

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of: David F. Sorrells, et al Attorney Docket No.: 12189-0090IP1
U.S. Patent No.: 7,496,342
Issue Date: February 24, 2009
Appl. Serial No.: 10/972,133
Filing Date: October 25, 2004
Title: DOWN-CONVERTING ELECTROMAGNETIC SIGNALS,
INCLUDING CONTROLLED DISCHARGE OF CAPACITORS

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PETITION FOR *INTER PARTES* REVIEW OF UNITED STATES

PATENT NO. 7,496,342 PURSUANT TO 35 U.S.C. §§ 311–319,

37 C.F.R. § 42

TABLE OF CONTENTS

I.	REQUIREMENTS FOR IPR	1
A.	Grounds for Standing.....	1
B.	Challenge and Relief Requested.....	1
C.	Claim Construction	2
1.	ParkerVision’s Proposed Constructions.....	4
2.	TI’s Constructions	5
3.	PTAB’s Constructions.....	6
D.	Level of Ordinary Skill in the Art.....	6
II.	THE ’342 PATENT.....	7
A.	Brief Description.....	7
B.	Prosecution History.....	8
C.	PTAB History	9
D.	Litigation history.....	10
III.	THE CHALLENGED CLAIMS ARE UNPATENTABLE.....	13
A.	GROUND 1A – DeMaw Renders Claims 18-21, 23 Obvious.....	13
1.	DeMaw Theory of Operation	13
2.	DeMaw Simulation	16
3.	Analysis	18
B.	GROUND 1B – the DeMaw-Tayloe Combination Renders Claims 22-23 Obvious.....	38
1.	Tayloe.....	38
2.	The DeMaw and Tayloe Combination.....	44
3.	Motivation to Combine DeMaw with Tayloe	44
4.	Analysis	47
C.	GROUND 2 – Macnally Renders Claims 18-23 Obvious.....	50
1.	Macnally	50
2.	Macnally Simulation	53
3.	Analysis	54
IV.	PTAB DISCRETION SHOULD NOT PRECLUDE INSTITUTION.....	78
A.	35 U.S.C. §325(d) – <i>Advanced Bionics</i>	78
B.	35 U.S.C. §314(a) – <i>General Plastic</i>	79
C.	35 U.S.C. §314(a) - <i>Fintiv</i>	79
V.	CONCLUSION AND FEES	80
VI.	MANDATORY NOTICES UNDER 37 C.F.R § 42.8(a)(1).....	80
A.	Real Party-In-Interest Under 37 C.F.R. § 42.8(b)(1).....	80
B.	Related Matters Under 37 C.F.R. § 42.8(b)(2)	81

C.	Lead And Back-Up Counsel Under 37 C.F.R. § 42.8(b)(3).....	81
D.	Service Information	82

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

LISTING OF CLAIM TERMS

Claim No.	Claim Element
18.P	A method for down-converting an electromagnetic signal, comprising the steps of:
18.1	(1) receiving an information signal;
18.2	(2) inverting the information signal to generate an inverted information signal;
18.3	(3) electrically coupling the information signal to a first capacitor and the inverted information signal to a second capacitor;
18.4	(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
18.5	(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;
18.6	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.
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.
22.	The method of claim 18, further comprising the step of: amplifying the first and second down-converted information signals.
23.	The method of claim 18, further comprising the step of: removing a carrier signal from the first and second down-converted information signals.

Texas Instruments Incorporated (“Petitioner” or “TI”) petitions for *Inter Partes* Review (“IPR”) of claims 18-23 (“the Challenged Claims”) of U.S. Patent No. 7,496,342 (“the ’342 Patent”). Compelling evidence presented in this Petition demonstrates at least a reasonable likelihood that TI will prevail with respect to at least one of the Challenged Claims.

I. REQUIREMENTS FOR IPR

A. Grounds for Standing

Petitioner certifies that the ’342 Patent is available for IPR. This petition is being filed within one year of service of a complaint against TI. TI is not barred or estopped from requesting review of the Challenged Claims on the below-identified grounds.

B. Challenge and Relief Requested

TI requests an IPR of the Challenged Claims on the grounds noted below. Dr. Ian Galton provides supporting testimony in his/her Declaration. TI-1003, *passim*.

Ground	Claim(s)	35 U.S.C. §103
1A	18-21, 23	DeMaw
1B	22-23	DeMaw in view of Tayloe
2	18-23	Macnally

Reference	Filing Date	Publication Date	Prior Art
DeMaw		1982	Pre-AIA §102(b)
Tayloe	October 15, 1998	May 8, 2001	Pre-AIA §102(e)
Macnally	September 10, 1998	March 23, 2000	Pre-AIA §102(a)

DeMaw published in 1982 and was indexed and made publicly accessible by Penn State Library in November, 1982. TI-1014, 14-17. Furthermore, DeMaw was published by Prentice-Hall, a “well-known, reputable compiler and publisher.” *Ericsson Inc. v. Intell. Ventures I LLC*, IPR2014-00527, Paper 41 at 10-11 (PTAB May 18, 2015); *see also VidStream LLC v. Twitter, Inc.*, 981 F.3d 1060, 1065-66 (Fed. Cir. 2020).

C. Claim Construction

All claim terms are construed according to the Phillips standard, and are given their plain meaning except as explained below. *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005); 37 C.F.R. § 42.100. Based on the well-established principal that “claim terms need only be construed to the extent necessary to resolve the controversy,” no express constructions are required to institute review and find the Challenged Claims unpatentable. *Wellman, Inc. v. Eastman Chem. Co.*, 642 F.3d 1355, 1361 (Fed. Cir. 2011).

In the co-pending litigation between ParkerVision and Texas Instruments, the parties have proposed claim constructions for certain terms in the '342 patent.

The terms and constructions are as follows:¹

Term	ParkerVision's Proposed Construction	TI's Proposed Construction
"controlling a charging and discharging cycle"	Plain-and-ordinary meaning	"controlling a cycle of charging and then discharging"
"switching device"	Plain-and-ordinary meaning wherein the plain-and-ordinary meaning is "an electronic device for opening and closing a circuit as dictated by an independent control input" ²	No construction necessary/ Plain and ordinary meaning, or if construction is necessary, an electronic device which opens and closes to break or complete an electrical path in a circuit

¹ *E.g.*, TI-1029, 13.

² The Federal Circuit recently affirmed the PTAB's finding of invalidity of U.S. 8190108 to ParkerVision.

These claim constructions are described in more detail below. While Petitioner endorses TI's interpretations of the claims, the prior art analyzed here renders the claims unpatentable under either parties' constructions.

1. ParkerVision's Proposed Constructions

ParkerVision proposes a plain-and-ordinary meaning construction for “controlling the charging and discharging cycle” because the “language of the term is straightforward” and there are “no words that are unclear.” TI-1010, 5.

According to ParkerVision, the claim limitation “does not impose a sequential order of events,” but rather, the language of the claim term “simply means there is a switching device for each capacitor—a first switching device controls a charging/discharging cycle of a first capacitor, and a second switching device controls a charging/discharging cycle of a second capacitor.” *Id.*

ParkerVision proposes a plain-and-ordinary meaning construction for “switching device,” but also proposes that, if a construction were necessary, that the plain-and-ordinary meaning be “an electronic device for opening and closing a circuit as dictated by an independent control input.” ParkerVision notes that the court considered this term in another patent and adopted ParkerVision's constructions. ParkerVision also points to the '342 patent specification as showing

that “there is always a second input (i.e., an independent control input) coming into each switch.” *Id.*, 7.

2. TI’s Constructions

TI proposes that “controlling a charging and discharging cycle” means “controlling a cycle of charging and then discharging.” TI points to the ’342 patent specification’s description of the invention that “repeatedly describes the ‘charging’ and ‘discharging’ portions of the cycle recited in method claim 18 as separate and distinct events.” TI-1029, 11. TI points out that charging occurs “when a switch is closed” and discharging occurs “when the switch is opened.” *Id.* According to TI, in the ’342 patent specification, “the alleged invention is always either charging or discharging, and never simultaneously both charging and discharging.” *Id.*

TI’s proposes no construction / plain-and-ordinary meaning of “switching device”; but if a construction is necessary, TI proposes “an electronic device which opens and closes to break or complete an electrical path in a circuit.” *Id.*, 9. TI’s proposal does not require that the switching device include an independent control input. *Id.* First, TI notes that the other constructions ParkerVision points to are not for the ’342 patent, and therefore are inapposite. *Id.*, 10. Second, TI argues that adding the requirement of an independent control input adds ambiguity to an otherwise unambiguous term. *Id.*, 11. Specifically, “nothing in ParkerVision’s

definition explains what the control signal is independent of.” *Id.* In support of its construction, TI points to definitions of a switch or switching device from general purpose and technical dictionaries, none of which require an independent control input. *Id.*, 10.

3. PTAB’s Constructions

In addition to the parties’ proposed constructions, the PTAB has previously construed certain terms in connection with the ’342 patent as follows:³

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

As will be discussed in more detail below, the prior art renders the Challenged Claims unpatentable under ParkerVision’s, TI’s, and the PTABs constructions of the aforementioned terms.

D. Level of Ordinary Skill in the Art

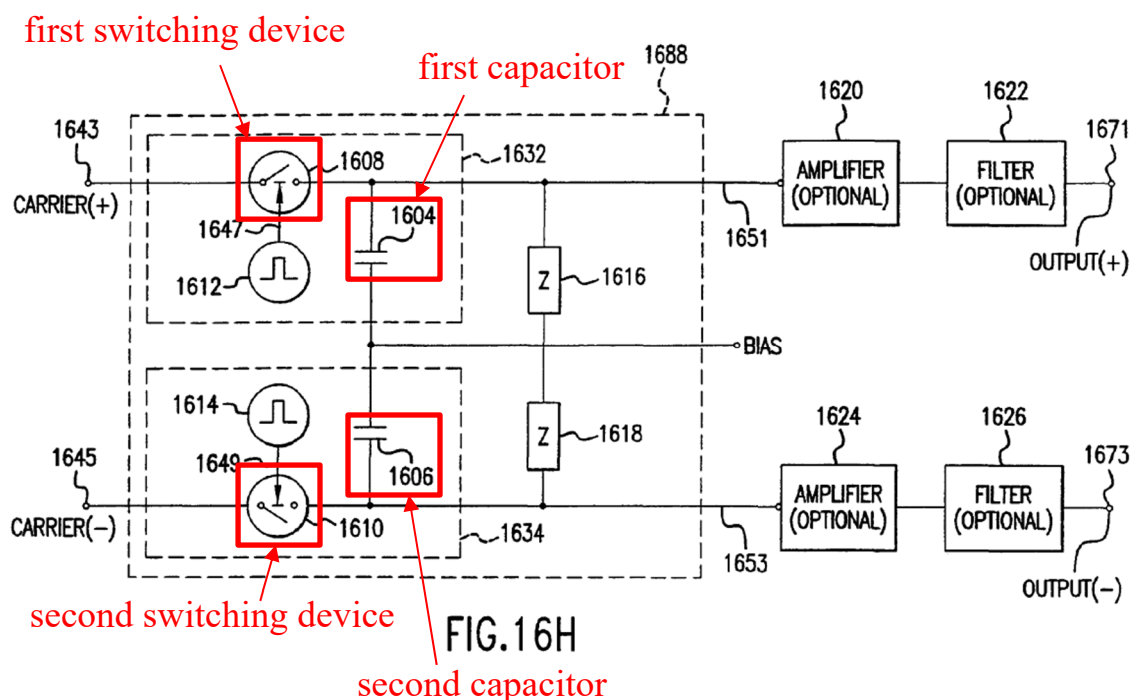
A person of ordinary skill in the art (“POSITA”) as of the ’342 Patent’s priority date (April 14, 2000) would have had at least a bachelor’s degree in electrical engineering or a related subject and two or more years of experience in the field of EM circuit design. Less work experience may be compensated by a higher level of education, such as a master’s degree. TI-1003, 28-30.

³ TI-10[xa], 8-13.

II. THE '342 PATENT

A. Brief Description

The '342 Patent is directed to “down-converting and up-converting an electromagnetic (EM) Signal.” TI-1001, Abstract. The '342 patent generally relates to the down-conversion of an electromagnetic (“EM”) signal. TI-1001, 1:43-45, 6:25-29. Figure 16H of the '342 patent, reproduced below, illustrates an example of a receiver with two switches. TI-1001, 3:47-48, 18:6-9, 20:33-39.



The Challenged Claims are limited to a method of down-conversion using particular circuit elements, including first and second switching devices, first and second capacitors and first and second impedance devices. *See, e.g.*, TI-1001, 52:37-57.

As discussed below, the '342 patent resulted from a divisional application of U.S. Application No. 09/855,851 (the '851 application), which was itself a continuation-in-part of U.S. Application No. 09/550,644 (the '644 Application), filed on April 14, 2000. The claims of the '342 patent were not supported by the '644 application. The materials describing differential embodiments in the '342 specification discussed above, as well as FIGS. 16A, 16H and section titled "Receiver Embodiments having two Aliasing Modules," were new matter added in the '851 application.

B. Prosecution History

As mentioned briefly above, the '342 patent resulted from application No. 10/972,133 (the '133 Application). The '133 Application is a Division of the '851 Application, now US 7,010,286, filed on May 16, 2001. The '851 Application is a Continuation-in-Part of the '644 Application, filed on April 14, 2000. The '133 Application claims the benefit of several provisional applications,⁴ but the '644 Application is the earliest claimed priority date (the so-called Critical Date). Thus, this Petition treats April 14, 2000 as the Critical Date for purposes of prior art.

⁴ 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.

During prosecution, the claims were the subject of an obviousness-type double patenting rejection. The pending claims were otherwise allowed. The application filed a terminal disclaimer to overcome the double patenting rejection. The claims were subsequently issued.

C. PTAB History

Claim 18 of the '342 patent was previously challenged in a Petition for IPR by RPX, whose petition was denied institution. *See, e.g.*, TTI-1030 (PTAB January 8, 2015). Institution in that proceeding was denied, because RXP failed to provide evidence of Oxner, but rather due to RPX's failure as a petitioner to adequately convey how the circuit of their primary reference, Oxner, implemented each method step of claim 18. TI-1030, 17. In fact, in evaluating Oxner, the PTAB agreed with RPX that "Oxner expressly describes all the structural features required to implement each method step recited in independent claim 18." TI-1030, 17. However, the PTAB concluded that "RPX does not present sufficient evidence to support a finding that Oxner expressly or inherently describes how these structural features perform the functions associated with each method step." *Id.*

The present petition is distinguishable from the prior RPX petition in that none of the prior art relied on in that petition is being asserted here. Although DeMaw (TI-1016), advanced here, was discussed in connection with the Oxner in the RPX petition's claim construction section (due to DeMaw being the subject of

an invalidity analysis of claim 18 raised by Qualcomm in the district court – discussed below), DeMaw was not applied against claim 18 in the RPX proceeding. *See* §II.D, *infra*.

In discussing DeMaw, RPX noted that the circuit of Figure 6.7 “had a similar configuration to FIG. 16H of the ’342 patent, which the switches upstream of the capacitor.” Petition, PTAB-IPR2014-01107, 17-18. DeMaw, itself, notes that Figure 6.7 is similar (but not identical) to a circuit suggested in Oxner. DeMaw, 196.

Here, DeMaw is a different circuit than Oxner. As discussed below, DeMaw includes all of the structural features required to implement each method step recited in independent claim 18. *See also*, §II.D (discussing DeMaw in the Qualcomm litigation and Federal Circuit appeal). Furthermore, here, Petitioner provides evidence with respect to De Maw that was missing from RPX’s presentation Oxner. Namely this Petition provides conclusive evidence by way of simulations by Dr. Galton of how DeMaw’s circuit operates to perform each method step of claim 18.

In addition to evaluating RPX’s petition, the PTAB also construed two terms. The PTAB’s claim construction are summarized above, in §I.C.3.

D. Litigation history

Claim 18 has previously been considered by the Federal Circuit as the result of an appeal from *ParkerVision Inc. v. Qualcomm Inc.*, 3-11-cv-00719 (MDFL) (complaint filed July 20, 2011). The jury in the district court proceeding had found claim 18 not invalid and infringed. TI-1031, 5, 25-26. Qualcomm moved for judgment as a matter of law (JMOL) for invalidity of claim 18 in view of DeMaw based on their expert witness's testimony about DeMaw's circuit operation. *Id.*, 6, 11, 25-26; TI-1039. In response, ParkerVision argued that the expert witness "failed to establish that DeMaw satisfies the 'generating' limitation of claim 18." TI-1040, 17 (claim 18 requires "performing a plurality of charting 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" (emphasis added)). Instead, ParkerVision argued, the expert showed that the down-converted signals were generated before the impedance devices at the output of the switches. *Id.* ParkerVision also argued that the expert witness's simulation of the DeMaw circuit was flawed because the expert used his own values for the circuit components. TI-1040, 17-18.

The court denied Qualcomm's motion for JMOL of invalidity. TI-1031, 6. Qualcomm appealed the district court's denial of JMOL to the Federal Circuit. *ParkerVision, Inc. v. Qualcomm Inc.*, 3-11-cv-00719, dkt 553 (July 15, 2014).

The Federal Circuit *reversed the district court's denial* of Qualcomm's JMOL on invalidity, finding “*no basis on which a reasonable jury could reject the evidence that DeMaw anticipates claim 18 of the '342 patent.*” TI-1031, 28-29. The Federal Circuit found that “even though Figure 6.7 of DeMaw does not expressly state that the capacitors engage in ‘charging and discharging’ to generate a baseband signal,” the expert testimony “regarding the DeMaw circuit established that charging and discharging is ‘implicit’ in that reference.” *Id.*, 28. 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.*

By asserting claim 18 of the ’342 patent against Petitioner, Patent Owner is taking the position that this claim is not invalid.

In agreement with the findings of the Federal Circuit, this Petition details how claim 18 is unpatentable in view of DeMaw. As discussed below, DeMaw’s circuit shown in FIG. 6.7 corresponds to FIG. 16H of the ’342 patent, and the simulations of DeMaw’s circuit show that the operations include charging and discharging to generate a baseband signal across impedance devices, as claimed in claim 18. The analysis addresses how the down-converted signals are generated

across the impedance devices, and is based on a model using component values that conform to the circuit's intended operational parameters. TI-1003, 60, 67-68, 69-117.

III. THE CHALLENGED CLAIMS ARE UNPATENTABLE

A. GROUND 1A – DeMaw Renders Claims 18-21, 23 Obvious

1. DeMaw Theory of Operation

DeMaw is a book titled, “Practical RF Design Manual,” and was first published in 1982 by Prentice-Hall. DeMaw describes a dual field effect transistor (FET) balanced mixer, shown in FIG. 6.7, which can be part of a superheterodyne receiver. TI-1003, 69. This circuit takes two inputs, V_{RF} and V_{LO} , and generates the output V_{IF} . In the explanation of the circuit operation that follows, V_{LO} can be considered a periodic waveform with fundamental frequency f_{LO} ⁵(or it can be a squared-up version of a sinusoid), and V_{RF} can be a modulated sinusoidal carrier of frequency f_{RF} . TI-1003, 37, 69. See also §III.A.2, *infra*, for the selection of the signals for the simulation.

⁵ DeMaw, 3.A.1.

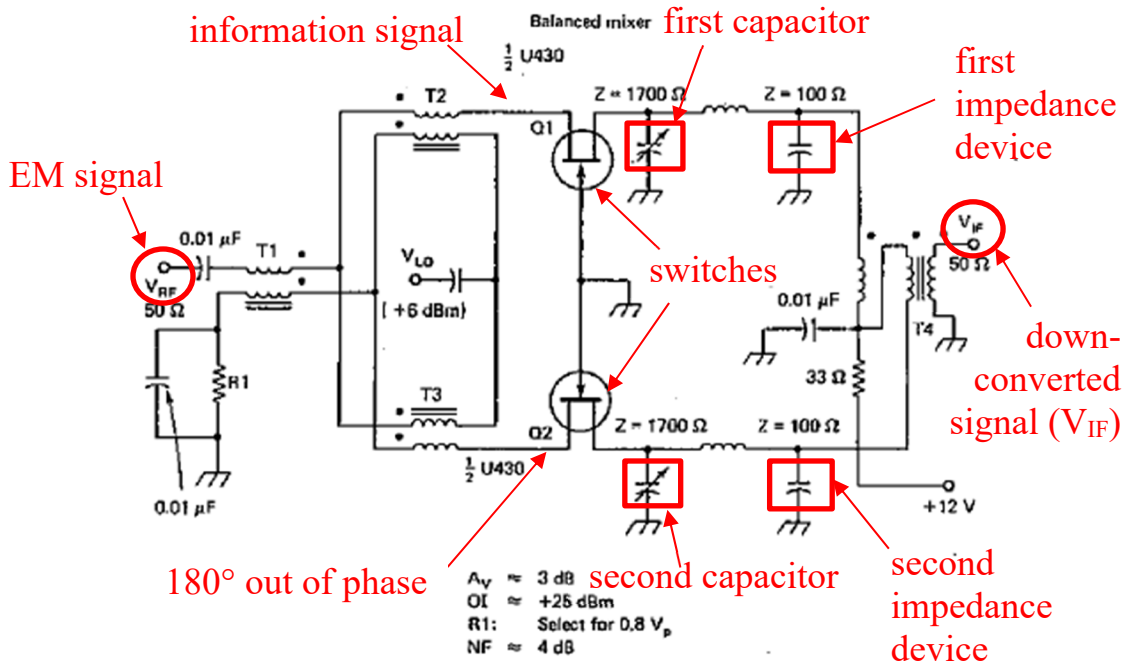


Figure 6.7 Dual FET balanced mixer using a Siliconix U430 device.

