

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

TEXAS INSTRUMENTS INCORPORATED,
Petitioner

v.

PARKERVISION, INC.,
Patent Owner

Case IPR2024-00934
Patent 7,496,342

PETITIONER'S REPLY TO PATENT OWNER'S RESPONSE

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LIST OF EXHIBITS

Exhibit No.	Description
TI-1001	U.S. Patent No. 7,496,342 to David F. Sorrells, et al (“the ’342 Patent”)
TI-1002	Excerpts from the Prosecution History of the ’342 Patent (“the Prosecution History”)
TI-1003	Declaration and Curriculum Vitae of Dr. Ian Galton
TI-1004	U.S. Patent No. 6,230,000 (“Tayloe”)
TI-1005-1007	Reserved
TI-1008	Complaint, <i>ParkerVision, Inc. v. Texas Instruments Incorporated</i> , 6:23-cv-00384, W.D. Tex., filed May 18, 2023
TI-1009	ParkerVision, Inc.’s Proposed Claim Constructions, <i>ParkerVision, Inc. v. Texas Instruments Incorporated</i> , 6:23-cv-00384, W.D. Tex., filed February 14, 2024
TI-1010	ParkerVision Inc.’s Responsive Claim Construction Brief, <i>ParkerVision, Inc. v. Texas Instruments Incorporated</i> , 6:23-cv-00384, W.D. Tex., filed March 27, 2024
TI-1011-1012	Reserved
TI-1013	Claim Chart For Infringement of U.S. Patent No. 7,496,342 by TI Chips, <i>ParkerVision, Inc. v. Texas Instruments Incorporated</i> , 6:23-cv-00384, W.D. Tex., filed December 6, 2023
TI-1014	Declaration of June Ann Munford
TI-1015	Declaration of Rickea McLeod
TI-1016	DeMaw, Practical RF Design Manual (Prentice-Hall 1982)
TI-1017	Reserved
TI-1018	Declaration of Maureen Honeycutt
TI-1019	Ziemer Tranter, <i>Principles of Communications, Systems, Modulation, and Noise</i> , Fourth Edition, Published 1995
TI-1020	Thomas H. Lee, <i>The Design of CMOS Radio-Frequency Integrated Circuits</i> , Cambridge University Press, 1998 (Excerpts)
TI-1021	U.S. Patent No. US 7,065,327
TI-1022	U.S. Provisional Patent Application 60/099,723 (“MacNally-Provisional”), filed September 10, 1998
TI-1023	International Publication No. WO 00/16492 (“Macnally”)
TI-1024-1027	Reserved
TI-1028	Jacques C. Rudell et al, “A 1.9GHz Wide-Band IF Double Conversion CMOS Receiver for Cordless Telephone

	Applications” IEEE Journal of Solid-State Circuits, Vol. 32, No. 12, Dec. 1997 2071-2088
TI-1029	Defendant Texas Instruments Inc.’s Claim Construction Brief, <i>ParkerVision, Inc. v. Texas Instruments, Inc.</i> , 6:23-cv-00384 (WDTX March 6, 2024).
TI-1030	Decision Denying Institution, <i>RPX Corp. v. ParkerVision Inc.</i> , PTAB-IPR2014-01107, Paper 7 (Jan. 8, 2015)
TI-1031	Notice of Entry of Judgement Accompanied by Opinion, <i>ParkerVision Inc. v. Qualcomm, Inc.</i> , 621 F. App'x 1009 (Fed. Cir. 2015)
TI-1032-1038	Reserved
TI-1039	Qualcomm’s Renewed Motion for Judgement as a Matter of Law, <i>ParkerVision, Inc. v. Qualcomm Inc.</i> , 3:11-cv-00719-RBD-JRK, dkt 499 (<u>MDFL December 20, 2013</u>)
TI-1040	ParkerVision’s Response in Opposition to Qualcomm’s Renewed Motion for Judgement as a Matter of Law, <i>ParkerVision, Inc. v. Qualcomm Inc.</i> , 3:11-cv-00719-RBD-JRK, dkt 516 (<u>MDFL January 24, 2014</u>)
TI-1041	Stipulation
TI-1042	Second Declaration of Dr. Ian Galton
TI-1043	Razavi, <i>A 900-MHz CMOS Direct Conversion Receiver</i> , IEEE Symposium on VLSI Circuits, Kyoto, Japan, 1997, pp. 113-114, doi: 10.1109/VLSIC.1997.623833 (“Razavi”)
TI-1044	E. Oxner, Siliconix Application Note AN72-1 “FETs in Balanced Mixers,” 1979. (“Oxner”)
TI-1045	B. Gilbert, "The MICROMIXER: a highly linear variant of the Gilbert mixer using a bisymmetric Class-AB input stage," in IEEE Journal of Solid-State Circuits, vol. 32, no. 9, Sept. 1997
TI-1046	I. Galton and C. Weltin-Wu, “Understanding Phase Error and Jitter: Definitions, Implications, Simulations, and Measurement,” IEEE Transactions on Circuits and Systems I: Regular Papers, vol. 66, no. 1, Jan. 2019
TI-1047	D. E. Johnson, J. L. Hilburn, and J. R. Johnson, Basic Electric Circuit Analysis, 7th Edition, Prentice-Hall, 1978
TI-1048	Adel S. Sedra, Kenneth C. Smith, Microelectronics Circuits, 4th Edition, Oxford University Press, 1997
TI-1049	K. R. Laker, W. M. C. Sansen, Design of Analog Integrated Circuits and Systems, McGraw-Hill, Inc., 1994

TI-1050	Cho, E. Dukatz, M. Mack, D. MacNally, M. Marringa, S. Mehta, C. Nilson, L. Plouvier, S. Rabi, “A Single-Chip CMOS Direct-Conversion Transceiver for 900MHz Spread-Spectrum Digital Cordless Phones,” IEEE International Solid-State Circuits Conference, Technical Digest, February, 1999
TI-1051	Deposition Transcript of Dr. David Ricketts, June 25, 2025
TI-1052	Email Exchange Re: Discovery
TI-1053	Content of Extranet Provided to ParkerVision
TI-1054	Second Declaration of June Ann Munford
TI-1055-1059	Reserved
TI-1060	Third Declaration of Dr. Ian Galton

TABLE OF AUTHORITIES

Power Integrations, Inc. v. Fairchild Semiconductor Int'l, Inc., 843 F.3d 1315, 1336 (Fed. Cir. 2016)

Power Integrations, Inc. v. Fairchild Semiconductor Int'l, Inc., 904 F.3d 965 (Fed. Cir. 2018)

Ecolab, Inc. v. FMC Corp., 569 F.3d 1335 (Fed. Cir. 2009)

E.I. DuPont De Nemours & Co. v. Synvina C.V., 904 F.3d 996, 1006 (Fed. Cir. 2018) (“DuPont”)

UCB, Inc. v. Actavis Lab's UT, Inc., 65 F.4th 679, 687 (Fed. Cir. 2023)

I. INTRODUCTION

Texas Instruments (TI), through Dr. Galton's original simulations, has proven claims 18-21 unpatentable. Dr. Galton's additional simulations confirm the prior art satisfy these claims, and that Patent Owner's (PO's) complaints about the simulations are immaterial. Patent Owner's arguments should be rejected for the reasons below.

II. DEMAW

A. PO Mischaracterizes the Operation of the Switching Devices

The Federal Circuit affirmed DeMaw's operation anticipates claim 18. TI-1031, 28-29; Petition 10-13. Thus, DeMaw performs "a plurality of charging and discharging cycles of the first and second capacitors to generate first and second down-converted information signals." TI-1031, 28-29; Petition 10-13. And the '342 patent claims discharging when the switching devices are open (not entirely off). TI-1001, 20:1-11. Thus, it has been established that DeMaw's JFETs "open" to perform the claimed discharging.

PO's argument the switches must entirely block current ignores that the '342 patent characterizes "open" as when the control signal is "between apertures." TI-1001, 38:4-15 ("capacitors are sized to discharge...during a period of time that a switching device is open (**i.e., between apertures**)" (emphasis added)). And as Ricketts explained, JFETs can operate at a gate-source off voltage ($V_{gs(off)}$) and

still conduct current. TI-1051, 17:5-12. Thus, contrary to PO's assertion, the control signal being "between apertures" does not automatically imply the JFET 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.

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

¹ If PO disagrees whether the "open" state of a JFET is *effectively* off, the claims are indefinite. POR, 30. Neither the '342 patent or PO provide a measure of whether a switch is *effectively* off.

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.

2. *DeMaw Teaches or Discloses the Claimed Method Because DeMaw’s Capacitors Discharge the Claimed Percentages*

DeMaw need only perform the claimed range once. *Power Integrations, Inc.*, 843 F.3d at 1336. Here, based on Dr. Galton’s original and additional simulations, DeMaw’s capacitors achieve the claimed discharge percentages at least once. Thus, method claims 18-21 are unpatentable.

Moreover, given that the Federal Circuit has affirmed DeMaw’s operation anticipates claim 18, there is nothing inventive about optimizing the circuit to achieve the desired performance characteristics of claims 19-21. Paper 10, 22-23. As the Board observed, “where the general conditions of a claim are disclosed in the prior art,” as DeMaw does here for claim 18, “it is not inventive to discover the optimum or workable ranges by routine experimentation.” Paper 10, 22-23 (citing *DuPont*, 904 F.3 at 1006). Dr. Galton explains both why a POSITA would seek to

optimize the capacitor discharge rates (*e.g.*, signal strength and signal-to-noise) and that doing so is routine. TI-1060, ¶¶12-15. Therefore, claims 19-21 are unpatentable.

3. The Open Period

The claims require a percentage discharge when the switch is open, not whenever the capacitors are discharging. Dr. Galton shows that DeMaw's capacitors discharge within the claimed ranges when the LO is high—the switch is open. Indeed, the '342 patent says the percentages are achieved “during a period of time that the switch is open,” which is between apertures. TI-1001, 50:13-25. The '342 patent does not support the claimed percentages measured whenever the capacitors are discharging. Thus, Dr. Galton's histograms accurately represent the discharge percentages. The histograms show claimed discharges to at least 200%, so even halving the “switch open period” would satisfy the claimed discharges. TI-1060, ¶¶37-38.

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.



B. JFET Selection Is Immaterial

A JFET is a switching device. Claims 18-21 do not require a specific type of JFET. Nor is there any dispute that DeMaw, with LTSpice's generic JFET model, performs "down-converting."

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

And here, Dr. Galton's original and additional simulations both achieve the claimed discharge percentages. *Infra*, §II.E; TI-1003, ¶¶114-116; TI-1042, ¶¶16-144; TI-1060, ¶12. Galton stands by his original simulations, which prove that DeMaw renders claims 18-21 unpatentable.

² Dr. Galton's "mistake" was a typo. The typo caused LTSpice to not recognize the requested JFET, and default to a generic JFET. EX2036, 44:6-8.

