

Texas Instruments Inc.
(Petitioner)

v.

Parker Vision Inc.
(Patent Owner)

Petitioner's Demonstratives

Case IPR2024-00936

U.S. Patent Nos: 9,118,528

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

FISH.

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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The '528 Patent



US09118528B2

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

(10) **Patent No.:** **US 9,118,528 B2**
(45) **Date of Patent:** ***Aug. 25, 2015**

(54) **METHOD AND SYSTEM FOR DOWN-CONVERTING AN ELECTROMAGNETIC SIGNAL, AND TRANSFORMS FOR SAME, AND APERTURE RELATIONSHIPS**

(58) **Field of Classification Search**
USPC 455/413, 113, 118, 130, 131, 162.1, 455/190.1, 191.1, 313, 323, 343, 350; 327/113; 375/130, 142, 143, 150, 152, 375/316, 343
See application file for complete search history.

(71) Applicant: **ParkerVision, Inc.**, Jacksonville, FL (US)

(72) Inventors: **David E. Sorrells**, Jacksonville, FL (US); **Michael J. Bultman**, Jacksonville, FL (US); **Robert W. Cook**, Switzerland, FL (US); **Richard C. Looke**, Jacksonville, FL (US); **Charley D. Moses**, Jacksonville, FL (US); **Gregory S. Rawlins**, Lake Mary, FL (US); **Michael W. Rawlins**, Lake Mary, FL (US)

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

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.
This patent is subject to a terminal disclaimer.

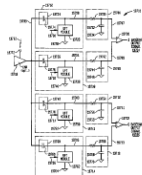
(21) Appl. No.: **14/172,392**
(22) Filed: **Feb. 4, 2014**
(65) **Prior Publication Data**
US 2014/0241464 A1 Aug. 28, 2014

Related U.S. Application Data
(60) Continuation of application No. 13/549,213, filed on Jul. 13, 2012, now Pat. No. 8,660,513, which is a (Continued)

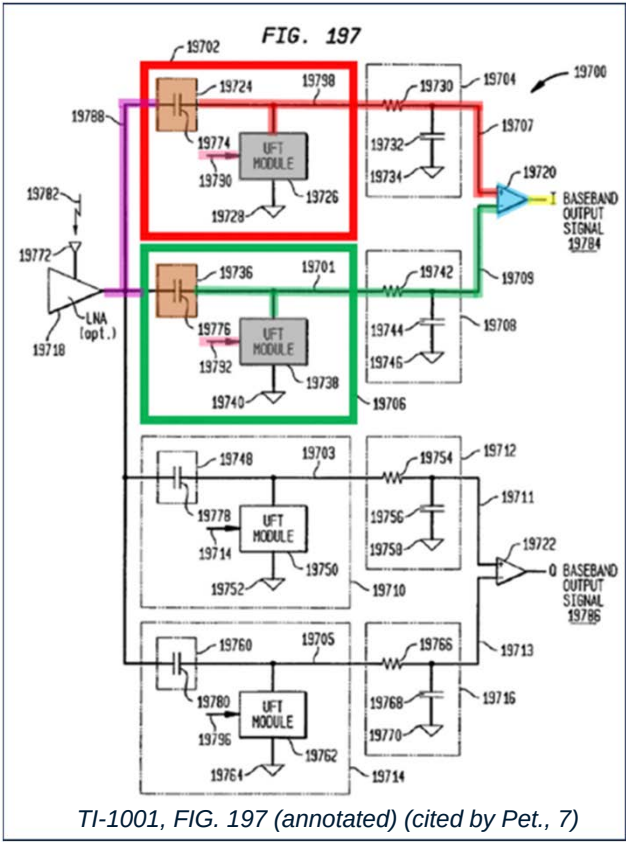
(51) Int. Cl. **H04L 27/12** (2006.01)
H03C 1/02 (2006.01)
(Continued)

(52) U.S. Cl. **H04L 27/12** (2013.01); **H03C 1/02** (2013.01); **H04D 7/00** (2013.01); **H04B 1/0025** (2013.01); **H04B 1/28** (2013.01); **H04B 7/12** (2013.01); **H04L 27/00** (2013.01)

36 Claims, 284 Drawing Sheets

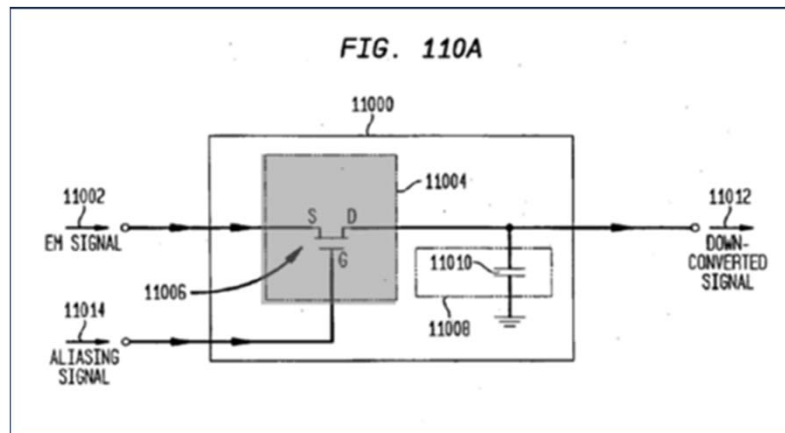


TI-1001



TI-1001, FIG. 197 (annotated) (cited by Pet., 7)