DeMaw, FIG. 6.7 (annotated)

The three transformers T1, T2, and T3 are arranged in a configuration known as a 180° hybrid coupler. TI-1003, 69. This achieves three goals:

- 1) The quiescent operating point of Q1 and Q2 can be set via the resistor R1.
- 2) The RF signal V_{RF} is electrically coupled in-phase at the source of Q1 and 180° out-of-phase at the source of Q2.
- 3) The local oscillator signal V_{LO} is electrically coupled in-phase at the sources of both Q1 and Q2. TI-1003, 69.

The circuit formed by Q1, the upper capacitor-inductor-capacitor (C-L-C) network and one winding of transformer T4, is identical to the circuit formed by Q2, the lower C-L-C network and another winding of transformer T4. Thus, the

right-half of this circuit starting at Q1 and Q2 form a differential circuit, symmetric along the horizontal midpoint axis.

DeMaw explains that the value of R1 is selected “to give a V_{GS} of 0.8 the pinchoff voltage.” DeMaw, 196. This bias point, along with the large swing of V_{LO} (DeMaw, 194-195), causes the signals at the sources of Q1 and Q2 to traverse a highly nonlinear region of its V_{GS} - I_{DS} transfer characteristic. TI-1003, 71. This nonlinearity causes intermodulation between the components of the signals at the sources of Q1 and Q2. TI-1003, 71. As discussed above, the source of Q1 is driven by a signal which contains components proportional to $+V_{LO}$ and $+V_{RF}$, while the source of Q2 is driven by a signal which contains components proportional to $+V_{LO}$ and $-V_{RF}$. TI-1003, 71. The aforementioned nonlinearity in the transistor V_{GS} - I_{DS} transfer characteristic results in the drain currents of Q1 and Q2 containing signals proportional to the products V_{LO}^2 , V_{RF}^2 , and $V_{LO}V_{RF}$. TI-1003, 71. Using trigonometric identities, it can be computed that the drain currents of Q1 and Q2 contain many different frequency components. TI-1003, 71. The C-L-C networks which follow the drains of Q1 and Q2 are known as π -matching networks, and they are bandpass impedance matching networks that are tuned to the frequency $|f_{LO}-f_{RF}|$, which is called the intermediate frequency f_{IF} . TI-1003, 71. Therefore, the following statements about the voltages across the second impedance devices can be made:

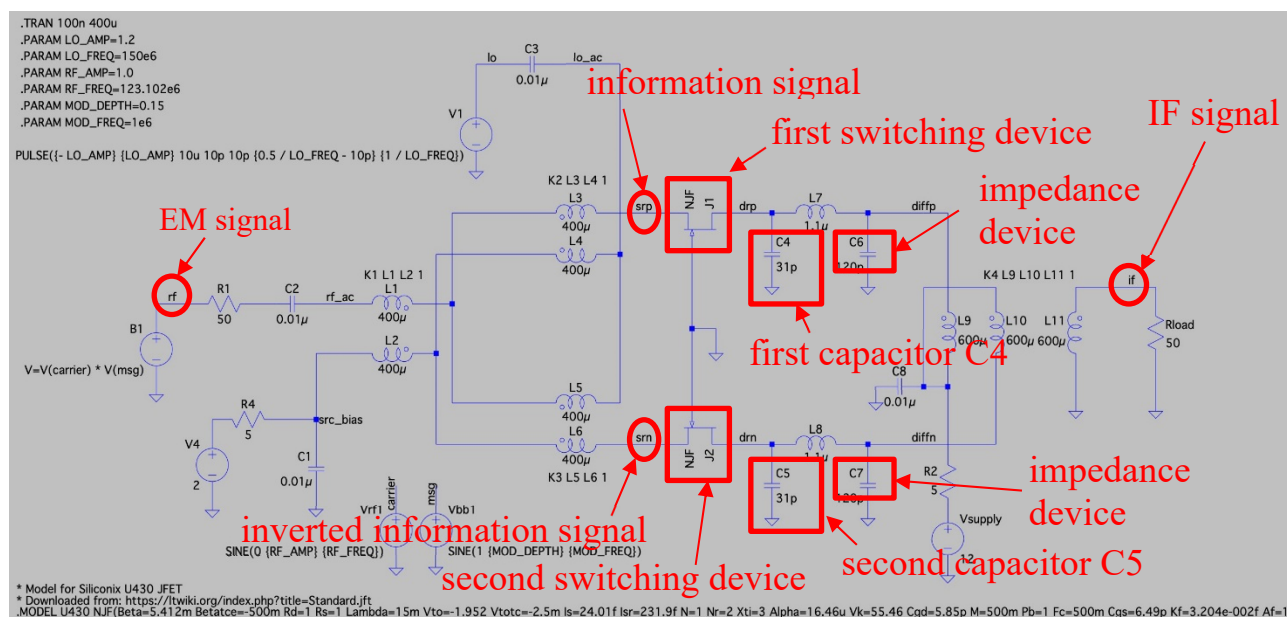
- 1) The signal components whose frequencies are far from f_{IF} are rejected by the π -match network.
 - 2) The signal components at frequency f_{IF} are 180 out of phase.
 - 3) There are signal components at frequencies $2f_{LO}$ $2f_{RF}$, etc., that are in-phase.
- TI-1003, 71.

The transformer T4 is wound in a manner that the differential signal across the second impedance devices is transferred to its output terminal, while the common mode signal is suppressed. TI-1003, 71. Thus, the output of this circuit V_{IF} is dominated by the signal proportional to $V_{LO}V_{RF}$, which is the goal of the mixer. TI-1003, 71.

2. DeMaw Simulation

The analysis of DeMaw includes a simulation of the above circuit using LTspice XVII (17.2.4), a SPICE-compatible simulator. The original SPICE simulator was developed at the University of California at Berkeley in the 1970s, and was acknowledged as an IEEE Milestone in 2011. LTspice is a version promulgated by Analog Devices, Inc. As shown here, and as discussed by Dr. Galton, the simulation parameters align with DeMaw, and the results of the simulation of DeMaw are consistent with expected results.

The DeMaw circuit shown in FIG. 6.7 was modeled as shown in DEMAW-SIM-FIG. 1:



DEMAW-SIM-FIG. 1, DeMaw Balanced Mixer

Simulation data was generated using LTspice, then imported into Python for plotting using numpy and matplotlib libraries, which are well-known and well-regarded among those practicing in this technology area. TI-1003, 72-74.

Waveform data is not modified or post-processed in any way unless noted in the plots. TI-1003, 72-74.

For the DeMaw circuit simulations, parameter values that were described in DeMaw were used, with minor adjustments. TI-1003, 72-74. For example, the exact parameters of the transformers were not provided; only the physical description was given. *Id.* Reasonable values were calculated based on the circuit operating conditions. *Id.* In particular, the transformer coupling ratio is ideal, however using a realistic coupling ratio would not affect the presented results. *Id.*

A SPICE model was found for the exact JFET specified in the book, the Siliconix U430. *Id.*

The DeMaw circuit was simulated for 400 microseconds. TI-1003, 72-74. The LO signal used is a square wave of 150MHz and amplitude of 1.2V peak. TI-1003, 72-74. While using a square wave for the LO of this circuit is unconventional, it does not alter the circuit behavior in any way relevant to the presented results. *Id.* It was chosen to be able to clearly see the transition between switch ON and OFF states. *Id.*

3. Analysis

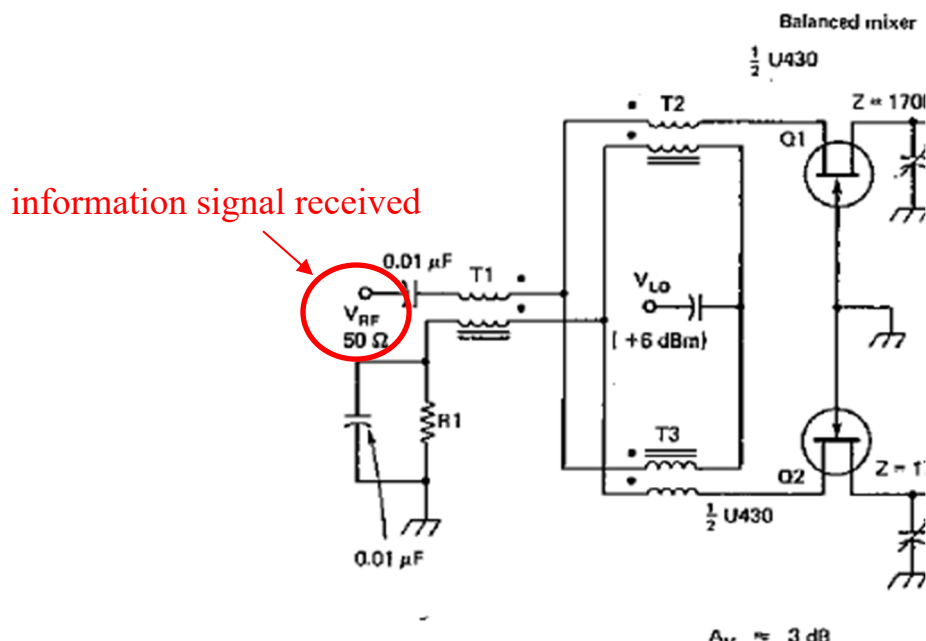
The analysis of DeMaw below takes into consideration each of the claim constructions.

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

As explained above, and as will be shown through simulation, DeMaw describes a balanced mixer that operates to down-convert an electromagnetic signal (an RF signal) into an intermediate frequency (IF) signal. DeMaw, 196-197; TI-1003, 95, *see also id.*, 33-35. The method steps are described below using the FIG. 6.7 circuit provided by DeMaw. Simulation waveforms are also provided for each method step (as appropriate) as additional evidence that the method steps are performed by the circuit. TI-1003, 95.

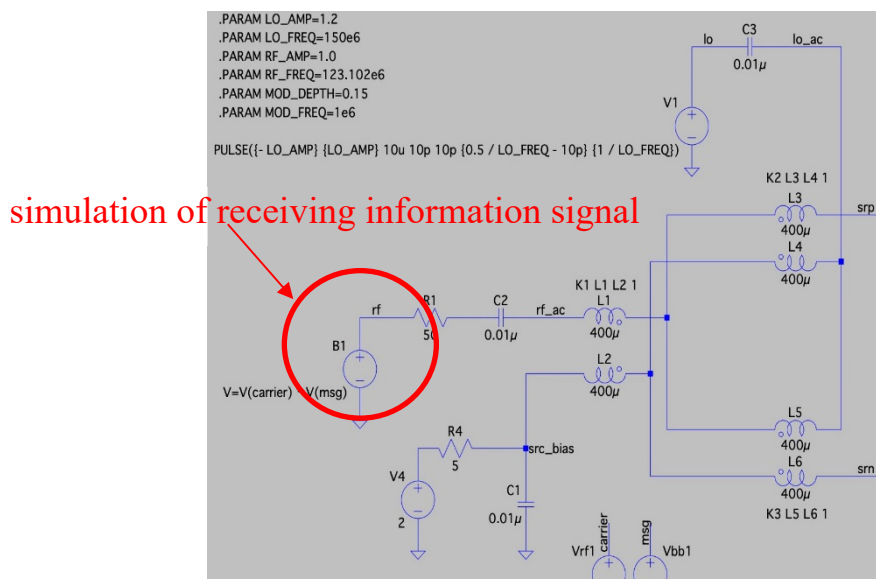
18.1 (1) receiving an information signal;

DeMaw describes receiving an information signal. Specifically, DeMaw's balanced mixer receives an RF information signal into a single-ended input, as shown in FIG. 6.7 below:



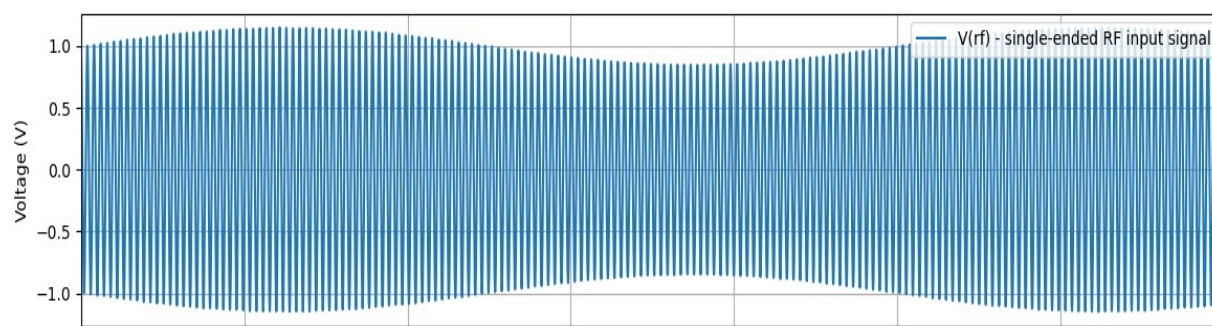
DeMaw, FIG. 6.7 (partial, annotated)

In simulation, V_{RF} is modeled as a sine-wave carrier of 123.102MHz, amplitude 1.0V. TI-1003, 96. This carrier is amplitude-modulated 15% by a 1.0MHz pure sinusoid. *Id.* The carrier frequency was chosen to ensure that there are no perfect ratios which would create simulation artifacts in this noiseless simulation. TI-1003, 96. In all realistic scenarios, any amount of noise would have the same effect. This source is shown in DEMAW-SIM-FIG. 1:



DEMAW-SIM-FIG. 1 (partial, annotated)

The single-ended RF input signal is illustrated by DEMAW-SIM-FIG. 2:

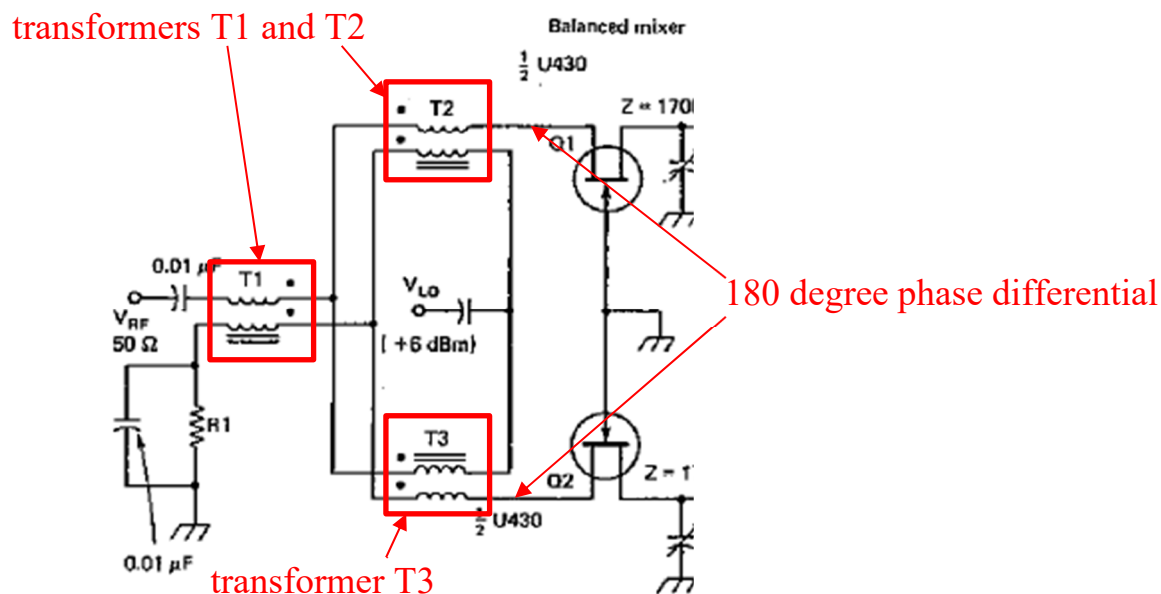


DEMAW-SIM-FIG. 2 (RF Input Signal) TI-1003, 96.

18.2 (2) inverting the information signal to generate an inverted information signal;

DeMaw's circuit uses the trio of transformers T1, T2, and T3 operating as a 180° hybrid coupler described above, to create "a 180° phase differential between

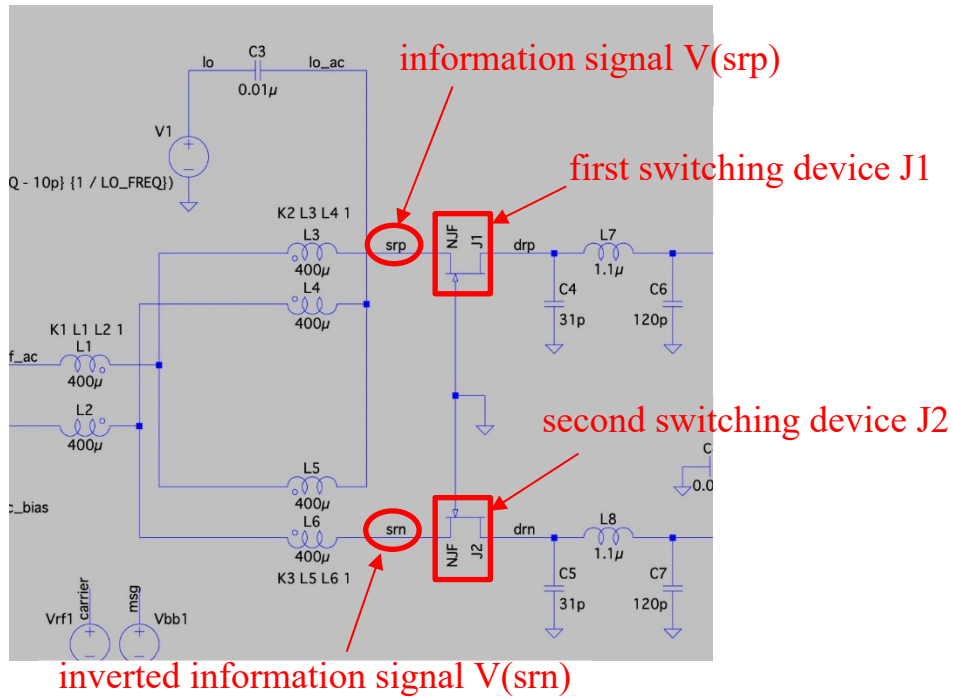
the sources of switching devices Q1 and Q2.” (DeMaw, 196-197). The inverted information signal is shown below:



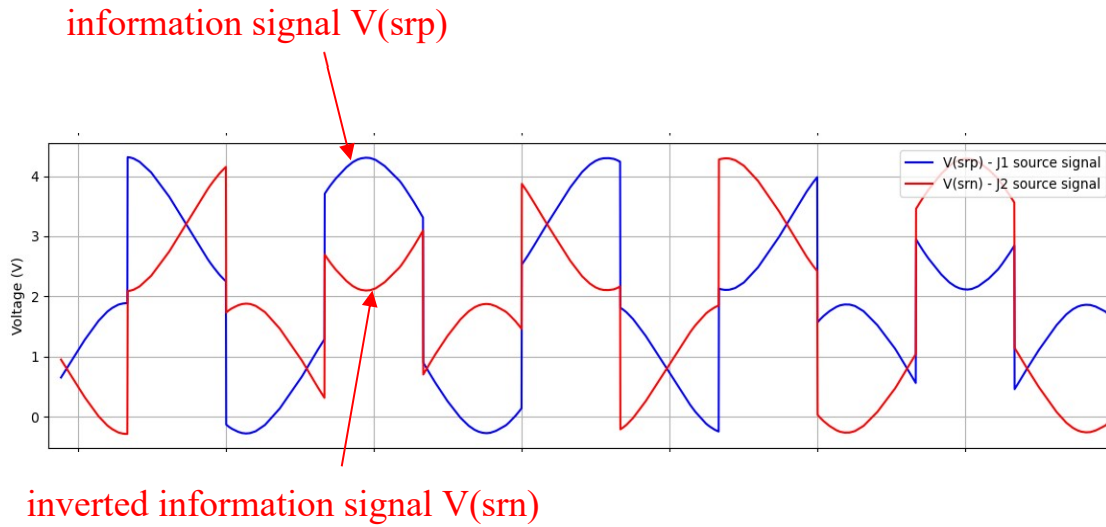
DeMaw, FIG. 6.7 (partial, annotated)

A POSITA would have recognized that the creation of a differential signal with a 180° offset includes inverting the information signal. TI-1003, 97-98. Q1 and Q2 are switching devices according to any claim construction because each includes an independent control input (the source of the transistor), and they can complete or break a circuit.