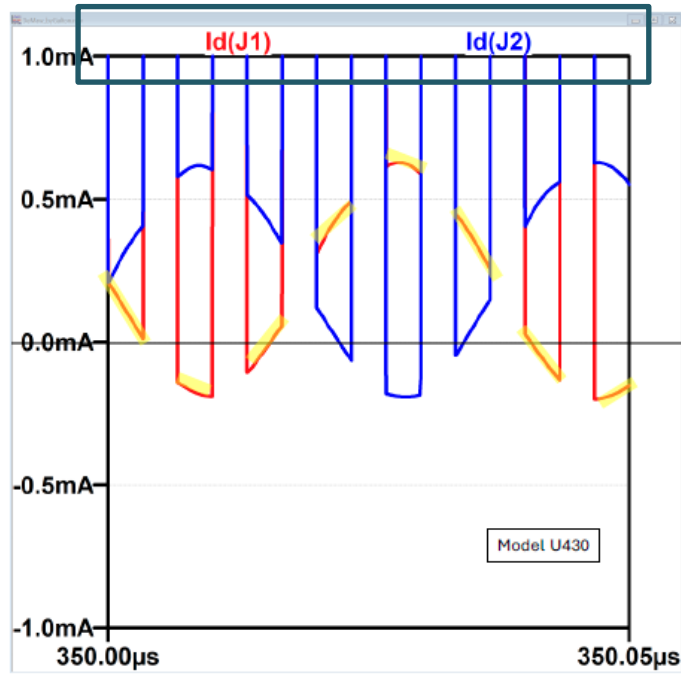
³ The same is true for all the simulations in TI-1042. PO requested and Petitioner provided the additional simulations, LTSpice files, raw output, raw plots and the Python code (15 GB of materials). PO then deposed Dr. Galton and addressed them in its POR. PO had ample opportunity to respond to these additional simulations.

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.

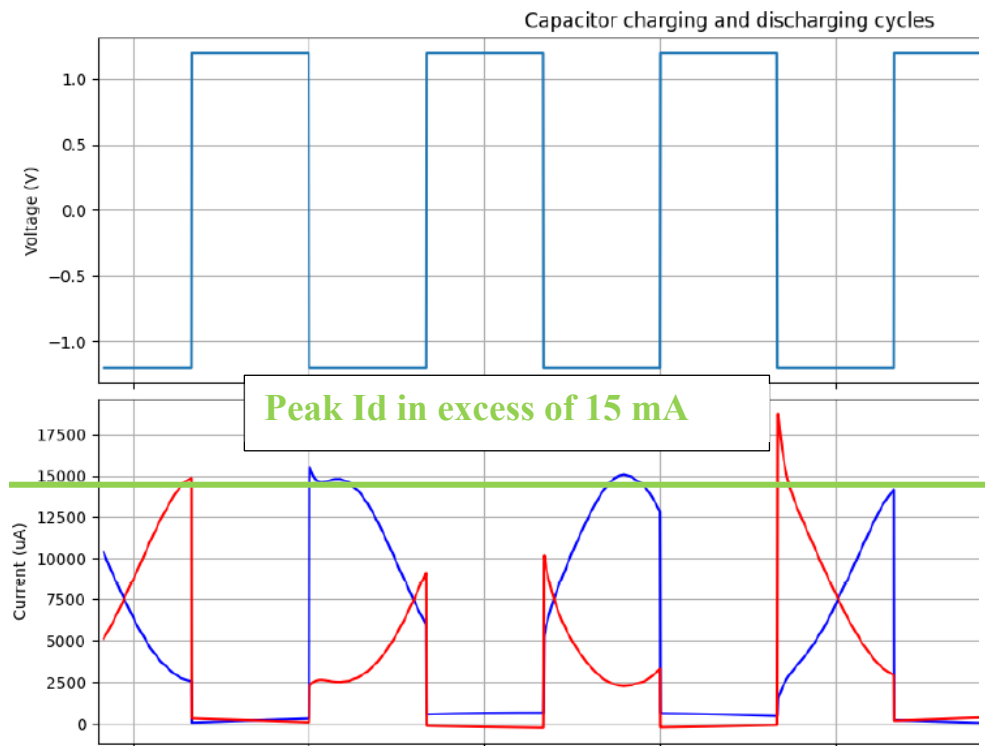
A POSITA implementing DeMaw would have performed routine optimization to select the JFET type for the circuit's desired performance. TI-1060, ¶¶12-15. Dr. Galton's inadvertent use of the generic JFET model is consistent with this routine optimization. TI-1060, ¶¶11-15. Petition, 10-11; TI-1031, 6, 28-29. In fact, Oxner, from where DeMaw derives its circuit, lists multiple suitable JFETs. TI-1041, 6-33; TI-1016, 8 (referencing Oxner). Oxner evinces that DeMaw need not use a U430 JFET, and that a POSITA would consider JFET selection routine optimization. TI-1060, ¶¶11-15.

PO's plots comparing the drain currents from the generic JFET and U430 simulations (POR, 46) 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):

plot cuts off peak drain current to 15mA

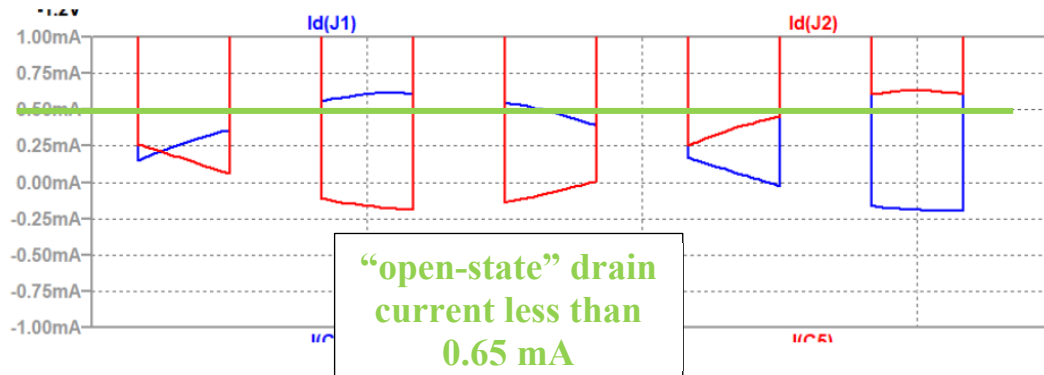


TI-1060, ¶21.



TI-1042, DEMAW-SIM-FIG. 5 (revised) (**annotated**)

TI-1060, ¶¶22-25. As shown by Ricketts, the open-state drain current hovers just under 0.65 mA:



EX2021, ¶285 (annotated)

The difference in drain current between about 15 mA to about 0.65 mA illustrates the switches “effectively” turning off. TI-1060, ¶24; EX2021, ¶201.

C. Galton’s Local Oscillator Was Consistent with DeMaw

DeMaw does not specify the LO waveform shape. However, a POSITA would have understood, or found it obvious, that DeMaw uses a “squared-up” LO, because squared-up LO are used in “most modern practical mixer circuits.” TI-1003, ¶¶37-38, 69, 74, 139-140; EX2036, 41:1-12; TI-1060, ¶¶34-36.

DeMaw’s notation of “LO = f_0 ” is not evidence that it uses a sinusoidal LO. POR, 42; TI-1060, ¶33. As Dr. Galton explained, electrical engineers refer to the frequency of a periodic signal as a single number. Ricketts agrees. EX2021, ¶78; TI-1051, 28:3-16; EX2036, 43:19-21 (Q: “So the LO used in your simulation of

Figure 6.7 of DeMaw uses a square wave having a 150-megahertz frequency.

Correct?"; A: "That is correct." (emphasis added)). The '342 patent references harmonically rich signals, including square waves, by a fundamental frequency. TI-1001, 13:6-32. Thus, POSITA would have understood f_0 could represent a fundamental frequency or first harmonic of a signal that includes multiple harmonics. TI-1060, ¶33.

PO's argument that a square wave introduces high-frequency components that distort the mixer's operation is wrong. POR, 43; TI-1060, ¶34. Even the '342 patent recognizes that sinusoids can be harmonically rich. TI-1001, 13:20-32. Thus, even if the square wave introduced high-frequency components, they would be within the scope of DeMaw's description. TI-1060, ¶34.

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.

D. Operating Values and Biasing

PO next complains about Dr. Galton's biasing network as resulting in "a gate-source voltage (V_{GS}) at or near the JFET's pinch-off voltage." POR, 43 (emphasis added). DeMaw recommends (does not require) a V_{GS} of 0.8 the pinchoff voltage, which is "near the JFET's pinch-off voltage." *Id.* Thus, PO's complaint lacks merit. Dr. Galton's simulation of the bias is simpler to model but

provides the same results for the bias voltage. TI-1060, ¶¶45-48. Indeed, the 1.2V LO voltage (3V peak-to-peak or 1.5V peak) that Dr. Galton used was within the operating range identified in DeMaw (1.2V is 80% a pinchoff voltage of 1.5V). TI-1016, 8; TI-1060, ¶66.

Next, Dr. Galton confirmed that the 123.102 MHz input frequency and the 150 MHz LO are appropriate for DeMaw. TI-1060, ¶¶39-40. PO's complaint here concerns the transformers, not the circuit at large. *Id.*, ¶¶41-42. Dr. Galton also confirmed that the transformers he used "exhibit negligible degradation at 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. Galton's first and second declarations, all of the LO signals use a 50% duty cycle, which is a non-negligible aperture necessary to perform energy transfer (per the '342 patent). TI-1001, 11:3-12, 38-42. PO does not argue the 50% duty cycle is wrong, and Ricketts's simulations use a 50% duty cycle. EX2021, ¶¶283-286. Indeed, if PO's argument about requiring a sinusoidal LO is to be believed, then DeMaw's LO uses a 50% duty cycle, by definition. TI-1051, 27:3-12.

Contrary to PO's arguments, DeMaw does not restrict the LO amplitude to 2V. TI-1060, ¶¶43-44. DeMaw provides a range for the pinchoff of the U430 from

-1 to -4V, $V_{gs}(\text{off})$ (and Ricketts agrees). TI-1016, 8; TI-1051, 17:13-21, 18:8-21; EX2021, ¶245. Dr. Galton's simulation assumed a 3V pinchoff voltage, well within normal range. Still, Dr. Galton confirmed that using a pinch-off voltage of 2V would not have affected the general behavior of the circuit or changed his opinions. TI-1060, ¶¶43-44.

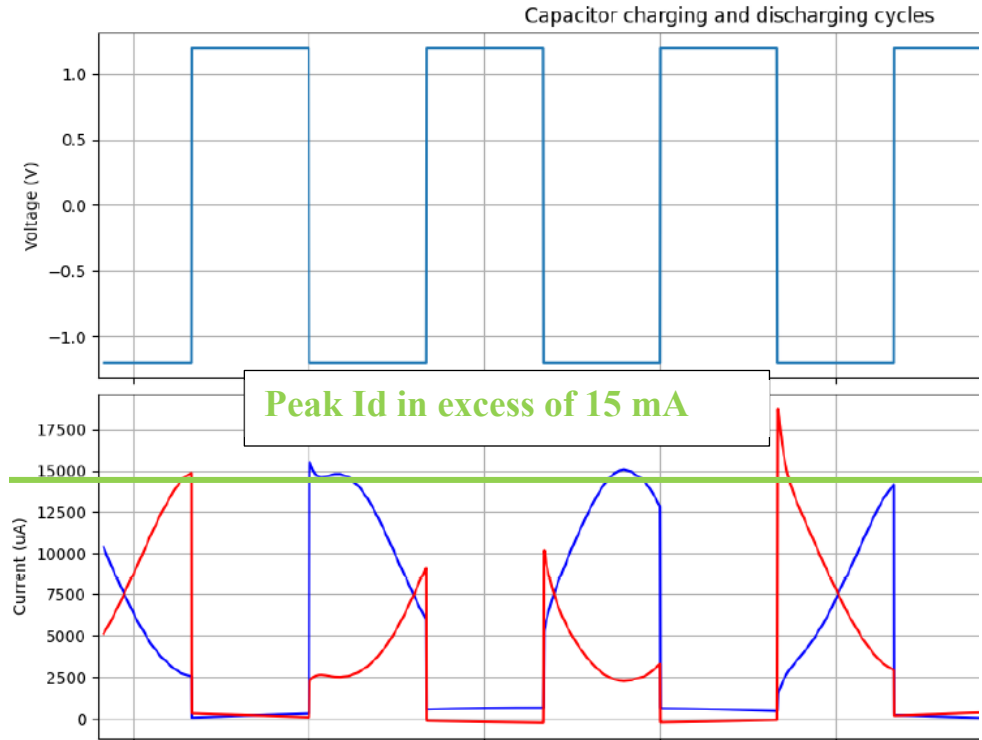
E. Additional DeMaw Simulations Show That PO's Complaints Are Immaterial

Dr. Galton responded to the POPR's allegations of cherry-picking circuit values and operating parameters by running additional simulations using PO's identified values and parameters. TI-1042, *passim*. Dr. Galton's confirmed the aspects that PO complained about did not materially affect the circuit operation – *i.e.*, DeMaw still rendered claims 18-21 unpatentable. TI-1060, ¶¶67-77.

