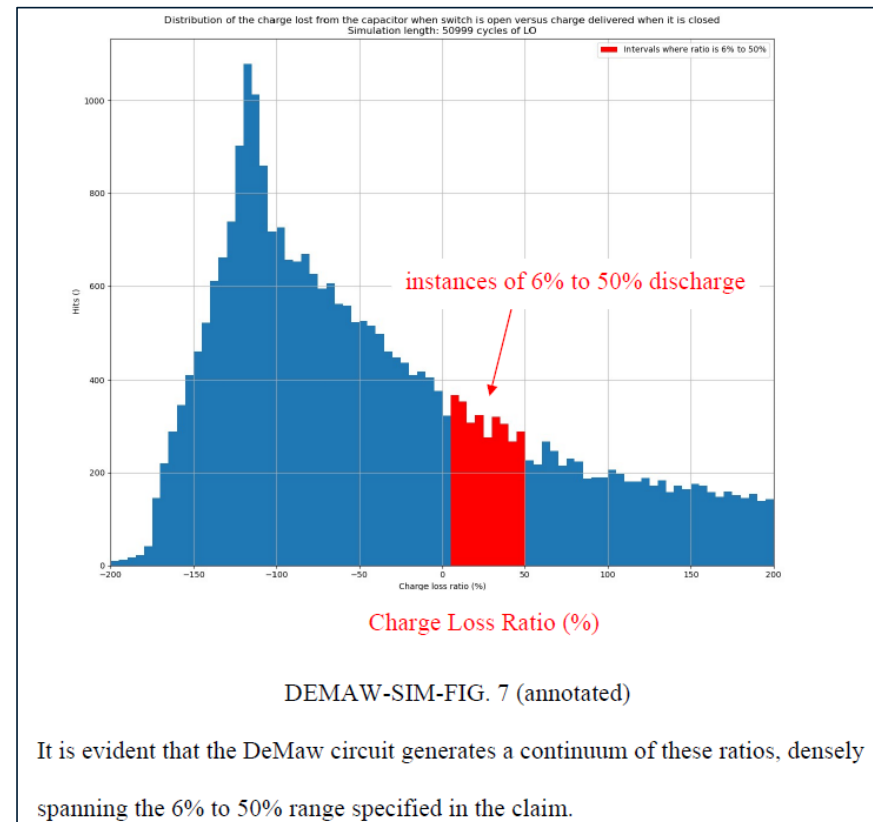
DeMaw Original Histograms

- Galton's Original DeMaw Histograms Show Performance of the Claimed Discharge Percentages

Galton's Original Histograms Show the Claimed Discharge Percentages

114. DeMaw teaches claim 19. Specifically, using the transition edges of the LO signal, and the knowledge that the switch opening and closing is dictated by the LO signal amplitude, we can compute on a cycle-by-cycle basis the charge ratio described in claim 19. This ratio is collected for 50,999 simulation cycles and plotted as a histogram, shown in DEMAW-SIM-FIG. 7.

TI-1003, ¶ 114 (cited by Pet. at 35-36)



Pet. at 26 (citing TI-1003, ¶ 114)

FISH.

Demonstrative Exhibit – Not Evidence

Antecedent Basis Informs the Interpretation of Claims 19-21

wherein the information signal is used to store a charge on the first capacitor when the first switching device is closed and the inverted information signal is used to store a charge on the second capacitor when the second switching device is closed.

TI-1001, claim 18

19. The method of claim 18, wherein the first capacitor discharges between six percent to fifty percent of the total charge stored therein during a period of time that the first switching device is open, and wherein the second capacitor discharges between six percent to fifty percent of the total charge stored therein during a period of time that the second switching device is open.

TI-1001, claim 19 (cited by Reply at 20)

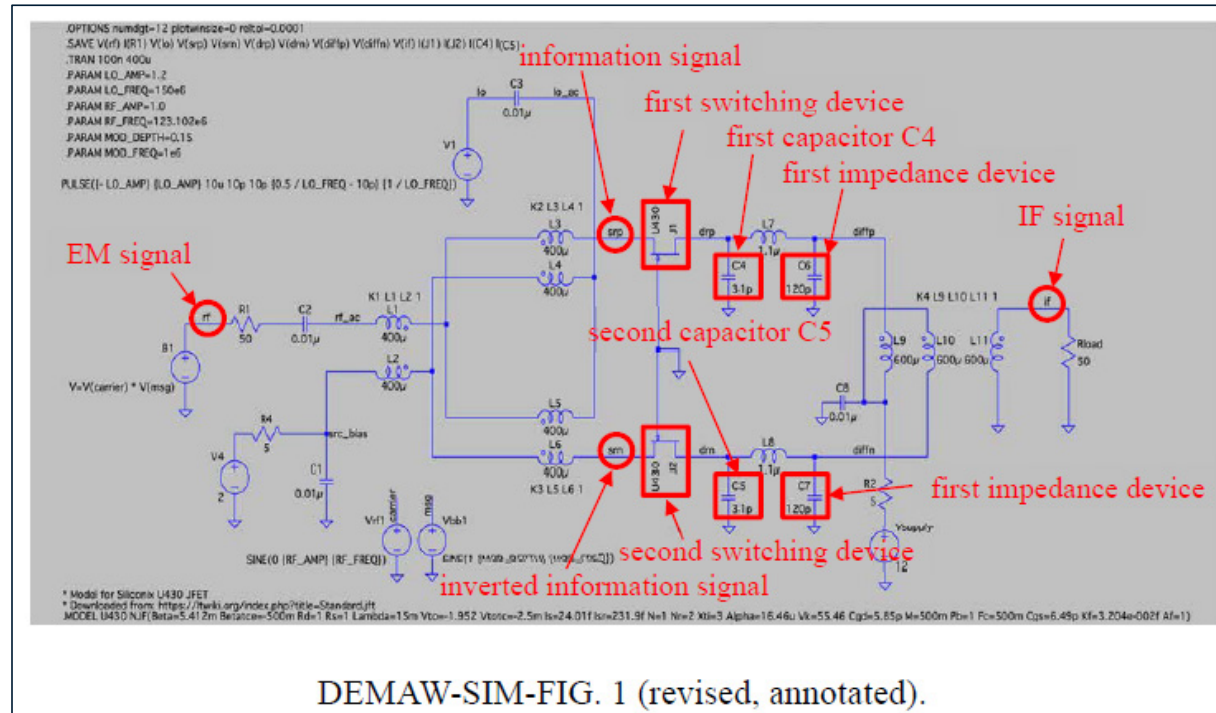
Second Simulations of DeMaw's Mixer

- DeMaw simulations using the U430 JFET model
 - Claim Construction – “open”
 - JFET Selection Is Immaterial
- DeMaw simulations using different input signal values
- DeMaw simulations using a different square wave configuration
- DeMaw simulations using different input signal values and a sinusoidal LO

DeMaw simulations using the U430 JFET

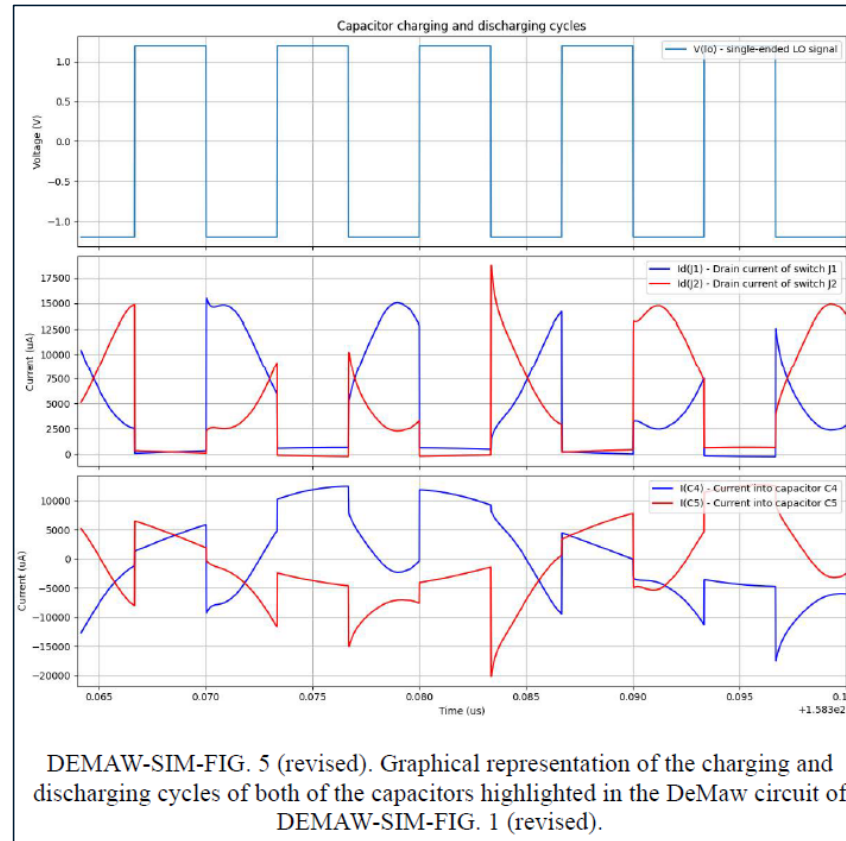
- DeMaw simulations using the U430 JFET model
 - Claim Construction – “open”
- DeMaw simulations using different input signal values
- DeMaw simulations using different input signal values and a sinusoidal LO

DeMaw Circuit with U430 Model



TI-1042, ¶ 5 (cited by Petition at 5-6)

DeMaw Circuit with U430 Model

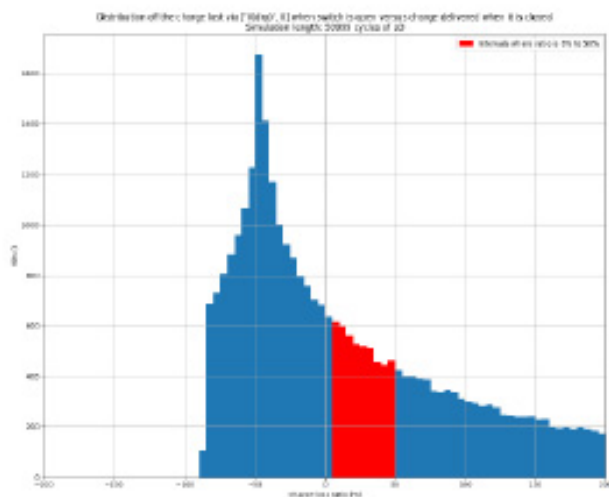


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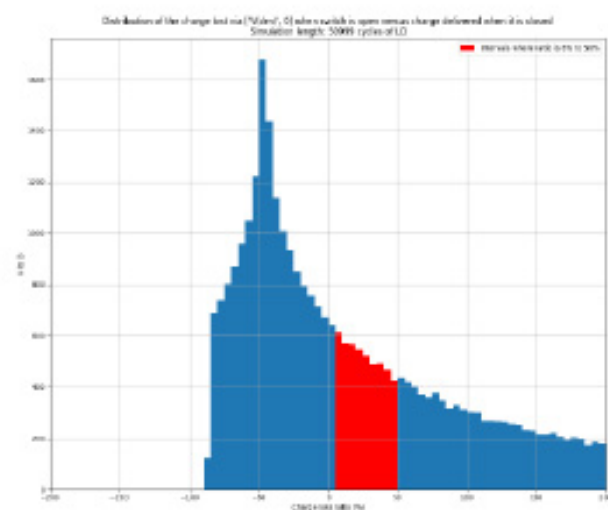
TI-1042, ¶ 5 (cited by Reply at 7-9, 13)

Demonstrative Exhibit – Not Evidence

DeMaw Circuit with U430 Model



DEMAW-SIM-FIG. 7A (revised). Charge loss ratio percentages histogram for capacitor C4 (circuit of DEMAW-SIM-FIG. 1 (revised)).



DEMAW-SIM-FIG. 7B (revised). Charge loss ratio percentages histogram for capacitor C5 (circuit of DEMAW-SIM-FIG. 1 (revised)).

TI-1042, ¶11 (showing instances of discharge percentages between 6-50 percent)

Reply at 13-14 (citing TI-1042, ¶11)

FISH.

Demonstrative Exhibit – Not Evidence

Claim Construction – “open”

- The dependent claims require that the first and second capacitors discharge within a range of percentages when the switching devices are “open”
- There is a dispute as to what the term “open” means
- PO advances a definition that would require no drain current to flow through the switch when the switch is “open”
 - Problematic from a practical stand-point, as no real-world transistors fully stop conducting
- The 342 patent defines “open” to be the period “between apertures”
 - No express requirement about drain current
 - No characterization of the switch to be fully “off” or entirely block current

Practical Switches Continue Conducting

19. There is no such thing as a perfect switch in any practical circuit. All physically implementable transistor switches have a non-zero on-resistance and a non-infinite off-resistance, and all have parasitic capacitance which bypasses the switch regardless of whether the switch is off or on (thereby providing a signal path around the switch even when it is off). Hence, if Dr. Ricketts' position is that the '342 patent applies only to circuits with ideal switches, then the "ideal" operation of the DeMaw circuit would still render claims 18-21 unpatentable. See EX2021, ¶202. However, this seems unlikely to be his position as it would imply that no practical circuit would ever satisfy the requirements of Claims 18-21, i.e., it would not be possible to design a practical circuit that infringes on the '342 patent. The '342 patent contemplates JFETs as "switching devices." *E.g.*, '342 patent, cl.9. Additionally, AN72-1, which describes the Oxner circuit upon which the

TI-1060, ¶ 19 (cited by Reply at 2-3) (annotated)

FISH.

Demonstrative Exhibit – Not Evidence

Practical Switches Continue Conducting

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TI-1060, ¶ 19 (cited by Reply at 2-3) (annotated)

FISH.

Demonstrative Exhibit – Not Evidence

“open” is “between apertures”

In embodiments of the invention such as, for example, aliasing modules 300, one or more capacitors are sized to discharge between about six percent to about fifty percent of the total charge stored therein during a period of time that a switching device is open (i.e., between apertures). It is noted that this range is provided for illustrative purposes. Other

TI-1001, 38:4-15 (citing by Reply at 1) (annotated)

apertures of control signal 1646, as described herein. During a period of time that switching device 1608 is open (i.e., between the apertures of control signal 1646), a percentage of the total charge stored on capacitor 1604 is discharged. As

TI-1001, 50:13-25 (cited by Reply at 4) (annotated)

What “open” Means Is a Claim Construction Issue

1. Claim Construction of a Switching Device Cannot Render the Claims Inoperable

Importantly, Dr. Galton clarified the distinction between real and ideal JFET behavior. TI-1060, ¶¶18-32. In the ideal case, a JFET can stop conducting when off. *Id.*, ¶¶19-20. In reality, all JFETs continue conducting when off. *Id.*, ¶¶18-32 (discussing practical switching behavior). Ricketts recognizes this: “the JFET **effectively** turns off.” EX2021, ¶201 (emphasis added). If an absolute “off-state” were imposed onto the claimed switching devices (*i.e.*, active switching devices, like MOSFETs or JFETs), the claims could never be satisfied because no practical switching devices would suffice.¹

*Reply at 2-3 (citing:
TI-1060, ¶¶ 18-32)*

PO advances a construction of “switching device” to be “an electronic device for opening and closing a circuit.” POR, 25 (citing IPR2021-00346 concerning U.S. Pat. No. 8,190,108). But PO interprets open to mean entirely off, blocking current. POR, 46. PO’s interpretation of the construction cannot render the claims inoperable. *Power Integrations, Inc.*, 904 F.3d at 972 (an “inoperable construction is wrong”). PO’s requirement of entirely blocking current would render the claims inoperable because it excludes all real-world JFETs. TI-1060, ¶¶18-19.