The simulation is used to plot the voltages at nodes *srp* and *srn*, which are connected to the sources of the first and second switching devices J1 and J2, respectively. These are labeled in DEMAW-SIM-FIG. 1:



DEMAW-SIM-FIG. 1, (partial, annotated)



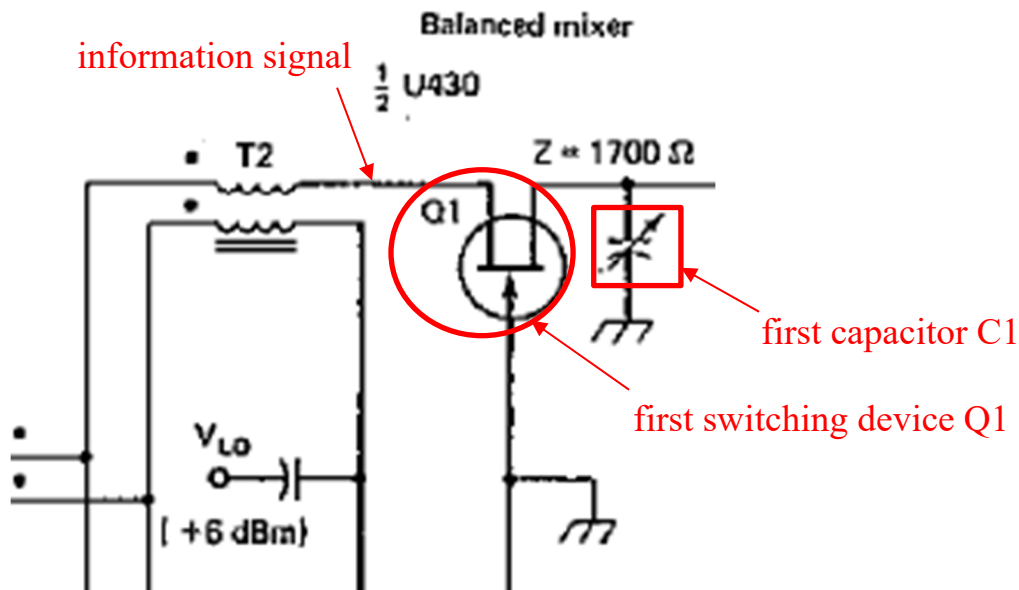
DEMAW-SIM-FIG. 4, inverted information signal

DEMAW-SIM-FIG. 4 shows the information signal *V(srp)* (in blue) sampled at the source of the first switching device *J1*. Likewise, DEMAW-SIM-FIG. 4 shows the

inverted information signal $V(srn)$ (in red) sampled at the source of the second switching device J2. This plot demonstrates the hybrid coupler operation, whereby the information signal and inverted information signals are superimposed upon an in-phase LO signal, appearing at the first and second switching devices, respectively.

18.3 (3) electrically coupling the information signal to a first capacitor and the inverted information signal to a second capacitor;

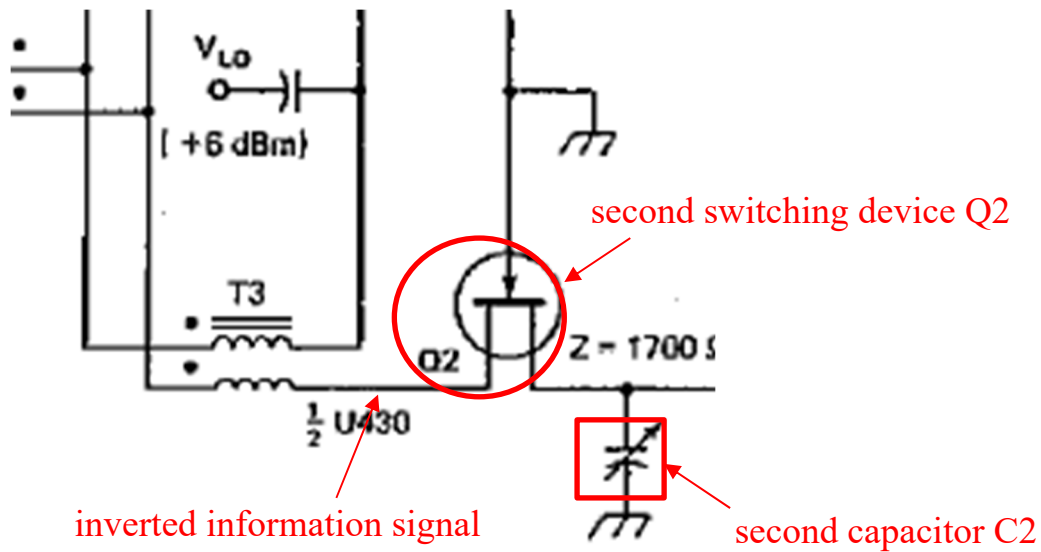
DeMaw teaches element 18.3. During operation, when switching device Q1 is closed, the information signal is electrically connected (or coupled) to the first capacitor.



DeMaw, FIG. 6.7 (partial, annotated)

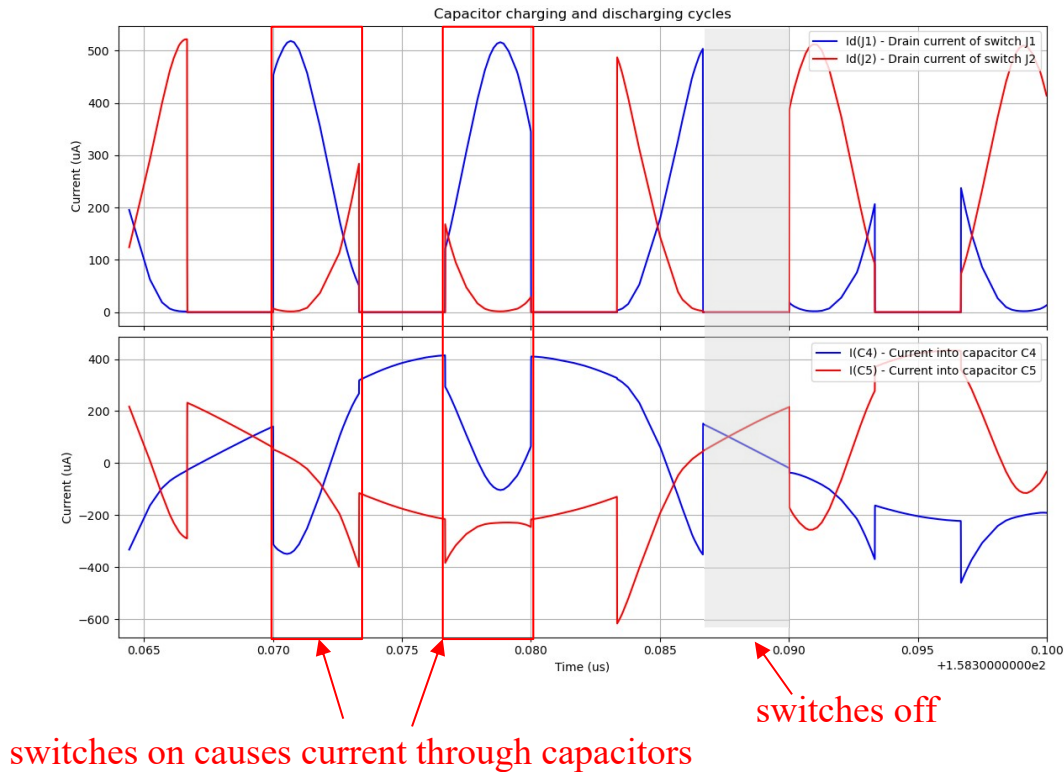
The first switching device Q1 “electrically couples” the information signal to the first capacitor C1 (under any construction) when it is turned on (switching device is closed) because it electrically connects (directly) the information signal to the first capacitor. TI-1003, 99-100. More precisely, the current that flows through the drain of Q1 is proportional to the voltage at the source of Q1, which contains the information signal. This current causes charge to accumulate in capacitor C1. TI-1003, 100. Therefore, the amount of charge present on Q1 (and therefore the voltage across it) is a function of the information signal present at the other side of the switch.

By invoking the differential symmetry of this portion of the circuit that was explained in the previous section, the preceding paragraph can be used to demonstrate that this circuit electrically couples the inverted information signal to a second capacitor. That is, the second switching device Q2 “electrically couples” the inverted information signal (under any construction) to the second capacitor C2 when it is turned on because it electrically connects (directly) the inverted information signal to the second capacitor. TI-1003, 101.



DeMaw, FIG. 6.7 (partial, annotated)

DEMAW-SIM-FIG. 4, below, shows the drain current through the first and second switching devices J1 and J2, indicating that the switches electrically couple the information signal and inverted information signal to the first (C4) and second (C5) capacitors, respectively:



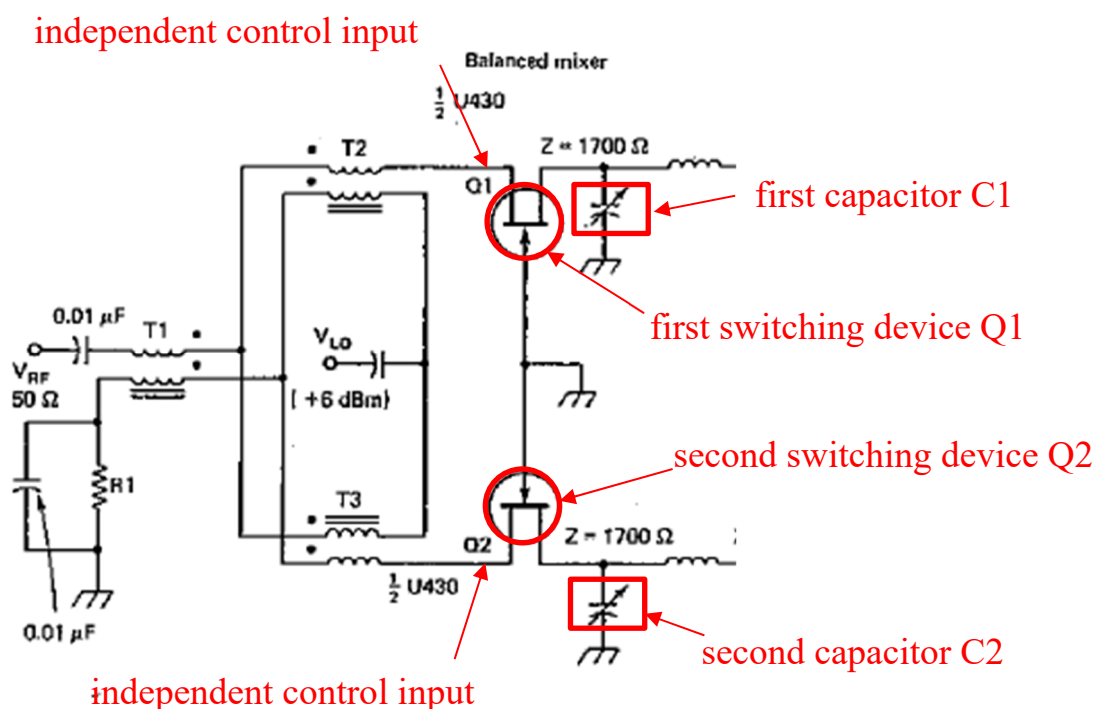
DEMAW-SIM-FIG. 4 (annotated)

DEMAW-SIM-FIG. 4 shows drain current of the first switching device J1 becomes non-zero when the switching device J1 is on, indicated by the red boxes surrounding portions of the waveform. The current in the first capacitor C4 reacts when the first switching device is turned on, visibly influenced by the current through J1. TI-1003, 101-103.

Likewise, DEMAW-SIM-FIG. 4 shows identical electrical coupling between the inverted information signal to the second capacitor C5 by turning on the second switching device J2. TI-1003, 104.

18.4 (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

The DeMaw circuit includes a first switching device Q1 that controls the charging and discharging of the first capacitor C1 based on a control signal. The first switching device Q1 includes an independent control input (transistor source) and is controlled by a control signal based on V_{LO} , as shown in FIG. 6.7:

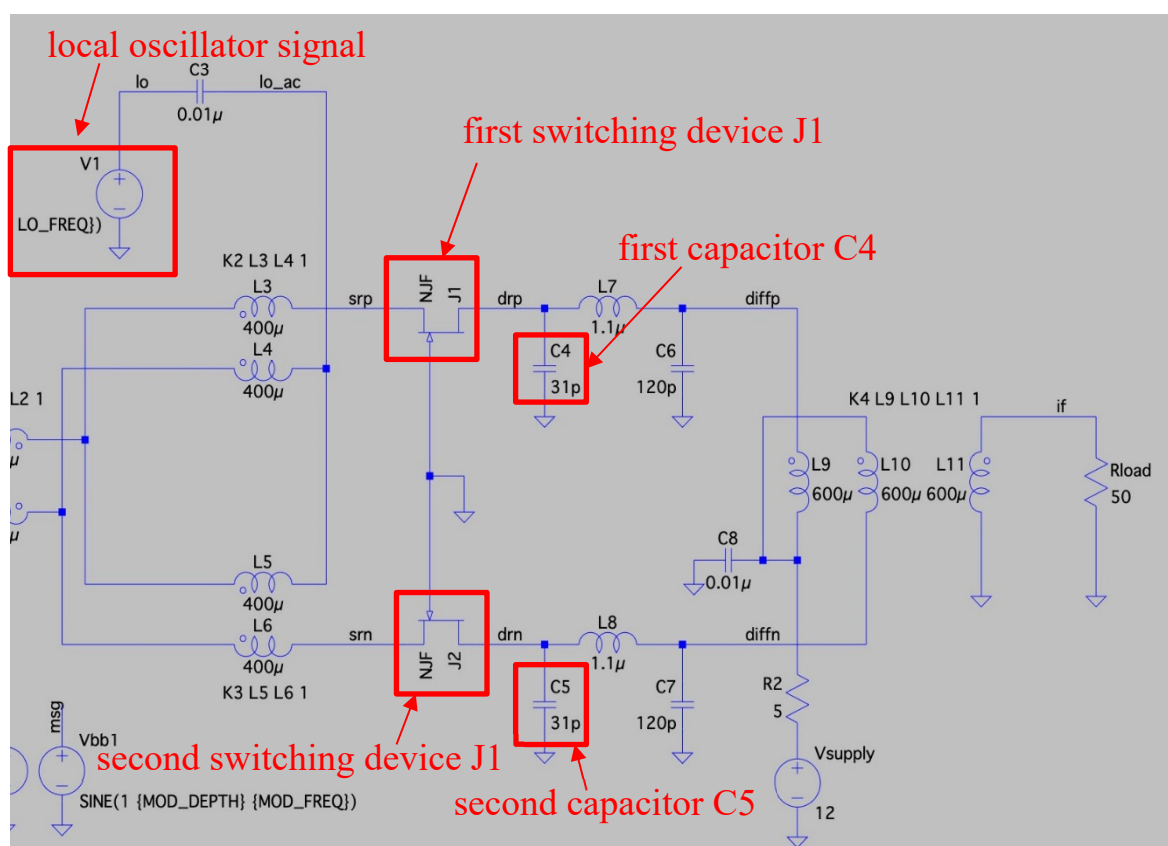


DeMaw, FIG. 6.7 (partial, annotated)

Likewise, the DeMaw circuit includes a second switching device Q2 that controls the charging and discharging of the second capacitor C2 based on a control signal. The second switching device Q2 has an independent control input (transistor source), and is controlled by a control signal based on V_{LO} , as shown in FIG. 6.7,

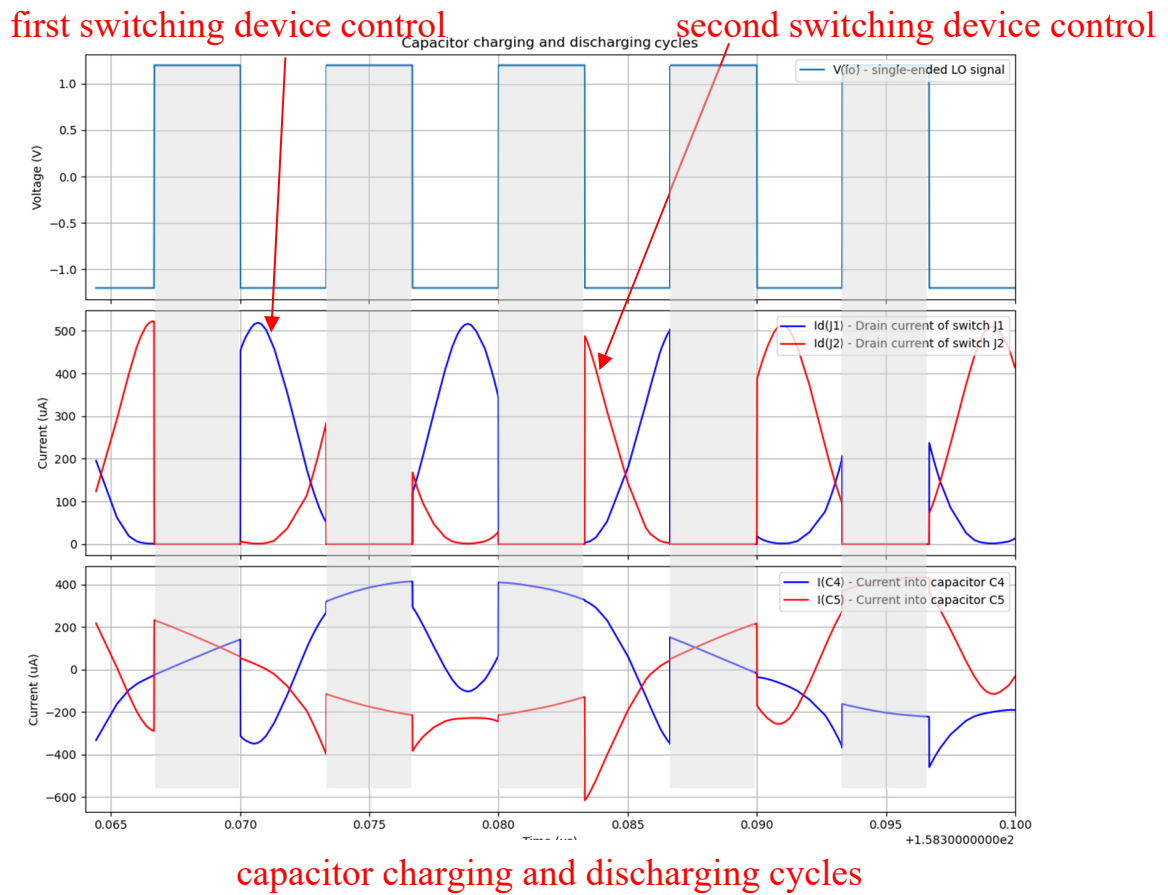
above. TI-1003, 105-109. The charging and discharging occurs in “cycles” due to the periodic nature of the control signals, satisfying TI’s construction. These cycles are illustrated by simulation.

DEMAW-SIM-FIG. 1 shows the simulation setup to demonstrate this claim. Specifically, it will be shown that the LO signal controls the periodic charging and discharging of first and second capacitors C4 and C5, respectively, through switching devices J1 and J2. In this simulation, the LO signal is a 150MHz square wave with 1.2V peak amplitude. TI-1003, 107.



DEMAW-SIM-FIG. 1, (partial, annotated)

DEMAW-SIM-FIG. 1 shows the controlling of the charging and discharging cycles of the first and second capacitor by the first and second switching devices, respectively, where the open and closing times of the switches are aligned with the low periods of the LO signal. The grayed-out regions are aligned to intervals of time where the LO signal is high, and during these intervals no current flows through switches J1 or J2. TI-1003, 108.