1. The U430 Simulations Do Not Show a Material Difference in Circuit Operation

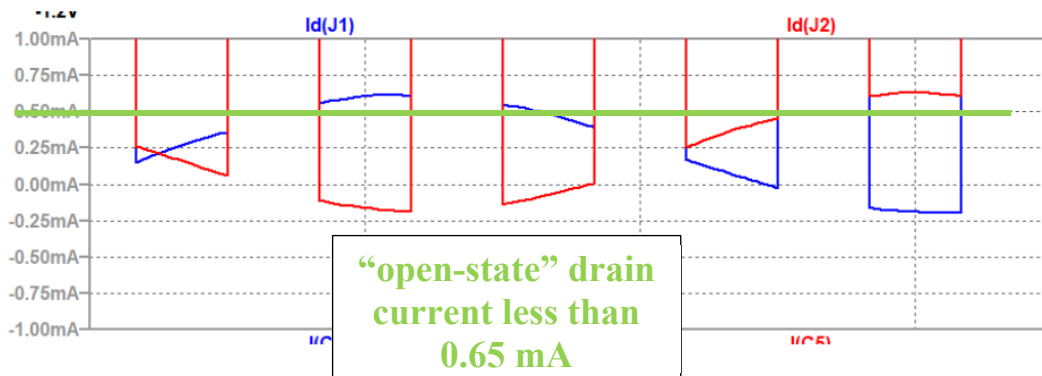
The POR argues that the U430 JFETs materially alter DeMaw's performance. POR, 46, 51. This is not so. DeMaw simulated with the U430 JFET also performs claims 18-21.

First, the difference between the open/closed drain current of the U430 switches is significant (greater than 15mA):



TI-1042, DEMAW-SIM-FIG. 5 (revised) (annotated)

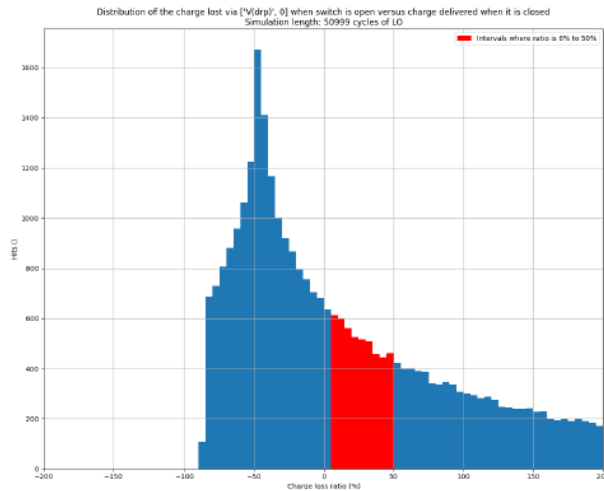
As shown by Ricketts, the open-state drain current hovers just under 0.5 mA:



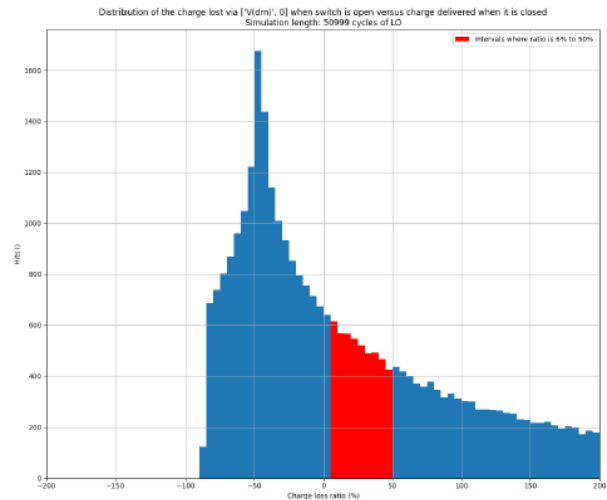
EX2021, ¶285 (annotated); POR, 51

Thus, DeMaw discharges when the switching devices are “open.” Additionally, that the drain current drops from a value on-the-order of 15 mA to less than 0.65

mA (a factor of over 20) illustrates the switches “effectively” turning off, as Ricketts put it. TI-1060, ¶¶24-25, 117; EX2021, ¶201. When open, the capacitors discharge the claimed percentages:



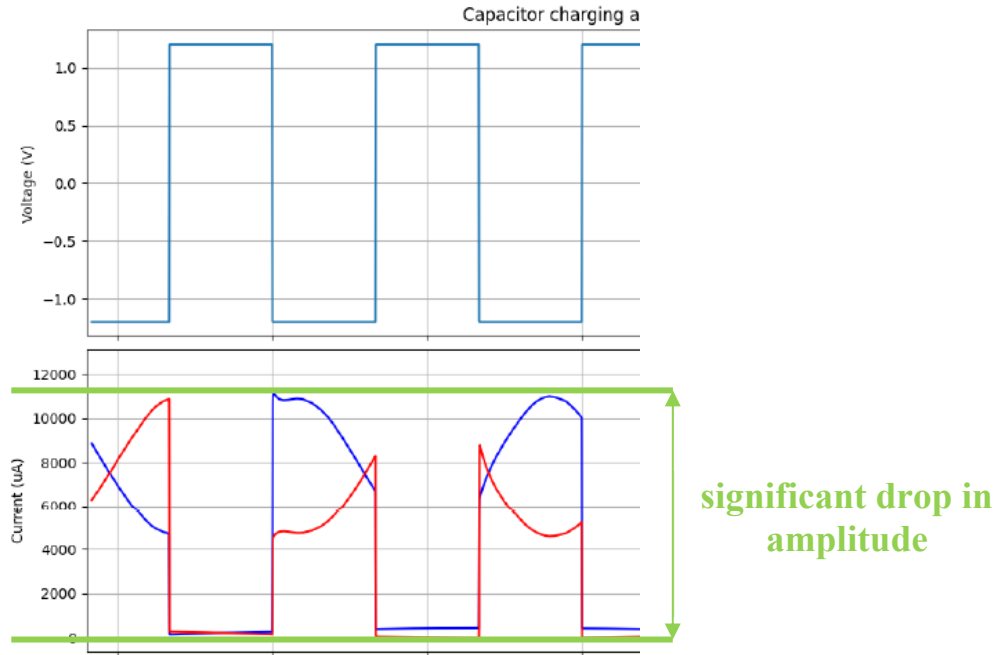
DEMAW-SIM-FIG. 7A (revised). Charge loss ratio percentages histogram for capacitor C4 (circuit of DEMAW-SIM-FIG. 1 (revised)).



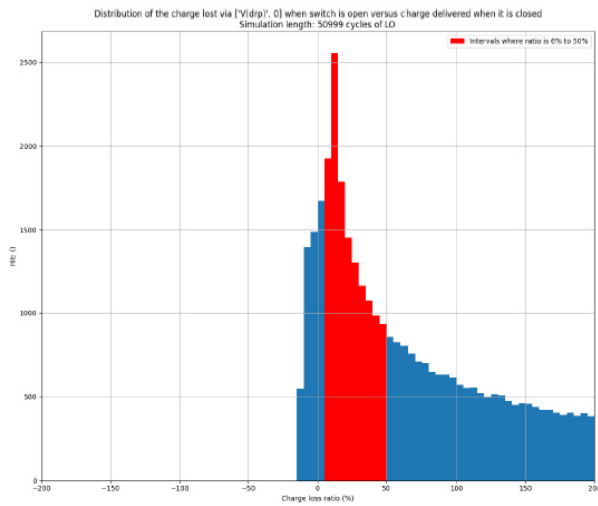
DEMAW-SIM-FIG. 7B (revised). Charge loss ratio percentages histogram for capacitor C5 (circuit of DEMAW-SIM-FIG. 1 (revised)).

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

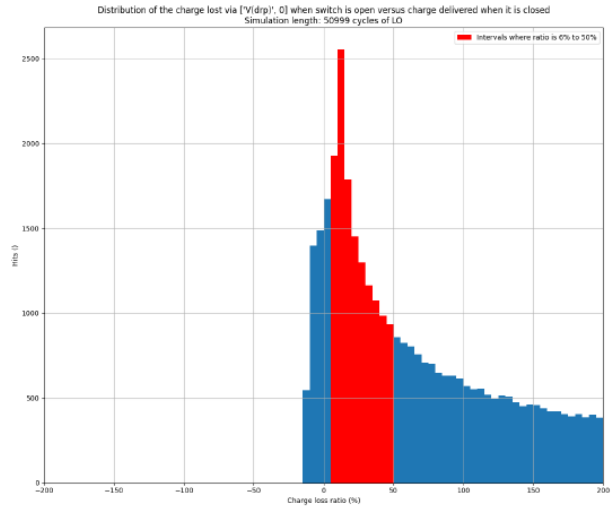
Furthermore, Dr. Galton explained that the U430 JFETs caused “a significant increase in mixer gain.” TI-1042, ¶4. Thus, to “ensure that the increase in mixer gain did not cause the mixer to operate above its compression point,” Dr. Galton provided another set of simulation results using the U430 JFETs with a smaller input signal. *Id.* These simulations likewise show a significant drop in drain current for the open-state of the switching devices and yielded histograms that meet the claimed discharges:



TI-1042, ¶14 (DEMAW-SIM-FIG. 5.1)



DEMAW-SIM-FIG. 7.1A. Charge loss ratio percentages histogram for capacitor C4 (circuit of DEMAW-SIM-FIG. 1.1).



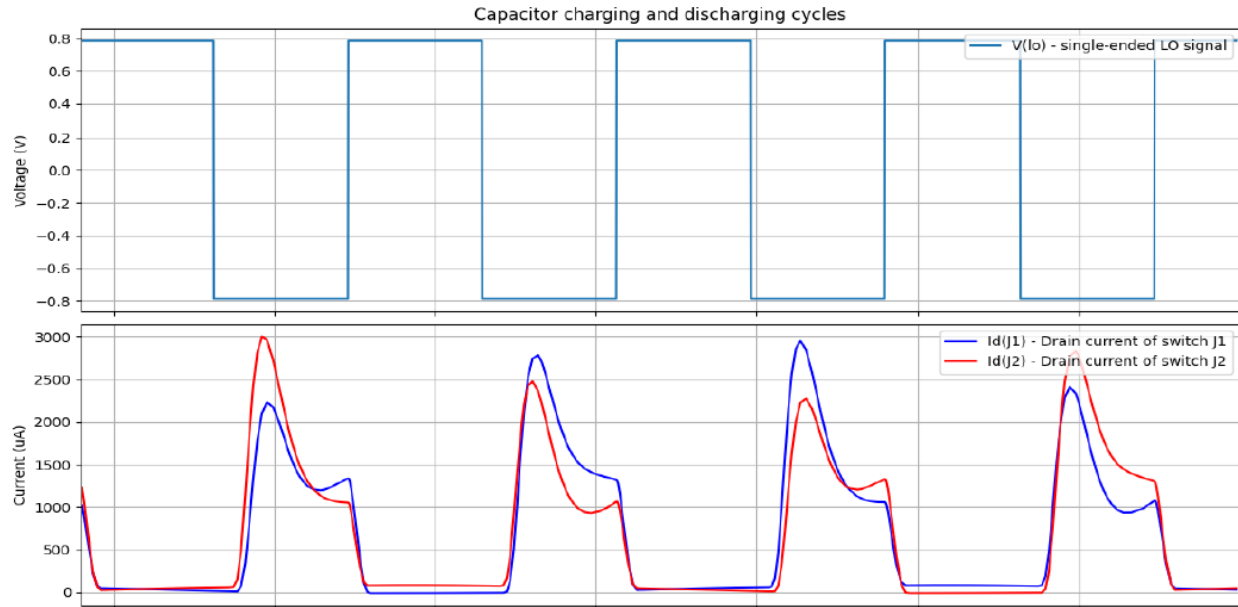
DEMAW-SIM-FIG. 7.1B. Charge loss ratio percentages histogram for capacitor C5 (circuit of DEMAW-SIM-FIG. 1.1).