The '528 Patent



TI-1001, FIG. 110A (annotated) (cited by Pet., 7)

FET 11006 receives the EM signal 11002 and aliasing signal 11014. In one embodiment, aliasing signal 11014 includes a train of pulses having non-negligible apertures that repeat at an aliasing rate. The aliasing rate may be harmonic or sub-harmonic of the EM signal 11002. FET 11006 samples EM signal 11002 at the aliasing rate of aliasing signal 11014 to generate down-converted signal 11012. In one embodiment, aliasing signal 11014 controls the gate of FET 11006 so that FET 11006 conducts (or turns on) when the FET gate-to-source voltage (V_{GS}) exceeds a threshold voltage (V_T). When the FET 11006 conducts, a channel is created from source to drain of FET 11006 so that charge is transferred from the EM signal 11002 to the capacitor 11010. More specifically, the FET 11006 conductance ($1/R$) vs V_{GS} is a continuous function that reaches an acceptable level at V_T , as illustrated in FIG. 110B. The charge stored by capacitor 11010 during successive samples forms down-converted signal 11012.

TI-1001, 108:40-51 (cited by Pet., 7)

The '528 Patent: Claim 1

1. A system for frequency down-converting a modulated carrier signal to a baseband signal, comprising:

- a first switch coupled to a first control signal which comprises a sampling aperture with a specified frequency, wherein the first switch is on and a portion of energy that is distinguishable from noise is transferred from the modulated carrier signal as an output of said first switch during the sampling aperture of the first control signal;
- a first energy storage element that stores the transferred energy from the modulated carrier signal and outputs a down-converted in-phase baseband signal portion of said modulated carrier signal;

■ ■ ■ ■

TI-1001, 192:32-43 (Claim 1)

■ ■ ■ ■

- a second switch coupled to a second control signal which comprises a sampling aperture with a specified frequency, wherein the second switch is on and a portion of energy that is distinguishable from noise is transferred from the modulated carrier signal as an output of said second switch during the sampling aperture of the second control signal;

- a second energy storage element that stores the transferred energy from the modulated carrier signal and outputs a down-converted inverted in-phase baseband signal portion of said modulated carrier signal;

wherein the portions of transferred energy from each of the first and second switch are integrated over time to accumulate said portions of transferred energy from which said down-converted in-phase baseband signal portion and said down-converted inverted in-phase baseband signal portion are derived; and

- a first differential amplifier circuit that combines said down-converted in-phase baseband signal portion with said down-converted inverted in-phase baseband signal portion and outputs a first channel down-converted differential in-phase baseband signal.

TI-1001, 192:40-51 (claim 1 (Cont.))

FISH.

The Technology and Prior Art

The Technology and Prior art

Taylor (TI-1004)


US00623000B1

(12) **United States Patent**
Taylor

(10) **Patent No.:** **US 6,230,000 B1**
(45) **Date of Patent:** **May 8, 2001**

(54) **PRODUCT DETECTOR AND METHOD THEREFOR**

(75) **Inventor:** **Daniel Richard Taylor, Phoenix, AZ (US)**

(73) **Assignee:** **Motorola Inc., Schaumburg, IL (US)**

(*) **Notice:** Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) **Appl. No.:** **09/173,030**

(22) **Filed:** **Oct. 15, 1998**

(51) **Int. Cl.:** **H04B 1/26; H04B 1/00**

(52) **U.S. Cl.:** **455/323; 455/303; 455/304; 455/313**

(58) **Field of Search** **455/302, 303, 455/304, 324, 338, 339, 313, 318, 323, 375/323, 329, 332, 327/113, 45; 329/304**

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Article entitled "A 1.5 GHz Highly Linear CMOS Down-conversion Mixer" published in IEEE Journal of Solid-State Circuits, vol. 30, No. 7, Jul. 1995.

Article entitled "Recent Advances in Shortwave Receiver Design" by Dr. Ulrich L. Rohde in QST, Nov. 1992.

Article "Asymmetric Polyphase Networks" by M.J. Gilling in Electrical Communication, vol. 48, No. 1 and 2, 1973.

Article entitled "High-Performance, Single-Signal Direct-Conversion Receivers" by Rick Campbell —QST Magazine (Jan. 1993).

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Primary Examiner—Dwayne Bost
Assistant Examiner—Raymond B. Persino
(74) **Attorney, Agent, or Firm**—Dana B. LeMoine; Timothy J. Lorenz; Frank J. Bogacz

(57) **ABSTRACT**

A product detector for converting a signal to baseband includes a commutating switch which serves to sample an RF waveform four times per period at the RF frequency. The samples are integrated over time to produce an average voltage at 0 degrees, 90 degrees, 180 degrees and 270 degrees. The average voltage at 0 degrees is the baseband in-phase signal, and the average voltage at 90 degrees is the baseband quadrature signal. Alternatively, to increase gain, the 0 degree average can be differentially summed with the 180 degree average to form the baseband in-phase signal, and the 90 degree average can be differentially summed with the 270 degree average to produce the baseband quadrature signal.