PO's Expert Agrees that JFETs Continue Conducting When "open"

5 Q. What is Vgs(off)?
6 What does that mean?
7 A. So we're describing here the pinch-off voltage.
8 And so, my understanding is Vgs(off) would be the state
9 of the FET when it has its lowest current, which, here in
10 DeMaw, they may consider to be off. But you have to look
11 at the specific transistor. But that's the region that
12 they're, I think, referring to with that Vgs.

TI-1051, 17:5-12.

*TI-1051, 17:5-12 (annotated)
(cited by Reply at 1-2), TI-1060, ¶ 32*

Galton Clarified that Idealized Switches have Zero Drain Current

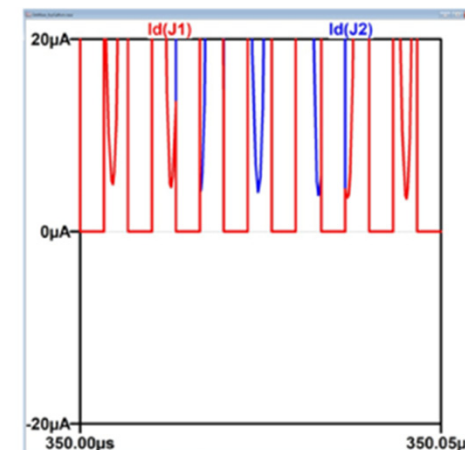
26. Nevertheless, the point is that the JFETs are acting as switches, just not ideal switches.¹ And as I mentioned above, ideal switches do not exist in practice.

TI-1060, ¶ 26 (cited by Reply at 2-3)

28. No practical switches, e.g., those implemented by transistors (MOS transistors, JFET transistors, bipolar junction transistors, etc.) are ideal. All conduct some current when off, but they conduct far more current when on. The difference between the generic JFETs and the Siliconix U430 JFETs is that the former conduct less current when off (and when on) than the latter. Even the

TI-1060, ¶ 28 (cited by Reply at 2-3)

20. No switch is ideal, so no matter what type of transistor is used to implement a switch, the switch will conduct some current when the switch is “off”. For example, had Dr. Ricketts zoomed in further on the left simulation plot below, current flow would have been visible even when the switch is in its off state.

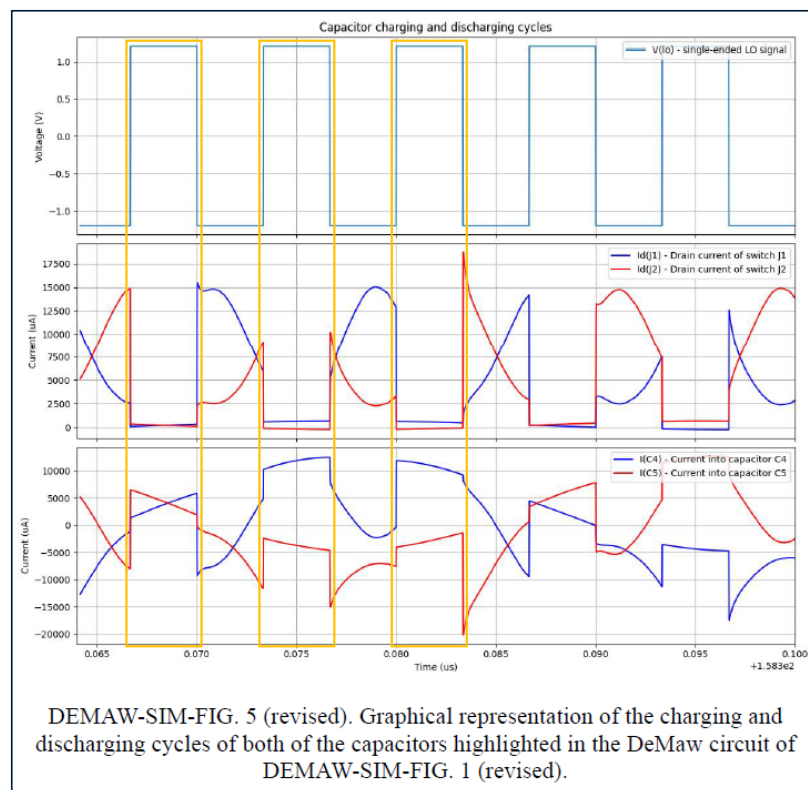


TI-1060, ¶ 20 (cited by Reply at 2-3)

FISH.

Demonstrative Exhibit – Not Evidence

DeMaw U430 JFETs Discharge “Between Apertures”

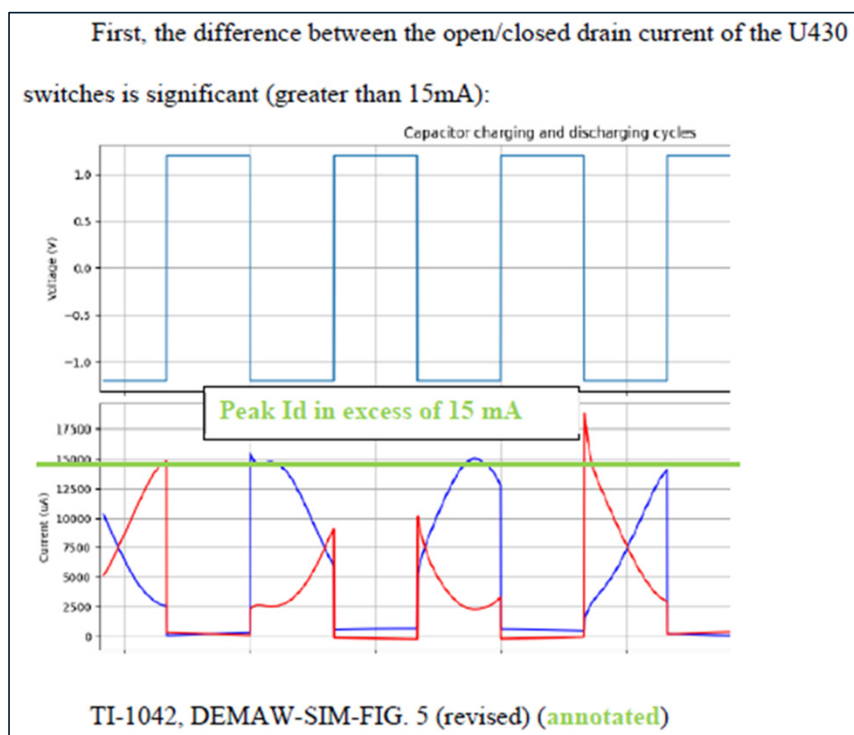


TI-1042, ¶ 8 (cited by Reply at 8, 13) (*annotated*)

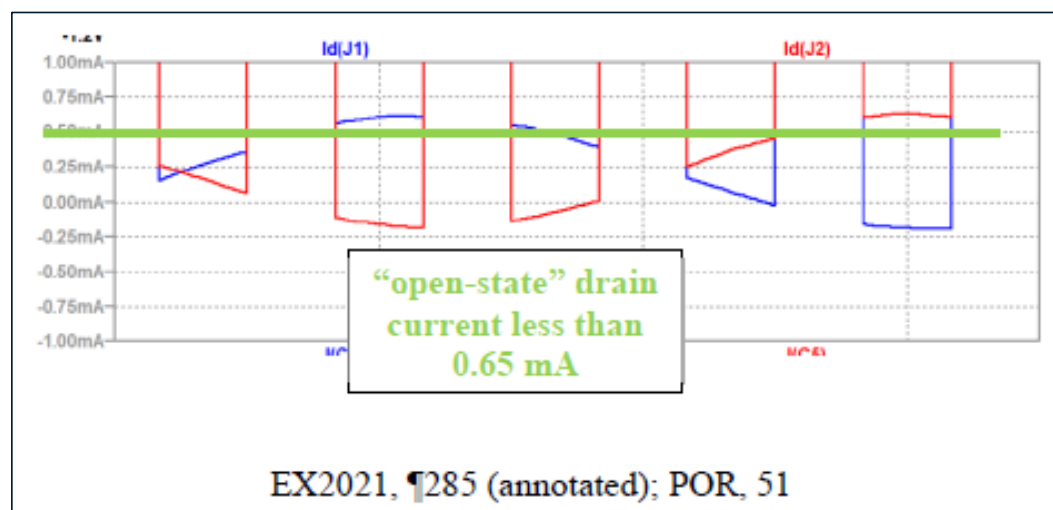
FISH.

Demonstrative Exhibit – Not Evidence

U430 JFETs Block Drain Current by >20x (from 15 mA to less than 0.65 mA)



Reply at 12-14 (citing TI-1042, ¶ 8)

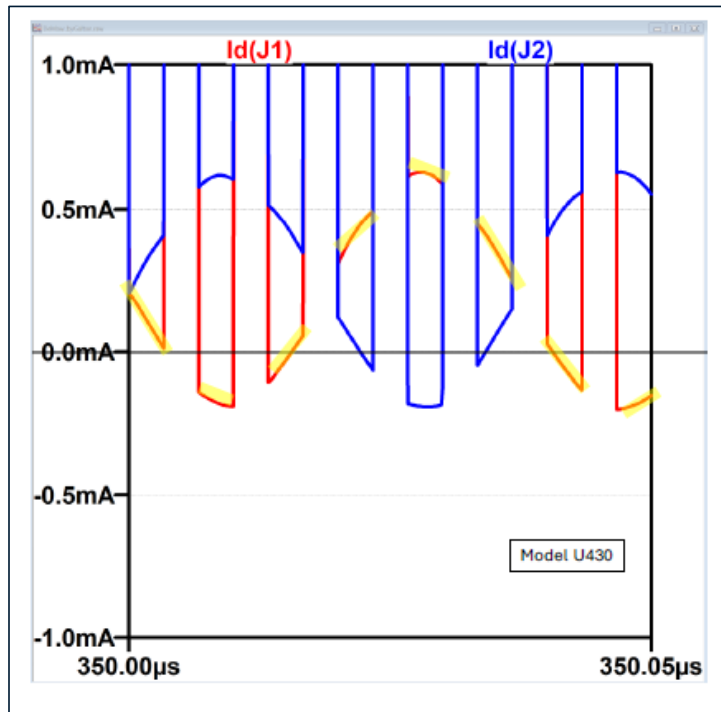


Reply at 12-14 (citing EX2021, ¶ 285)

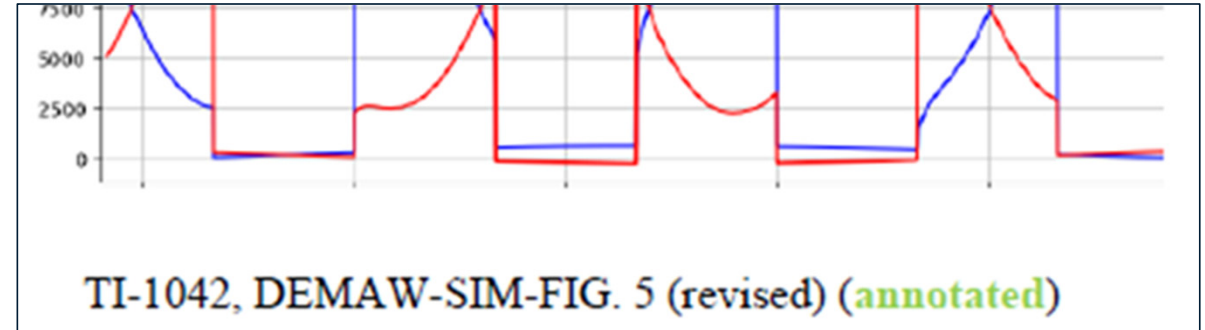
FISH.

Demonstrative Exhibit – Not Evidence

POR Exaggerates the Drain Current Without Showing How Much It Drops



POR at 46.



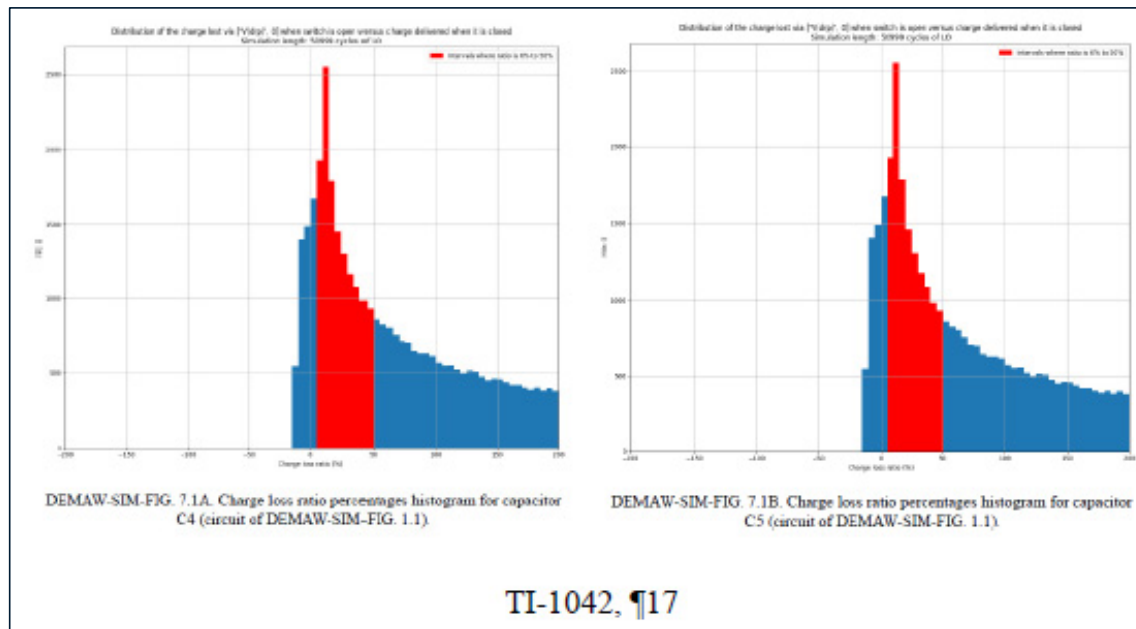
FISH.

Demonstrative Exhibit – Not Evidence

DeMaw simulations using different input signal values

- U430 JFETs caused an increase in mixer gain
- To headoff more complaints by PO, Dr. Galton simulated DeMaw using a smaller input signal.