TI-1042, ¶17

2. *Additional Square Wave Simulations Show PO's Complaints Are Immaterial*

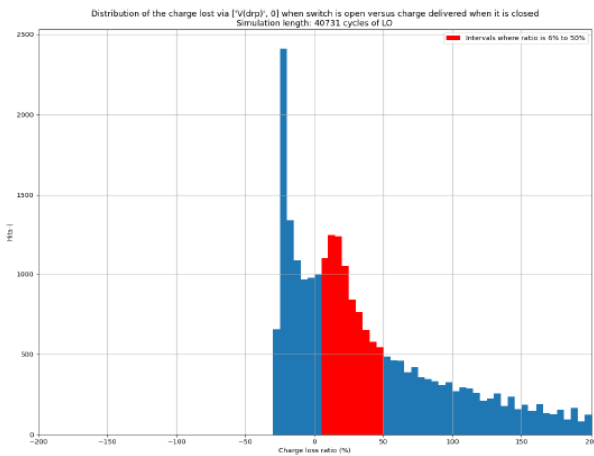
The POPR accused Dr. Galton of selecting parameters “to ‘get the results [he] needed.’” TI-1042, ¶18. In response, Dr. Galton ran additional simulations using the U430 JFET “as closely as possible” to DeMaw. *Id.* The Board had acknowledged that Dr. Galton had sufficiently explained his “selection of parameter values taught by DeMaw together with expected minor adjustments.” Inst. Dec., 24. But, Dr. Galton confirmed that even under PO’s restrictive view of DeMaw, the circuit performs the method of claims 18-21.

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:

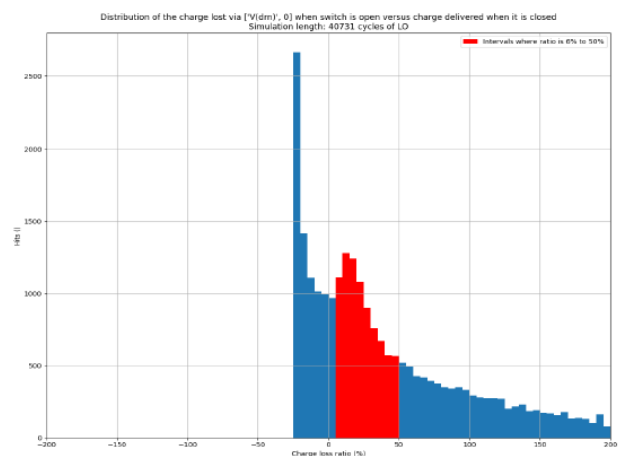


TI-1042, ¶46 (DEMAW-SIM-FIG. 5.6, circuit of DEMAW-SIM-FIG. 1.6)

And the circuit discharges the claimed percentages:



DEMAW-SIM-FIG. 7.6A. Charge loss ratio percentages histogram for capacitor C4 (circuit of DEMAW-SIM-FIG. 1.6).



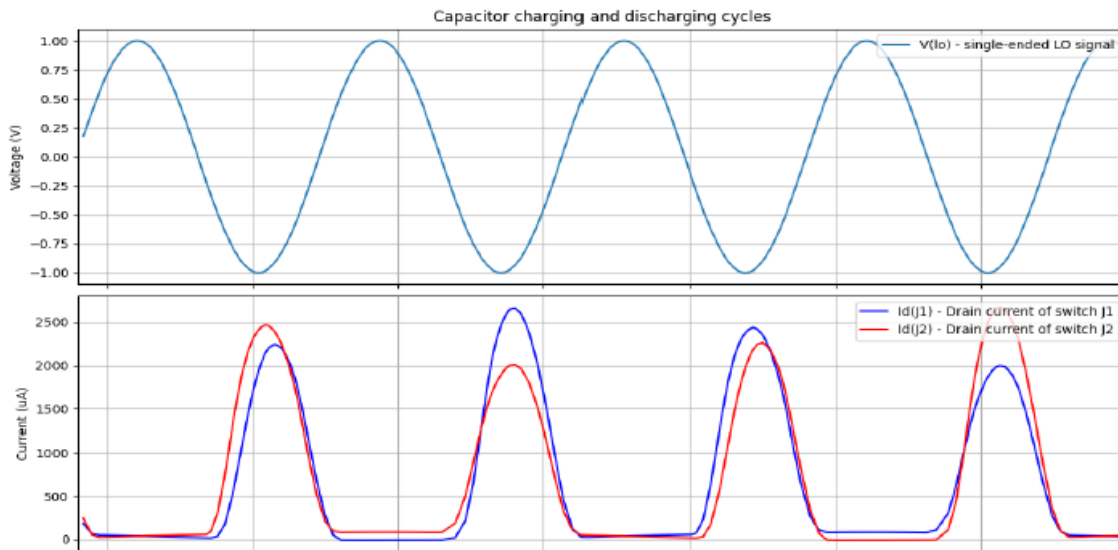
DEMAW-SIM-FIG. 7.6B. Charge loss ratio percentages histogram for capacitor C5 (circuit of DEMAW-SIM-FIG. 1.6).

TI-1042, ¶¶48-49

The other data provided by Dr. Galton shows similar results. TI-1042, §III.

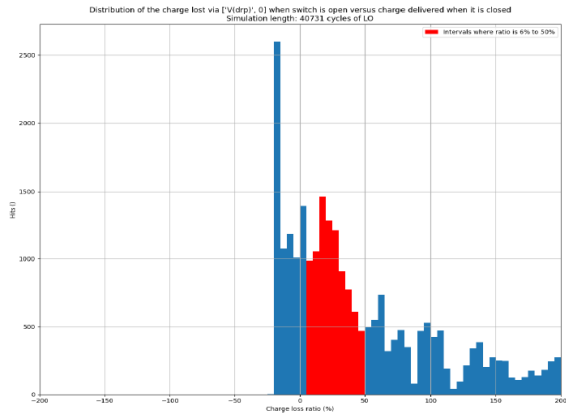
3. Sine Wave Simulations Show the Claimed Circuit Performance

Dr. Galton also addressed PO's complaints about shape of the LO. POR, 43. While DeMaw is silent as to the shape of its LO, Dr. Galton selected a squared-up LO because that was common practice. TI-1042, ¶19. Dr. Galton ran DeMaw's simulations using the same circuit parameters as his second set of square-wave simulations, but with sinusoidal LO. TI-1042, §IV. The sinusoidal LO did not materially affect DeMaw's operation. TI-1060, ¶¶34-36. Using the simulation with the lowest input signal as an example, the simulation shows that the switches "effectively" turn off during the open state:

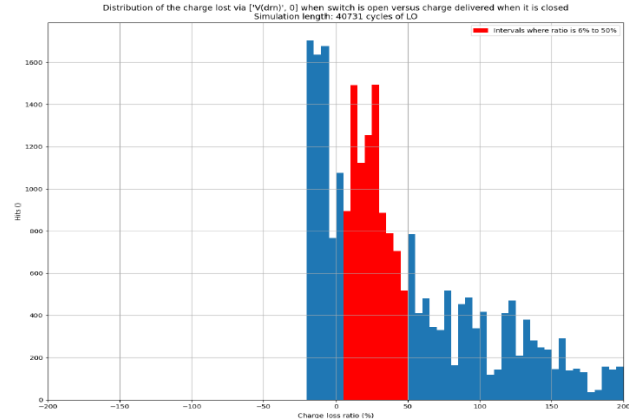


TI-1042 (DEMAW-SIM-FIG. 5.11)

Likewise, the capacitors discharge the claimed percentages:



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



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

TI-1042 ¶¶81-82.

The other data provided by Dr. Galton shows similar results. TI-1042, §IV.

4. Under Ricketts's Interpretation of the Claims, DeMaw Still Shows Performance

PO acknowledges that DeMaw discharges the claimed percentages, even when using their own formula. POR, 85; EX2021, ¶426. The POR states that “**nearly all** of the percentage discharged falls outside the ranges set forth in claims 19-21.” POR, 85; EX2021, ¶426 (emphasis added); TI-1060, ¶59. Nearly all. Not none. Thus, PO admits that some discharge percentages fall **inside** the ranges set forth in claims 19-21. Only one instance is needed to render the claims unpatentable.

PO's interpretation of the “total charge stored” is incorrect. TI-1003, ¶114. Claim 18's circuit down-converts an EM signal by transferring energy, that was stored on a capacitor during an aperture period, by discharging the stored energy

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.

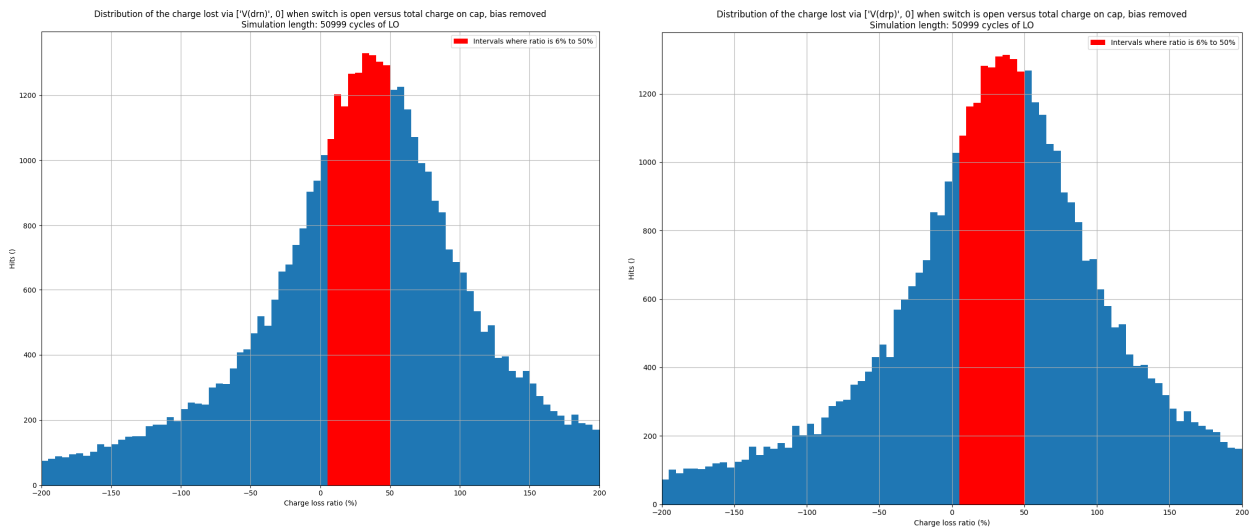
The voltage across the capacitors have a constant bias voltage and a time-varying voltage. TI-1060, ¶61. PO’s characterization of the claims (and Ricketts’s equations) ignores the bias voltage on the capacitors. TI-1060, ¶¶49-56. That bias voltage masks the energy representing the information signal 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.