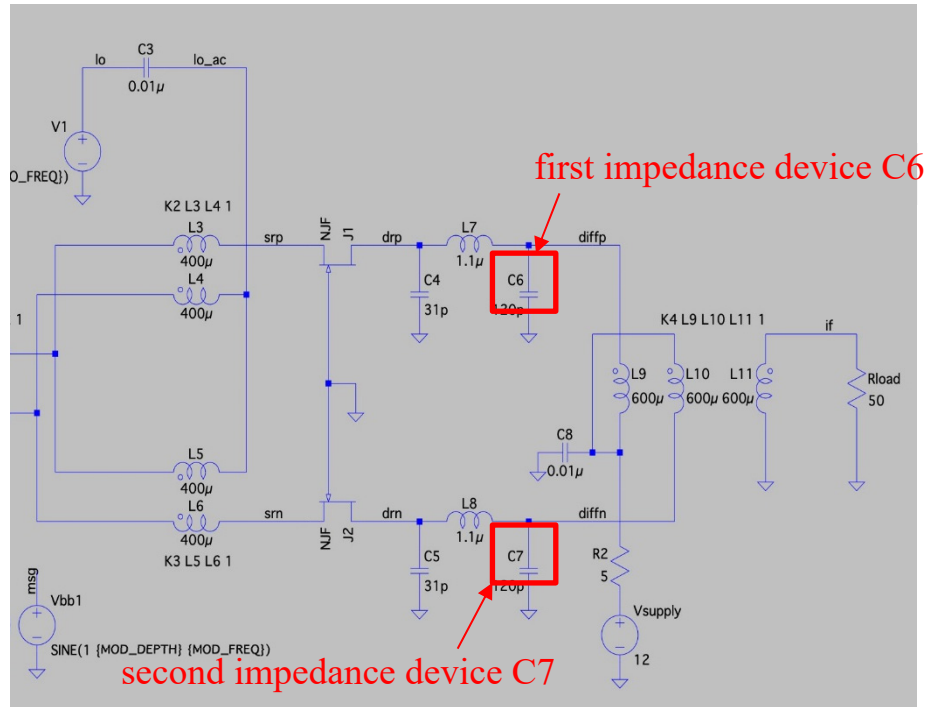
DEMAW-SIM-FIG. 4 (annotated)

Because switch J1 and J2 are controlled by local oscillator V_{LO} , the charging and discharging occurs in cycles. These cycles occur sequentially, and thus,

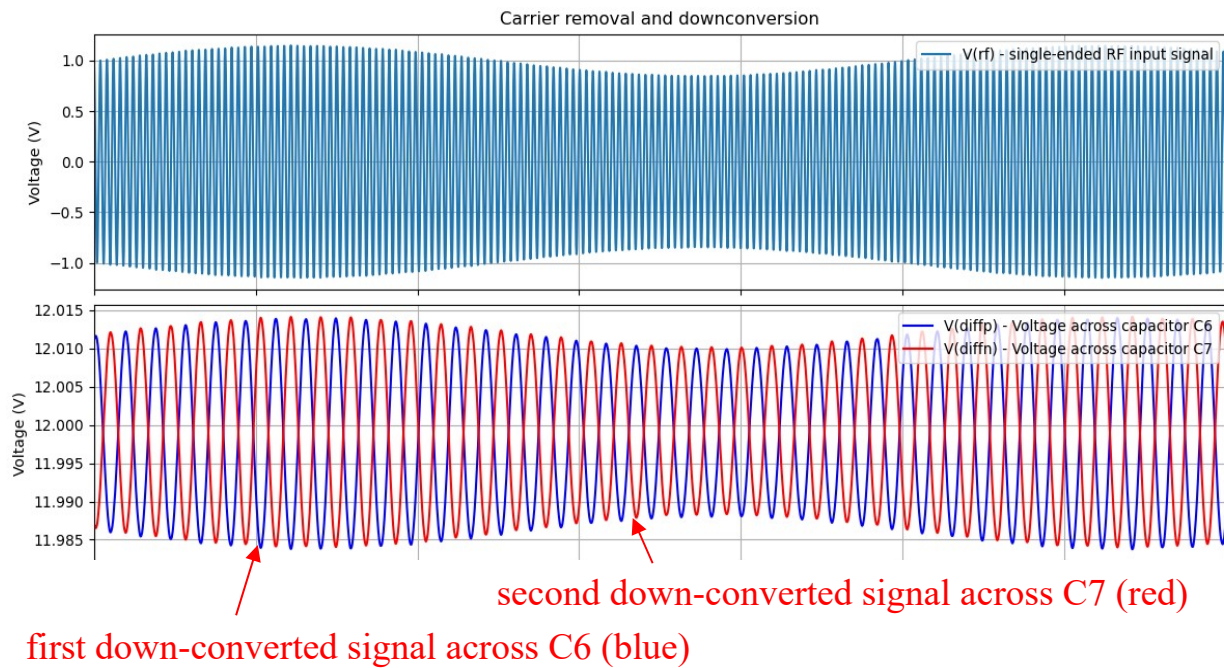
DeMaw's operation would satisfy TI's constructions. DeMaw's circuit structure already satisfies ParkerVision's constructions because "a first switching device [J1] controls a charging/discharging cycle of a first capacitor [C4]" and "a second switching device [J2] controls a charging/discharging cycle of a second capacitor [C5]." TI-1010, 6; TI-1003, 105-109.

18.5 (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;

As discussed above, the DeMaw circuit performs a plurality of charging and discharging cycles of the first and second capacitors. TI-1003, 108-112. These first and second capacitors are coupled to first and second impedance devices capacitors C6 and C7, respectively. Capacitors C6 and C7 are impedance devices because they exhibit an impedance. TI-1003, 110. DEMAW-SIM-FIG. 1 shows this, as well:



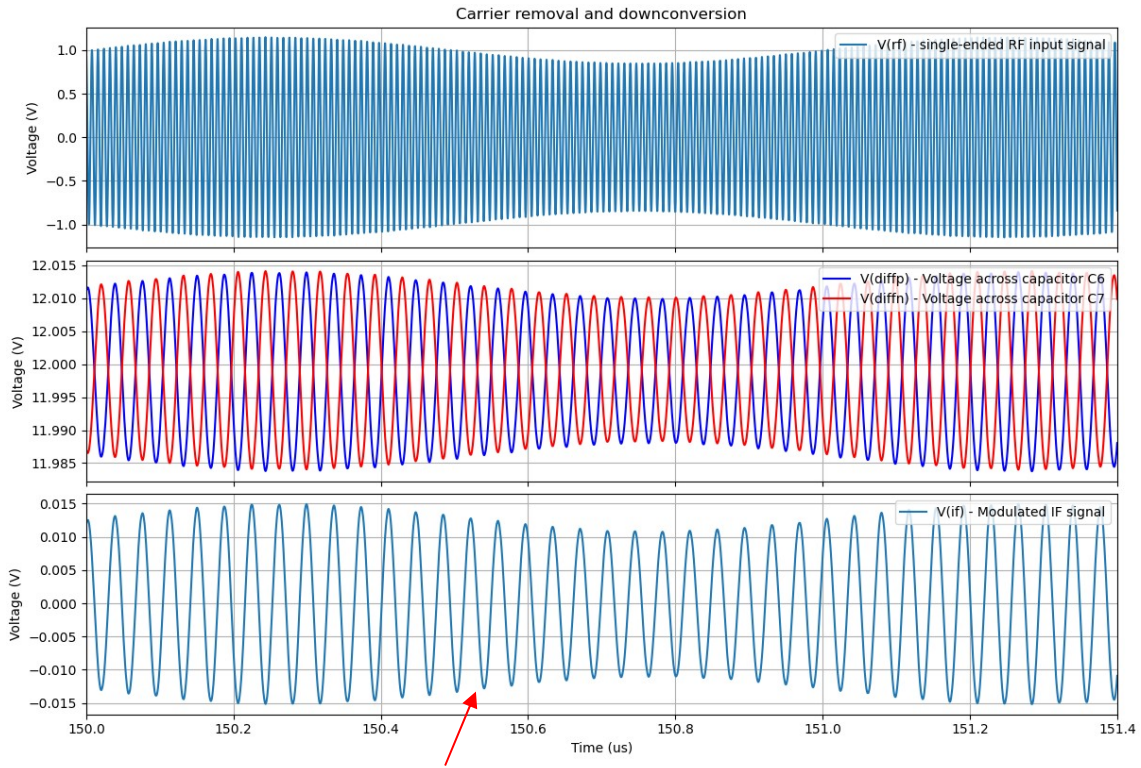
DEMAW-SIM-FIG. 1, (partial, annotated)



DEMAW-SIM-FIG. 5 (annotated)

As shown in DEMAW-SIM-FIG. 5 a first down-converted signal $V(\text{diffp})$ is generated across first capacitor C6 due to performing a plurality of charging and discharging cycles of the first capacitor C4. TI-1003, 111. Likewise, a second down-converted signal $V(\text{diffn})$ is generated across second capacitor C7 due to performing a plurality of charging and discharging cycles of the second capacitor C5. *Id.* As can be seen by DEMAW-SIM-FIG. 5, the first down-converted signal $V(\text{diffp})$ and the second down-converted signal $V(\text{diffn})$ are at a lower frequency than the RF input signal, as they have been translated to f_{IF} . *Id.*

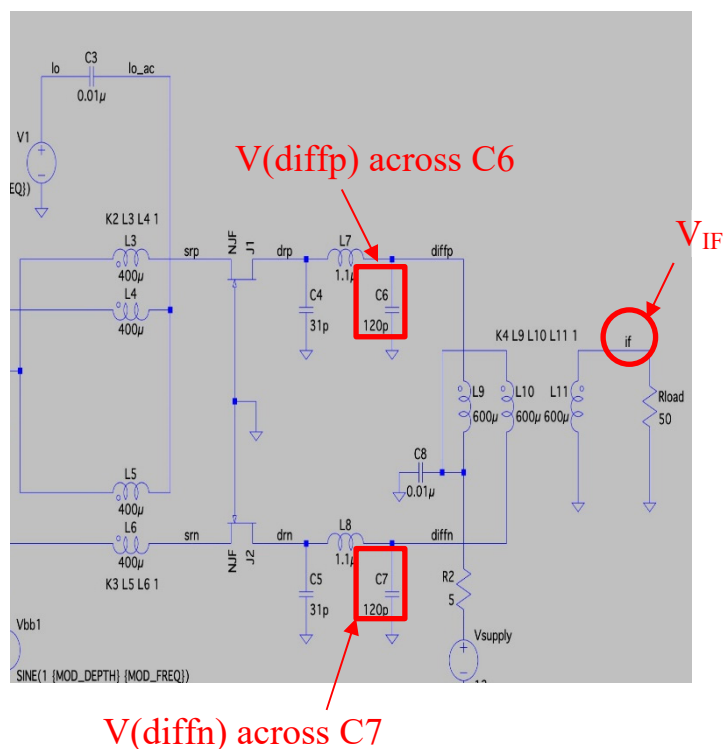
DeMaw also combines the first and second down-converted signals into a single IF signal $V(\text{if})$, via the differential to single-ended transformer. TI-1003, 112. DEMAW-SIM-FIG. 6 shows this, as well. *Id.*



V(if) – combined down-converted signal

DEMAW-SIM-FIG. 6

The sampling points for $V(diffp)$, $V(diffn)$, and $V(if)$ is shown in DEMAW-SIM-FIG. 1:



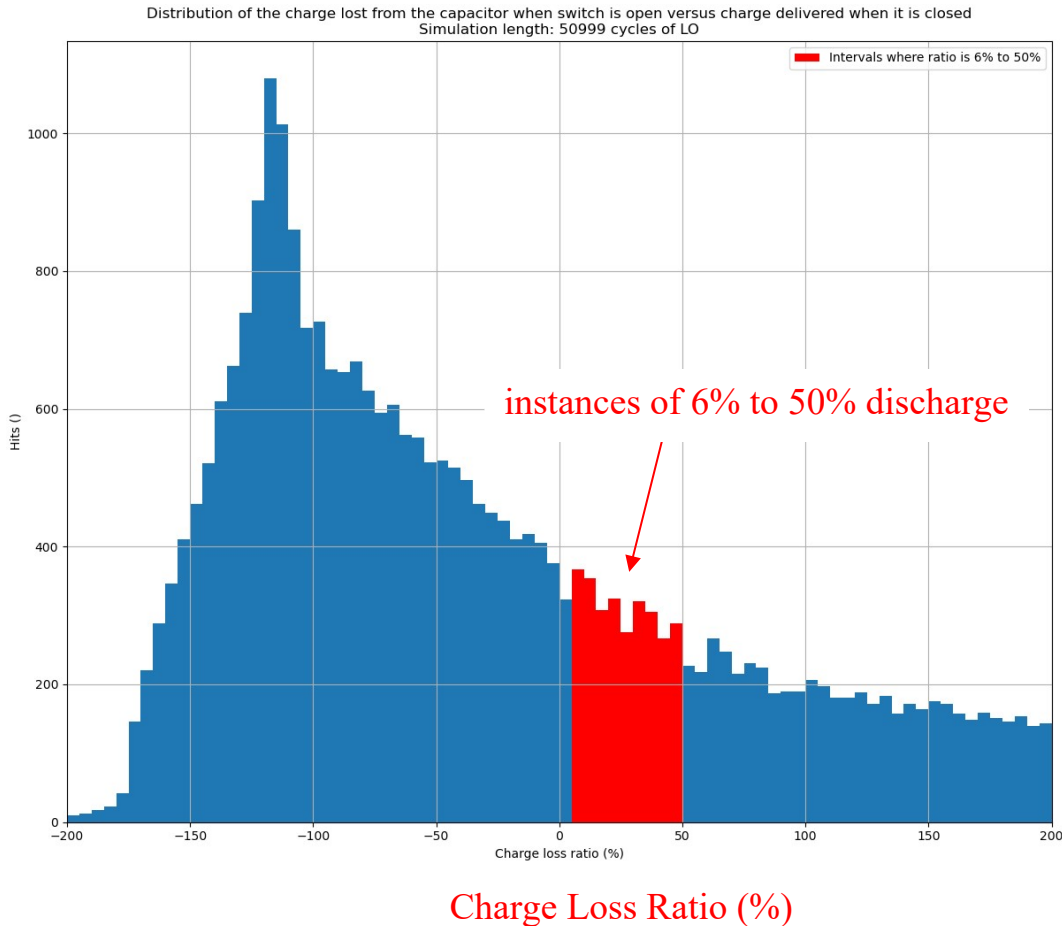
DEMAW-SIM-FIG. 1, (partial, annotated); TI-1003, 112.

18.6 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.

As was already explained for claim element 18.3, the currents through switches J_1 and J_2 when they are closed are functions of their source voltages, $V(srp)$ and $V(srn)$, respectively. These voltages contain the information signal and inverted information signal, respectively. Therefore, the charges delivered to first and second capacitors C_4 and C_5 while switches J_1 and J_2 are closed are functions of the information signal and inverted information signal, respectively. TI-1003, 113, 100-104.

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.

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.



DEMAW-SIM-FIG. 7 (annotated)

It is evident that the DeMaw circuit generates a continuum of these ratios, densely spanning the 6% to 50% range specified in the claim.

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.

From DEMAW-SIM-FIG. 7, the histogram shows a continuum of occurrences of discharging ratio that includes the claim's 10-25% discharging rate. TI-1003, 114-115.

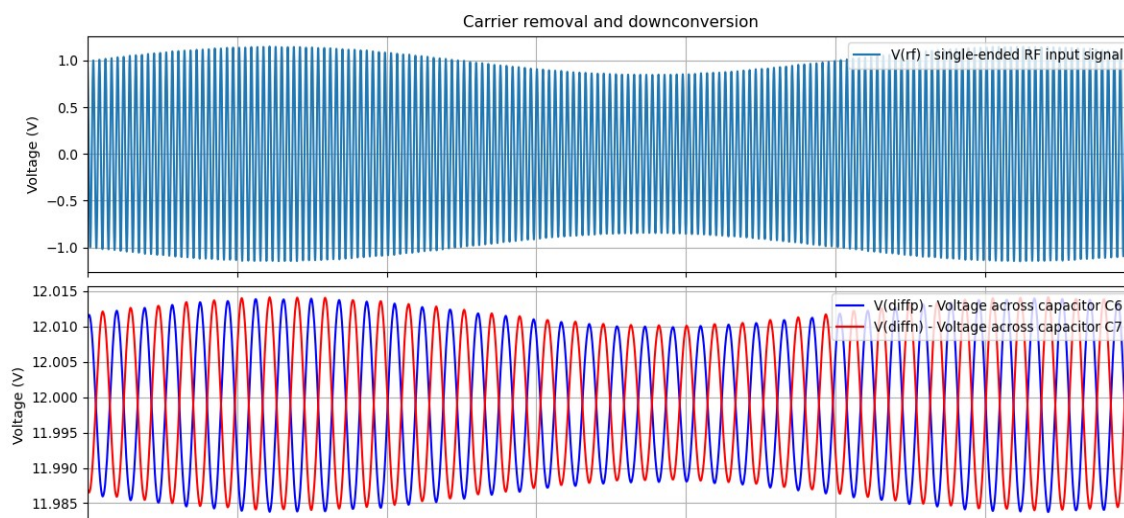
21. The method of claim 18, wherein the first capacitor discharges between fifteen percent to thirty percent of the total charge stored therein during a period of time that the first switching device is open, and wherein the second capacitor discharges between fifteen percent to thirty percent of the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

From DEMAW-SIM-FIG. 7, the histogram shows a continuum of occurrences of discharging ratio that includes the claim's 15-30% discharging rate. TI-1003, 114, 116.

23. The method of claim 18, further comprising the step of removing a carrier signal from the first and second down-converted information signals.

DeMaw teaches claim 23. Specifically, DeMaw's balanced mixer receives an RF signal input that has a carrier frequency, and outputs an intermediate frequency, where the carrier frequency is removed. TI-1003, 117. Fundamentally, a carrier frequency is absent from the intermediate frequency signal after down-conversion: the IF signal contains lower frequencies. *Id.*

This removal of the carrier frequency from each of the first and second down-converted signals is also illustrated by DEMAW-SIM-FIG. 5. TI-1003, 117.



DEMAW-SIM-FIG. 5 (annotated)

As shown in the above plot, the RF input signal is a 123.102MHz AM-modulated carrier. The differential signal across the first and second impedance devices is a 26.898MHz IF signal with the same modulation as the input. It is shown that the input 123.102MHz carrier has been removed. TI-1003, 117. It is understood by a POSITA that to fully recover the baseband signal, this mixer would be part of the first down-conversion stage in a superheterodyne receiver. Nevertheless, the claim is satisfied in that a carrier was removed from the first and second down-converted information signals. *Id.*

B. GROUND 1B – the DeMaw-Tayloe Combination Renders Claims 22-23 Obvious

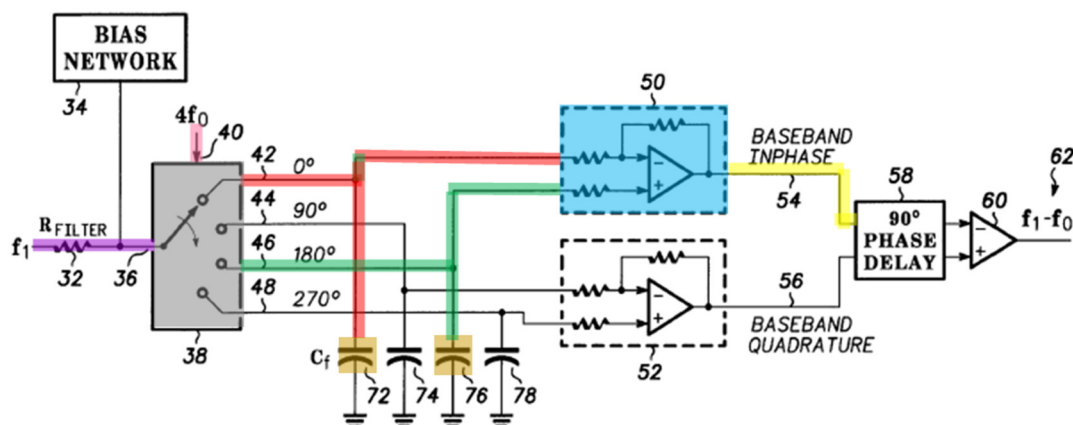
1. Tayloe

Tayloe is directed to a direct conversion receiver (also referred to as a “product detector”) “for converting a signal to baseband.” TI-1004, Abstract,

1:51-52. Tayloe's direct-conversion circuitry operates to down-convert a radio frequency (RF) or intermediate frequency (IF) signal to baseband. *See, e.g.*, Tayloe, 2:13-14 ("In operation, an RF or IF signal f_1 is received at resistor 32."); see also TI-1001, 1:60-63 (describing that "the invention down-converts the electromagnetic signal to a demodulated baseband information signal"). Tayloe explains that its direct conversion receiver includes a switch that "serves to sample an RF waveform four times per period at the RF frequency." *Id.*, Abstract. "The samples are integrated over time to produce an average voltage at 0 degrees, 90 degrees, 180 degrees and 270 degrees" *Id.* "The average voltage at 0 degrees is the baseband in-phase signal, and the average voltage at 90 degrees is the baseband quadrature signal." *Id.*

Tayloe describes that, "to increase gain, the 0 degree average can be differentially summed with the 180 degree average to form the baseband in-phase signal." *Id.* Tayloe achieves this differential summation using a summing amplifier that amplifies the difference between 0 and 180 degree baseband signals. *Id.*, 2:56-67. Tayloe states that "[d]irect conversion receivers are desirable in part because they convert signals of interest directly to baseband (or near zero hertz) from a radio frequency (RF) or an intermediate frequency (IF)." *Id.* at 1:10–13.

Tayloe discloses an example of a direct conversion receiver in FIG. 3:



30 **FIG. 3**

TI-1004, Figure 3 (annotated).