DeMaw Simulation Shows Performance of Claimed Discharge Percentages with a Small Input Signal



Reply at 15 (citing TI-1042, ¶17)

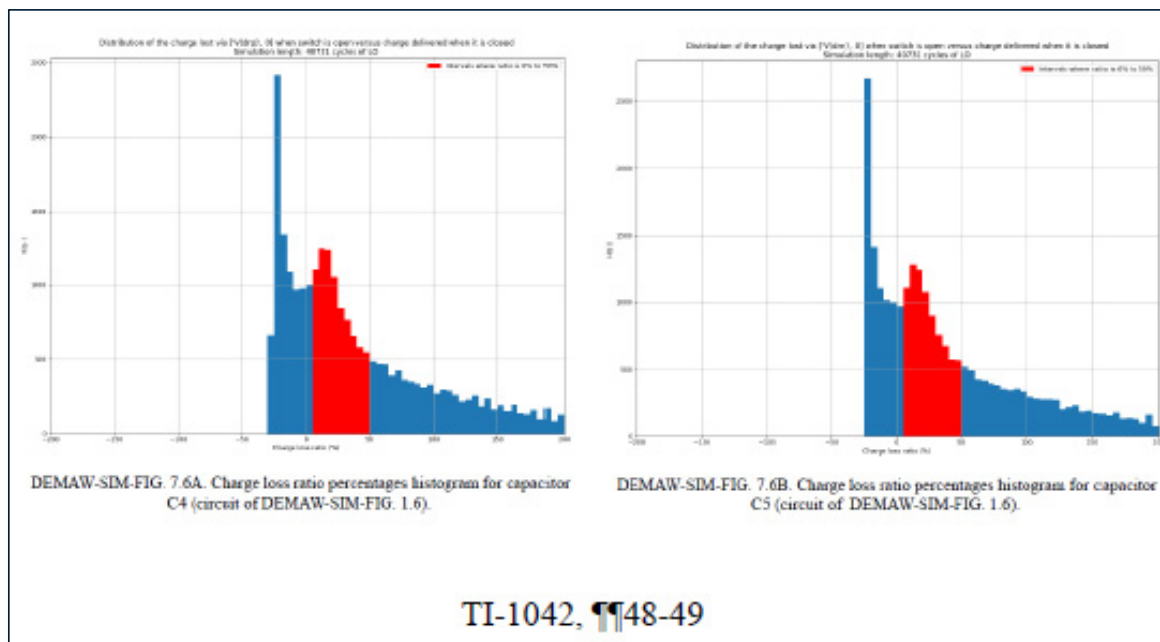
FISH.

Demonstrative Exhibit – Not Evidence

DeMaw simulations Using a Different Squared-up Local Oscillator Configuration

- The Board had acknowledged that Dr. Galton had sufficiently explained his “selection of parameter values taught by DeMaw together with expected minor adjustments.” Inst. Dec. at 24.
- But, Dr. Galton confirmed that even under PO’s restrictive view of DeMaw, the circuit performs the method of claims 18-21.
- The results are that DeMaw still performs the claimed discharge percentages

DeMaw Simulation Shows Performance of Claimed Discharge Percentages with a Small Input Signal



Reply at 17 (citing TI-1042, ¶¶ 48-49)

DeMaw Simulations Using Different Input Signal Values and a Sinusoidal Local Oscillator (LO)

- DeMaw does not require a sinusoidal LO
- Dr. Galton also simulated DeMaw using a sinusoidal LO due to PO's complaints in the POPR

DeMaw Does Not Require a Sinusoidal LO

TABLE 6.1 Comparison of Output Products from Mixers

(N)	Single-Ended Mixer				
	f_o	$2f_o$	$3f_o$	$4f_o$	$5f_o$
f_s	$f_o \pm f_s$	$2f_o \pm f_s$	$3f_o \pm f_s$	$4f_o \pm f_s$	$5f_o \pm f_s$
$2f_s$	$2f_o \pm f_s$	$2f_o \pm 2f_s$	$3f_o \pm 2f_s$	$4f_o \pm 2f_s$	$5f_o \pm 2f_s$
$3f_s$	$3f_o \pm f_s$	$3f_o \pm 2f_s$	$3f_o \pm 3f_s$	$4f_o \pm 3f_s$	$5f_o \pm 3f_s$
$4f_s$	$4f_o \pm f_s$	$4f_o \pm 2f_s$	$4f_o \pm 3f_s$	$4f_o \pm 4f_s$	$5f_o \pm 4f_s$
$5f_s$	$5f_o \pm f_s$	$5f_o \pm 2f_s$	$5f_o \pm 3f_s$	$5f_o \pm 4f_s$	$5f_o \pm 5f_s$
(0.5 N)	Singly Balanced Mixer				
	f_o	$2f_o$	$3f_o$	$4f_o$	$5f_o$
f_s	$f_o \pm f_s$	$2f_o \pm f_s$	$3f_o \pm f_s$	$4f_o \pm f_s$	$5f_o \pm f_s$
$2f_s$	$2f_o \pm f_s$	$2f_o \pm 2f_s$	$3f_o \pm 2f_s$	$4f_o \pm 2f_s$	$5f_o \pm 2f_s$
$3f_s$	$3f_o \pm f_s$	$3f_o \pm 2f_s$	$3f_o \pm 3f_s$	$4f_o \pm 3f_s$	$5f_o \pm 3f_s$
$4f_s$	$4f_o \pm f_s$	$4f_o \pm 2f_s$	$4f_o \pm 3f_s$	$4f_o \pm 4f_s$	$5f_o \pm 4f_s$
$5f_s$	$5f_o \pm f_s$	$5f_o \pm 2f_s$	$5f_o \pm 3f_s$	$5f_o \pm 4f_s$	$5f_o \pm 5f_s$
(0.25 N)	Doubly Balanced Mixer				
	f_o	$2f_o$	$3f_o$	$4f_o$	$5f_o$
f_s	$f_o \pm f_s$	—	$3f_o \pm f_s$	—	$5f_o \pm f_s$
$2f_s$	$2f_o \pm f_s$	—	$3f_o \pm 2f_s$	—	$5f_o \pm 2f_s$
$3f_s$	$3f_o \pm f_s$	—	$3f_o \pm 3f_s$	—	$5f_o \pm 3f_s$
$4f_s$	$4f_o \pm f_s$	—	$4f_o \pm 3f_s$	—	$5f_o \pm 4f_s$
$5f_s$	$5f_o \pm f_s$	—	$5f_o \pm 3f_s$	—	$5f_o \pm 5f_s$

LO = f_o , signal frequency = f_s
 $2f_o \pm f_s$ = third-order product
 $3f_o \pm 3f_s$ = sixth-order product, etc.
N = number of mixer products

POR at 42 (citing TI-1016, Table 6.1)
(annotated)

Indeed, DeMaw itself provides no basis for using a square wave. To the contrary, a POSITA understands that DeMaw teaches a sinusoidal signal. In particular, Table 6.1 in DeMaw specifically states that “LO = f_o , signal frequency = f_s .” A POSITA understands this refers to a sinusoidal signal, because a sinusoidal signal has a “single frequency” component. A square wave, however, is not a single frequency but, rather, a composite of multiple harmonics/frequencies. Ex.- 2021, ¶¶240-241.

POR at 42 (citing TI-1016, Table 6.1)
(annotated)

LO = f_o , signal frequency = f_s

FISH.

Demonstrative Exhibit – Not Evidence

DeMaw Refers to a Single, Fundamental Frequency

signal 306 is periodic, but is not sinusoidal. A POSITA would have understood fo
represents the fundamental frequency of a signal that includes multiple harmonics
of the fundamental frequency. In fact, even Dr. Ricketts agrees that a square wave
can be characterized by its fundamental frequency. EX2021, at ¶78; TI-1051, 28:3-
16. Likewise, the '342 patent states that even harmonically rich signals, including
square waves, have a fundamental frequency. E.g., TI-1001, 13:20-32.

TI-1060, ¶ 33 (cited by Reply at 9-10)

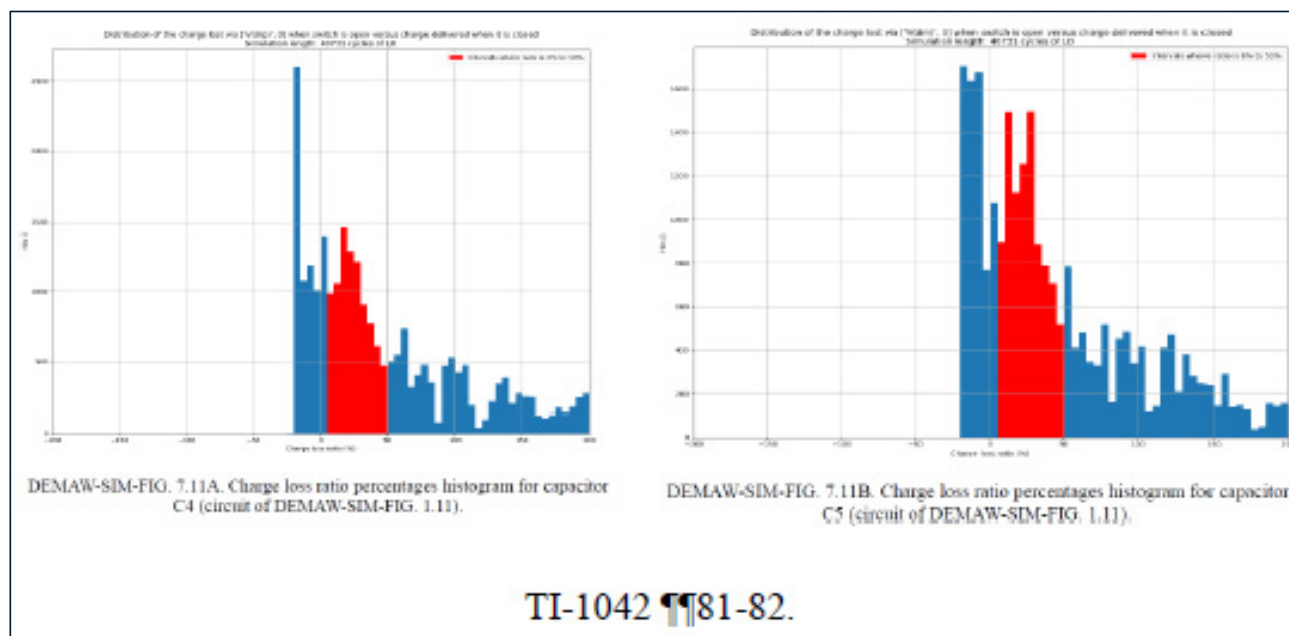
Harmonically rich signal 1308 is comprised of a plurality
of sinusoidal waves whose frequencies are integer multiples
of the fundamental frequency of the waveform of the har-
monically rich signal **1308**. These sinusoidal waves are
referred to as the harmonics of the underlying waveform, and
the fundamental frequency is referred to as the first harmonic.

TI-1001, 13:20-32 (cited by Reply at 9-10)

10	THE WITNESS: The <u>square wave</u> , the pulse, and
11	the impulse <u>fundamental frequency</u> , yes, they can describe
12	it with that. Duty cycle and pulse width are related.
13	So if you have a <u>fundamental frequency</u> and you have a
14	pulse width, you get a duty cycle. So those two in the
15	same. And then, of course, there's a shape conveyed in
16	the figure in 78.

*Ricketts Deposition, TI-1051, 28:10-16 (cited
by Reply at 9-10) (annotated)*

DeMaw Shows Performance of Claimed Discharge Ranges When Using a Sinusoidal LO

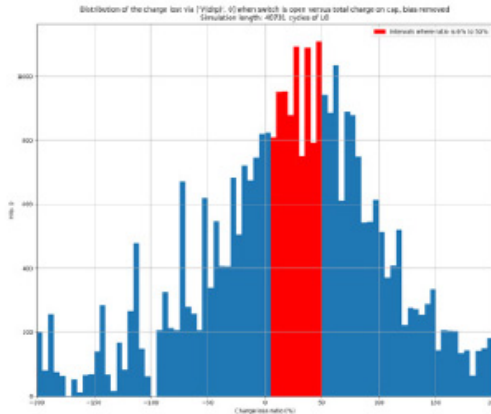


Reply at 19 (citing TI-1042, ¶¶ 81-82)

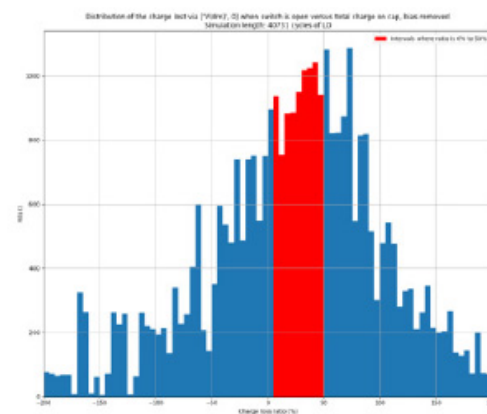
Under PO's Interpretations, DeMaw Still Performs the Claimed Discharge Percentages

- Dr. Galton originally provided histograms to show performance of claims 19-21 based on the claims requiring the “information signal” and the “inverted information signal” contributing to the charge stored on the capacitor.
 - Under this interpretation, only the change in charge from the information signal needs to be considered for the discharge percentage calculation; the bias voltage does not affect the change in the charge
- Dr. Ricketts took a different interpretation, requiring all of the charge from previous charging to be factored into the discharge percentage calculations
 - Under this interpretation, the charge attributable to the bias voltage must be removed from the calculations
 - This is also a claim construction issue that requires looking at the plain meaning of the claims, as well as the intrinsic record

Under PO's Interpretations, DeMaw Still Performs the Claimed Discharge Percentages



DEMAW-SIM-FIG. 7.11A. Post-processed charge loss ratio percentages histogram for capacitor C4 (circuit of DEMAW-SIM-FIG. 1.11).



DEMAW-SIM-FIG. 7.11B. Post-processed charge loss ratio percentages histogram for capacitor C5 (circuit of DEMAW-SIM-FIG. 1.11).

TI-1060, ¶¶57-58.

Dr. Galton provides similar histograms for other variations of DeMaw, all of which show the claimed discharge percentages. TI-1060, ¶¶57-58.

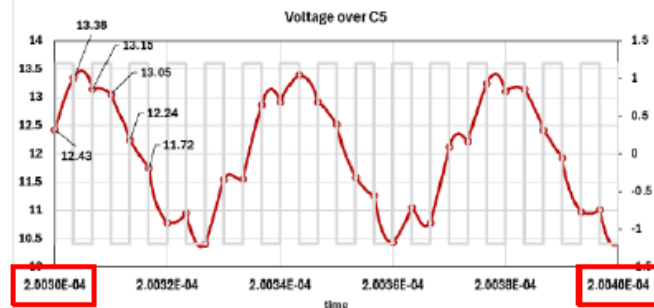
Reply at 22 (citing TI-1060, ¶¶ 57-58)

FISH.

Demonstrative Exhibit – Not Evidence

PO's Expert Only Provided an Analysis of 2 Cycles of Data

419. Figure 2 shows a zoomed in span of voltage across C5 together with the LO pulses.



[FIGURE 2: Zoom in of portion of C5 voltage to demonstrate voltage points]

Exhibit 2021, ¶ 419 (annotated).

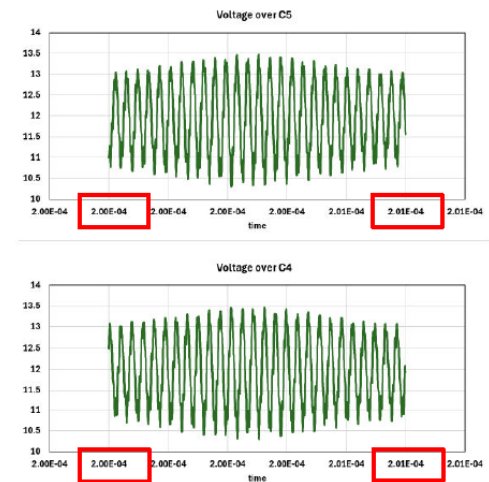
421. As an example for the few points shown in Figure 2 above, we will have the numbers shown below.

V(t0)	V(t1)	%
12.427	13.348	7.42 (charging)
13.146	13.052	-0.71
12.248	11.748	-4.08

Exhibit 2021, ¶ 421 (annotated).