14 Claims, 3 Drawing Sheets

TI-1004, Fig. 3 (annotated) (cited by Pet., 11)

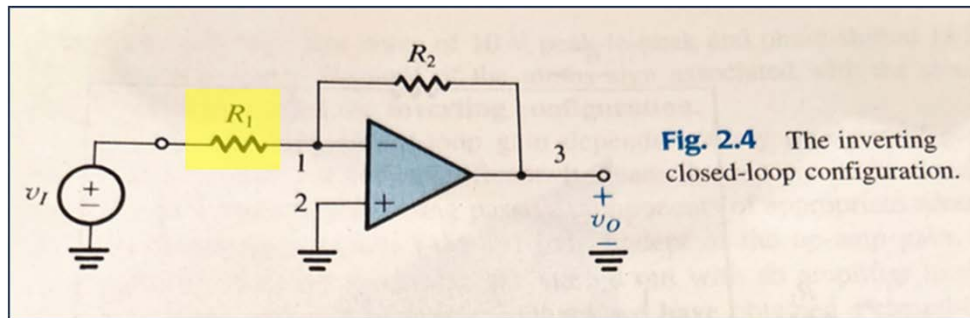
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Conventional Op-Amp Circuit Operation

Sedra/Smith Textbook (TI-1046)



TI-1046, Fig. 2.4 (annotated)

Input and Output Resistances

Assuming an ideal op amp with infinite open-loop gain, the input resistance of the closed-loop inverting amplifier of Fig. 2.4 is simply equal to R_1 . This can be seen from Fig. 2.5(b), where

$$R_i \equiv \frac{v_I}{i_1} = \frac{v_I}{v_I/R_1} = R_1$$

TI-1046, at 68 (annotated)

Dr. Galton's Declaration (TI-1066)

33. The accompanying text explains that the "the input resistance of the closed-loop inverting amplifier of FIG. 2.4 is simply equal to R_1 " (TI-1046, Page 68). It goes on to characterize the amplifier as having a "low input resistance" (TI-1046, Page 69), thereby implying that R_1 must have a "low" resistance, and characterizes a few mega-ohms as "impractically large" (TI-1046, Page 69).

TI-1066, ¶33 (cited by Reply, 23)

1055, Pages 719-720). Therefore, increasing the value of the resistance, R , increases the power of the noise introduced by the resistor. Consequently, a POSITA would understand that it is undesirable to use extremely large resistors in circuits like wireless receivers that must amplify very small signals, as the noise would severely degrade the receiver's noise figure.

TI-1066, ¶29 (cited by Reply, 23)

Conventional Op-Amp Circuit

Sedra/Smith Textbook (TI-1046)

The Closed-Loop Gain

We now wish to analyze the circuit in Fig. 2.4 to determine the closed-loop gain G , defined as

$$G \equiv \frac{v_O}{v_I}$$

We will do so assuming the op amp to be ideal. Figure 2.5(a) shows the equivalent circuit, and the analysis proceeds as follows: The gain A is very large (ideally infinite). If we assume that the circuit is “working” and producing a finite output voltage at terminal 3, then the voltage between the op amp input terminals should be negligibly small. Specifically, if we call the output voltage v_O , then, by definition,

$$v_2 - v_1 = \frac{v_O}{A} \approx 0$$

It follows that the voltage at the inverting input terminal (v_1) is given by $v_1 \approx v_2$. That is, because the gain A approaches infinity, the voltage v_1 approaches v_2 . We speak of this as the two input terminals “tracking each other in potential.” We also speak of a “virtual short circuit” that exists between the two input terminals. Here, the word *virtual* should be emphasized, and one should *not* make the mistake of physically shorting terminals 1 and 2 together while analyzing a circuit. A **virtual short circuit** means that whatever voltage is at 2 will automatically appear at 1 because of the infinite gain A . But terminal 2 happens to be connected to ground; thus $v_2 = 0$ and $v_1 \approx 0$. We speak of terminal 1 as being a **virtual ground**—that is, having zero voltage but not physically connected to ground.

TI-1046, at 65 (annotated)

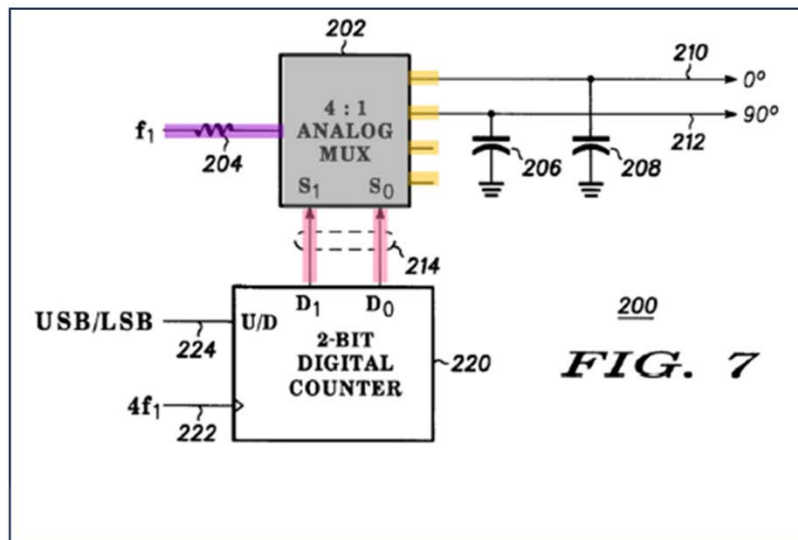
Dr. Galton's Declaration (TI-1066)