The ’342 patent claims the time-varying component. TI-1001, 38:11-15. Consistently, the ’342 patent itself removes the bias voltage from its own plots. TI-1001, FIG. 16D and accompanying text (showing “the rate of discharge of

capacitor 1606 between apertures,” of less than 0.7V, where the bias is 3.3V),
23:60-67, 45:24-27.

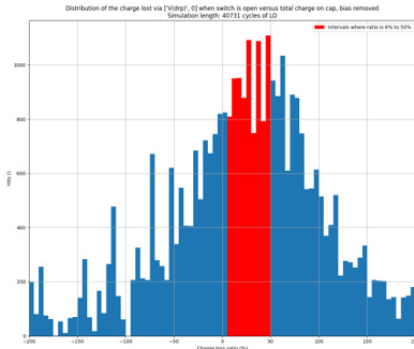
The charge stored/discharged in a cycle of the circuit is small relative to the bias voltage. TI-1060, ¶¶54. The bias voltage mathematically skews the charging/discharging percentages, which is likely why PO argues for them. *Id.* But, under PO’s interpretation, the same circuit could be made to avoid 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.

That said, using Ricketts’s interpretations of claims 19-21, and appropriately removing the bias voltage, shows instances of the claimed discharge percentages:

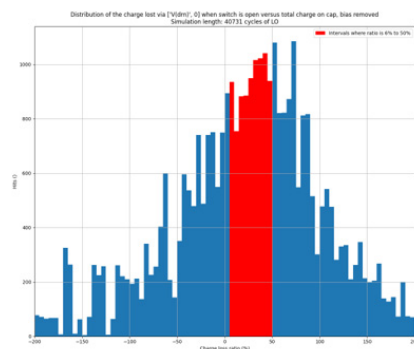


DeMaw Histograms Using Ricketts’s Equations (Minus Bias Voltage) and Original
Operating Conditions

Likewise, using Dr. Galton's additional models and the modified Ricketts's methodology, discharges the claimed percentages. Taking the lowest input signal as the example, there are instances with the claimed ranges:



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.

F. Ricketts's DeMaw Simulations Are Flawed

Ricketts own data and plots for DeMaw are flawed. First, as discussed above, Ricketts incorrectly determines the discharge percentages by not accounting for the constant bias voltage. TI-1060, ¶¶50-56. Second, Ricketts only provides data for a $2\mu\text{s}$ time-span – a statistically insignificant amount of data. *Id.*, ¶132. By contrast, Dr. Galton provided $400\mu\text{s}$ and 50,999 cycles. TI-1003, ¶114. In that time period, Dr. Galton illustrated many discharges within the claimed ranges.

III. MACNALLY

A. Macnally shows the claims

Macnally renders claim 18 unpatentable. And PO does not dispute that TI's histograms show the claimed discharge percentages under Dr. Galton's theories. Rather than providing their own simulations and data to contradict TI's, PO's argument rests on their misunderstanding of the claimed switching behavior and basic circuit operation. Specifically, PO argues that Macnally does not disclose the "electrically coupling" limitation, does not disclose the first and second "switching device," and that Dr. Galton used incorrect discharge calculations. POR, 90-102. Dr. Galton has proven that PO's arguments are faulty.

1. Macnally discloses the "electrically coupling" limitation

Claim 18 requires the *information signal*/inverted *information signal* be coupled to the capacitors. Macnally shows both.

The Petition explains that the "RF_P information signal input to the mixer is a version of the received information signal that is transformed and amplified." Petition, 61-62 (TI-1023, 8:18-25, 10:20-25 (describing low noise amplifier)). But also, the information signal is the non-bias component of the drain current of transistor M1 and the inverted information signal is the non-bias component drain current of transistor M2. TI-1060, ¶¶84-90. This drain current flows through switching device M5 and into the capacitor C1, as shown in annotated FIG. 3:



TI-1023, FIG. 3 (partial, annotated)

Petition 61.

A POSITA would understand that the information signal applied at the gate-side of M1 and M2 is the same information signal on the drain current flowing through M1 and M2; the information signal is merely propagated by a different set of wires and a different set of charge carriers. TI-1060, ¶89. The RF_P input signal causes M1 to behave like a variable resistor, which consequently causes the otherwise constant bias current through M1 to vibrate at the same frequency as the RF_P input signal, communicating the information from the RF_P input signal to the bias current. TI-1060, ¶¶86-89; EX2021, ¶202. Same for RF_N and M2, the inverted information signal. TI-1060, ¶86. Thus, the information and inverted information carried by the RF_P and RF_N inputs are translated to the current flowing

in the mixer. *Id.* The information is preserved. Petition 61-62. PO admits that Macnally uses a 50% duty cycle LO, which is a non-negligible aperture. POR, 33, 35; 1001, 11:3-12, 38-42. Thus, Macnally transfers non-negligible amounts of energy from the information signal to the capacitors. TI-1060, ¶¶86-90.

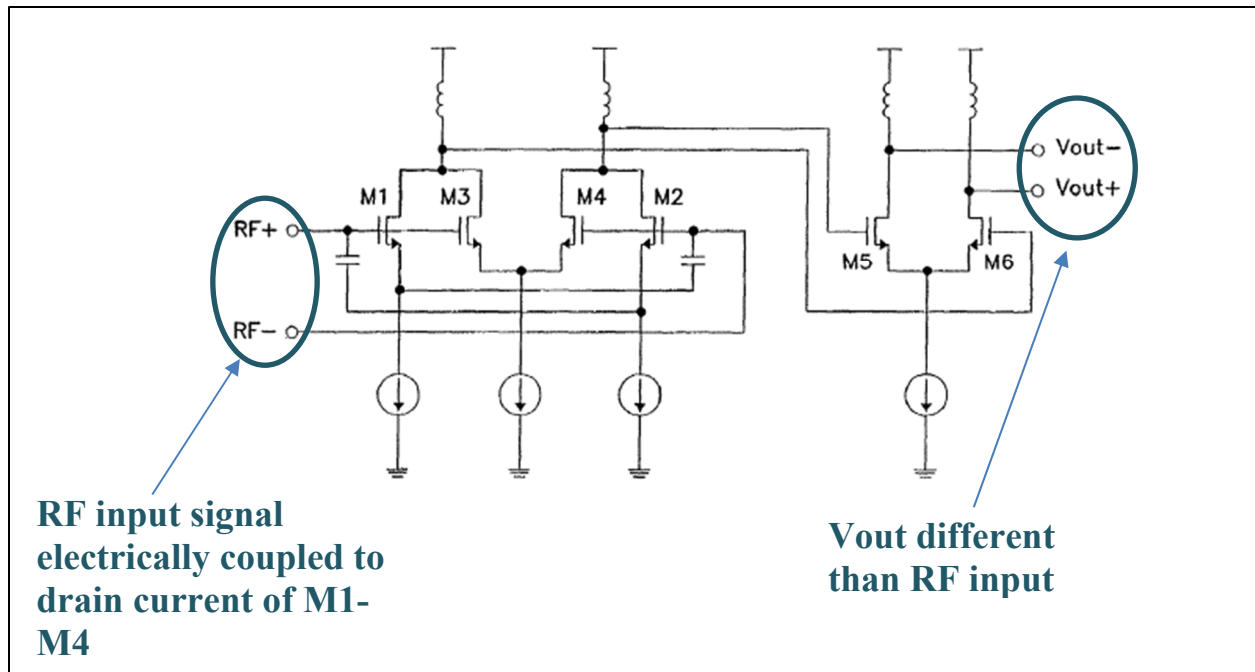
That Macnally communicates the information signal across different set of charge carriers is consistent with the '342 patent, which explains that the information signal can pass a low-noise amplifier (LNA), but still be the received information signal. TI-1060, ¶¶90-92.

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:



Macnally, FIG. 2 (**annotated**)

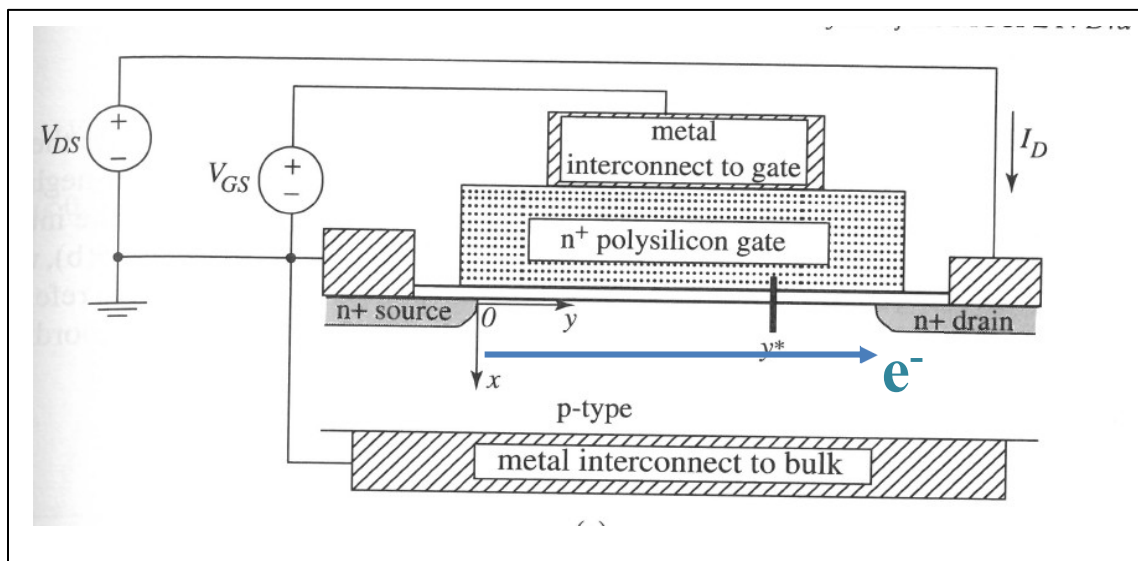
The LNA receives the RF input signal at gates of M1-M4, and outputs, Vout, a physically different set of charge carriers than the RF input signal. *Id.*; Macnally, 2:22-23, 6:57-64, text accompanying FIG. 2. A POSITA would have understood that Vout is an RF information signal because it retains the radio frequency information from the input that is eventually down-converted.⁴ TI-1001, 49:29-46; TI-1060, ¶¶93-96 (explaining Macnally is a typical LNA and providing other examples).

The plain meaning of “information signal” simply denotes a signal with information. There is no requirement in the claims or the specification that the

⁴ It is not disputed that Macnally performs down-conversion.