Demonstrative Exhibit – Not Evidence

418. Figure 1 (below) shows voltage across C4 and C5 over one full cycle of the modulated IF signal, which contains multiple LO pulses (Modulation frequency 1MHz, IF frequency 26.9MHz, LO frequency 150MHz).



[FIGURE 1: Voltage across C5 and C4]

Exhibit 2021, ¶ 418 (annotated).

Ricketts Excluded Data from His Results

5 Q. Okay. So paragraph 418 starts at 200
6 microseconds and ends at 201 microseconds. So it's,
7 approximately, one microsecond.
8 And then appendix B starts at 10 microseconds
9 and ends at 12 microseconds; is that right?
10 A. Just a moment. So figure 2, after paragraph
11 419, has a zoom in so you can see the timing a little
12 better where you can see the actual RF clock and you can
13 see the clock in the wave form on there.
14 But I think your question was on appendix B.
15 The first table starts at 10 microseconds. That's
16 correct. And then it ends at 11.9 microseconds at the
17 end of the table, which would be on page 184.
18 Q. So that's, approximately, 1.9 microseconds
19 across that table; is that correct?
20 A. That would be 1.9 microseconds. That's correct.
21 And that's to capture one cycle of the modulated signal.

TI-1051, 55:9-21 (Pet. MTE at 2)

9 Q. So let me -- let me re-ask it because I think I
10 was imprecise.
11 What you've shown here is the complete set of
12 data for a subset of the total time that the simulation
13 runs, correct?
14 A. The plot here --
15 MS. LEPORE: Objection. Form.
16 THE WITNESS: The plot here shows, it looks
17 like, from 200 to 201 microseconds. So that's that
18 portion of time. And that would be a subset of time of
19 the simulation.

TI-1051, 52:9-20 (Pet. MTE at 2)

Ricketts Excluded Data from His Results

5	Q. Okay. Now I feel like I might have been
6	imprecise in this. I understand that appendix B has
7	the -- actually, let me rephrase this.
8	Is appendix B the complete set of results from
9	Dr. Galton's simulations?
10	A. I think I'd have to be a little bit more precise
11	in that you can run a simulation forever, for as long as
12	you want, for hours, and <u>this simulation only runs for as</u>
13	<u>long as the data points that are listed there.</u>

TI-1051, 54:5-13 (Pet. MTE at 2)

1	Q. Going back down to appendix B, why does the time
2	start at 10 microseconds as opposed to 0?
3	A. Well, this is a, you know, full transistor level
4	simulation. So you know, everything starts off, and then
5	circuits wake up. And so, <u>I picked a period that</u> -- when
6	it was operating in its normal operation, which would be
7	after a wake-up period.

TI-1051, 57:1-7 (Pet. MTE at 2)

Claims 19-21 Do Not Include a Bias Voltage

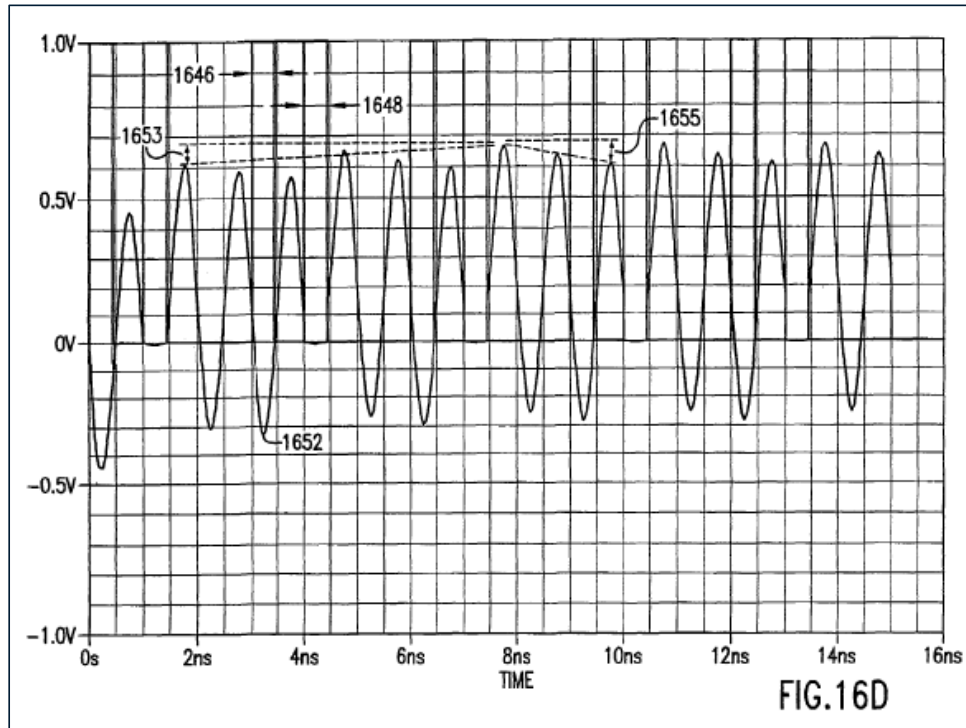
- Claim 18 clarifies that the information signal and inverted information signal are used to store charge on the capacitors, not the bias
- The specification does not include the bias in the discharge calculation (e.g., FIGS. 16D and 16J)
- DeMaw's down-converted signal does not include a bias component, so the calculation of the discharge percentages is consistent with how DeMaw works.

The Bias Should Be Removed from the Discharge Percentage Calculations

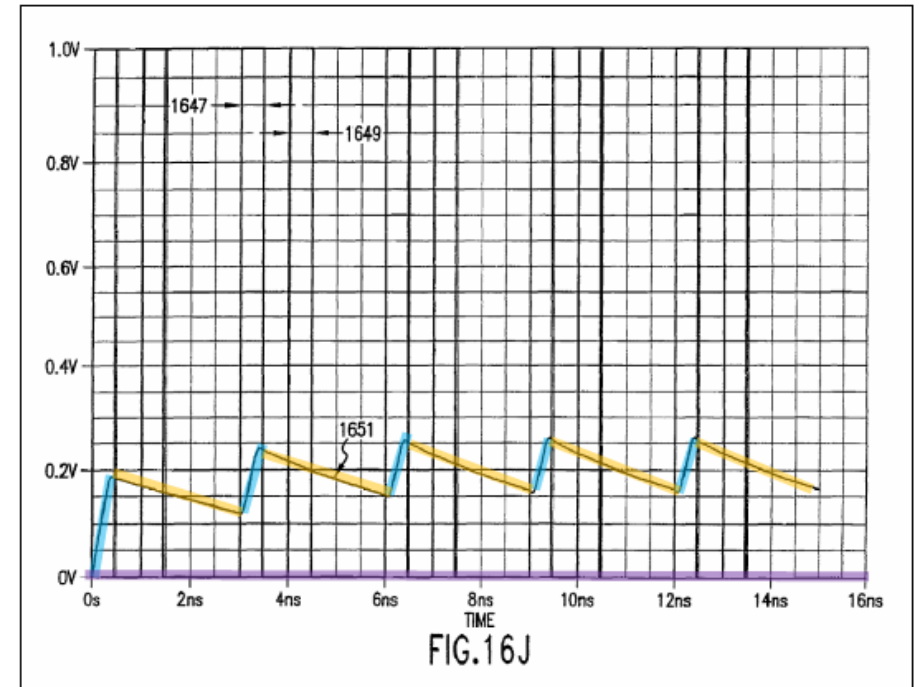
The charge stored/discharged in a cycle of the circuit is small relative to the bias voltage. TI-1060, ¶¶54. The bias voltage mathematically skews the charging/discharging percentages, which is likely why PO argues for them. *Id.* But, under PO's interpretation, the same circuit could be made to avoid the claims by changing the magnitude of the bias voltage. TI-1060, ¶64. This is outside the intent of the patent. TI-1001, FIGS. 16A, 16H, & 16O and accompanying text.

Reply at 21 (citing TI-1060, ¶¶ 54, 64)

The 342 Patent Specification Does Not Include Bias in the Discharge Percentage Calculation



Pet. at 33 (citing TI-1001, FIG. 16D)

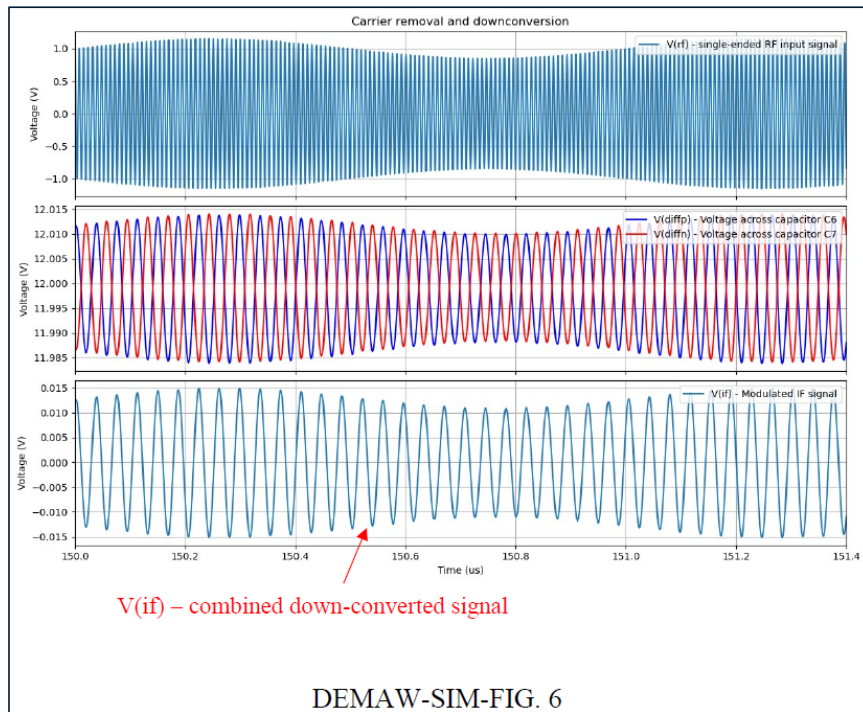


Sur-reply at 9 (citing TI-1001, FIG. 16J)

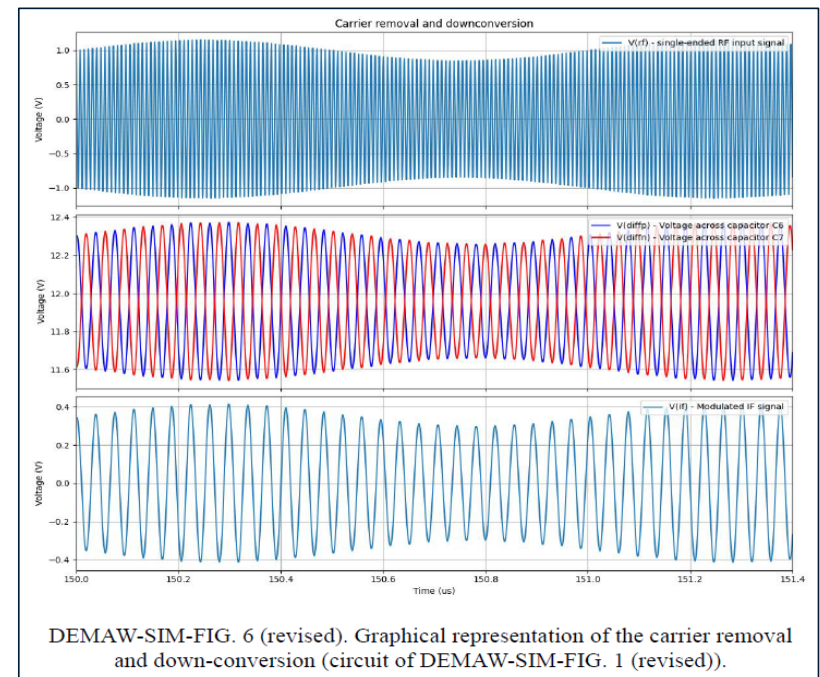
FISH.

Demonstrative Exhibit – Not Evidence

Like the 342 Patent, DeMaw's Down-Converted Signal Does Not Include the 12 V Bias Component



Pet. at 33 (citing TI-1003, ¶ 112)



TI-1042, ¶ 9

FISH.

Demonstrative Exhibit – Not Evidence

Issue 2 Macnally

FISH.

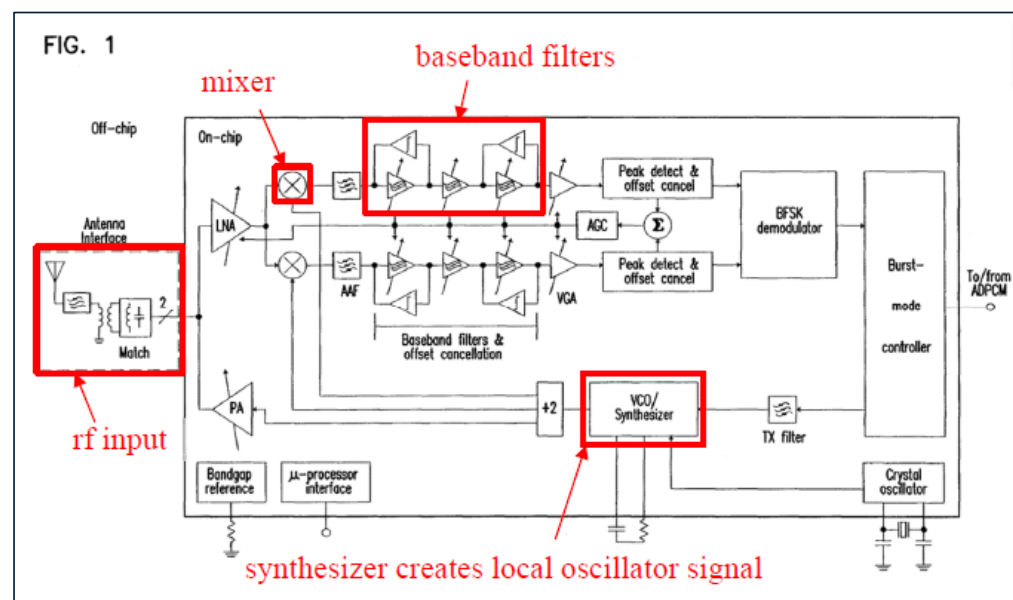
DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

Macnally

- The information signal and inverted information signal are “electrically coupled” to the capacitor
- Claim construction – “electrically coupling” means “indirectly or directly connecting such that an electrical signal can flow between”
- Macnally Teaches switching devices
- Charge on capacitors change (Pet. Reply)
- Galton provided histograms using both his interpretations and Ricketts interpretations (in rebuttal), both show the claimed discharge percentage ranges.