The receiver receives an RF input signal f_1 and down-converts this signal to produce signal of interest 62. *Id.*, 2:13-67 (“[A]n RF ... signal f_1 [purple] is received at resistor 32.... After passing through resistor 32, the input signal is received by commutating switch 38 [gray] at input 36. Commutating switch 38 switches input 36 to outputs 42 [red], 44, 46 [green], and 48.... As commutating switch 38 cycles through the four outputs, capacitors 72-78 charge to voltage values substantially equal to the average value of the input signal during their respective quadrants.... The outputs of commutating switch 38 are input to summing amplifiers 50 [light blue] and 52. Summing amplifier 50 [light blue] differentially sums the 0 degree output [42 (red)] and the 180 degree output [46 (green)], thereby producing baseband in-phase signal 54 [yellow]. The resulting

signals are then summed by summing amplifier 60 to produce the signal of interest 62”); TI-1003, 76-79.

Taylor's receiver has four frequency down-conversion circuits, the outputs of which are labeled “0°,” “90°,” “180°,” and “270°,” each including a switch and a storage element (*e.g.*, capacitor). TI-1003, 79.

The 0° frequency down-conversion module provides a 0° down-converted signal 42 (red). TI-1004, 2:13-18 (“[A]n RF ... signal f_1 [purple] is received at resistor 32.... After passing through resistor 32, the input signal is received by commutating switch 38 [gray] at input 36. Commutating switch 38 switches input 36 to output 42 [red]....”), 2:46-48 (“Output 42 [red] represents the average value of the [RF] input signal [f_1 (purple)] during the first quarter wave of the period [of the input signal f_1], and is termed the 0 degree output.”); TI-1003, 80.

The 0° frequency down-conversion module includes a switch 38 (gray), which periodically couples the input signal f_1 (purple) to the output 42. TI-1004, 2:16-26. Moreover, the rate at which the switch 38 periodically couples the input signal f_1 at input 36 (purple) to the output 42 is determined by a control signal ($4f_0$, pink) supplied to a control input 40 of the switch. *Id.*, 2:18-20 (“The rate at which commutating switch 38 operates is controlled by a signal present at control input 40.”); TI-1003, 81. At the start of each successive cycle of the $4f_0$ control signal, the commutating switch changes which of its four outputs, 42, 44,

46, and 48, is connected to its input 36. As there are four outputs, this means that each of the commutating switch outputs, 42, 44, 46, and 48, is successively connected to input 36 at a frequency of f_0 Hz for a duration of $1/(4f_0)$ seconds.

The 0° frequency down-conversion module also includes a capacitor 72 (brown). “During the time that [the] switch 38 connects input 36 [receiving the RF input signal f_1] to output 42, charge builds up on capacitor 72.” TI-1004, 2:32-33. The voltage across the capacitor 72 corresponding to this charge constitutes the average value of the RF input signal f_1 during first quarter of the period of the signal f_1 and is output from the 0 degree frequency down-conversion module as the 0° down-converted signal 42 (red). *Id.*, 2:46-48 (“Output 42 [red] represents the average value of the input signal during the first quarter wave of the period, and is termed the 0 degree output.”), 2:18-26; TI-1003, 82.

Similarly, the 180° frequency down-conversion module provides a 180° down-converted signal 46 (green). TI-1004, 2:13-18 (“After passing through resistor 32, the [RF] input signal [f_1] is received by commutating switch 38 [gray] at input 36. Commutating switch 38 switches input 36 to output[] ... 46 [green]....”), 2:50-53 (“Output 46 [green] represents the average value of the input signal [f_1 (purple)] during the third quarter wave of the period [of the input signal f_1], and is termed the 180 degree output.”), 2:18-26; TI-1003, 83.

The 180° frequency down-conversion module includes the switch 38 (gray) and a capacitor 76 (brown). When the switch 38 couples the input signal f_1 (purple) to the output 46, charge builds up on the capacitor 76 (brown). TI-1004, 2:18-38 (“During the time that commutating switch 38 connects input 36 to output 42, charge builds up on capacitor 72.... The same principle holds true for capacitor[] 76 ... when commutating switch 38 connects input 36 to output[] 46....”).) Thus, voltage across the capacitor 76 constitutes the average values of the RF input signal f_1 during the third quarter of the period of the signal f_1 and is output from the 180° frequency down-conversion module as the 180° down-converted signal 46 (green). *Id.*, 2:50-53 (“Output 46 [green] represents the average value of the input signal during the third quarter wave of the period, and is termed the 180 degree output.”), 2:18-26; TI-1003, 84.

The 90° and 270° frequency down-conversion modules each have a similar operation and structure. TI-1004, 2:35-39 (“Likewise, during the time commutating switch 38 connects input 36 to output 44, charge builds up on capacitor 74. The same principle holds true for capacitors 76 and 78 when commutating switch 38 connects input 36 to outputs 46 and 48 respectively.”); TI-1003, 85. “As commutating switch 38 cycles through the four outputs, capacitors 72–78 charge to voltage values substantially equal to the average value of the input signal during their respective quadrants” TI-1004, 2:39-43. “Output 44 represents

the average value of the input signal during the second quarter wave of the period, and is termed the 90 degree output.” *Id.*, 2:48-50. “Output 48 represents the average value of the input signal during the fourth quarter wave of the period, and is termed the 270 degree output.” *Id.*, 2:53-55.

2. The DeMaw and Tayloe Combination

DeMaw describes a receiver that uses a balanced mixer for communications circuits that down-converts a radio frequency (RF) signal into an intermediate frequency (IF) signal. *See, e.g.*, DeMaw, 197; TI-1003, 118, 69-74. The DeMaw balanced mixer circuit does not down-convert the IF signal to baseband. In the combination, the IF signal of DeMaw is further down-converted to baseband by a removing the carrier signal from the first and second down-converted (IF) signals, in a manner similar to that described by Tayloe. TI-1003, 118-123.

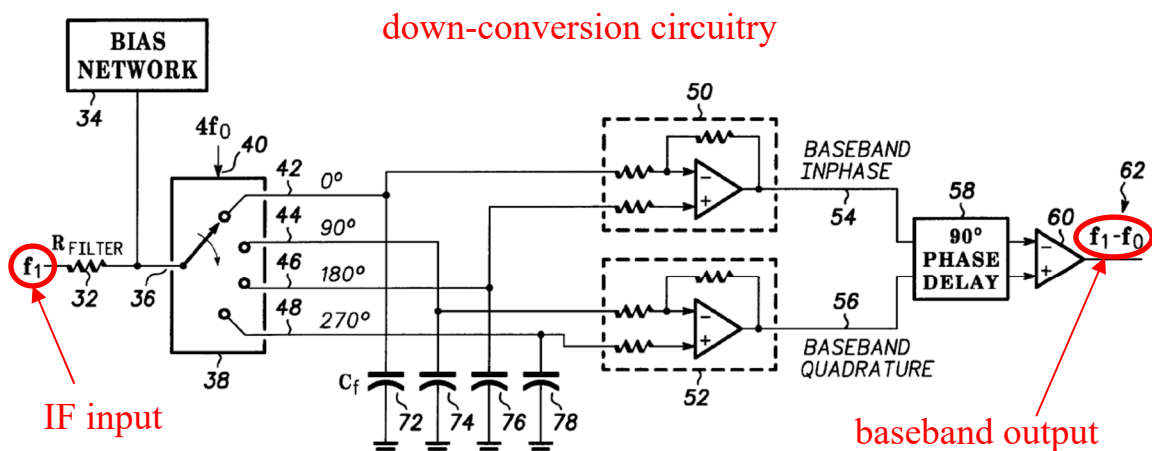
3. Motivation to Combine DeMaw with Tayloe

As mentioned above, a POSITA would have understood that DeMaw’s balanced mixer produced first and second down-converted signals at an intermediate frequency (IF). DeMaw, FIG. 6.7 (outputting V_{IF}). A POSITA would have understood that further circuitry would have been required to obtain a baseband signal from the IF signal. TI-1003, 119, 71, 112. Therefore, a POSITA implementing DeMaw’s balanced mixer would have sought out down-conversion

circuitry to further down-convert the IF signal to baseband, like the circuitry in Tayloe. TI-1003, 119.

DeMaw's balanced mixer outputs a single-ended IF output produced by the combination of the first and second down-converted signals. TI-1003, 120. A POSITA implementing DeMaw, therefore, would have sought a second down-converting circuit that was already configured to receive a single-ended IF input to produce a baseband signal, which is what Tayloe describes. Tayloe's down-conversion circuitry "is applicable anywhere signals need to be converted to baseband, such as in the last stage of a superheterodyne receiver," like that of DeMaw. Tayloe, 6:2-5; TI-1003, 120.

The circuitry of Tayloe is reproduced below, which shows a single ended IF input and a baseband output:



Tayloe, FIG. 3 (annotated)

Tayloe describes that, in operation, “an RF or **IF** signal f_1 is received at resistor 32.” Tayloe, 2:13-14 (emphasis added). Tayloe also explains that “the carrier signal frequency is exactly equal to f_0 .” *Id.*, 3:50-52; *see also id.*, 1:9-21 (describing local oscillator signal f_0 and that the signal of interest $f_1 - f_0$ is produced at baseband). The output of Tayloe’s down-conversion circuitry is a baseband signal. *See, e.g.*, Tayloe, 1:9-21, 1:65-67, 2:2-3, 2:65-67, 3:54-59, 4:1-8. Therefore, a POSITA would have recognized that Tayloe provides a circuit that can receive the single-ended IF input from DeMaw and output a baseband signal. TI-1003, 121.

A POSITA would have found further motivation in the benefits that Tayloe touts for its down-conversion circuit. TI-1003, 122. For example, Tayloe’s down-conversion circuitry addresses signal losses that occur in other designs during the down-conversion process. Tayloe, 1:35-42 (describing conversion loss from 6-8 dB). By contrast, Tayloe’s circuitry exhibits less than 1 dB of conversion loss, which is a 6-7 dB improvement over other designs. Tayloe, 3:6-10. In addition, Tayloe’s design has the ability to be configured for different bandwidth detection scenarios, exhibiting narrowband detection characteristics. Tayloe, 3:21-27. These advantages, in addition to Tayloe’s single-ended input, provide multiple reasons for why a POSITA would be motivated to use Tayloe to down-convert DeMaw’s IF signal to baseband. TI-1003, 122.

A POSITA would have had a reasonable expectation of success using Tayloe's down-conversion circuitry to further down-convert DeMaw's IF signal to obtain a baseband signal. TI-1003, 123. Tayloe describes experimental results that describe possible implementations of its circuitry. *See, e.g.*, Tayloe, 5:30-60. The experimental results illustrate to a POSITA that Tayloe's down-conversion circuitry, indeed, works to obtain a baseband signal from signals like DeMaw's IF signal. TI-1003, 123.

4. Analysis

22. The method of claim 18, further comprising the step of amplifying the first and second down-converted information signals.

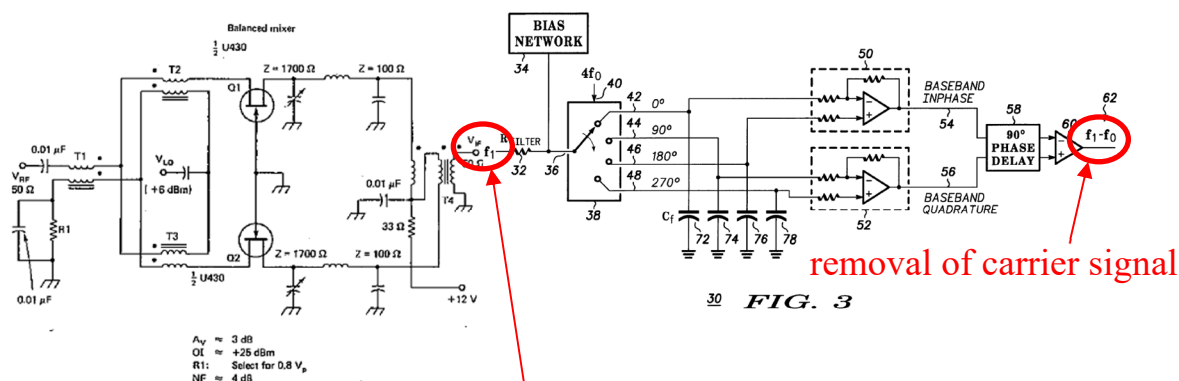
The DeMaw-Tayloe combination renders claim 22 obvious. In the combination, Tayloe amplifies the first and second down-converted information signals. TI-1003, 124. For example, in Tayloe, the output of each capacitor represents the average value of the input signal during respective quarter waves of the period. TI-1004, 2:46-55. The in-phase outputs are input to a summing amplifier that amplifies the difference between the 0 and 180 degree signals to produce a baseband in-phase signal likewise, the quadrature outputs are input to a summing amplifier that amplifies the difference between the 90 and 270 degree signals to create a baseband quadrature signal. TI-1004, 2:56-67; TI-1003, 124.

DeMaw outputs a singled ended IF signal that is representative of individual first and second down-converted signals. Tayloe receives the single-ended IF

signal as an input and further down-converts it to baseband in-phase and base-band quadrature signals. Tayloe then amplifies each of the baseband in-phase and baseband quadrature signals. The amplification of the baseband in-phase signal, for example, is mathematically equivalent to amplification of the first down-converted signal because the components to the right of the switches in the DeMaw circuit, the components in Tayloe, and amplification are all linear operations, so their order can be interchanged without changing the behavior of the circuit to the extent that linearity holds. Likewise, the amplification of the baseband quadrature signal, for example, is mathematically equivalent to the amplification of the second down-converted signal.

23. The method of claim 18, further comprising the step of removing a carrier signal from the first and second down-converted information signals.

The DeMaw-Tayloe combination renders claim 23 obvious. In the combination, Tayloe's direct-conversion circuitry removes the carrier frequency from the first and second down-converted (IF) signals from DeMaw's balanced mixer circuit. TI-1003, 126-127. The combined circuit is provided below in DeMaw, FIG. 6.7 and Tayloe, FIG. 3:



IF signal output from DeMaw input to Tayloe

DeMaw, FIG. 6.7 with Tayloe, FIG. 3 (annotated).

In operation, Tayloe receives the IF signal from DeMaw at resistor 38. TI-1004, 2:13-14. The commutating switch 38 is controlled by a control signal $4f_0$, where f_0 is the carrier frequency. TI-1004, 2:15-27. The commutating switch 38 “remains closed at each of the four outputs for substantially 90 degrees at the frequency of the input signal.” TI-1004, 2:27-32. During the time that commutating switch 38 is closed, charge builds up on a capacitor. TI-1004, 2:33-34. “Each of the capacitors functions as a separate integrator, each integrating a separate quarter wave of the input signal.” *Id.*, 2:41-45. The output of each capacitor represents the average value of the input signal during respective quarter waves of the period. TI-1004, 2:46-55; TI-1003, 126-127. The in-phase outputs are input to a summing amplifier that amplifies *the difference* between the 0 and 180 degree signals to produce a baseband in-phase signal likewise, the quadrature outputs are input to a summing amplifier that amplifies *the difference* between the 90 and 270 degree signals to

create a baseband quadrature signal. TI-1004, 2:56-67; TI-1003, 125-126. A

POSITA would have recognized that such summing of the difference between the inverted signals removes the carrier signal from the first and second down-converted information signals. TI-1003, 126-127.

C. GROUND 2 – Macnally Renders Claims 18-23 Obvious

1. Macnally

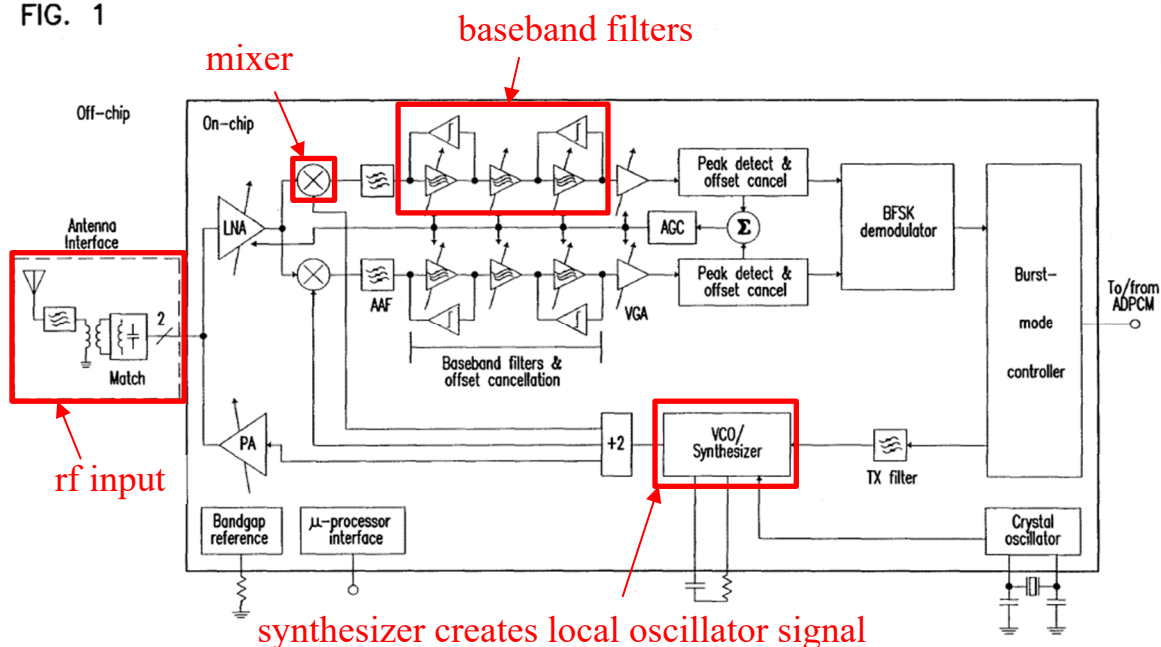
Macnally, titled A Single-Chip CMOS Direct-Conversion Transceiver, is an International Patent Publication No. 00/16492 published on March 23, 2000.

Macnally claims the benefit of priority to U.S. Provisional Patent Application No. 60/099,723, filed on September 10, 1998.

Macnally describes “[a] single-chip CMOS direct conversion transceiver [including] a receiver having a baseband filter, and a demodulator.” TI-1023, Abstract, 1:5-6. Macnally’s fully-integrated transceiver, shown in FIG. 1, “incorporates RF circuits 102, 104, synthesizer 106, baseband filters 108, demodulator 110, and digital signal processing.” TI-1023, 8:22-24; TI-1003, 87.

FIG. 1 is shown below:

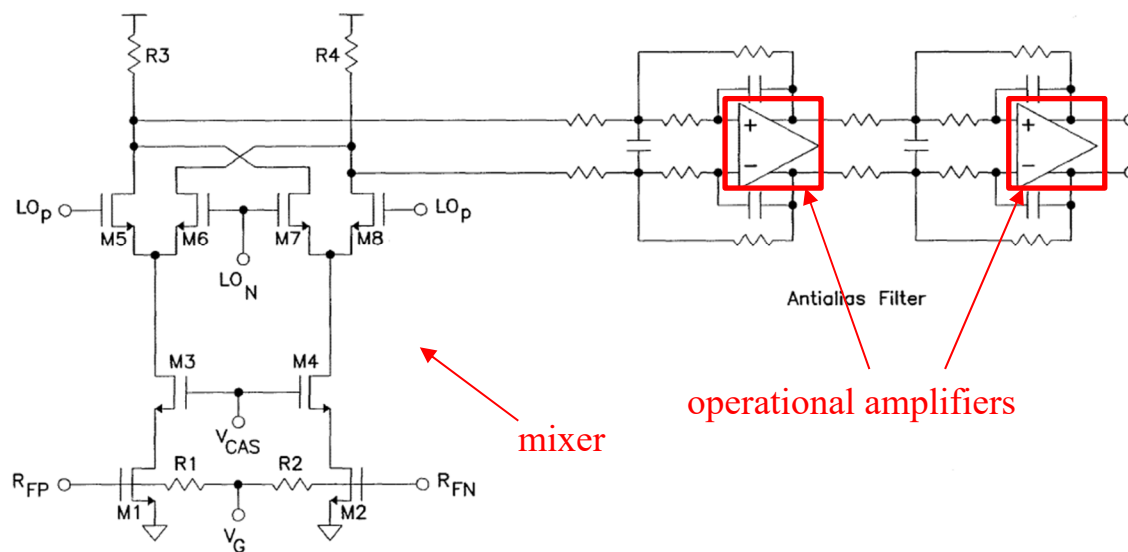
FIG. 1



TI-1023, FIG. 1 (annotated)

For the receiver, Macnally shows a “diagram of a mixer 142 and an antialiasing filter 144,” shown below. *Id.*, 12:15.

FIG. 3



TI-1023, FIG. 3 (annotated).