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.*

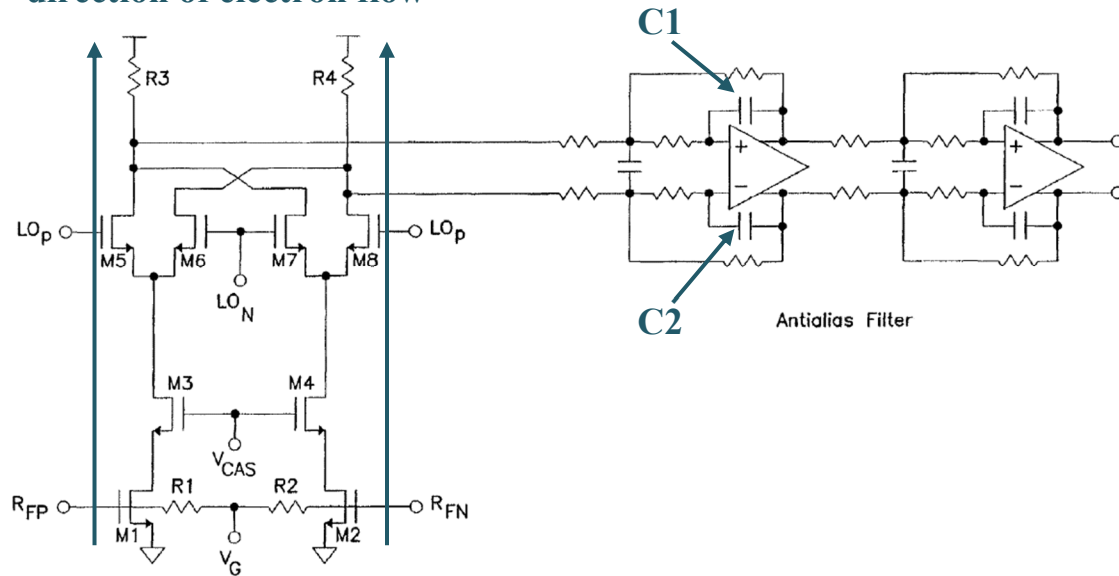
Furthermore, PO’s argument that current flows downward in Macnally is misleading. POR, 93-97; TI-1060, ¶¶97-98. Electrons are negatively charged, and flow low to high voltage, even through active switches:



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

direction of electron flow



Thus, Macnally discloses “electrically coupling the information signal to a first capacitor” and “electrically coupling the inverted information signal to a second capacitor.”

Contrary to PO's assertions, Macnally discloses the switching behavior of claim 18. POR, 97. Macnally unambiguously explains: "The LO input transistors [M5, M6, M7, M8] *operate as switches*." TI-1023, 7:12-14 (emphasis added); TI-1060, ¶¶78, 136-138. The switches M5 and M8 cause capacitors C1 and C2, respectively, to store energy from the information signal when closed and to discharge that energy when open. TI-1060, ¶¶99-100; EX2021, ¶216 (explaining

that “Macnally uses a 50% duty cycle LO”). When switches M5 and M8 are open, they isolate the information signal from the capacitors. TI-1060, ¶¶99-100.

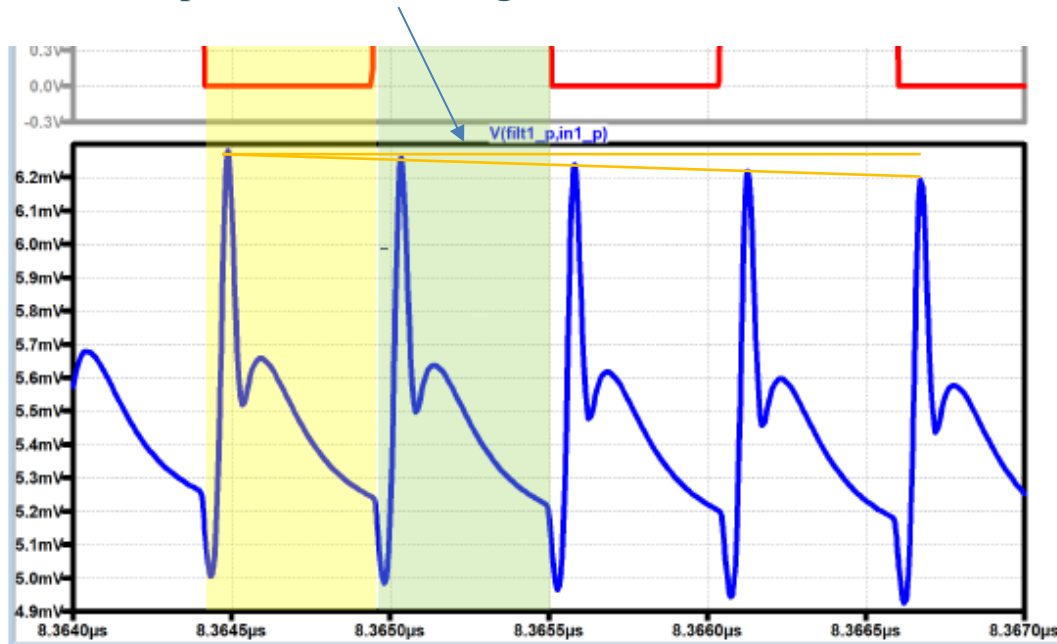
PO’s explanation of the current flow in Macnally is wrong. POR, 99-101. Neither capacitor is connected to VDD. TI-1060, 65. The op-amp sets its output voltages to ensure that its two input voltages are nearly equal, and the input voltages are set by the Macnally mixer circuit. *Id.* The constant bias current through the mixer’s resistors ensures that the op-amp’s input voltages are well below VDD. *Id.*

The drain current carrying the information is the information signal and traverses the conductive pathway from ground through the switches M3-M8. Petition, 61-62; TI-1060, ¶¶93-95. Thus, switches opening and closing control the amount of charge from the information signal that reaches the capacitors. Petition, 62-63; TI-1060, ¶100.

PO’s assertion that “charge on the capacitor remains materially the same whether the corresponding transistor is ON (conducting) or OFF (not conducting)” misrepresents the functioning of Macnally and the plot. POR, 98-99. First, if it were true that the “charge on the capacitor remains materially the same,” then the circuit would not function to down-convert a signal. TI-1060, ¶112. Yet, no one disputes Macnally down-converts. *Id.*, ¶¶101, 107-112, 114-116; TI-1003, ¶114;

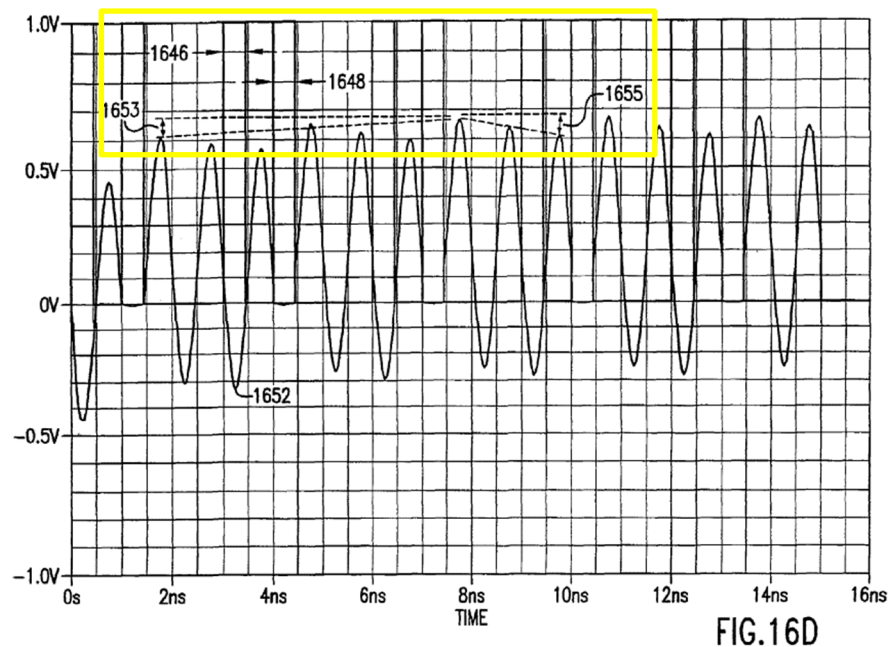
TI-1042, ¶¶80. Second, PO's plot reveals that the average of the waveform over the yellow region is higher than that over the green region:

non-zero slope indicates discharge and down-conversion



POR, 98 (annotated); TI-1060, ¶112

This difference represents the down-conversion. *Id.* The slope represents the rate of discharge of the capacitor (minus the bias voltage).



TI-1001, FIG. 16D (annotated)

The '342 patent shows the same in FIG. 16D, where slope 1653 represents the down-converted signal. Slope 1655 is the rate of discharge of capacitor 1606 between apertures. TI-1001, 19:1-5.

B. The Petition's Macnally Simulations Render Claims 18-21 Unpatentable

As with DeMaw, Dr. Galton's additional Macnally simulations were responsive to criticisms in the POPR. The additional simulations confirm that 1) Dr. Galton's original simulations accurately represented Macnally's behavior, 2) PO's complaints were immaterial, and 3) reinforce that Macnally renders claims 18-21 unpatentable under different modeling choices. TI-1060, ¶¶102, 110-111.

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.

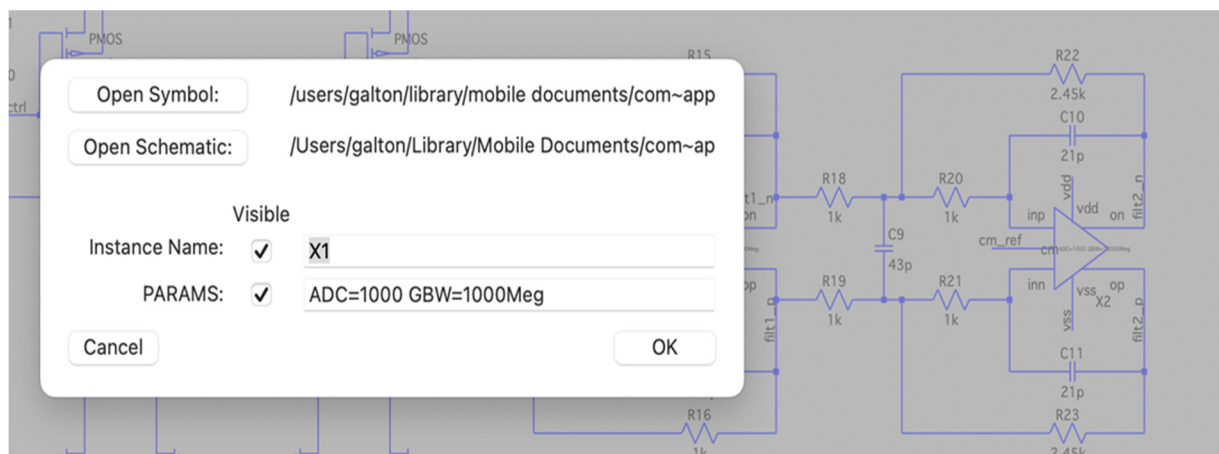
For example, Dr. Galton modeled Macnally's power supply and resistors R3 and R4 using a constant current source, which is a common practice, because of Macnally's high mixer gain. TI-1060, ¶¶82-83; POR, 68. Dr. Galton explains that "[c]urrent sources provide a way of achieving large resistances without large voltage drops or large circuit areas." TI-1060, ¶82. Dr. Galton believed (and still believes) that R3 and R4 were actually implemented as current sources, due to Macnally's mixer high gain (14.2 dB). *Id.* As Dr. Galton showed, whether modeled with resistors or as current sources, Macnally performs the claims. *Id.*, ¶115-116. And PO has failed to show why modeling the resistors using constant current sources materially affected the simulations.

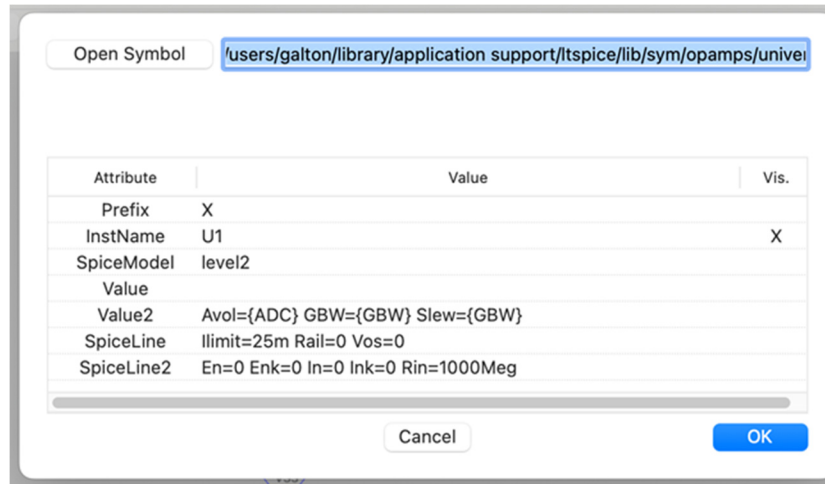
Similarly, PO complains the simulations use a full-swing LO. POR, 67. However, Macnally explains the "LO input transistors operate as switches," which a POSITA would understand implies that the LO signal approximates a square wave with an amplitude large enough to ensure this behavior. TI-1021, 7:12-14;

TI-1060, ¶79. A full-swing LO clock signal is the most straight-forward way to implement Macnally consistent with its intent. TI-1060, ¶79.