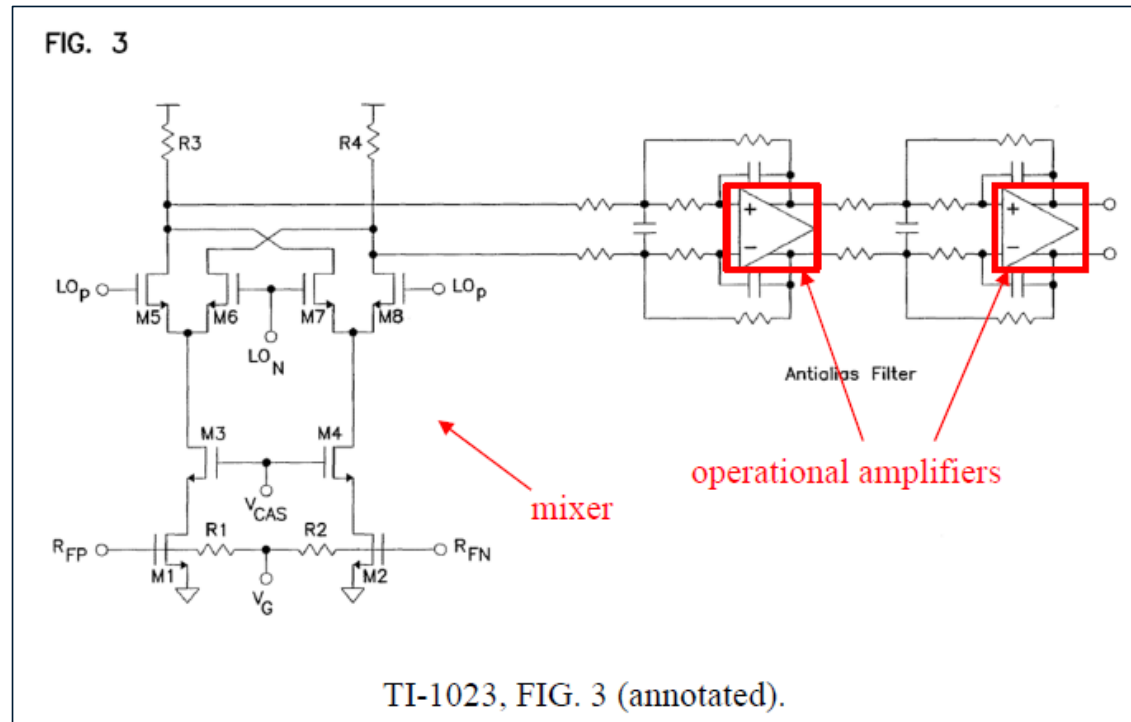
Macnally (TI-1021)

PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION International Bureau		
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)		
(51) International Patent Classification : H04B 1/30, 1/40	A1	(11) International Publication Number: WO 00/16492 (43) International Publication Date: 23 March 2000 (23.03.00)
(21) International Application Number: PCT/US99/20792 (22) International Filing Date: 10 September 1999 (10.09.99) (30) Priority Data: 60/099,723 10 September 1998 (10.09.98) US (63) Related by Continuation (CON) or Continuation-in-Part (CIP) to Earlier Application US 60/099,723 (CON) Filed on 10 September 1998 (10.09.98) (71) Applicant (for all designated States except US): LEVEL ONE COMMUNICATIONS, INC. [US/US]; 9750 Goethe Road, Sacramento, CA 95827 (US). (72) Inventors; and (75) Inventor/Applicants (for US only): MACNALLY, Donald, Evan [US/US]; 141 Breeze Street, San Francisco, CA 94110 (US); CHO, Thomas, B. [US/US]; 356 Olander Avenue, Alameda, CA 94502 (US); RABBI, Shabir [US/US]; 2162 Stanton Court, Palo Alto, CA 94306 (US); MEHTA, Srenik, Suresh [US/US]; 1468 6th Avenue, San Francisco, CA 94122 (US); NELSON, Christopher, Donald [US/US]; 170 South 14th Street, San Jose, CA 95112 (US); MACK,		
(54) Title: A SINGLE-CHIP CMOS DIRECT-CONVERSION TRANSCIEVER		
Abstract A single-chip CMOS direct conversion transceiver includes an RF circuit, a transmitter having a synthesizer, a receiver having a baseband filter, and a demodulator. The synthesizer is coupled to the RF circuit. The baseband filter is coupled to the RF circuit and the synthesizer. The demodulator is coupled to the baseband filter. The RF circuit, the synthesizer, the baseband filter, and the demodulator are arranged and configured in CMOS devices and provide a complete interface between an antenna and a voiceband codec.		



TI-1023, FIG. 1 (annotated)
cited by Pet. at 51

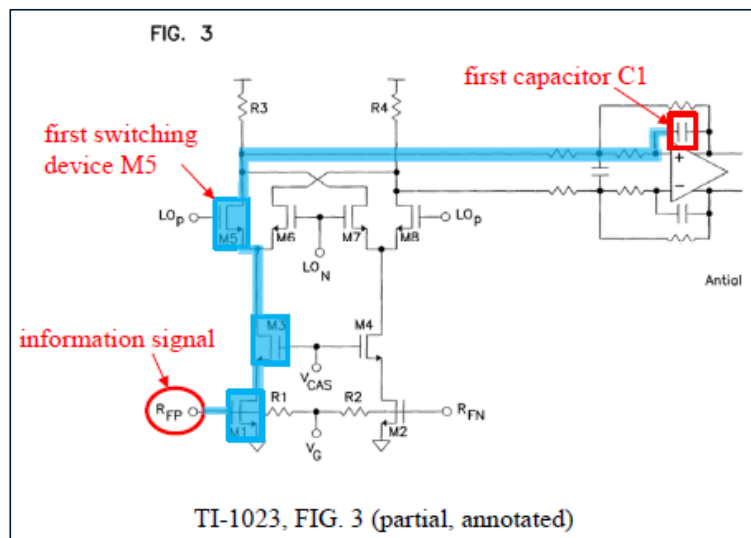
Macnally's Mixer Includes All of the Claimed Structure of Claim 18



TI-1023, FIG. 3 (annotated)
cited by Pet. at 51

Macnally's Mixer Includes All of the Claimed Structure of Claim 18

Demonstrative Exhibit – Not Evidence



TI-1023, FIG. 3 (cited by Pet. at 60-63; Reply 23-24; TI-1003, ¶¶ 145-148; TI-1060, ¶¶ 84-98)

Macnally Unambiguously Refers to M5 and M6 as Switches

variations with process and temperature. The LO input transistors operate as switches that steer a process and temperature independent current. The output of the

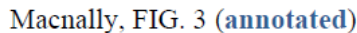
TI-1021, 12:19-20 (cited by Pet. at 60, Reply at 28; TI-1003, ¶¶ 85-86; TI-1060, ¶ 78)

79. Similarly, Dr. Ricketts criticizes my simulation for using a full-swing LO clock signal that was “neither taught nor suggested by the patent.” EX2021, ¶365. However, the Macnally patent states that the “LO input transistors operate as switches” which implies that the LO signal approximates a square wave, and that the amplitude of the square wave is large enough to ensure this behavior. The easiest way to do this, and, therefore, the most likely way that Macnally did it, is to use a full-swing LO clock signal.

TI-1060, ¶¶ 78-79 (cited by Reply at 28)

FISH.

Demonstrative Exhibit – Not Evidence



TI-1023, FIG. 3 (*annotated*) (cited by Reply at 27-28)
TI-1060, ¶ 135

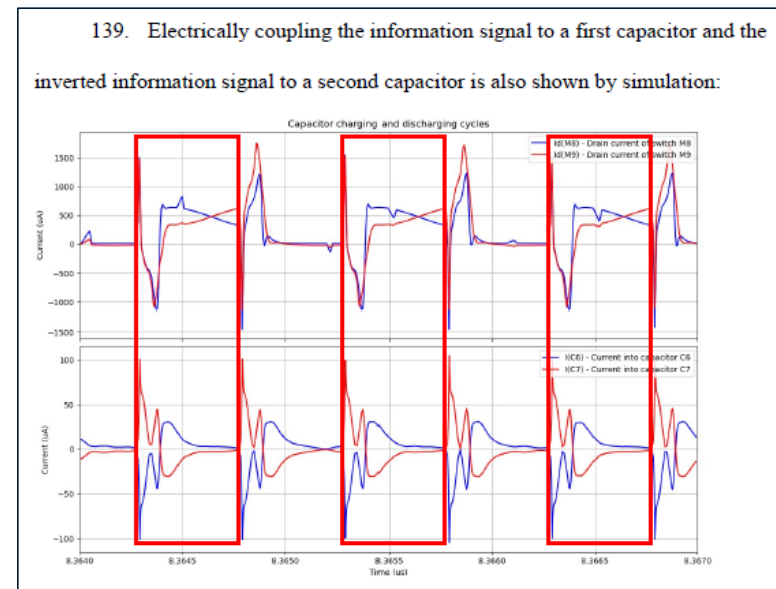
TI-1060, ¶ 135 (cited by Reply at 27-28)

PO Mischaracterizes Galton's Testimony About Macnally's Electron Flow

This is incorrect; in reality, the electron flow is from the source to the drain.

Electrons are negatively charged, so they flow toward the positive supply voltage,
not toward ground. Dr. Ricketts's argument presented in Paragraphs 222-225 that

*TI-1060, ¶¶ 134-135 (Reply 28;
Sur-reply, 33-34)*



TI-1003, ¶ 139 (cited by Pet. at 39-40)

FISH.

Demonstrative Exhibit – Not Evidence

Galton Addressed PO's Argument About Macnally's Current Direction and Switch Conduction

Finally, Petitioner/Galton has no response to Ricketts's testing of MacNally's circuit (using Galton's own data) which, as shown below, demonstrates that current never becomes negative and, thus, only flows in one direction (downward). POR,95-97.

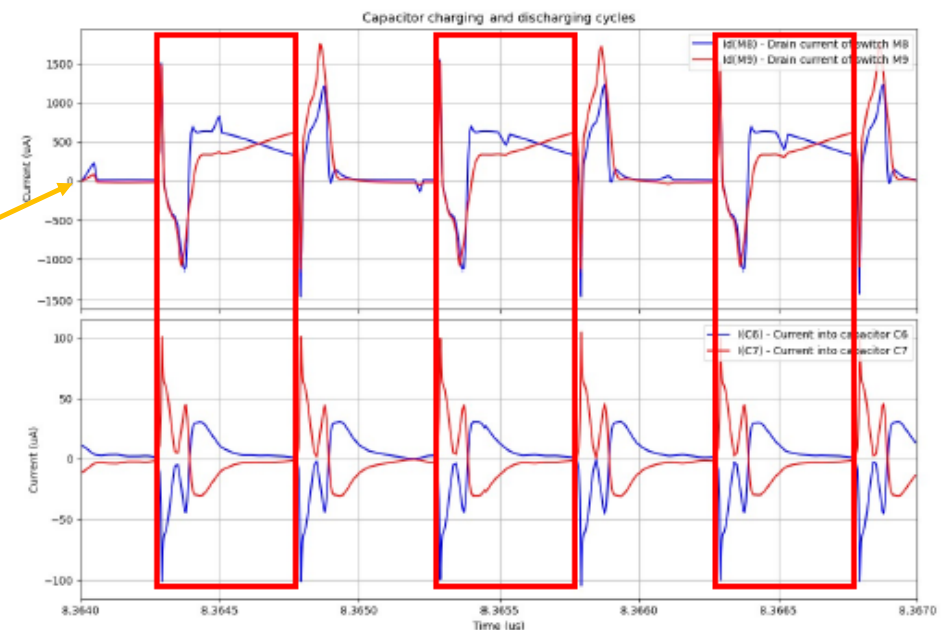
Sur-reply at 31

Drain current zero-crossing

As shown below, using M8 as an example, regardless of whether M5/M8 is "on"/closed (green shaded area) or "off"/open (yellow shaded area), Ricketts showed that the charge is materially the same. POR,98. This means that the circuit is continuously conducting, not switching. *Id.*,99.

Petitioner has no response. So Petitioner inexplicably begins to discuss down-conversion. Whether down-conversion occurs says nothing about M5/M8

139. Electrically coupling the information signal to a first capacitor and the inverted information signal to a second capacitor is also shown by simulation:



TI-1003, ¶ 139 (cited by Pet. at 39-40)

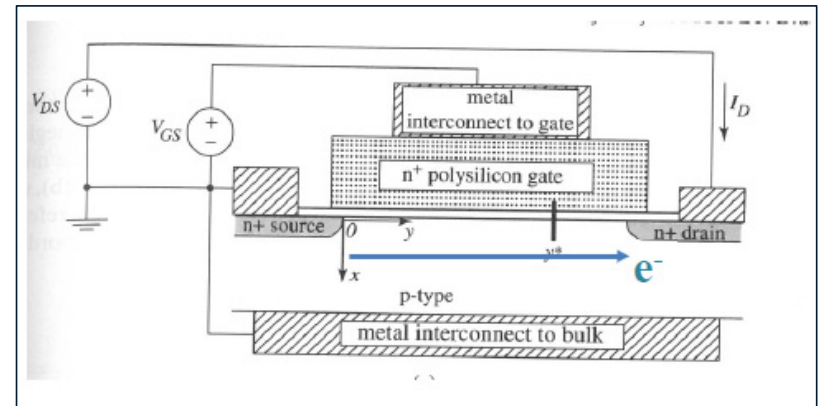
FISH.

Demonstrative Exhibit – Not Evidence

Experts Agree that Electrical Charge Flows from Low Voltage to High Voltage

41. Voltage: Voltage represents the difference in electric potential energy per unit charge between two points in a circuit. It quantifies the amount of potential energy available to move charges. Negative charges (electrons) are naturally attracted to higher voltages, while positive charges (protons) are drawn toward lower voltages.

*Ricketts Declaration, EX.-2021, ¶ 41
(cited by Reply at 27) (annotated)*



Electrons are negatively charged, so they flow toward the positive supply voltage.

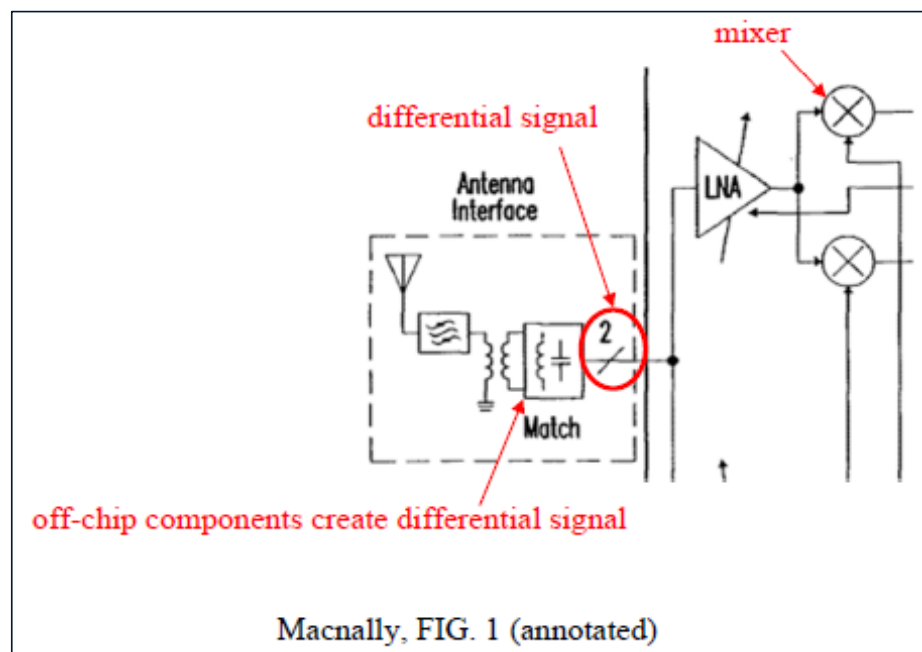
Pet. Reply at 27 (citing TI-1060, ¶ 134)

FISH.

Demonstrative Exhibit – Not Evidence

Macnally's Mixer Receives the Output from LNA

undisputed



TI-1003, ¶ 131 (cited by Pet. at 56-57)

The input to the mixer circuit is the information signal and inverted information signal output from the LNA.