in claiming that the “−” terminal node would have a high impedance. However, the feedback resistor in conjunction with the high open loop gain that op-amps have by design cause the node at the “−” terminal to have a very low impedance. As a POSITA would have first learned in their freshman or sophomore undergraduate circuits courses, this node is referred to as a virtual ground precisely because the feedback changes the impedance at that node from having a very high value to having a very low value (a ground terminal ideally has zero impedance, so the term “virtual ground” is meant to signify that the node has such a low impedance that it virtually behaves as a ground connection). TI-1046, Page 65.

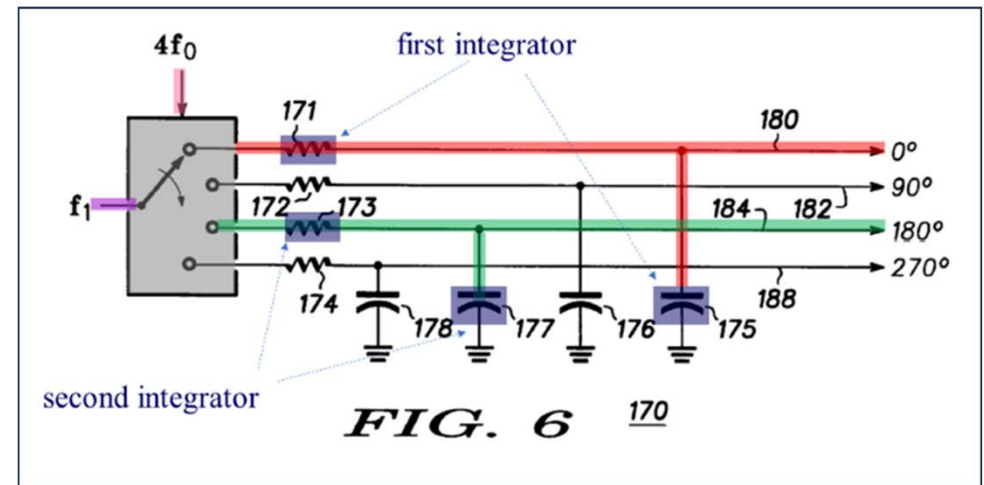
TI-1066, ¶17 (cited by Reply, 23)

The Technology and Prior art

Tayloe (TI-1004)



TI-1004, Fig. 7 (annotated) (cited by Pet., 17)



TI-1004, Fig. 6 (annotated) (cited by Pet., 14-15)

The Technology and Prior art

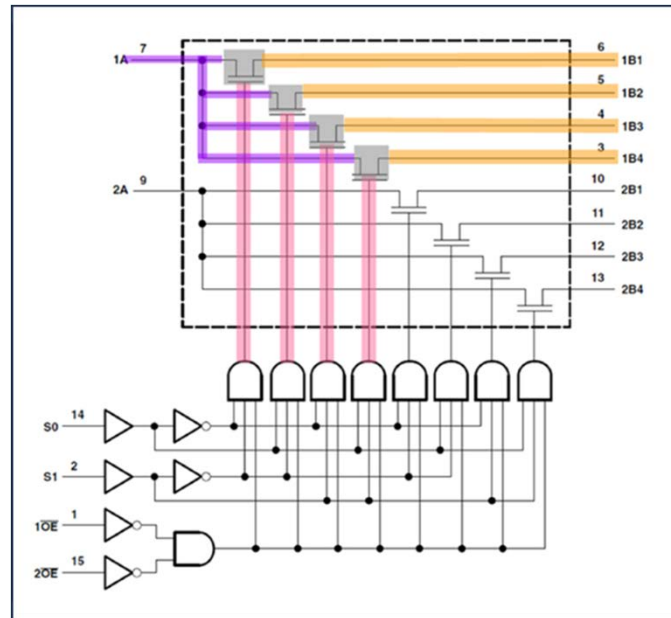
Taylor (TI-1004)

EXPERIMENTAL RESULTS

A direct conversion receiver which utilizes a Taylor Product Detector has been built. The receiver design is the same as direct conversion receiver 30 (FIG. 3) utilizing an analog multiplexer and a digital counter as shown in FIG. 7. The analog multiplexer is a Texas Instruments SN74BCT3253D. The digital counter is an industry standard 74ACT163. The analog multiplexer is a 5 volt part which has an effective input range of substantially zero to four volts. Bias network 34 biases the input of the analog multiplexer to substantially 2 volts. This represents the ability to handle input signals of up to substantially +19 dBm. This is advantageous in part because typical maximum signal ranges for prior art diode mixers is substantially +7 dBm. A further advantage is that analog multiplexers capable of operating at higher voltages can be readily obtained or easily designed, thereby increasing the dynamic range further.