Macnally discloses “[t]he output of the mixer 142 is fed to a four-pole Butterworth antialiasing filter 144.” TI-1023, 7:7-16,17-29 (“Two biquad stages form the four-pole Butterworth anti-alias filter”), FIG. 1 (full diagram); TI-1003, 88

Noteworthy, Macnally’s system includes certain “off-chip” components, including “an ISM band filter 112, a balun 114, an RF matching network 116, an RC loop filter for the [phase-locked loop] PLL 118, a crystal resonator 120, and a resistor 122 for biasing.” TI-1023, 8:24-26; TI-1003, 89-90.

Dr. Galton has provided a discussion of the design of a fourth-order Butterworth filter implemented as a cascade of two of the differential Rauch biquad stages as shown in Macnally FIG. 3. *See, e.g.*, TI-1003, 40-55. Each antialiasing filter described in Macnally has this form, although Macnally does not specify the component values. *Id.* Instead, Macnally states that the filter is a Butterworth filter with a -3 dB bandwidth of 2.4 MHz, and a gain of 15.6 dB. *Id.* The purpose of this document is to analyze the circuit shown in Macnally FIG.3, and choose component values, i.e., values of R_1 , R_2 , R_3 , R_4 , C_1 , C_2 , C_3 , and C_4 , that cause the direct conversion receiver of FIG. 3 to achieve the same -3 dB bandwidth and gain as the corresponding filter presented in Macnally under the constraint that the component values are appropriate for integration in a 0.6 micron CMOS process (the IC technology in which the circuit presented in Macnally was implemented). TI-1003, [cite to galton’s analysis]. According to Dr. Galton’s

analysis, the DC gain of the filter is 15.6 dB and the filter's -3 dB frequency is 2.4 MHz, as intended. TI-1003, 55.

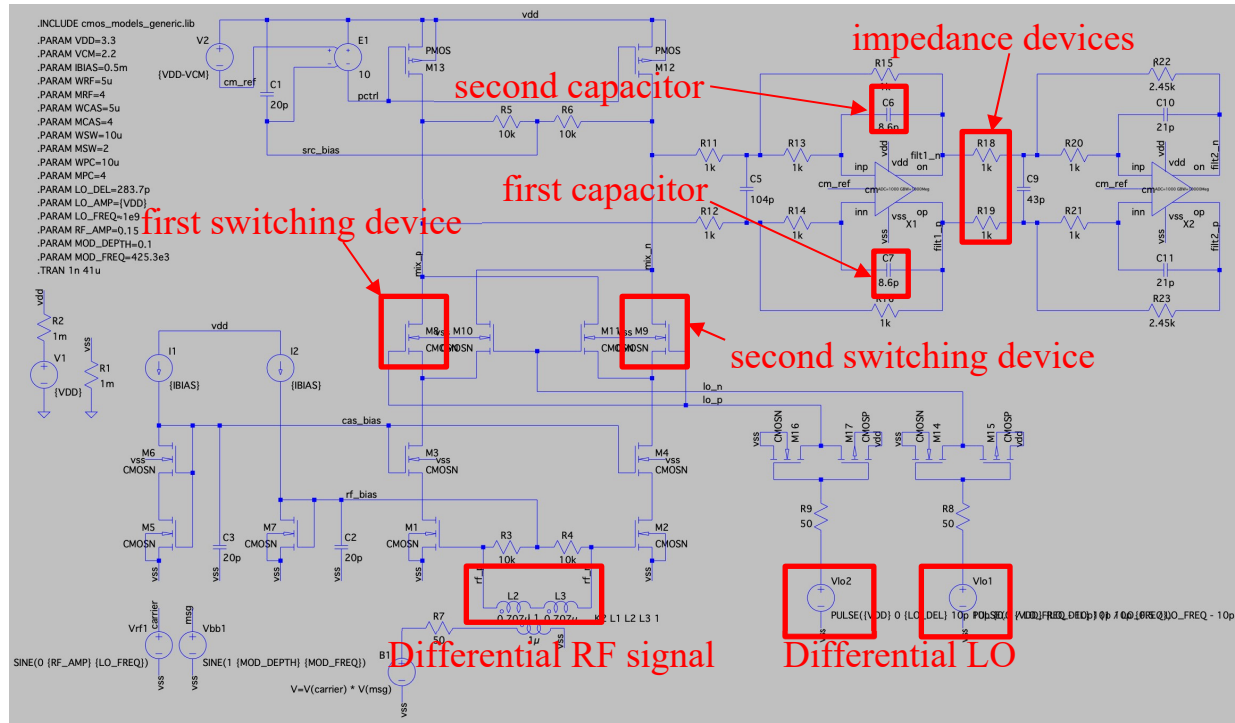
2. Macnally Simulation

The analysis of Macnally includes a simulation of the FIG. 3 circuit using LTspice XVII. As shown here, and as discussed by Dr. Galton, the simulation parameters align with Macnally, and the results of the simulation of Macnally are consistent with expected results. TI-1003, 92-94.

The circuit was built using the limited descriptive text available in the patent. TI-1003, 92-94. The SPICE technology library models a generic CMOS process with 0.6 μ m gate lengths, using a 3.3V supply voltage. *Id.* Dr. Galton made reasonable choices for device W/L ratios to make the circuit work as intended. *Id.* The circuit was not optimized in any way; however, further optimization (for noise and power, for example) would not materially affect the presented results. As no details of the biasing circuits were given for the mixer core, simple bias circuits and controllers were created. *Id.* These circuits rely on ideal elements such as voltage-controlled voltage sources. The usage of these devices is limited to non-critical areas that do not materially affect the presented results. Within the anti-aliasing filters, an op-amp macromodel was used that emulates an op-amp with 60dB of DC gain. *Id.* The choice of a macromodel accelerates simulation time, but does not affect the presented results. *Id.*

The entire Macnally simulation testbench is shown in MACNALLY-SIM-

FIG. 1, below:



MACNALLY-SIM-FIG. 1 (annotated)

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 10% by a 425.3 kHz sinusoidal message signal. TI-1003, 92-94. This simulation deviates from the original patent's intended modulation of BFSK. *Id.* Using AM over BFSK is simply to make the plots easier to interpret. *Id.* However, this choice does not alter the mixer's functionality or behavior in any way relevant to the presented results. *Id.*

3. Analysis

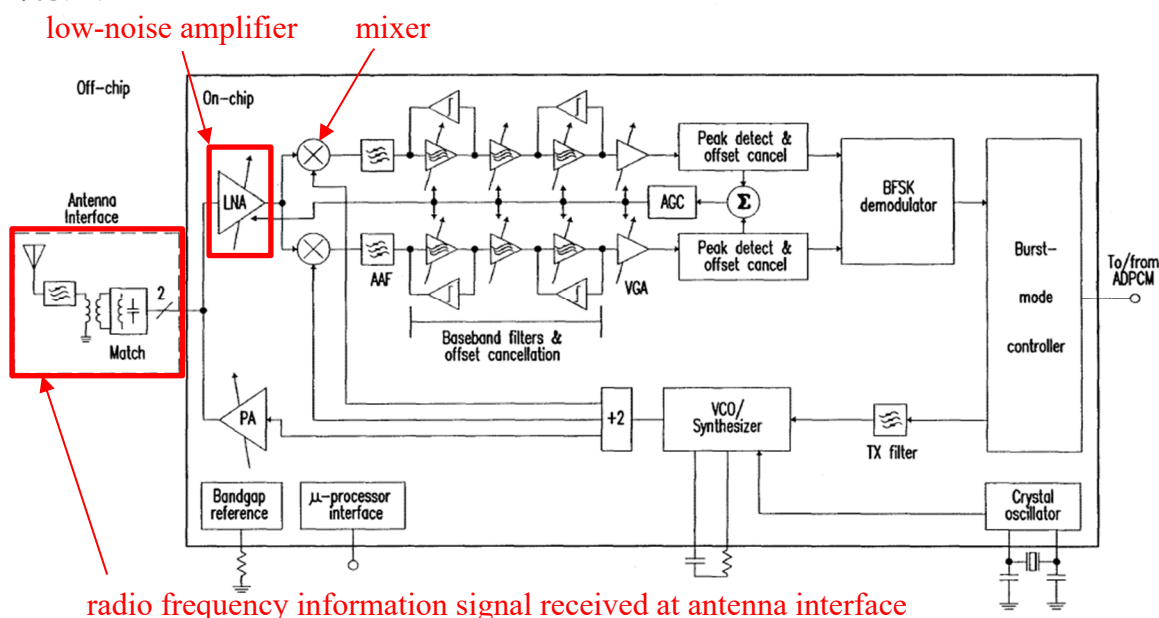
18.P A method for down-converting an electromagnetic signal, comprising the steps of

To the extent the preamble is limiting, Macnally describes a direct conversion transceiver circuit that when operated performs a set of steps, including down-converting an RF signal to baseband. *See, e.g.*, TI-1023, 8:18-24 (describing the direct-conversion transceiver with RF circuits and baseband filters), Abstract (describing a direct conversion transceiver), 1:5-6 (“This invention relates in general to communication systems, and more particularly to a single-chip CMOS direct-conversion transceiver.”), 2:19-25 (describing a single-chip CMOS direct-conversion transceiver that includes a receiver having a baseband filter); TI-1003, 128. A POSITA would have understood that a direct-conversion transceiver includes circuitry that when operated performs down-conversion of an electromagnetic signal into a baseband signal. TI-1003, 128.

18.1 (1) receiving an information signal;

Macnally teaches receiving an information signal (a radio frequency (RF) electromagnetic signal) at an antenna interface of the direct-conversion receiver. *See, e.g.*, TI-1023, 10:20-24, FIG. 1; TI-1003, 129-130. In operation, an RF information signal is received by Macnally’s antenna interface, as illustrated in FIG. 1, reproduced below:

FIG. 1



TI-1023, FIG. 1 (annotated)

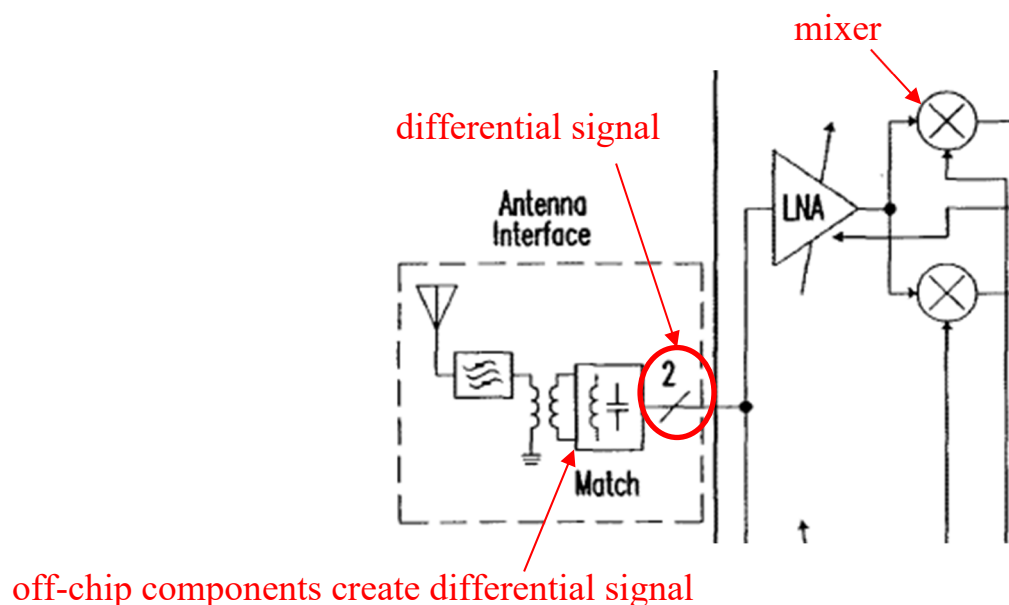
As explained by Macnally, the direct-conversion transceiver is “attached to the filter/antenna port of a radio transceiver.” TI-1023, 10:22-24. In addition, Macnally explains that radio transceivers “usually require” a “Low Noise Amplifier or (LNA) for clear reception.” *Id.*, 10:25-26.

A POSITA reading Macnally would have understood that the direct-conversion transceiver, in operation, received an RF information signal at the antenna. TI-1003, 130.

18.2 (2) inverting the information signal to generate an inverted information signal;

Macnally teaches inverting the information signal to generate an inverted information signal. TI-1003, 131-132. As shown in FIG. 1 below, after the RF

information signal is received by the antenna, the information signal is passed through a single-to-differential impedance transformer and matching network, the result of which is a fully differential signal, indicated by the circled “2” in FIG. 1:

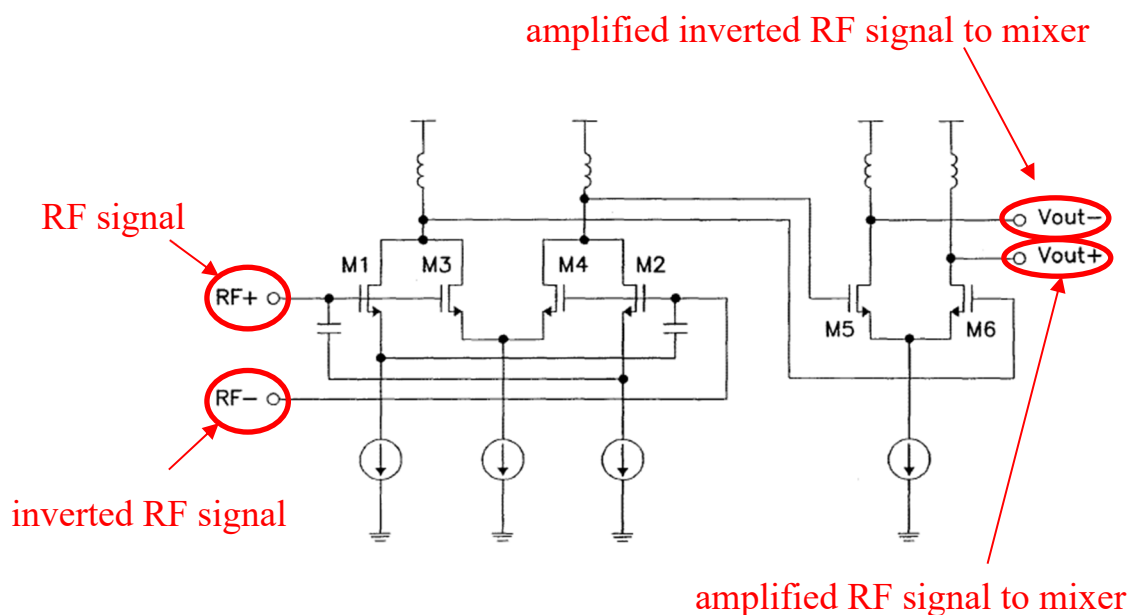


TI-1023, FIG. 1 (annotated)

As noted by Macnally, a “fully-differential analog signal path minimizes supply and substrate noise coupling.” TI-1023, 10:11-12. The creation of a fully differential signal involves “off-chip” circuitry that determines the difference between two single-ended signal values to create differential output, where the maximum values of the differential output are 180 degrees out of phase. TI-1003, 131. A POSITA would have recognized that the creation of a fully differential signal includes inverting the single-ended signal received at the antenna. TI-1003, 131.

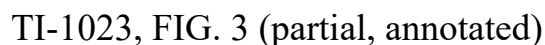
That the received information signal is inverted is readily apparent from the positive and negative RF signals input to the LNP, as shown in FIG. 2, and into the mixer, shown in FIG. 3:

FIG. 2



TI-1023, FIG. 2 (annotated)

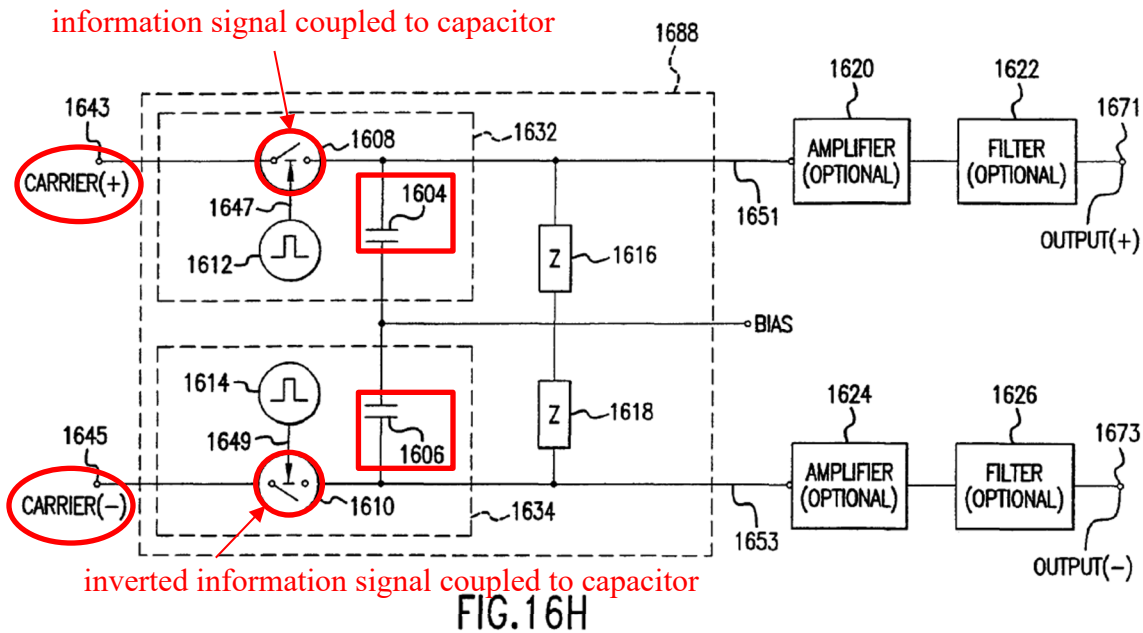
The LNA includes a first stage that “employs a capacitively cross-coupled input pair, M1 and M2, that provides both gain and impedance matching in parallel with a differential pair, M3 and M4, for additional gain.” TI-1023, 12:3-6. “The second stage of the LNA 138 is also a differential pair.” *Id.*, 6-7.



TI-1023, 12:16; TI-1003, 132.

59

1604 through switching device 1608.” *Id.* “Similarly, the inverted RF signal is coupled to capacitor 1606 through switching device 1610.” *Id.* FIG. 16H is shown below:



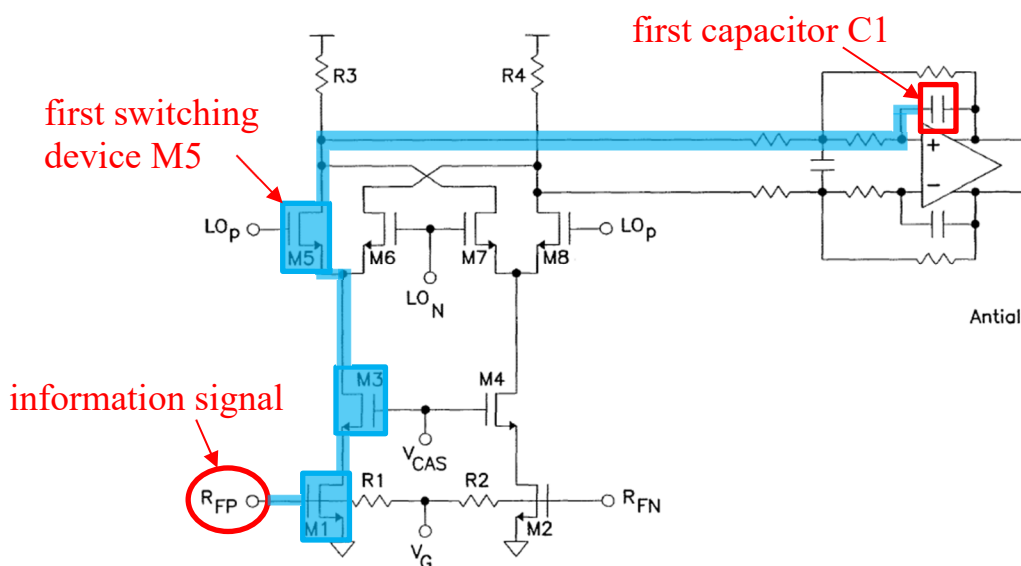
TI-1001, FIG. 16H (annotated)

Accordingly, electrically coupling the information signal to the first capacitor includes coupling the RF signal to a capacitor through a switching device. TI-1003, 132.

Macnally’s mixer and anti-aliasing circuit includes a first capacitor electrically coupled to the information signal through the mixer. *See, e.g.*, TI-1023, 12:19-20 (“The LO input transistors operate as switches that steer a process and temperature independent current.”); TI-1003, 133. Specifically, the RF_P input is

connected to capacitor C1 through first switching device M5 that is controlled by the independent control input coupled to local oscillator LOp. This electrical coupling is shown in FIG. 3 below:

FIG. 3



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

The RF_P information signal input to the mixer is a version of the received information signal that is transformed and amplified. *See, e.g.*, TI-1023, 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 that pre-processing steps. TI-1003, 133. Specifically, the information carried by the information signal is preserved. *Id.* Thus, the input RF_P is the claimed information signal. *Id.* The RF_P input is connected to the first capacitor C1 through a set of switches and resistors, as shown above in light blue.