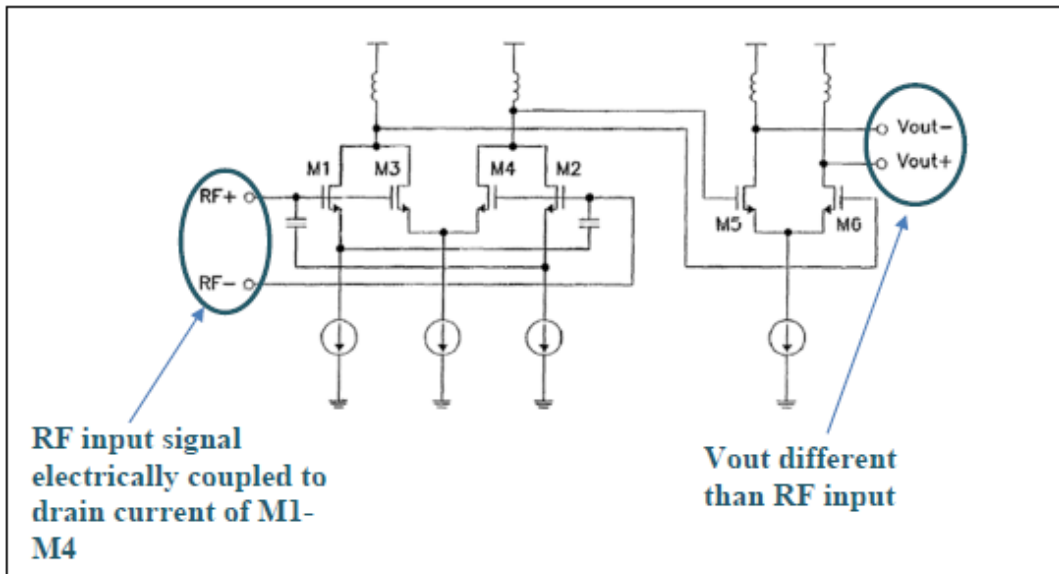
Macnally explains that radio transceivers “usually require” an “LNA.”

TI-1003, ¶¶ 131-132.

FISH.

Demonstrative Exhibit – Not Evidence

Macnally's LNA Inputs and Outputs Information Signals and Inverted Information Signals



Vout- is the inverted information signal RF-output from the LNA

Vout+ is the information signal RF+ output from the LNA

TI-1060, ¶¶ 90-96 (cited by Reply 25-27)

Macnally, FIG. 2 (annotated)

TI-1060, ¶¶ 90-96 (cited by Reply at 25-27)

PTAB Previously Construed “electrically coupling”

Claim Term	Construction
“electrically coupling”	“indirectly or directly connecting such that an electrical signal can flow between”

Pet. at 6; IPR2014-01107, Paper 7, at 8-10

EXAMPLE METHOD EMBODIMENT OF THE INVENTION

...

In step **6202**, a RF information signal is received. The RF signal can be received by any known means, for example, using an antenna or a cable. In embodiments, the RF signal may be amplified using a low-noise amplifier and/or filtered 40 after it is received. These steps, however, are not required in accordance with method **6200**.

In step **6204**, the received RF information signal is electrically coupled to a capacitor. For the receiver shown in FIG.

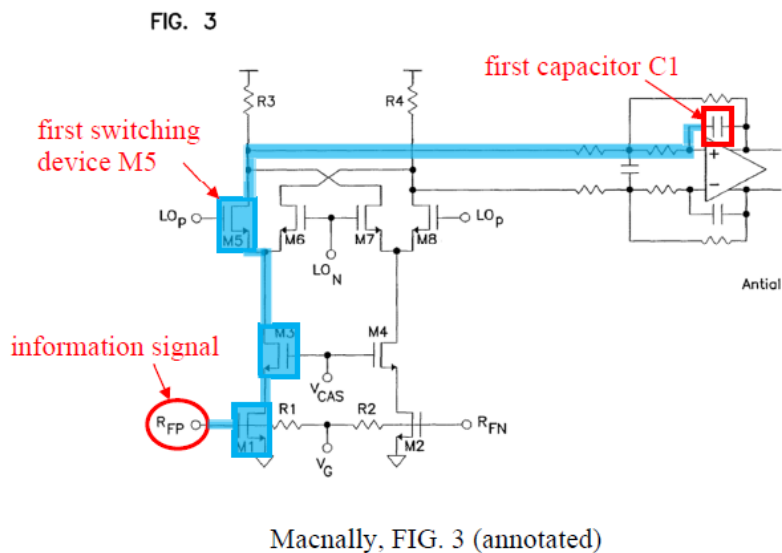
TI-1001, 20:26-42; Reply at 24-26; TI-1060, ¶¶ 90-92

FISH.

Demonstrative Exhibit – Not Evidence

Macnally performs “electrically coupling”

146. In operation, when the first switching device M5 is closed, the RF information signal is directed to the capacitor C1 so that charge is stored on the first capacitor C1. This is shown by FIG. 3 below:



147. In operation, when switching device M5 is closed, the information signal R_{FP} is directed to the first capacitor C1, thereby delivering charge to the first capacitor C1. The first capacitor C1 stores the charge.

E.g., TI-1003, ¶ 146-147 (cited by Pet. at 70-71)

FISH.

Demonstrative Exhibit – Not Evidence

Macnally performs “electrically coupling”

In step 6202, a RF information signal is received. The RF signal can be received by any known means, for example, using an antenna or a cable. In embodiments, the RF signal may be amplified using a low-noise amplifier and/or filtered ⁴⁰ after it is received. These steps, however, are not required in accordance with method 6200.

In step 6204, the received RF information signal is electrically coupled to a capacitor. For the receiver shown in FIG.

TI-1001, 49:29-46 (annotated)

A POSITA would have recognized (or found it obvious) that an LNA outputs the same information signal that it receives, but on different charge carriers. TI-1060,

¶93. Macnally shows a typical LNA:

Reply at 25 (citing TI-1001, 49:29-46; TI-1060, ¶90-93)

The R_{FP} information signal input to the mixer is a version of the received information signal that is transformed and amplified. See, e.g., Macnally, 8:18-25 (describing off-chip processes), 10:20-25 (describing low noise amplifier). However, the substance of the received information signal is preserved through those pre-processing steps. Specifically, the information carried by the information signal is preserved. *Id.* Thus, the input R_{FP} is the claimed information

TI-1003, 134 (cited by Pet. at 61)

FISH.

Demonstrative Exhibit – Not Evidence

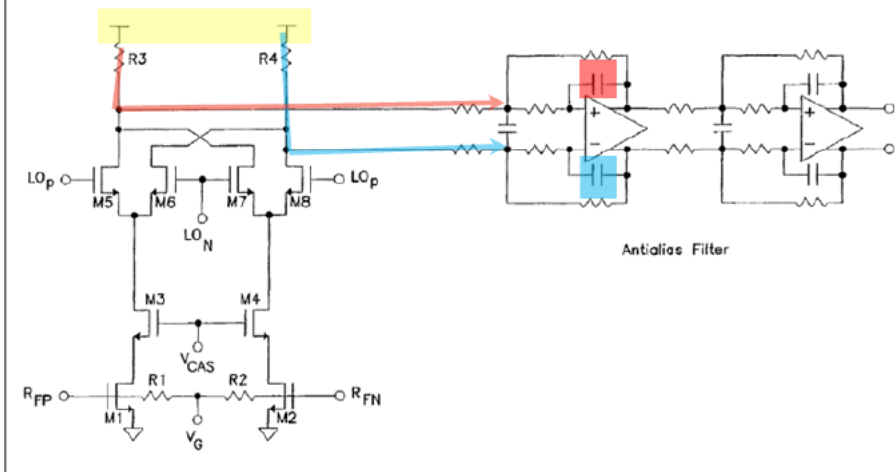
“information signal” Carries Its Plain Meaning

The plain meaning of “information signal” simply denotes a signal with information. There is no requirement in the claims or the specification that the information signal be the received EM input signal. POR, 33. Quite the opposite: claim 18, itself, distinguishes between the “electromagnetic signal” and the “information signal”/“inverted information signal.” TI-1001, cl. 18. That energy propagating the information signal and inverted information signal comes from the power supply is not relevant to the claims. *Id.*

Reply at 26-27

PO Misconstrues Macnally's Operation

FIG. 3



POR at 94

C. Macnally's Current Flow

97. Dr. Ricketts' assertion that "the current flowing from the power source to ground must be direct current (DC)," which is "the non-time varying (non-RF) current that provides the bias and operating points for M5, M6 and M7, M8," makes no sense in the context of Macnally's mixer. EX2021, ¶217. A POSITA knows that a DC current is a constant current by definition, and if the current flowing from the power supply (though resistors R3 and R4 in the Macnally mixer) were really a DC current, then the output voltages of the mixer would be constant. In this case, no signal would ever get to the antialias filter, so the receiver would not function.

TI-1060, ¶ 97 (cited by Reply at 26-27)

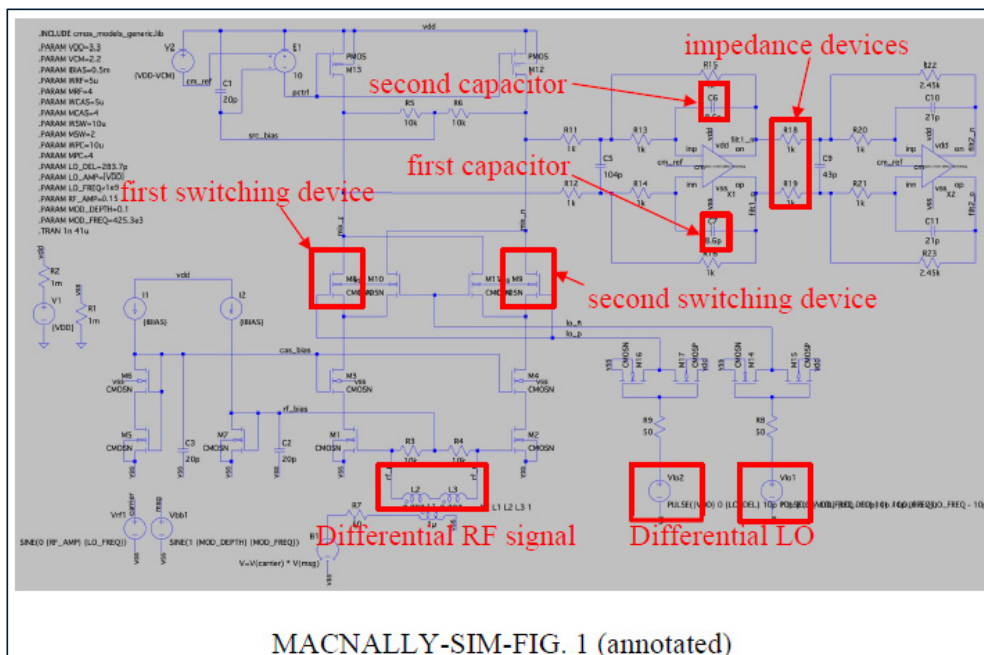
FISH.

Demonstrative Exhibit – Not Evidence

Galton's Macnally Model and Simulations

- Original Simulations
 - Resistors and current sources to model R3 and R4
 - 1 GHz sinusoidal carrier, AM modulated by a 425.3 kHz sinusoidal message signal
 - 1 GHz Local Oscillator

Macnally's Mixer Simulation



MACNALLY-SIM-FIG. 1 (annotated)

TI-1003, ¶¶ 93-93

cited by Pet. at 54

FISH.

Demonstrative Exhibit – Not Evidence

Galton Explained His Simulation Model

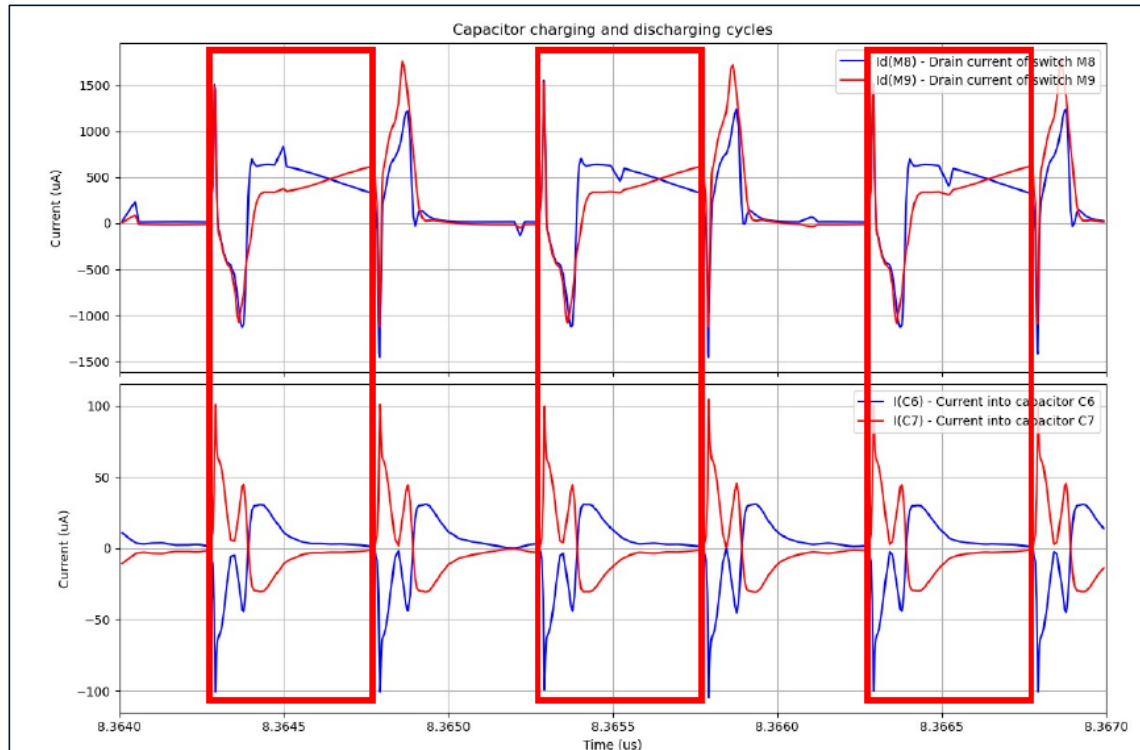
94. The circuit was operated with a 1.0GHz LO clock, performing direct down-conversion on an RF signal comprised of a 1.0GHz sinusoidal carrier amplitude-modulated (AM) 10% by a 425.3 kHz sinusoidal message signal. This simulation deviates from the original patent's intended modulation of BFSK. The use of AM modulation instead of BFSK modulation was simply to make the plots easier to interpret. However, this choice does not alter the mixer's functionality or behavior in any way relevant to the presented results.