PO complained Dr. Galton's use of LTSpice default devices for active load transistors M12 and M13 and his later use of resistors. POR, 68. Dr. Galton explains that "circuit diagrams published in papers, patents, and textbooks often represent current sources as resistors for simplicity because they affect the signal components of a circuit in the same way as large resistors." TI-1060, ¶67. Further, because the gain of the Macnally mixer is high (14.2 dB), Dr. Galton opines a POSITA would expect R3 and R4 to have actually implemented as current sources. *Id.*, ¶82.

PO asserts that the operational amplifier (universalopamp2) lacks any specified parameter values. POR, 69. PO did not query the LTSpice simulator correctly. *Id.*, ¶104-105. Dr. Galton provided the following two screens from LTSpice showing the values:

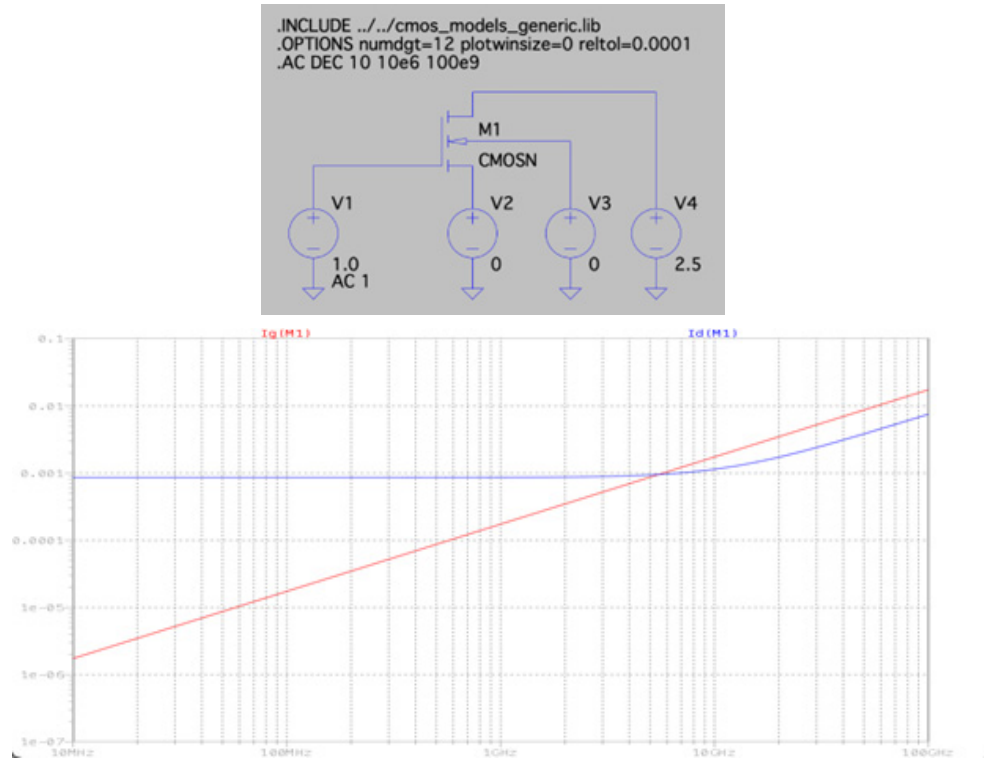




TI-1060, ¶¶121-122.

PO also incorrectly claimed that the simulations used different operational amplifiers. POR, 25. Dr. Galton, however, confirmed PO was again mistaken. TI-1060, ¶¶121-124.

PO claims that the original simulations omit device parasitic capacitances. POR, 69. Dr. Galton, however, confirmed that LTSpice's AC simulation of a single MOS transistor includes parasitic capacitances:



TI-1060, ¶¶128-131.

The gate current increasing with frequency means that the transistor model includes gate capacitance (which is the combination of multiple parasitic capacitances). *Id.*; TI-1049, ¶763.

Dr. Galton has explained his modeling choices; while PO has provided no reasoning or proof the simulations are invalid.

C. Galton's Second Set of Simulations *Verify Unpatentability*

PO's complaints are not flaws in Dr. Galton's simulations. Dr. Galton performed additional Macnally simulations purely to rebut the accusation that he

had “chosen component values and circuit configurations to ‘get the results [that TI] needed.’” TI-1042, ¶145. Dr. Galton stands by his original simulations.

Dr. Galton’s additional simulations are not a new theory of unpatentability; they confirm Dr. Galton did not cherry-pick values to reach a desired result and Macnally performs the claimed method under a variety of operational conditions.

TI’s position has been, and still is, that Macnally renders claims 18-21 unpatentable. Macnally’s transistors act as switches and control the charging and discharging of the information signal and inverted information signal electrically coupled to the capacitors. All simulations demonstrate this, despite taking different approaches modeling Macnally. While Dr. Galton explained his modeling, PO has not provided any reasoning for *why* they believe his selections render the model invalid. PO simply nitpicks immaterial features.

For example, PO complains the input signal was AM modulated. POR, 67. But Dr. Galton’s simulations shows modulation is immaterial to the operation of Macnally, as both modulation type down-convert the input signal. TI-1060, ¶¶80-81. And the claims do not require a specific information signal modulation.

Dr. Galton acknowledges that the first simulation mistakenly includes transistors with gate lengths of 300 nm, but changing the gate length to 600 nm did not materially alter Macnally’s performance. POR, 25; TI-1060, ¶¶118-120. Dr. Galton’s additional simulation led to the same conclusions as the original

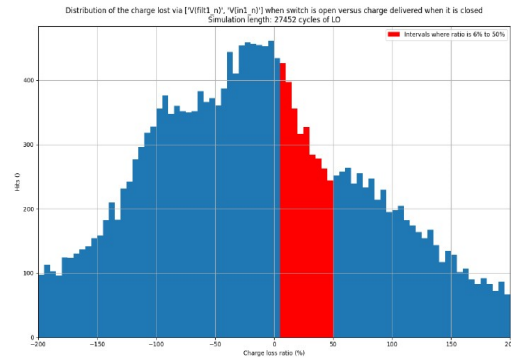
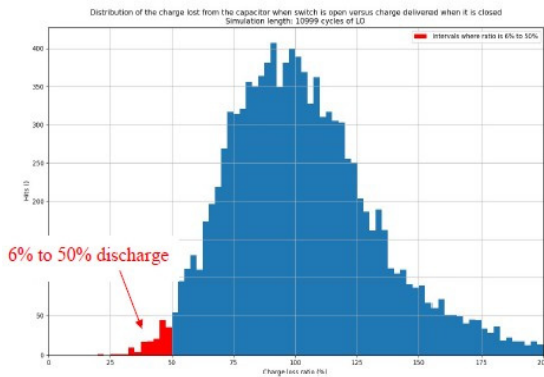
simulations. TI-1060, ¶102. The “inconsistency” does not “materially” impact the switching behavior as Ricketts claimed. *Id.*

Dr. Galton’s change in the transistors was done to account for changes in transconductance resulting from modifications responding to the POPR. TI-1060, ¶¶125-127. Yet, as demonstrated by every simulation he has run, Macnally satisfies the claims of the ’342 patent.

Regarding mixer gain adjustments, PO claims that Macnally does not disclose “cross-conducting” and does not disclose any 8.5mS transconductance value. POR, 71. Dr. Galton clarifies that “cross conducting” is common term-of-art. TI-1060, ¶¶105-106. “In the case of the Macnally mixer circuit, cross-conducting is said to occur if transistors M5, M6, M7, and M8 happen to simultaneously conduct current, and a POSITA would understand that such cross-conducting is highly undesirable because it shorts the output of the mixer and reduces the mixer’s gain.” *Id.* Also, Macnally published exactly the same circuit in a 1999 IEEE paper that mentions the 8.5mS value. TI-1060, ¶¶103-104; TI-1050, Table 13.7.1.

PO argues the additional simulations are a new theory of Macnally’s operation, but the original and additional simulations show disprove this. MACNALLY-SIM-FIGS. 2.1, 3.1, 4.1A and 4.1B *correspond* to MACNALLY-SIM-FIGS. 2, 3, 4, 5 and 6 except that the former were generated by simulating

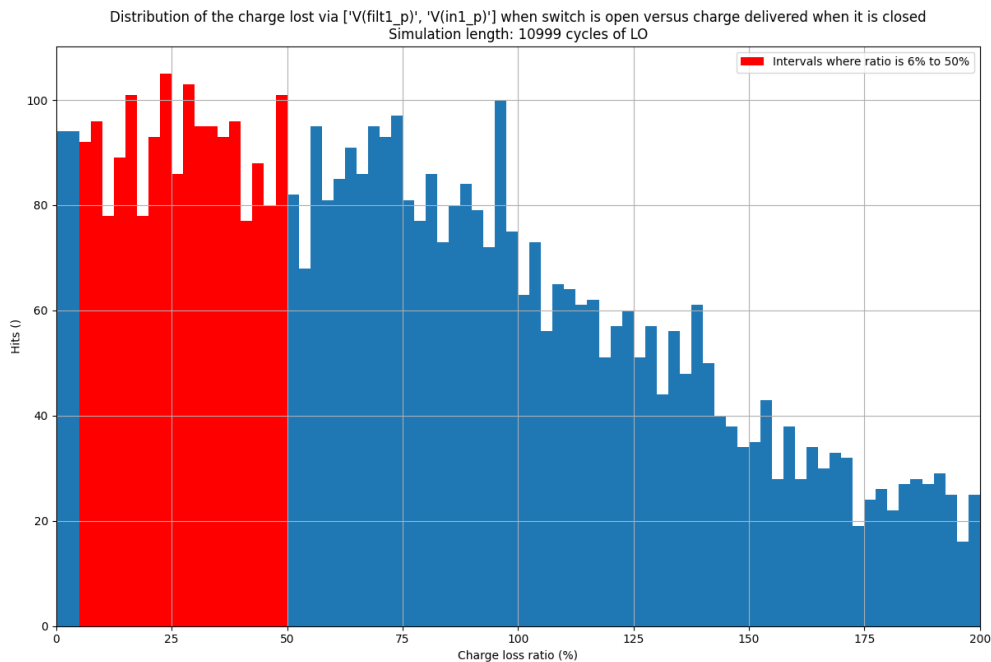
MACNALLYSIM-FIG. 1.1 and the latter were generated by simulating
MACNALLY-SIM-FIG. 1. TI-1060, ¶¶107-110.



MACNALLY-SIM-FIG. 4.1A. Charge loss ratio percentages histogram for capacitor C6 (circuit of MACNALLY-SIM-FIG. 1.1).