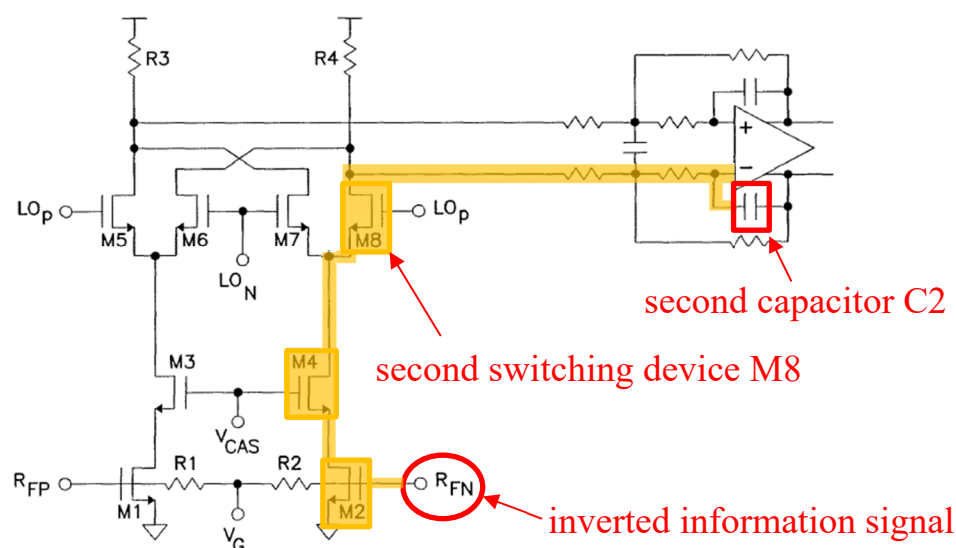
The information signal RF_P is directly connected to the first capacitor C1.

TI-1003, 134. When switches M1, M3, and M5 are closed, there is a direct conductive path between the RF_P input and the first capacitor C1 so the signal can flow to the first capacitor. In operation, when the switches M1, M3, and M5 are closed (M5 being closed by the control signal LOp), the method includes electrically coupling the information signal (RF_P) to the capacitor C1.

When one or more of switches M1, M3, and M5 are open, there is an “indirect” connection between the RF_p input and the capacitor C1. TI-1003, 135.

Likewise, Macnally's mixer and anti-aliasing circuit includes a second capacitor that is electrically coupled to the inverted information signal, as shown in FIG. 3 below:

FIG. 3



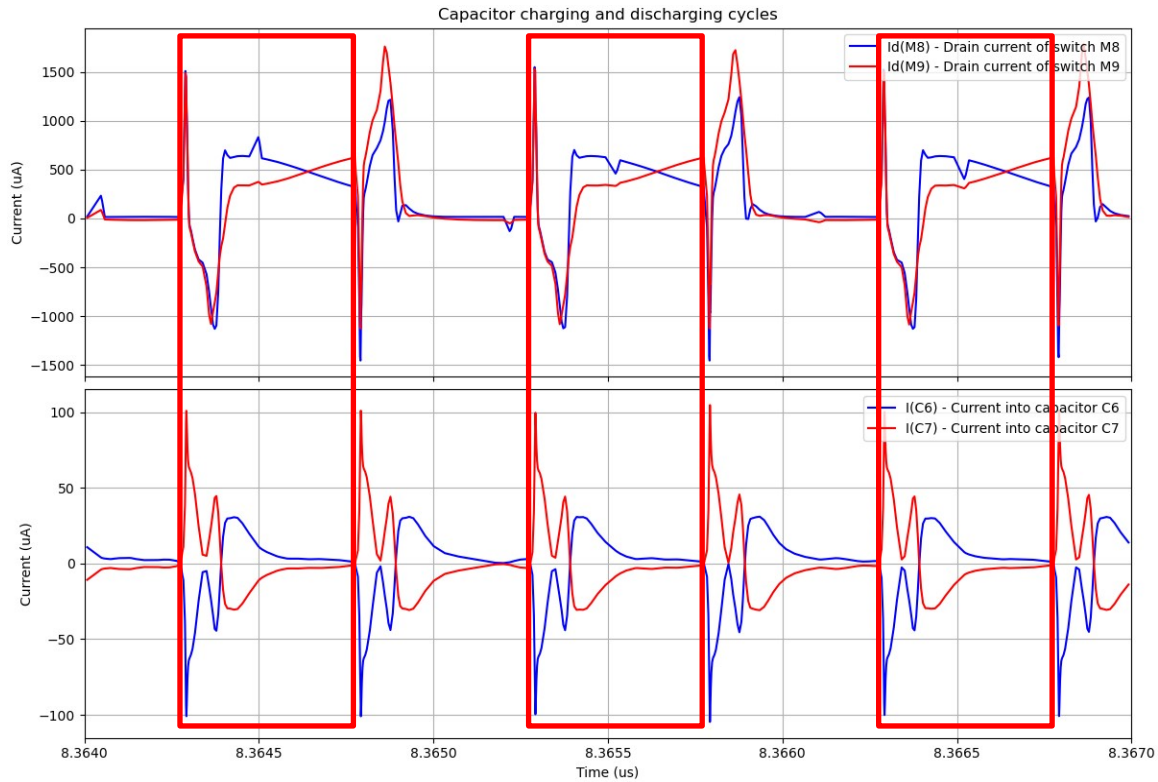
TI-1023, FIG. 3 (partial, annotated)

The RF_N information signal input to the mixer is an inverted version of the information signal RF_P . TI-1003, 136-137. The RF_N input is connected to the second capacitor C2 though a set of switches and resistors, as shown in orange highlighting above. Specifically, the inverted information signal RF_N is electrically coupled to the capacitor C2 through second switching device M8. *Id.*

The inverted information signal RF_N is directly and indirectly connected to the first capacitor C2. TI-1003, 138. When switching devices M2, M4, and M8 are closed, there is a direct conductive path between the RF_P input and the first capacitor C1. In operation, when switching devices M2, M4, and M8 are closed (M8 being closed by the control signal LOp), a conductive path is connects the inverted information signal RF_N input to the capacitor C2. *Id.* When one or more of switching devices M2, M4, and M8 are open, there is an “indirect” connection between the inverted information signal RF_N and the capacitor C1. *Id.*

Transistors M5 and M8 are switching devices according to any construction above. The each include independent control inputs (the gate of the transistor). And their activation completes a circuit; while their deactivation breaks a circuit. TI-1003, 140.

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



MACNALLY-SIM-FIG. 2 (annotated)

In the simulation, it is the nature of mixers and modulated signals that the information (encoded in the carrier modulation) varies on a much longer time scale than the carrier signal. TI-1003, 139. In particular, the Macnally circuit operates at a 10x higher carrier frequency than DeMaw, for the same baseband signal bandwidth. Therefore, although it is not possible to see the information signal present in the capacitor current waveforms of figure MACNALLY-SIM-FIG. 2 due to the narrow time plotting range. *Id.* This plot shows that switches M8 and M9 are indeed electrically coupled to capacitors C6 and C7, e.g., the clock feedthrough current spikes in the switch currents appear in the capacitor currents.

That the information signal is electrically coupled is by deduction, as this circuit produces the downconverted information signal at its output, and the only path between input and output passes through switches M8 and M9. *Id.*

18.4 (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

Macnally teaches controlling a charging and discharging cycle of the first capacitor with the first switching device electrically coupled to the first capacitor. *See, e.g.*, TI-1023, 12:19-20 (“The LO input transistors operate as switches that steer a process and temperature independent current.”). Macnally meets either parties’ constructions because it teaches a capacitor for each corresponding switch. TI-1003, 140.

The LO signal is a periodic waveform, and therefore the switching devices M5 and M8 are controlled cyclically. TI-1003, 140-141. As shown in the previous claim limitation that switches M5 and M8 are electrically coupled to capacitors C1 and C2. Therefore, the information signal which is connected to the gates of M1 and M2 appear as a differential current in the drains of M1 and M2. TI-1003, 140. Properly biased, the cascode devices M3 and M4 simply conduct this current to the switches, which include M5 and M8. Therefore, not only do the switches M5 and M8 control charging and discharging cycles of capacitors C1 and C2, respectively,

they do so with a current proportional to the information signal and inverted information signal, respectively. *Id.*

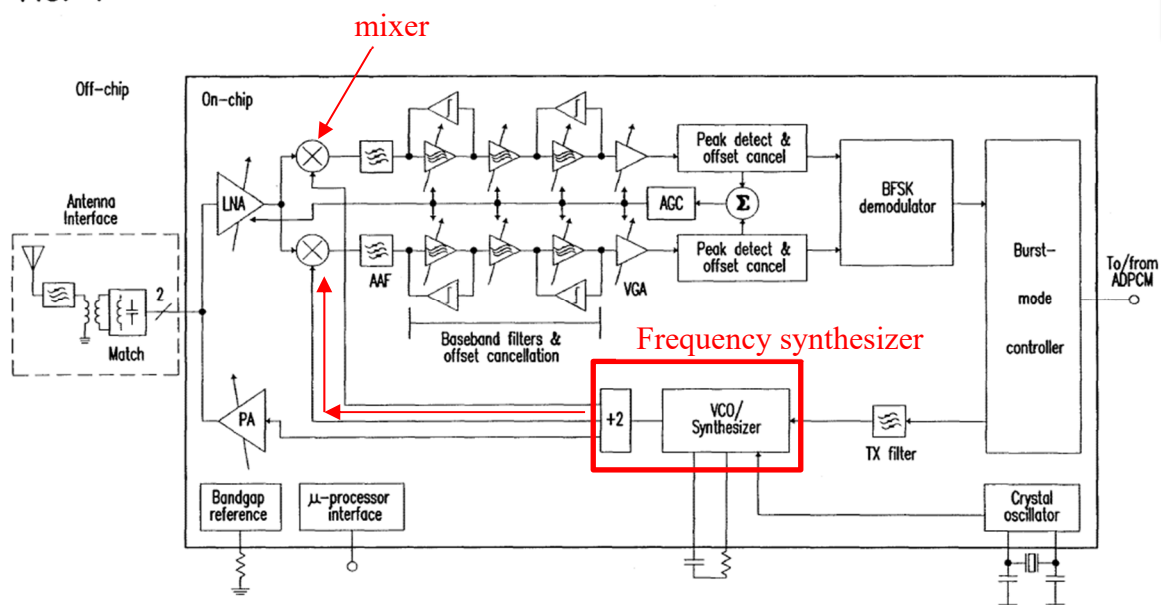
Because switch M5 is controlled by local oscillator LOp, the charging and discharging occurs in cycles. TI-1003, 141. These cycles occur sequentially, and thus, Macnally's operation would satisfy TI's constructions. Macnally's circuit structure already satisfies ParkerVision's constructions because "a first switching device [M5] controls a charging/discharging cycle of a first capacitor [C1]." TI-1009, 2.

Switching devices M5 and M8 are transistors that each include independent control inputs. In Macnally, the independent control input of the switching device is the gates of the transistor. TI-1003, 141.

18.5 (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;

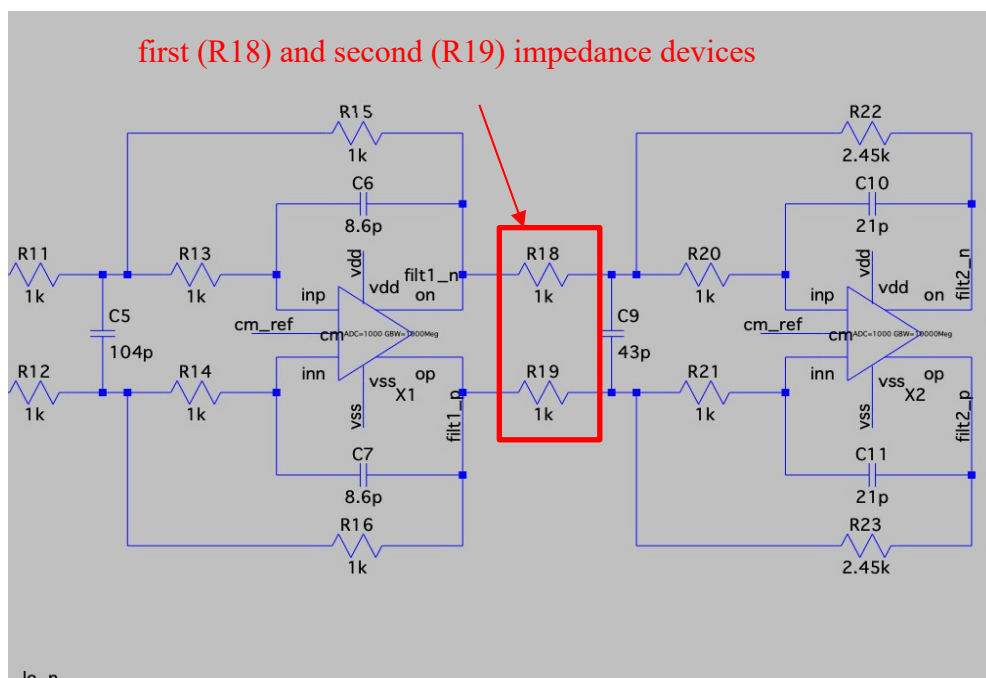
Macnally teaches element 18.5. Examining the block diagram shown below, it is understood that the signals LOp and LOn are generated by an on-chip frequency synthesizer. TI-1003, 142-144. A POSITA would recognize that the design intention is to operate the mixers with a continuous or burst of clock cycles, thereby performing a plurality of the charging and discharging cycles previously described. TI-1003, 142.

FIG. 1



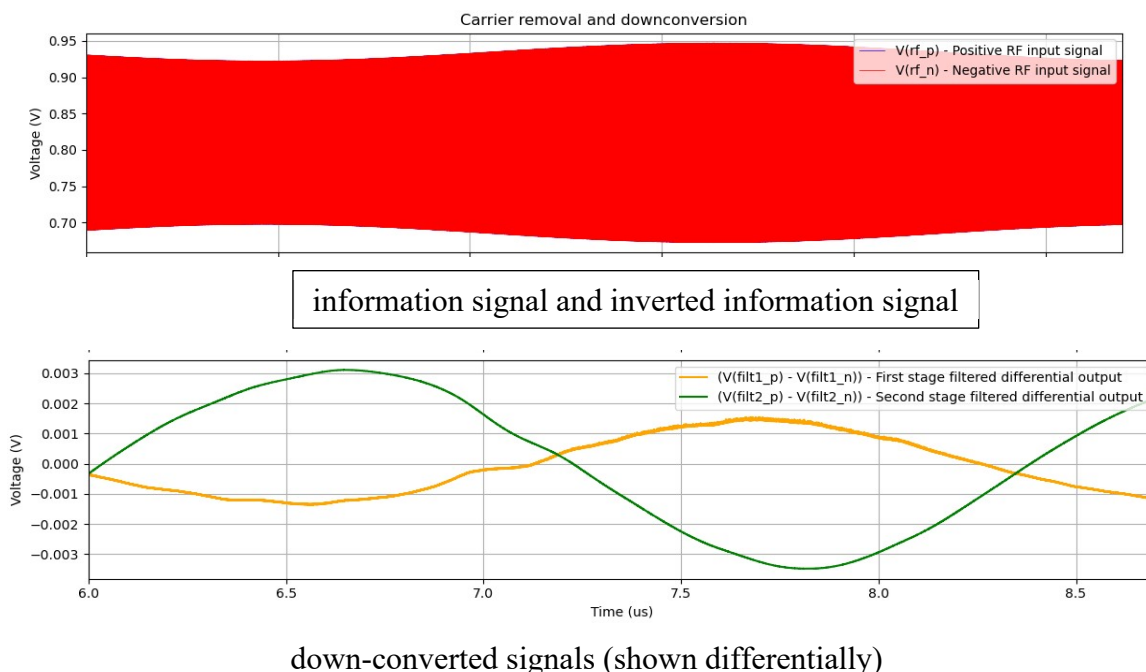
To demonstrate that this operation results in the downconverted information signal appearing across first and second impedance devices, the differential signal across resistors R18 (first impedance device) and R19 (second impedance device) was plotted, the locations of which are shown in MACNALLY-SIM-FIG. 1 below.

TI-1003, 143.



MACNALLY-SIM-FIG. 1 (partial, annotated)

The top pane of the waveform plot shows the input RF signal. Its frequency is so high relative to the downconverted information signal that the waveform appears as a solid band with this plot resolution. The trace $V(filt1_p)$ — $V(filt1_n)$ shows the downconverted information signal, with the carrier clearly removed. TI-1003, 144.



MACNALLY-SIM-FIG. 3 (annotated)

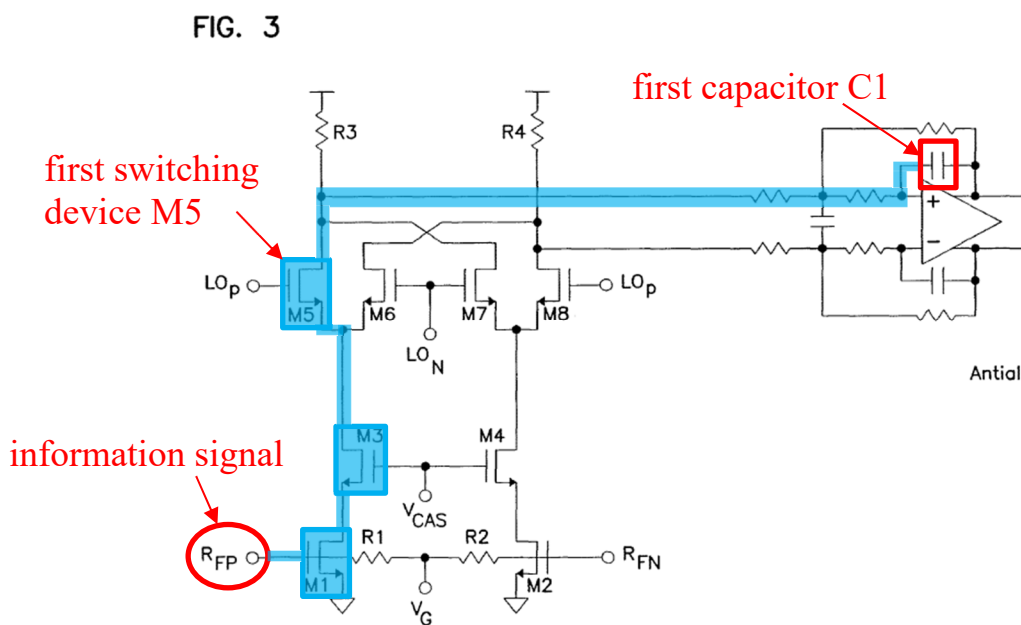
The use of differential signaling in this circuit would be recognized by a POSITA as advantageous to reject common-mode impairments of the mixer circuit, in particular clock leakage. TI-1003, 144. Nevertheless, a POSITA would also recognize that if the Rauch biquad filter were properly designed, *e.g.*, using the values presented in its analysis, then the dominant signal components present across the individual impedance devices R18 and R19 would be the down-converted information signal and down-converted inverted information signal, respectively. *Id.*

18.6 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.

See, supra, Ground 2, 18.3-4 (describing the operation of the Macnally circuit and how the operation of the switches causes charge to be stored on the capacitors). TI-1003, 145-148, 132-141.