E.g., TI-1003, ¶¶ 93-94 (cited by Pet. at 53)

149. Macnally teaches claim 19. As the mixer switches are driven by the full-swing LO clock signal, it is possible to compute the intervals of time when the switches are open versus closed. The identical post-processing script that was used

E.g., TI-1003, ¶¶ 93-94 (cited by Pet. at 53)

Macnally Simulations Show a Plurality of Charging and Discharging Cycles

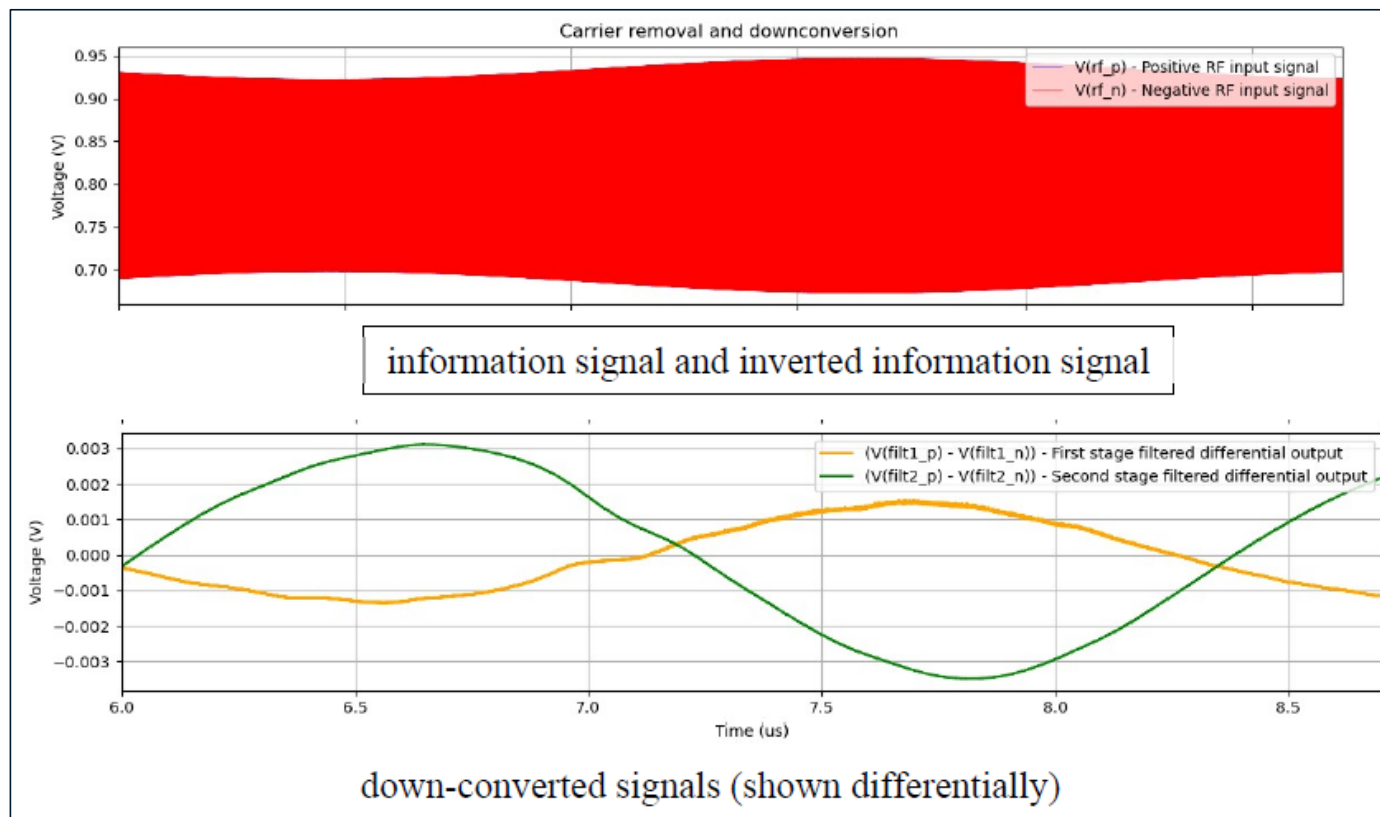


TI-1003, ¶¶ 139 (cited by Pet. at 64)

FISH.

Demonstrative Exhibit – Not Evidence

Macnally Simulations Show Down-Conversion to Baseband

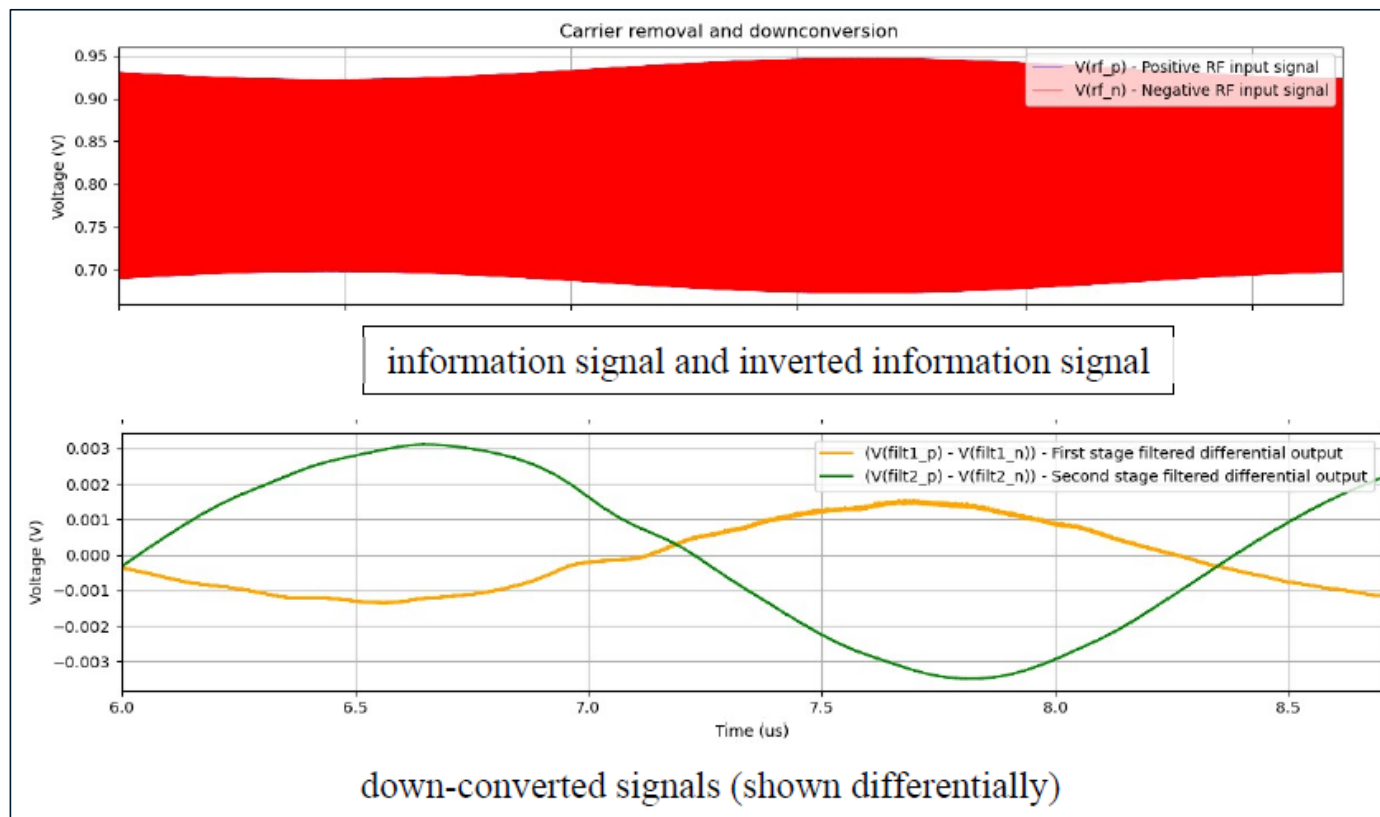


TI-1003, ¶¶ 144 (cited by Pet. at 68-69)

FISH.

Demonstrative Exhibit – Not Evidence

Macnally Simulations Show Down-Conversion to Baseband

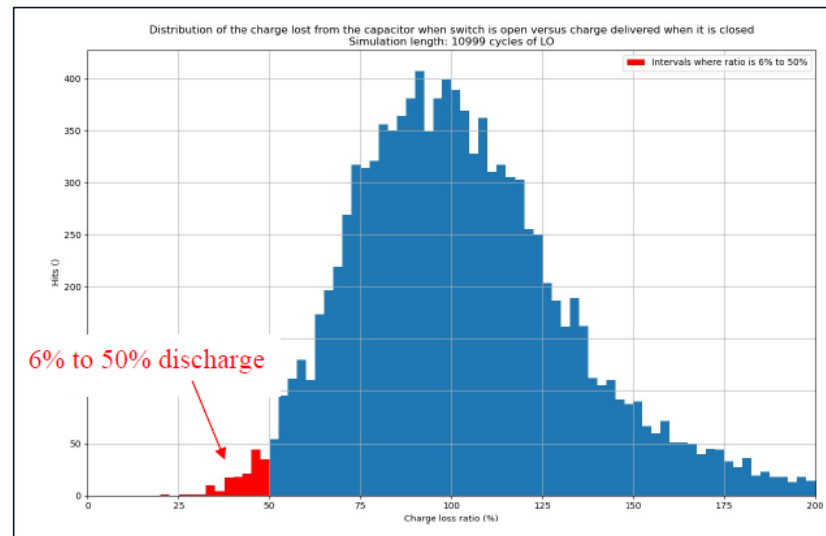


TI-1003, ¶¶ 144 (cited by Pet. at 68-69)

FISH.

Demonstrative Exhibit – Not Evidence

Galton Demonstrated that Macnally Discharges the Claimed Percentages



TI-1003, ¶¶ 144 (cited by Pet. at 68-69)

Galton Provided the Python Code

FISH

Demonstrative Exhibit – Not Evidence

Galton Provided PO with His Python Code

On March 17, 2025, Petitioner served additional materials from Dr. Galton, including a Second Declaration (Ex.-2039, Ex.-1) and the native Python code used for simulations (*Id.*, Ex.-2).

POR at 39

```
1  # *****
2  #
3  # Author: Colin Weltin-Wu (colinww@gmail.com)
4  # Date Created: Tue May 14 16:04:46 2024
5  # Project: parkervision
6  #
7  # Description
8  # -----
9  # Common library of functions.
10 #
11 # Version History
12 # -----
13 # 14-May-24: Initial version.
14 #
15 # *****
```

EX.-2039, Exhibit 2

Galton Provided PO with His Python Code

<pre>def cap_histogram(fid, fn, dat, lo, cap, tstart=60e-6, tend=400e-6, npts=None, pct_range=[-200, 200], act_lo=True): """Plot shows the histogram of charge in and out of the capacitor. Parameters</pre>	1	<pre>def cap_histogram(fid, fn, dat, lo, cap, tstart=60e-6, tend=400e-6, npts=None, pct_range=[-200, 200], act_lo=True, zero_mean=False): """Plot shows the histogram of charge in and out of the capacitor. use the TOTAL charge on the capacitor right before the switch opens.</pre>
<pre>crosses = slice_wave(vlo, cap_sig, act_lo=act_lo) # Get the number of events, subtract one since we need the final crossing nevent = crosses.shape[0] nevent -= 1 # Determine if we should limit the number of points if npts is not None and (npts < nevent): nevent = npts # Compute the total charge delivered to the cap when the switch is on, and</pre>	2	<pre>crosses = slice_wave(vlo, cap_sig, act_lo=act_lo) # Subtract the average capacitor voltage if zero_mean: vcap_avg = (np.diff(tvec).dot(cap_sig[1:] + cap_sig[:-1]) / (2 * (tvec[-1] - tvec[0]))) cap_sig -= vcap_avg # Get the number of events, subtract one since we need the final crossing nevent = crosses.shape[0]</pre>
<pre>for ii in range(nevent): idx0 = crosses[ii, 0] idx1 = crosses[ii, 1] idx2 = crosses[ii + 1, 0] # Use capacitor voltage, already integrated by spice qin[ii] = cap_sig[idx1] - cap_sig[idx0] qout[ii] = -(cap_sig[idx2] - cap_sig[idx1]) # Remove NaN values. This is safe since if qin[ii] is extremely small, # the charge transfer ratio is huge anyway, doesn't matter for this # computation. Just want to suppress divide by 0 warnings</pre>	3 4	<pre>for ii in range(nevent): idx0 = crosses[ii, 0] idx1 = crosses[ii, 1] idx2 = crosses[ii + 1, 0] # Use capacitor voltage, already integrated by spice # We are using the Ricketts definition of the discharge ratio, where # the denominator is "Total charge stored at the beginning of the # discharge period" qin[ii] = cap_sig[idx1] qout[ii] = -(cap_sig[idx2] - cap_sig[idx1])</pre>
<pre>ttl = 'versus charge delivered when it is closed' ttl += '\nSimulation length: {} cycles of LO'.format(nevent) ax.set_title(ttl) capstr = ''.join([str(x) for x in cap]) fh.savefig(fid + '/' + f'{fn}_cap_charge_histogram_{capstr}_{TNOW}.png')</pre>	5 6	<pre>ttl = 'versus total charge on cap' if zero_mean: ttl += '. bias removed' ttl += '\nSimulation length: {} cycles of LO'.format(nevent) ax.set_title(ttl) capstr = ''.join([str(x) for x in cap]) fh.savefig(fid + '/' + f'{fn}_cap_charge_histogram_to_{capstr}_{TNOW}.png')</pre>

TI-1060, ¶ 57

FISH.

Demonstrative Exhibit – Not Evidence

Incorporation by Reference

FISH

Demonstrative Exhibit – Not Evidence

Reply, 2 (citing TI-1042, ¶¶ 16-144)

entirely blocks current. *Id.*; POR, 51-52. Dr. Galton’s simulations show the claimed discharging occurring during the period “between apertures,” and demonstrate DeMaw satisfies the claims regardless of the JFET model used. TI-1003, ¶114; TI-1042, ¶¶16-144. Thus, Dr. Galton’s simulations show DeMaw discharges the claimed percentages.

Paper 30 at 2

This citation to TI-1042 is introducing Dr. Galton’s second declaration and is pointing to the simulations and results found in Dr. Galton’s Second Declaration.

Reply, 5-6 (citing TI-1042, *passim*)

Upon realizing Dr. Galton's original simulations had inadvertently called a generic JFET model instead of the U430 JFET identified by DeMaw, Petitioner offered and PO accepted a **second declaration** with revised simulations using the U430.² **TI-1042, *passim***; POR, 38; EX2036, 43:2-5. PO asked for and Petitioner provided the simulation, native LTSpice files, raw simulation output, raw plots, and the Python code used to analyze the output. TI-1052, TI-1053. And Petitioner agreed to extend the POR deadline to accommodate an additional deposition of Dr. Galton and to allow PO time to respond. PO had ample opportunity to respond to Dr. Galton's updated simulations employing the U430 JFET, and in fact, PO requested the opportunity.³ *Paper 30 at 5-6*

This citation to TI-1042 merely identifies TI-1042 as Dr. Galton's Second Declaration. The section of the Reply summarizes PO's request for additional simulation data, and Petitioner's acquiescence to additional time for PO to consider the additional simulation data.

Reply, 10 (citing TI-1042, §§ IV, VI)

Regardless, Dr. Galton's additional simulations confirm DeMaw satisfies the claims with a sinusoid LO. *Infra*, §II.E; TI-1003, ¶¶114-116; TI-1042, §§IV, VI; TI-1060, ¶¶35-36.

Paper 30 at 10

This citation to TI-1042 is pointing to Dr. Galton's simulations results to show that DeMaw performs the claims using a sinusoidal LO.

Reply, 11 (citing TI-1042, ¶¶ 18-76)

frequencies well above 150 MHz.” *Id.*, ¶40. Moreover, Dr. Galton’s additional simulations show that strict conformance to PO’s required circuit values do not alter the fundamental circuit behavior, and prove that Dr. Galton’s original simulations show the claimed discharge percentages. TI-1042, ¶¶18-76. In Dr.