EX2021, ¶389

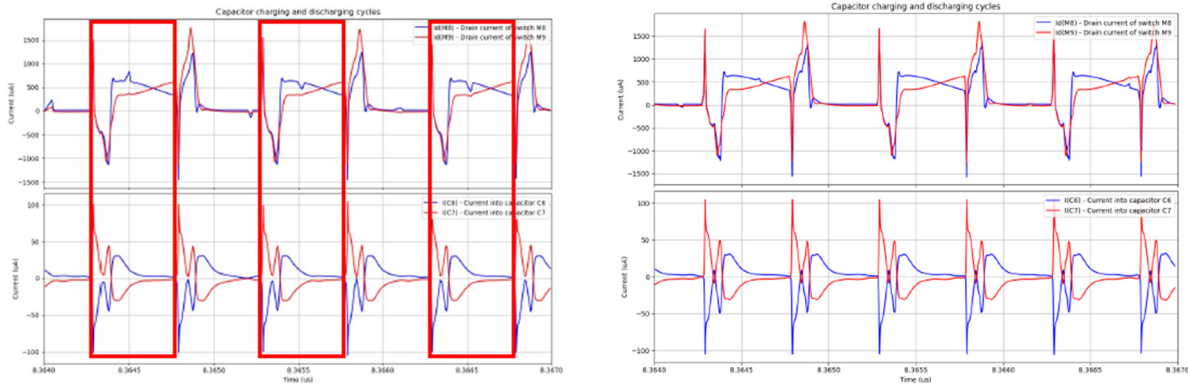
Dr. Galton also provided the following additional histogram for capacitor C6
(circuit of MACNALLY-SIM-FIG. 1):



TI-1042, ¶172.

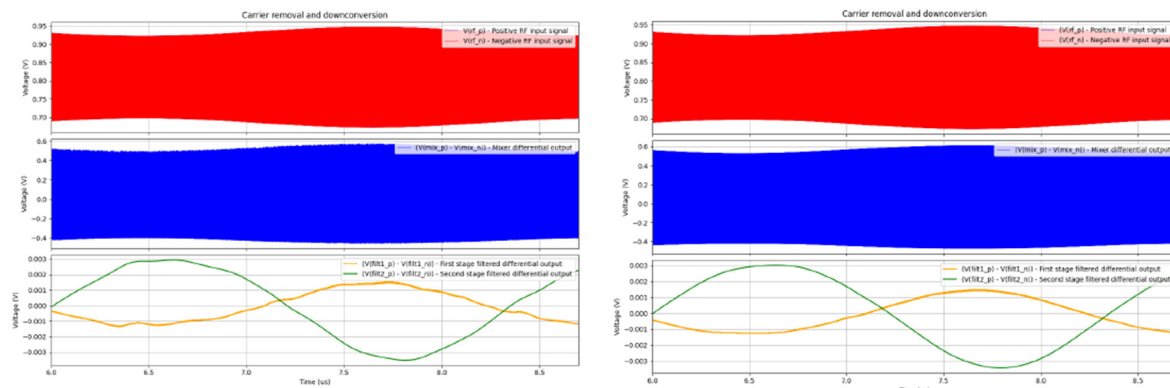
All histograms show that, regardless of operational parameters, Macnally produces the claimed discharge percentages.

Further, waveforms showing the information signal and inverted information signal electrically coupled to the capacitors show that the changes did not materially alter the circuit's operation:



MACNALLY-SIM-FIG. 2 (annotated) and MACNALLY-SIM-FIG.2 (different sim settings) (TI-1003, ¶139; TI-1042, ¶147)

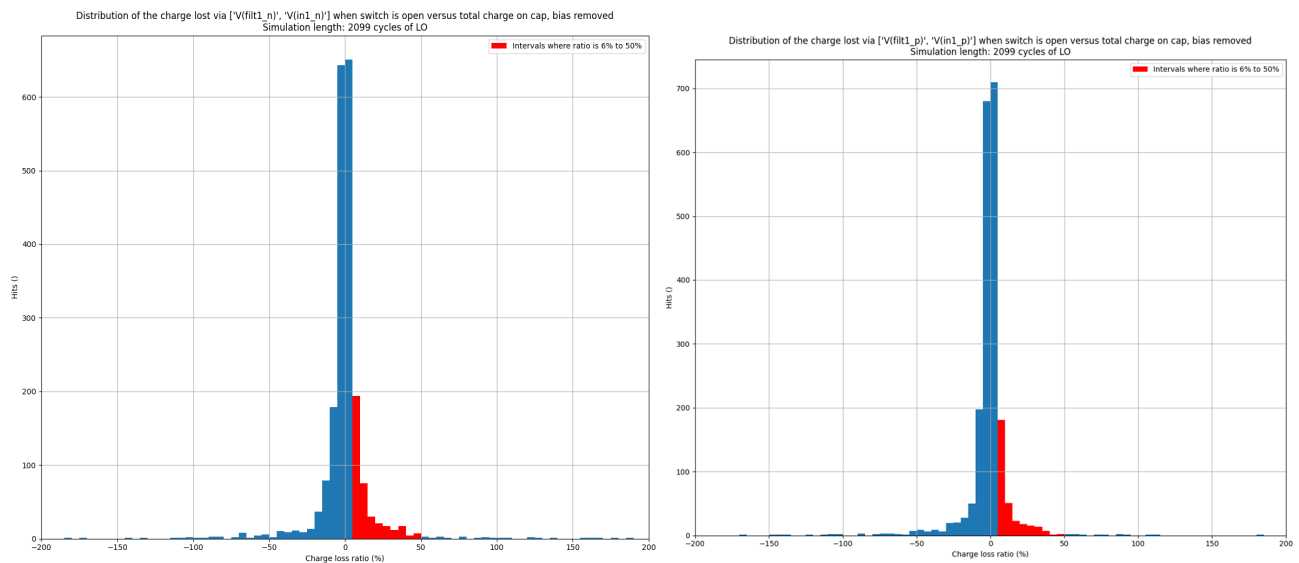
Similarly, simulations of the removal of the carrier signal from the first and second down-converted signals show that the operation was not materially altered:



MACNALLY-SIM-FIG. 6 and MACNALLY-SIM-FIG.6 (different sim settings)

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

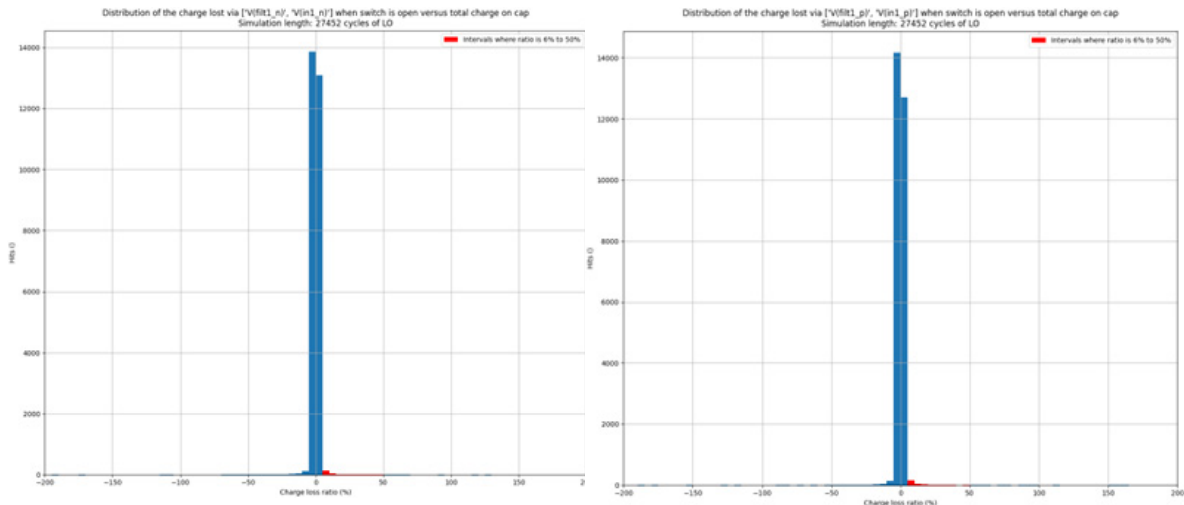
TI maintains that Dr. Galton's approach to calculating the discharge percentages is correct. But even under Ricketts's interpretation, Macnally renders claims 19-21 unpatentable. In DeMaw, the resulting percentages differed because Ricketts incorrectly accounted for bias voltage. TI-1060, ¶¶54-66. However, 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

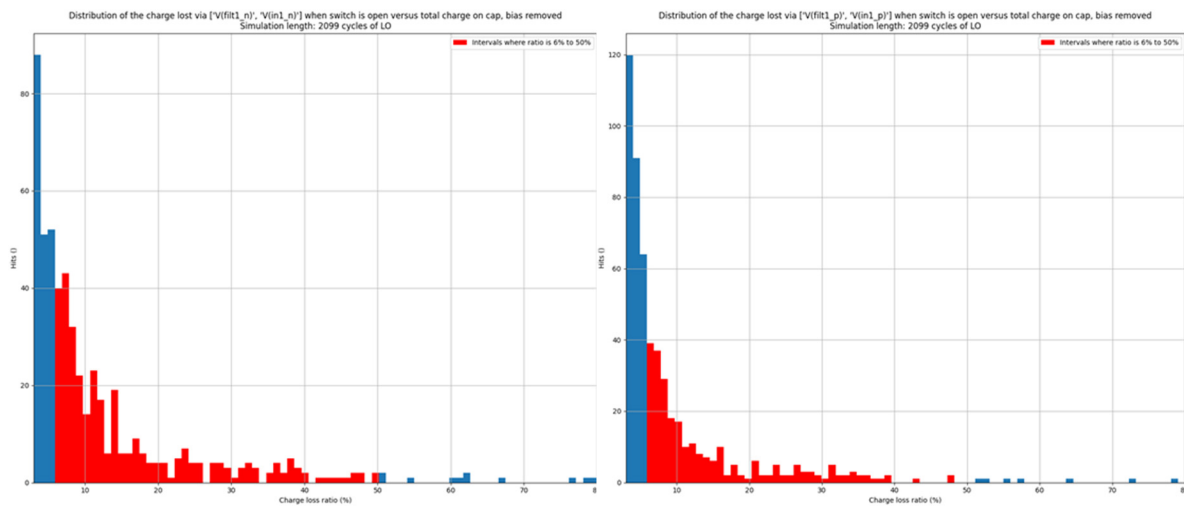
(TI-1060, ¶114)

Macnally histograms for discharge percentages for C6 and C7 using the updated operating conditions:



MACNALLY-SIM-FIG. 4.1A. Post-processed charge loss ratio percentages histogram for capacitor C6 and C7 (circuit of MACNALLY-SIM-FIG. 1.1)

TI-1060, ¶¶115-116. A close-up of the data shows the discharge percentages.



PO provides no data to contradict Dr. Galton's calculations, but Dr. Galton's original simulation showed that Macnally produces the claimed percentages under both interpretations. TI-1003, ¶¶114-116; TI-1042, ¶¶16-144.

IV. CONCLUSION

ParkerVision has failed to rebut the grounds in the Petition. Accordingly, the Board should find the Challenged Claims of the '342 patent unpatentable.

Respectfully submitted,

Date: July 7, 2025

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CERTIFICATION UNDER 37 CFR § 42.24(d)

Under the provisions of 37 CFR § 42.24(d), the undersigned hereby certifies that the word count for the foregoing Petitioners' Reply to Patent Owner's Response totals 5,597, which is less than the 5,600 allowed under 37 CFR § 42.24.

Respectfully submitted,

Date: July 7, 2025

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CERTIFICATE OF SERVICE

Pursuant to 37 CFR § 42.6(e), the undersigned certifies that on July 7, 2025, a complete and entire copy of the Petitioner's Reply to Patent Owner's Response and Accompanying Exhibits were provided by email to the Patent Owner by serving the correspondence addresses of record as follows:

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