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. TI-1003, 146. This is shown by FIG. 3 below:



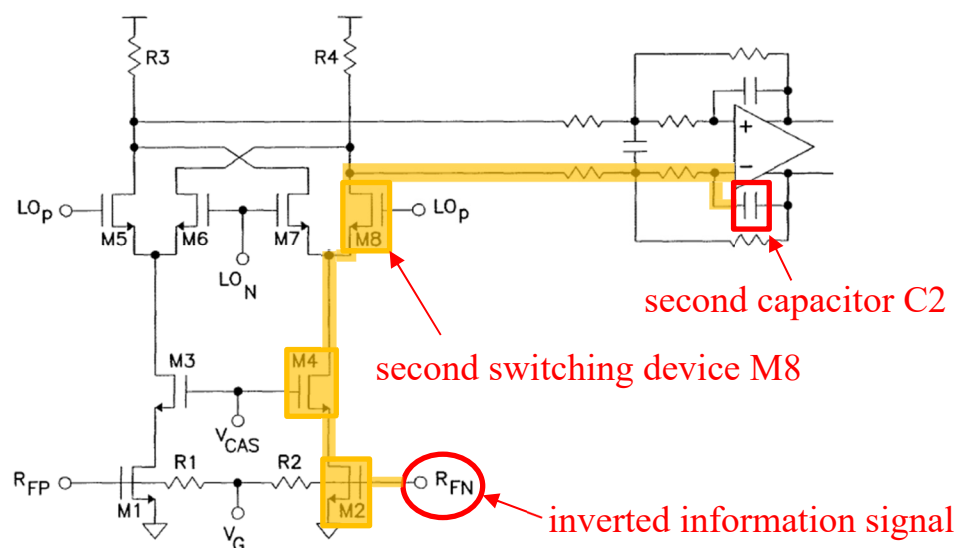
TI-1023, FIG. 3 (annotated)

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. TI-1003, 147. Thus, in Macnally, the

information signal RF_P is used to store a charge on the second capacitor C2 when the second switching device M8 is closed. *Id.*

Likewise, Macnally's second capacitor that is electrically coupled to the inverted information signal, as shown in FIG. 3 below:

FIG. 3



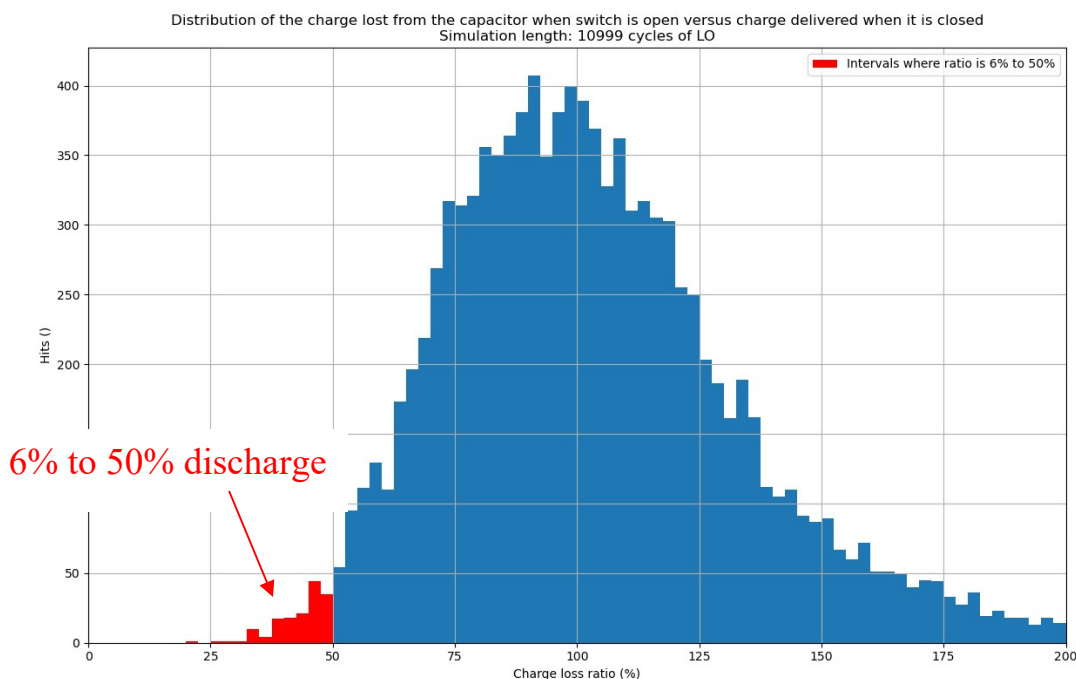
TI-1023, FIG. 3 (partial, annotated)

During operation, when the switching device M8 is closed, the inverted information signal is directed to the capacitor C2, the inverted information signal delivering charge to the capacitor C2, which stores charge. TI-1003, 148. Thus, in Macnally, the inverted information signal RF_N is used to store a charge on the second capacitor C2 when the second switching device M8 is closed. *Id.*

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.

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. TI-1003, 149. The identical post-processing script that was used to generate figure DEMAW-SIM-FIG. 7 is used to generate MACNALLY-SIM-FIG. 4, below. A region of occurrences within the 6% to 50% range is marked in red. *Id.*



MACNALLY-SIM-FIG. 4 (annotated)

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.

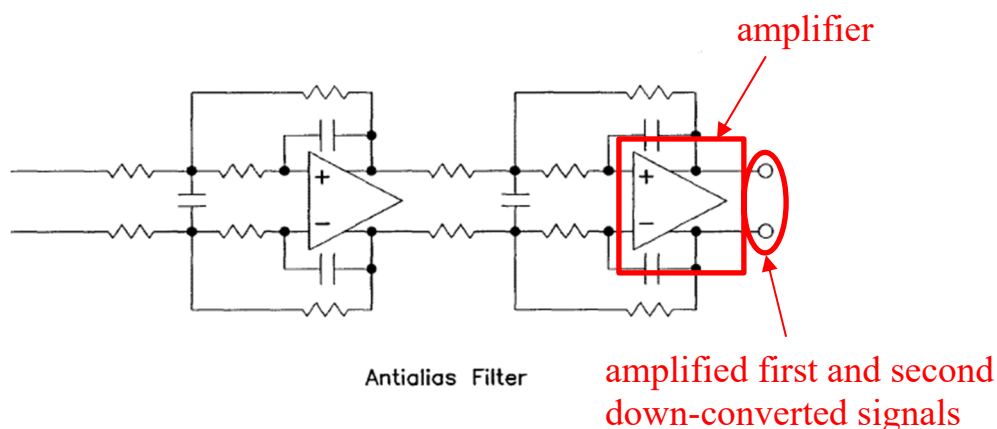
There are cycles where the charge loss ratio is 25%, which satisfies the claimed range of 10% to 25%. TI-1003, 149-150.

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.

There are cycles where the charge loss ratio is 25%, which satisfies the claimed range of 15% to 30%. TI-1003, 149, 151.

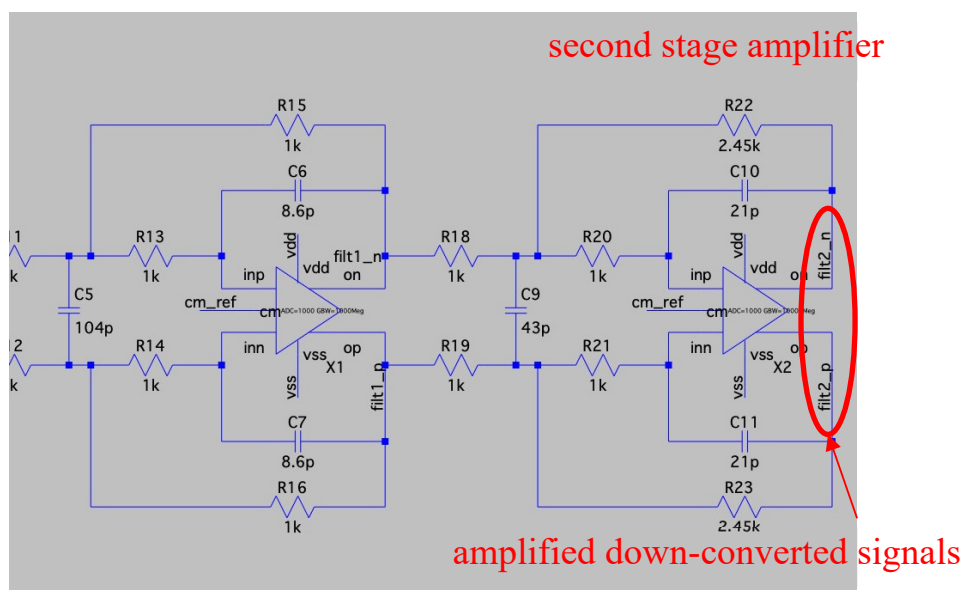
22. The method of claim 18, further comprising the step of amplifying the first and second down-converted information signals.

Macnally teaches the step of amplifying the first and second down-converted information signals. TI-1003, 152. For example, as shown in FIG. 3, first and second down-converted information signals are differential signals, which are amplified anti-aliasing filter as specified in the text of the patent, “Two biquad stages form the four-pole butterworth anti-alias filter with a nominal gain of 15.6dB...” TI-1023, 12:22-26.



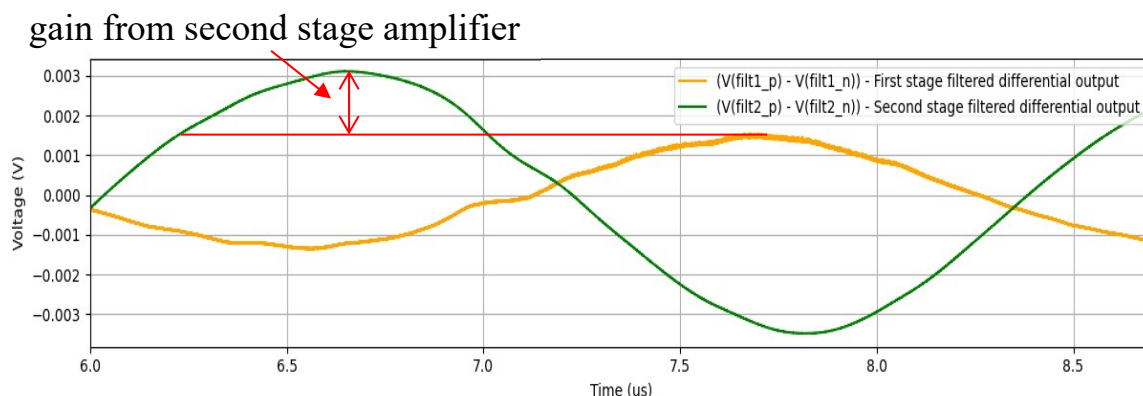
TI-1023, FIG. 3 (partial, annotated)

According to the analysis performed in this document, each biquad stage delivers a portion of the total 15.6dB gain. TI-1003, 152. Therefore, if the first and second downconverted information signals are defined across resistors R18 and R19, or equivalently the differential first stage output, then the amplified information signals are defined at the output of the second stage. *Id.*



MACNALLY-SIM-FIG. 1 (partial, annotated)

The simulation shows that in operation, the first and second down-converted signal are amplified by the second stage amplifier. TI-1003, 152.

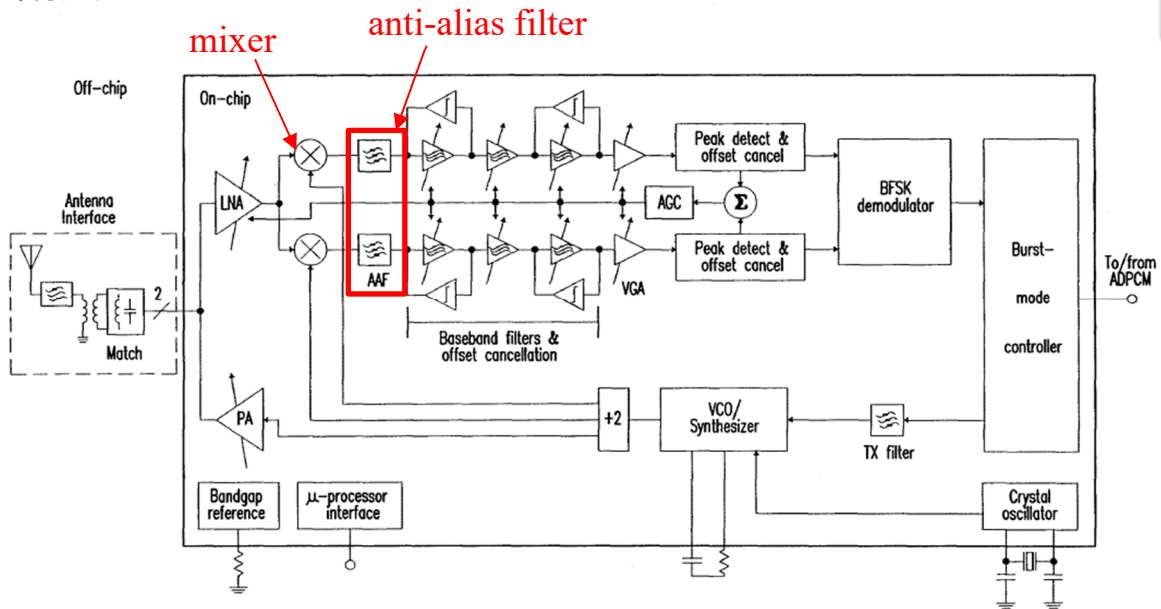


Macnally-SIM-FIG. 5

23. The method of claim 18, further comprising the step of removing a carrier signal from the first and second down-converted information signals.

Macnally teaches the step of removing a carrier signal from the first and second down-converted information signals. TI-1003, 153-154. As mentioned above, Macnally is a direct-conversion transceiver, which a POSITA would have recognized as including circuitry that, when operated, down-converts a radio frequency signal to baseband, which inherently removes the RF carrier. TI-1003, 153. Furthermore, recall that the direct-conversion transceiver circuitry includes baseband amplifiers downstream of the mixer, as well as anti-alias filters, as shown in FIG. 1:

FIG. 1

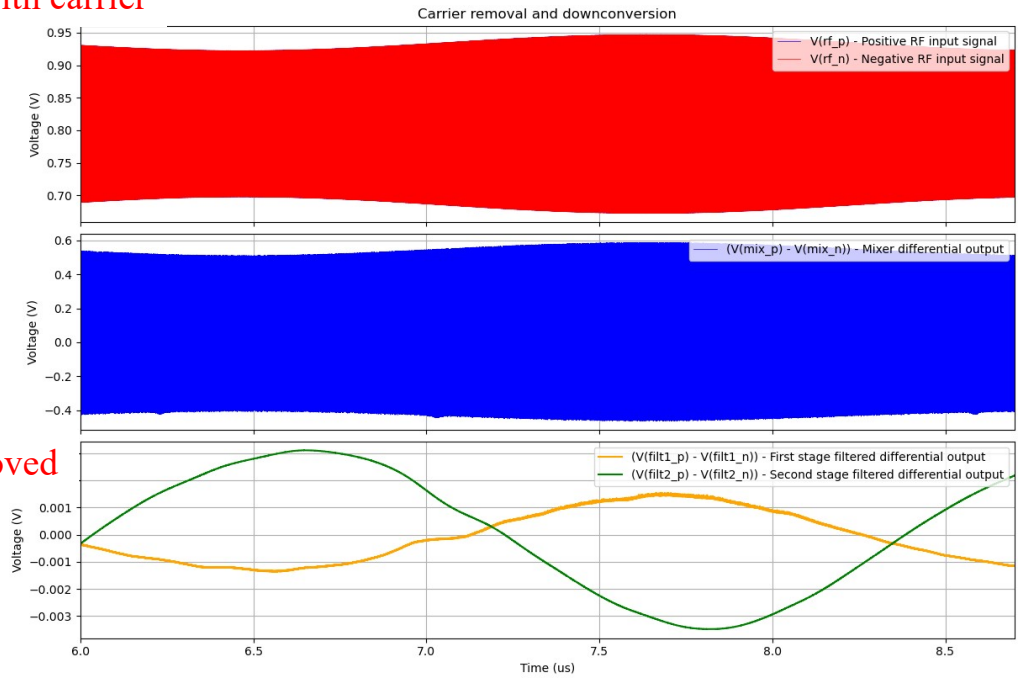


TI-1023, FIG. 1 (annotated)

As shown in FIG. 1, the Macnally circuitry includes baseband filters downstream of the mixer. TI-1003, 153.

In operation, the simulation also shows the removal of the carrier signal from the first and second down-converted signals:

RF signal with carrier



carrier removed

MACNALLY-SIM-FIG. 6

As can be seen by MACNALLY-SIM-FIG. 6, operation of the Macnally circuit down-converts the RF input signal and removes the carrier frequency. TI-1003, 154.

IV. PTAB DISCRETION SHOULD NOT PRECLUDE INSTITUTION

A. 35 U.S.C. §325(d) – *Advanced Bionics*

Advanced Bionics and the *Becton* factors strongly favor institution. [*Advanced Bionics LLC v. MED-EL Elektromedizinische Gerate GmbH*, IPR2019-01469, Paper 6 (PTAB Feb. 13, 2020) (“*Advanced Bionics*”) (precedential); *Becton, Dickinson and Co. v. B. Braun Melsungen AG*, IPR2017-01586, Paper 8 (PTAB Dec. 15 2017) (“*Becton*”) (precedential).

The Examiner did not issue a prior art rejection in the prosecution of the ’342 patent. *See, generally*, TI-1002. Neither DeMaw, nor Macnally (the primary references relied upon in this Petition) was presented to the Office. While Tayloe appears on the face of the ’342 patent, there is no indication in the ’342 Patent’s file history that the Examiner substantively considered any of the prior art applied in this Petition prior to allowing the application that issued as the ’342 Patent. *Id.* Tayloe has been relied upon in other IPRs challenging patents owned by Patent Owner which may involve related technology. However, the fact that Tayloe has never been applied to the ’342 patent, and certainly not in combination with DeMaw, favors institution.

Because the ’342 Patent’s prosecution did not involve any discussion between the applicant and the Examiner regarding the teachings of the prior art applied in this Petition, the patentability challenge based on the prior art asserted in

this Petition is not the same as, or substantially similar to, art and arguments previously presented to the Office in connection with the '342 Patent. *See, generally*, TI-1002. Accordingly, neither condition of the first prong of the *Advanced Bionics* framework is met, and there is no need to reach the second prong to resolve against discretionary denial under Section 325(d). *See, e.g., Oticon Medical AB et. al. v. Cochlear Ltd.*, IPR2019-00975, Paper 15 at 20 (PTAB Oct. 16, 2019) (precedential) (“There is new, noncumulative prior art asserted in the Petition...[f]or at least this reason, we determine not to exercise our discretion under § 325(d)”).

For at least the above-noted reasons, Petitioner respectfully submits that discretionary denial is unwarranted, and that the Board should instead institute IPR based on the instant Petition’s grounds.

B. 35 U.S.C. §314(a) – *General Plastic*

As discussed above (Section II.C), the '342 patent was previously challenged in an IPR filed by RPX (IPR2014-01107). TI was not involved in the prior IPR proceeding and relies on different, non-cumulative art in this petition. As such, the *General Plastic* factors favor institution.

C. 35 U.S.C. §314(a) - *Fintiv*

In *Apple Inc. v. Fintiv, Inc.*, the Board enumerated six factors that it will assess in determining whether to exercise discretion to deny institution under

§314(a) based on co-pending litigation. IPR2020-00019, Paper 11 at 2-3 (PTAB “precedential” Mar. 20, 2020). The USPTO issued updated discretionary denial guidance in view of the *Fintiv* factors and confirmed that “the PTAB will not discretionarily deny institution in view of parallel district court litigation where a petitioner presents a stipulation not to pursue in a parallel proceeding the same grounds or any grounds that could have reasonably been raised before the PTAB.” See June 21, 2022 Memorandum to Members of the PTAB, 3 (available at https://www.uspto.gov/sites/default/files/documents/interim_proc_discretionary_denials_aia_parallel_district_court_litigation_memo_20220621_.pdf). Here, Petitioner has eliminated any risk of duplicated effort by voluntarily presenting a *Sotera* stipulation to Patent Owner. TI-1041; *Sotera Wireless, Inc. v. Masimo Corp.*, IPR2020-01019, Paper 12 (PTAB Dec. 1, 2020). For at least this reason, and considering the compelling merits of the above-detailed Grounds, discretionarily denial is unwarranted and would be unjust.

V. CONCLUSION AND FEES

The Challenged Claims are unpatentable. Petitioner authorizes charge of fees to Deposit Account 06-1050.

VI. MANDATORY NOTICES UNDER 37 C.F.R § 42.8(A)(1)

A. Real Party-In-Interest Under 37 C.F.R. § 42.8(b)(1)

Texas Instruments Incorporated is the real party-in-interest.

B. Related Matters Under 37 C.F.R. § 42.8(b)(2)

The '342 Patent is the subject of a civil action, *ParkerVision, Inc. v. Texas Instruments Incorporated*, 6:23-cv-00384, W.D. Tex., filed May 18, 2023 (TI-1004), *ParkerVision, Inc. v. Qualcomm Incorporated*, 3-11-cv-00719 (MDFL) filed July 20, 2011 and *RPX Corporation v. ParkerVision, Inc.* IPR2014-01107 (PTAB) filed July 2, 2014.

Petitioner is not aware of any other disclaimers, reexamination certificates, or IPR petitions addressing the '342 Patent.

C. Lead And Back-Up Counsel Under 37 C.F.R. § 42.8(b)(3)

Petitioner provides the following designation of counsel.

Lead Counsel	Backup counsel
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D. Service Information

Please address all correspondence and service to the address listed above.

Petitioner consents to electronic service by email at IPR12189-0090IP1@fr.com
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Respectfully submitted,

Dated May 18, 2024

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CERTIFICATION UNDER 37 CFR § 42.24

Under the provisions of 37 CFR § 42.24(d), the undersigned hereby certifies that the word count for the foregoing Petition for *Inter Partes* Review totals 12,074 words, which is less than the 14,000 allowed under 37 CFR § 42.24.

Dated May 18, 2024

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CERTIFICATE OF SERVICE

Pursuant to 37 CFR §§ 42.6(e)(4)(i) *et seq.* and 42.105(b), the undersigned certifies that on May 18, 2024, a complete and entire copy of this Petition for *Inter Partes* Review and all supporting exhibits were provided by Federal Express, to the Patent Owner, by serving the correspondence address of record as follows:

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