Paper 30 at 11

This citation to TI-1042 is pointing to Dr. Galton’s simulations results to show that conformance to PO’s required circuit values do not alter the fundamental circuit behavior.

Reply, 32 (citing TI-1042, ¶¶ 145-52)

PO criticized several of aspects of Dr. Galton's modeling as affecting the simulated behavior of Macnally. POR, pp. 65-70. Yet, Dr. Galton provided ample explanation for how and why a POSITA would have selected the same parameters for his circuit simulations. TI-1003, ¶¶92-94; TI-1042, ¶¶145-152; TI-1060, ¶¶78-131.

Paper 30 at 11

The POR's complaint is about Dr. Galton's simulations.

This citation to TI-1042 is pointing to Dr. Galton's declarations where he describes his reasoning.

Reply, 2 (citing TI-1060, ¶¶ 18-32)

1. Claim Construction of a Switching Device Cannot Render the Claims Inoperable

Importantly, Dr. Galton clarified the distinction between real and ideal JFET behavior. TI-1060, ¶¶18-32. In the ideal case, a JFET can stop conducting when off. *Id.*, ¶¶19-20. In reality, all JFETs continue conducting when off. *Id.*, ¶¶18-32 (discussing practical switching behavior). Ricketts recognizes this: “the JFET effectively turns off.” EX2021, ¶201 (emphasis added). If an absolute “off-state”

Paper 30 at 2

Citations to Dr. Galton’s declaration support factual assertions—assertions that PO’s own expert agrees with.

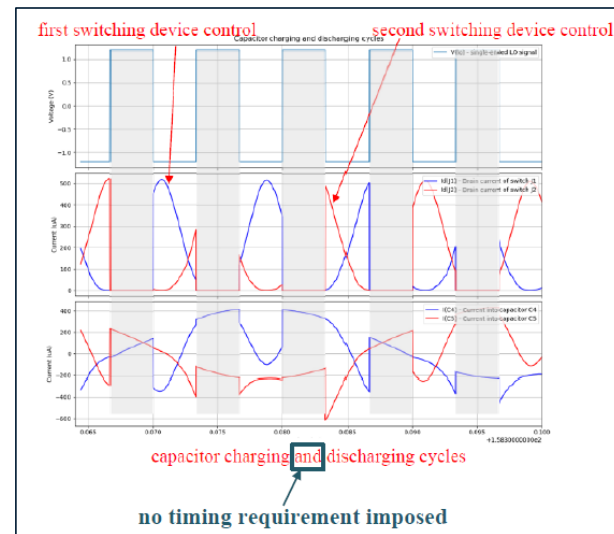
Reply, 4 (citing TI-1060, ¶¶ 141-44)

4. *No Timing Requirements on the Charging/Discharging Cycles*

The Petition does not impose a timing requirement on the charging/discharging cycle, so PO's argument on this issue is irrelevant. POR, 26; Petition, 29; TI-1060, ¶¶ 141-144.

Paper 30 at 4

The next page shows a screenshot from Dr. Galton's declaration →



Paper 30 at 5

FISH.

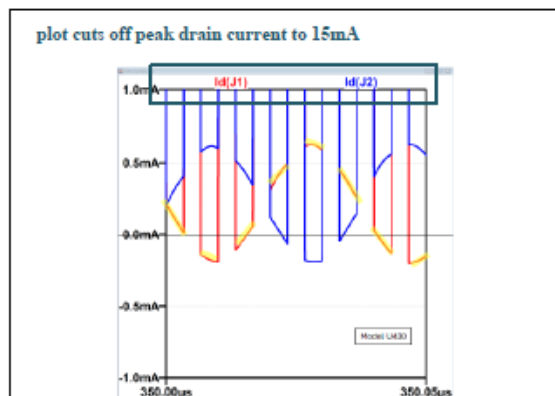
Demonstrative Exhibit – Not Evidence

Reply, 7 (citing TI-1060, ¶¶ 10-17)

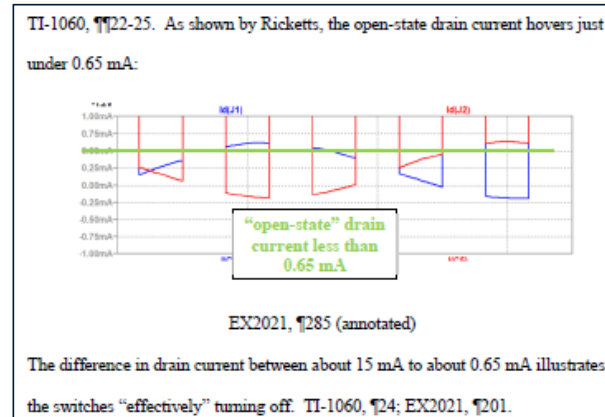
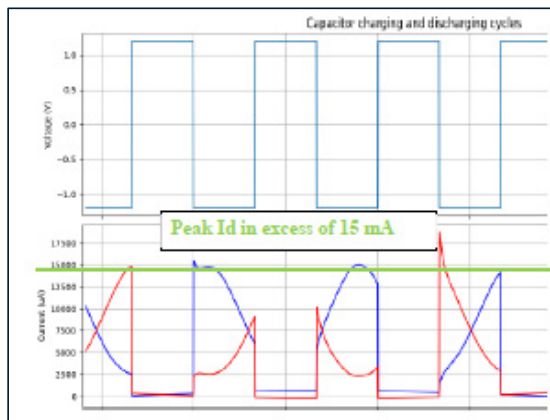
Using the generic JFET model was not wrong, *per se*. TI-1060, ¶¶6-9. If LTSpice had no U430 model, a POSITA would have picked a different JFET model and the generic JFET models would suffice because they represent the performance of common JFETs. TI-1060, ¶¶10-17. The generic JFET models have no extraordinary characteristics that might skew the simulation results. If anything, inadvertently using the generic JFET model shows the robustness of DeMaw to perform RF down-conversion, and to perform the method of claims 18-21, without forcing the circuit to meet the claims. *Paper 30 at 7*

The citations provide factual support for the assertions about LTSpice and the common JFETs.

Reply, 7-9 (citing TI-1060, ¶¶ 21-25)



TI-1060, ¶21.



Paper 30 at 7-9

The citations point to PO’s plots comparing the drain currents from the generic JFET and U430 simulations (POR, 46) to show that they are misleading because they do not show that the closed state current amplitude is significantly larger than the open-state (by a factor of 20).

The citations also point to Dr. Galton’s plots, which are reproduced in the Reply.

FISH.

Demonstrative Exhibit – Not Evidence

Reply, 20 (citing TI-1060, ¶¶ 49-56)

The voltage across the capacitors have a constant bias voltage and a time-varying voltage. TI-1060, ¶61. PO's characterization of the claims (and Ricketts's equations) ignores the bias voltage on the capacitors. TI-1060, ¶¶49-56. That bias voltage masks the energy representing the information signal stored on the capacitors during the aperture period, as shown in Ricketts's data sets, and must be removed. EX2021, App'x B. But as shown in the '342 patent, itself, the charge stored on the capacitors is less than 1V. TI-1001, FIG. 16D, 19:1-8.

Paper 30 at 20

The Reply explains why the bias needs to be removed from the discharge calculations – because it masks the energy representing the information signal stored on the capacitors during the aperture period. The citations to Dr. Galton's declaration provide *more* explanation about this from a technical perspective.

Reply, 20 (citing TI-1060, ¶¶ 60-65)

between aperture periods. TI-1001, 19:29-40, 38:4-15. The energy stored during the aperture period is the representative sample of the information signal. Thus, the change in the total charge stored during the aperture period, and not the entire charge stored by the capacitor, is the relevant charge for the down-conversion. TI-1001, 19:1-8; 50:26-34. The underlying bias voltage can be accounted for by looking at this change in charge. TI-1060, ¶¶ 60-65. The entirety of the signal is down-converted by the “plurality” of charging and discharging cycles. TI-1001, 20:1-11; 50:26-34. This bears out in the language of the claims, themselves, because the only antecedent in claim 18 for “the” total charge stored is the charged stored “when the [first/second] switching device is closed.” TI-1001, claim 18.

Paper 30 at 20

Citations to TI-1060, ¶¶ 60-65 are to factual support for why the claims should be interpreted to consider only the charge stored for information signals that provide energy between aperture periods.

FISH.

This interpretation accounts for contributions from the bias voltage.

Demonstrative Exhibit – Not Evidence

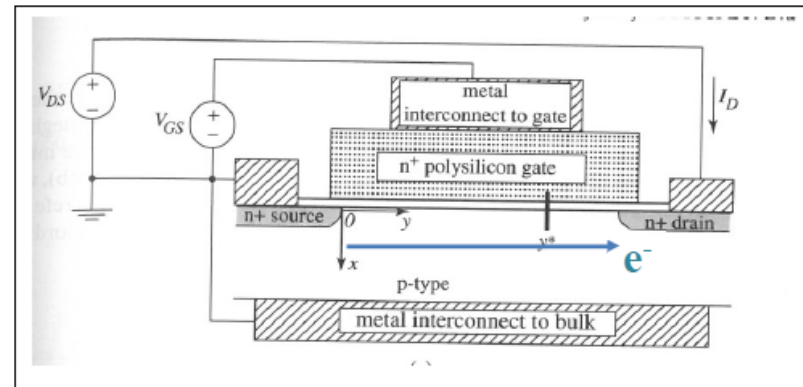
Reply, 27 (citing TI-1060, ¶¶ 97-98, 133-135)

Citations to TI-1060, ¶¶ 97-98 & 133-135 support the Reply's explanation of actual electron flow.

The Reply also points to the POR and to Ricketts's declaration for these same points.

More, that electrons flow from low to high is basic knowledge.

Furthermore, PO's argument that current flows downward in Macnally is misleading. POR, 93-97; TI-1060, ¶¶ 97-98. Electrons are negatively charged, and flow low to high voltage, even through active switches:



EX2021, 57 (annotated)

As shown, the electron flow is from the source to the drain. TI-1060, ¶¶ 133-135; EX2021, ¶¶ 39, 41. PO's argument that current in Macnally "flows downward" misleadingly applies conventional current, which was arbitrarily defined to flow from positive to negative. TI-1060, ¶ 135. In Macnally electrons flow from ground

FISH.

Demonstrative Exhibit – Not Evidence

Paper 30 at 27

Reply, 40 (citing TI-1060, ¶¶ 54-66)

Citations to TI-1060, ¶¶ 54-66 merely point back to Dr. Galton's explanation about Ricketts's equations incorrectly factoring in the bias voltage. The Reply includes an explanation of that on at least page 20.

But the central point of the Reply on Page 40 is that there is no bias component on the capacitors in Macnally, and citations to Dr. Galton's declaration provide an explanation.

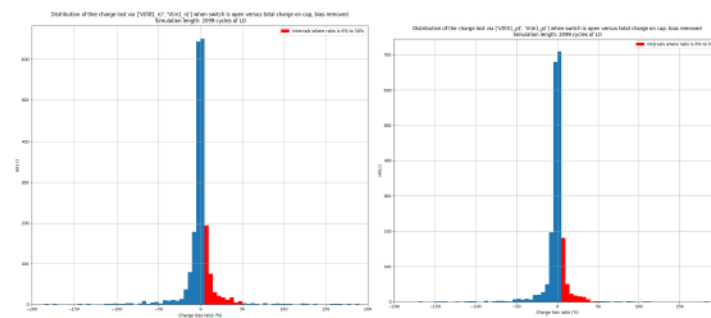
The Reply then provides a series of Macnally circuit histograms showing performance of the claimed discharge percentages.

FISH.

Demonstrative Exhibit – Not Evidence

D. Macnally Discharges the Claimed Percentages Under Ricketts's Theories

TI maintains that Dr. Galton's approach to calculating the discharge percentages is correct. But even under Ricketts's interpretation, Macnally renders claims 19-21 unpatentable. In DeMaw, the resulting percentages differed because Ricketts incorrectly accounted for bias voltage. TI-1060, ¶¶ 54-66. However, in Macnally, there is no bias component on the capacitors. TI-1060, ¶65. The original histograms and the histograms provided in Dr. Galton's second declaration show that Macnally discharges the claimed percentages. Dr. Galton has also provided an additional histogram showing Ricketts's new interpretations (using the original and updated simulation parameters):



Macnally Histograms for C6 and C7 Under Original Operating Conditions

(TI-1060, ¶114) *Paper 30 at 40*

Responses to Sur-reply

FISH.

Demonstrative Exhibit – Not Evidence

Dr. Galton Explained the Histograms During His Deposition

Dr. Galton explained how the histograms were created during his first deposition in February 2025

Q And how did you compute the charge ratio?

MR. MAGEE: Objection. Form.

A So we monitored the current flowing into and out of the capacitor, and we -- you know, we stored those traces from the simulator. And then the Python script calculated the ratio I just described and created a standard histogram of the results.

EX.-2036, 54:16-55:1

Dr. Galton Explained the Histograms During His Deposition

Dr. Galton explained how the histograms were created during his first deposition in February 2025

EX.-2036, 56:10-57:3

FISH.

Demonstrative Exhibit – Not Evidence

Q Well, how could someone independently verify your results without access to the source code?

A Well, we provide, you know, the exact information on what and how -- you know, what we simulated and how we simulated it. And so a person wanting to duplicate our results could use LTspice, just like we did, could type in the circuit just like we did, could use the same values just like we did. And then they could -- they could take the current waveforms through that capacitor and calculate the histogram.

And a histogram is a known thing. And so, you know, you could even do it with pencil and paper if you wanted to, but it's just more convenient to do it with a computer.

Dr. Galton Explained that Histograms Are Standard, Known Techniques

Dr. Galton explained how the histograms were standard, known techniques.

And he reiterated his offer to provide the python code to PO that day.

EX.-2036, 56:10-57:3

Q Why was that not included in your declaration previously?

A Because a histogram is a pretty standard -- you know, it's a known technique. We certainly could have, but it seemed like the declaration was already very long and, you know, it just seemed -- didn't seem necessary.

But like I said, I'm happy to provide it if you'd like.

Galton offered the python code during his deposition

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

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

EX.-2036, 55:18-22

Galton Provided PO The Python Code

PO Included It as an Exhibit to EX.-2039

Josh Griswold

From: Josh Griswold
Sent: Monday, March 17, 2025 3:17 PM
To: jcharkow@daignaultiyr.com; Stephanie Mandir; kduche@daignaultiyr.com; Taylor Lepore; IPR12189-0092IP1; PTAB Inbound; Rishi Gupta; Yao Wang; Rick Bisenius PV
Cc:
Subject: RE: Texas Instruments Inc., and NXP USA, Inc. v. ParkerVision, Inc. - Extension Request for Patent Owner Responses

Jason,

We're setting up a Sharepoint site where you can download the additional materials from Dr. Galton. I believe you should be receiving login details shortly. We sent it to you, Stephanie, Konah, and Taylor, so anyone who wants can access the data.

Best,
Josh

TI-1052 (email to PO providing Python code and other simulation data)

```
1  # *****
2  #
3  # Author: Colin Weltin-Wu (colinww@gmail.com)
4  # Date Created: Tue May 14 16:04:46 2024
5  # Project: parkervision
6  #
7  # Description
8  # -----
9  # Common library of functions.
10 #
11 # Version History
12 # -----
13 # 14-May-24: Initial version.
```

EX.-2039, Exhibit 2

FISH.

Demonstrative Exhibit – Not Evidence