TI-1005, 5:33-37 (cited by Pet., 17-18)

TI-Datasheet (TI-1005)



TI-1005, 2 (annotated) (cited by Pet., 19)

The Technology and Prior art (Macnally)

Macnally (TI-1021)



US09706532B1

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

(10) **Patent No.:** **US 7,065,327 B1**
(45) **Date of Patent:** **Jun. 20, 2006**

(54) **SINGLE-CHIP CMOS DIRECT-CONVERSION TRANSDUCER**

(58) **Field of Classification Search** 370/280, 370/294, 455/73, 76, 78, 82, 83, 183.1
See application file for complete search history.

(75) **Inventors:** **Donald Evan Macnally**, San Francisco, CA (US); **Thomas B. Cho**, Alameda, CA (US); **Shahriar Rahbi**, Palo Alto, CA (US); **Srenk Suresh Mehta**, Pleasanton, CA (US); **Christopher Donald Nihon**, San Jose, CA (US); **Michael Peter Mack**, San Francisco, CA (US); **Laurence Marguerite Plouvier**, San Francisco, CA (US); **Menne Marrings**, San Francisco, CA (US); **Eric S. Dukatz**, San Francisco, CA (US)

(73) **Assignee:** **Intel Corporation**, Santa Clara, CA (US)

(*) **Notice:** Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) **Appl. No.:** **09/762,720**
(22) **PCT Filed:** **Sep. 10, 1999**
(86) **PCT No.:** **PCT/US99/20792**
§ 371 (c)(1),
G2, (4) **Date:** **Nov. 20, 2001**
(87) **PCT Pub. No.:** **WO00/16492**
PCT Pub. Date: **Mar. 23, 2000**
Related U.S. Application Data
(60) **Provisional application No. 60/099,723**, filed on Sep. 10, 1998.
(51) **Int. Cl. B04B 1/44** (2006.01)
(52) **U.S. Cl.** 455/78; 455/83

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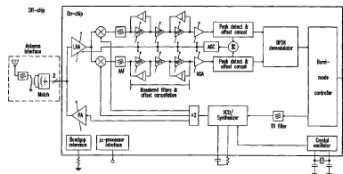
(Continued)

Primary Examiner—Bing Q. Bui
(74) **Attorney, Agent, or Firm**—Blakely, Sokoloff, Taylor & Zafman LLP

(57) **ABSTRACT**

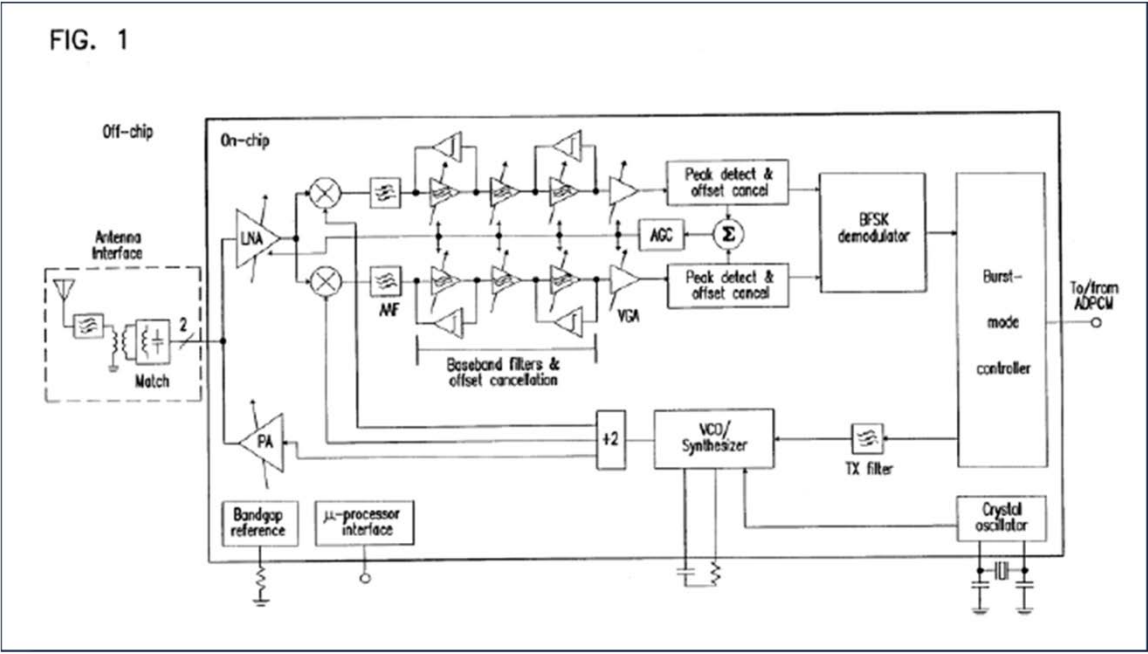
A single-chip CMOS direct conversion transducer includes an RF circuit, a transmitter having a synthesizer, a receiver having a baseband filter, and a demodulator. The synthesizer is coupled to the RF circuit. The baseband filter is coupled to the RF circuit and the synthesizer. The demodulator is coupled to the baseband filter. The RF circuit, the synthesizer, the baseband filter, and the demodulator are arranged and configured in CMOS devices and provide a complete interface between an antenna and a voiceband codec.

14 Claims, 16 Drawing Sheets



1

TI-1021



TI-1021, Fig. 1 (annotated) (cited by Inst. Decision, 21)

The Technology and Prior art

Razavi (TI-1017)

15-2

A 900-MHz CMOS Direct Conversion Receiver

Behzad Razavi

Formerly with: Hewlett-Packard Laboratories, Palo Alto, CA

Presently with: University of California, Los Angeles

This paper describes the design of a single-chip 900-MHz CMOS direct conversion receiver (DCR) fabricated in a digital 0.6- μm technology and operating from a 3-V supply.

Shown in Fig. 1 is the DCR architecture, consisting of a low-noise amplifier (LNA), quadrature mixers, simple low-pass filters (LPFs), a local oscillator (LO), a divide-by-two circuit, and baseband amplifiers, A_1 . An important goal in the design has been to achieve a relatively high gain (approximately 35 dB) in the RF section so as to minimize the effect of the $1/f$ noise contributed by the baseband amplifiers. For this reason, passive mixers have been avoided even though they provide potentially higher linearity than do their active counterparts. Another goal has been to include the LO on the chip so as to obtain a realistic estimate of the leakage to the front end. The design incorporates on-chip inductors extensively to improve the performance.

On the other hand, to minimize the noise current of M_7 , the allowable drain-source voltage of this device must be as large as possible. In this design, the noise current of M_7 is suppressed in the band of interest (and higher harmonics thereof) through the use of the degenerating inductor L_3 . This technique makes it possible to choose $V_{DS7} \approx 0.5$ V with negligible noise penalty, thereby allowing a large voltage drop across R_1 and R_2 .

The output nodes of the mixer are loaded with on-chip capacitors to suppress high-frequency components, but channel-selection filtering is not included here.

Fig. 3 illustrates the LO and the divide-by-two circuit. Using a cross-coupled pair M_1 - M_2 and 10-nH inductors L_1 and L_2 , the oscillator operates at 1.8 GHz while directly driving the divider. The latter is configured as a master-slave flipflop driven differentially through M_3 - M_4 and M_5 - M_6 . Proper sizing of the devices in each block enables division ratio to be exact of 2.

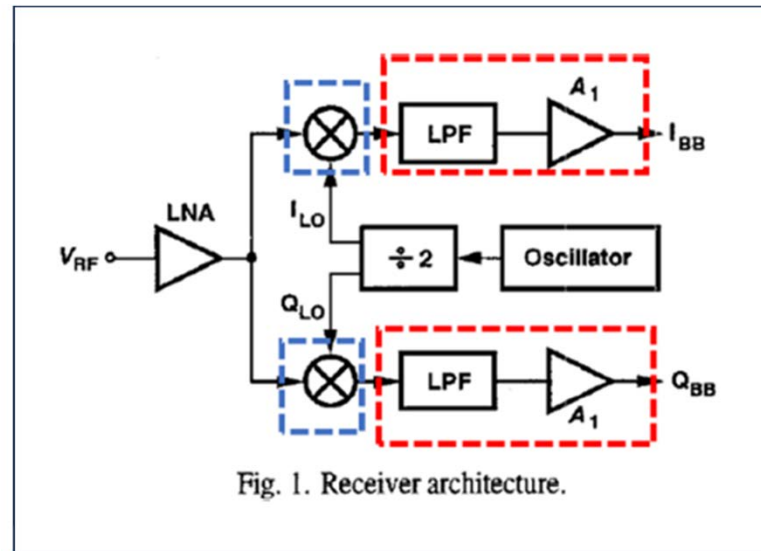


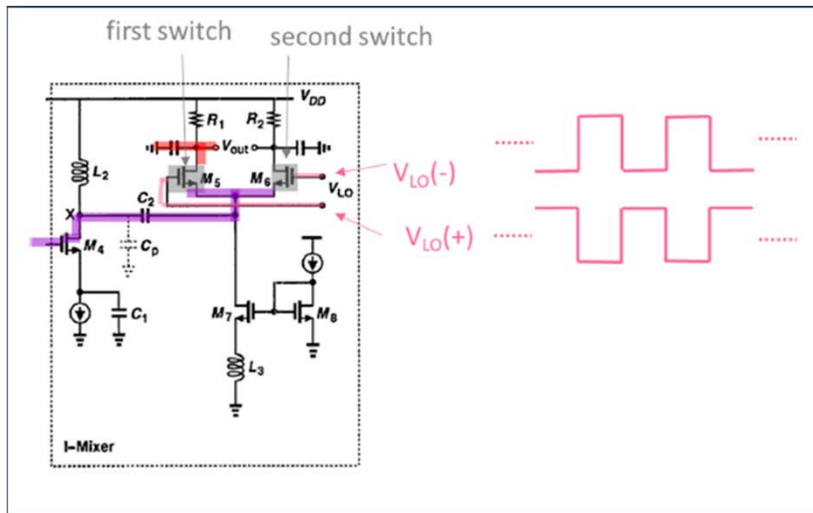
Fig. 1. Receiver architecture.

TI-1017, 113 (cited by Pet., 62)

TI-1017, Fig. 1 (annotated) (cited by Pet., 62-64)

Conventional MOSFET Transistor Operation

Razavi (TI-1017)



TI-1017, Fig. 2 (annotated by Dr. Galton)

Dr. Galton's Declaration

118. In the illustrated in-phase mixer, the switching pair M_5 and M_6 are alternately turned on or off under the control of V_{LO} , which has an upper component ($V_{LO(-)}$) and a lower component ($V_{LO(+)}$) oscillating in complementary manner relative to each other. I provide a diagram below illustrating square waveforms of complementary V_{LO} components operating on the switching pair).

TI-1003, ¶118 (annotated by Pet., 63)

Conventional MOSFET Transistor Operation

Dr. Galton's Declaration

119. Each time one switch of the pair (e.g., first switch M_5) is turned on, the transistor switch is CLOSED and the drain terminal is conducting so that charge is accumulated on a corresponding capacitor in the presence of resistor R_1 . This on-duration corresponds to the period where $V_{LO}(+)$ is high. In the meantime, the other switch (e.g., second switch M_6) is turned off because $V_{LO}(-)$ is low. When first switch (M_5) is turned off, a portion of the accumulated charge is discharged through resistor R_2 . During this period first switch (M_5) is off, $V_{LO}(-)$ is high and second switch (M_6) is turned on so that charge is accumulated on a corresponding capacitor in the presence of resistor R_2 . A portion of the accumulated charge is similarly discharged through R_2 when second switch (M_6) is turned off. The cycle then repeats.

TI-1003, ¶119 (annotated by Pet., 63-64)

'528 Patent – Issues Raised By PO

- Issues Raised PO
 - Whether Tayloe and Macnally are prior art
 - Whether claimed “energy storage element”/”storage element” requires a low impedance load
 - Whether TI has demonstrated sufficient motivation to combine prior art as well as reasonable expectation of success (assuming energy storage element requires a low impedance load)
- Undisputed:
 - Claim elements not disputed are met.
 - The Tayloe-Based combination would render obvious all challenged claims (if independent claim 1 is invalidated).
 - The Razavi-Based combination would render obvious all challenged claims (independent claim 1, and dependent claims 8 and 19 are invalidated).

FISH.

PO Fails to Swear Behind

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

Patent Owner Attempts Swear Behind

Patent Owner's Response

Claims 1, 3, 5, 8-9, 11-18 of the '528 patent were conceived at least as early as January 20, 1998 and diligently reduced to practice by no later than April 29, 1998.

POR at 23

Petition

Texas Instruments Incorporated ("Petitioner") petitions for *Inter Partes* Review ("IPR") of claims 1-5, 8, 9, 11-23, 26, 27, and 29-36 ("the Challenged Claims") of U.S. Patent No. 9,118,528 ("the '528 Patent"). Compelling evidence presented in this Petition demonstrates at least a reasonable likelihood that Petitioner will prevail with respect to at least one of the Challenged Claims.

Pet at 1

not all Challenged Claims

Pet. Reply at 1

Patent Owner Fails to Swear Behind

1

Uncorroborated Inventor's testimony of conception

Pet. Reply at 3-4, 7, 18-20

2

No evidence the schematics correspond to the chip tested by Boeing

Pet. Reply at 4-7

3

No evidence that schematics or the chip tested by [REDACTED] would meet all claimed features

Pet. Reply at 7-16

4

No showing of constructive reduction to practice

Pet. Reply at 17-18

Inventor's Testimony of Conception Must be Corroborated

1

***Apator Meters APS v. Kamstrup A/S*, 887 F.3d 1293, 1295 (Fed. Cir. 2018)**

It is well established, however, that when a party seeks to prove conception through an inventor's testimony the party must proffer evidence, "in addition to [the inventor's] own statements and documents," corroborating the inventor's testimony. *Mahurkar v. C.R. Bard, Inc.*, 79 F.3d 1572, 1577 (Fed. Cir. 1996); *Hahn v. Wong*, 892 F.2d 1028, 1032 (Fed. Cir. 1989).

...the "**evidence of corroboration must not depend solely on the inventor himself.**" *Cooper v. Goldfarb*, 154 F.3d 1321, 1330 (Fed. Cir. 1998); see also *Hahn*, 892 F.2d at 1033 (corroborating evidence must be "independent of information received from the inventor").

(cited by Pet. Reply at 7)

PO's allegation of conception solely relied on Sorrels' testimony

1

Patent Owner's Response

David Sorrells (ParkerVision's CTO) confirmed that the above shows ParkerVision's [REDACTED] shown above to be last modified on March 6, 1997. Ex.-2016, ¶¶7-10; Ex.-2012. The Eddie chip [REDACTED] Ex.-2016, ¶5. The Eddie chip [REDACTED] [REDACTED] *Id.*

POR at 24

Sorrels' Declaration

5. In the summer of 1996, ParkerVision began to design its first integrated circuit (IC) chip called "Eddie." ParkerVision completed the design of the Eddie chip by early 1997. The Eddie chip used [REDACTED]

[REDACTED]

6. By early 1997, ParkerVision completed the layout for the Eddie chip.

7. The layout of the first Eddie chip can be found in a file [REDACTED] (Exhibit 2012).

EX2016 at ¶¶5-7

Sorrels cannot authenticate PO's swear-behind documents

1

Sorrels' Declaration

9. As can be seen (below left) in the properties of the [REDACTED] this file shows that it was last modified on March 6, 1997. As can be seen (below right) in the metadata from a Relativity database, it also shows that the file was last modified on March 6, 1997. This date is consistent with the time that the ParkerVision team and I were working on the layout of the Eddie chip.

EX2016, at ¶9

*Relativity database was not used
by ParkerVision in 1997-1998*

Sorrels' Deposition

Q. The list in Exhibit 2029, did you check the date on the document relative to the metadata for each of those documents?

A. Not for each one, no, sir. You know, it forked over a lot of them and so the decision was made to put everything that it forked over into the database. So, no, sir, I did not check each individual entry.

Q. Okay. Do you know if Relativity was used by ParkerVision in 1997-98?

A. I'm pretty comfortable with the answer of no.

Q. Do you know how the files got from ParkerVision into Relativity?

A. The answer is I do not know specifically.

TI-1068, 24:7-21 (cited by Pet. Mot. to Exclude 8-9)

Sorrels cannot authenticate PO's swear-behind documents

1

Patent Owner's Response

Mr. Sorrells confirmed that the ParkerVision team continuously worked on the Eddie chip and circuit board through the time it was tested/evaluated. *Id.*, ¶28.

Mr. Sorrells provided a list of ParkerVision files reflecting ParkerVision's continuous work. *Id.*, ¶¶28-30. Ex.-2029.

Mr. Sorrells authenticated all of the files listed or referenced above. *Id.*, ¶27.
31.

POR at 27

*Mr. Sorrells has no knowledge of the
Relativity database*

Sorrels' Deposition

Q. And is the -- is it fair to say the Relativity database is stored on a hard drive or a server someplace?

A. I don't know where it's stored. I will tell you that it was readily available when I was looking at it with the attorneys.

Q. Do you know who maintains the server or hard drive that has the Relativity database?

MS. LEPORE: Objection, calls for speculation.

A. This is a deposition, so I can only guess. If you want me to guess, I will, but just know that it's speculation.

BY MR. GRISWOLD:

Q. Understood. So you don't know? You would have to guess?

A. Yes.

TI-1068, 21:5-21 (cited by Pet. Mot. to Exclude 8-9)

No evidence the schematics correspond to the chip tested by [REDACTED]

2

Dr. Dickens' Deposition

Q Okay. In reviewing this document, were you able to determine the circuit, schematic for the circuit, that was actually tested by [REDACTED]?

ATTORNEY CHARKOW: Objection. Form.

A No. No. They didn't provide a schematic of the actual test, device under test in the report.

EX2043, 72:11-17

Q Okay. And based on your review of this schematic and [REDACTED] can you determine if this was the circuit that was tested by [REDACTED]?

ATTORNEY CHARKOW: Objection to form.

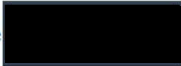
A In my opinion, I don't believe this -- this circuit was the one that was actually tested, that was represented to be, but I don't think it was. And this looks to me, maybe an early version or something. But I would just be speculating. I don't know.

EX2043, 73:10-20

No evidence the schematics correspond to the chip tested by Boeing

2

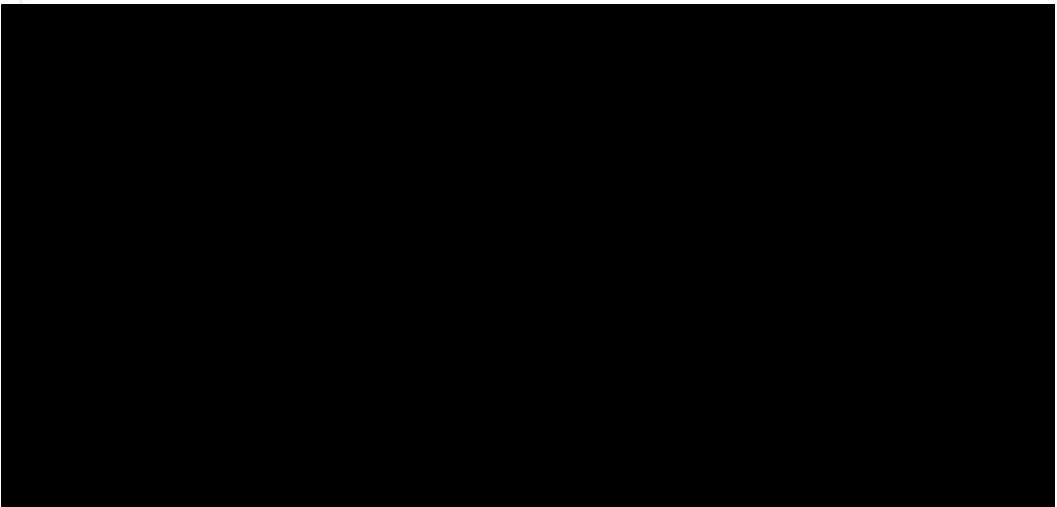
Sorrels' Declaration

9. As can be seen (below left) in the properties of the  this file shows that it was last modified on March 6, 1997. As can be seen (below right) in the metadata from a Relativity database, it also shows that the file was last modified on March 6, 1997. This date is consistent with the time that the ParkerVision team and I were working on the layout of the Eddie chip.

EX2016, ¶9 (cite by Pet. Reply at 3-4)

2

16. The layout of the circuit board (Exhibit 2013) can be seen below left and the schematic of the circuit board can be seen below right. Part 63 is shown both on the circuit board layout and schematic and represents the location of the Eddie chip on the circuit board. The layout of the circuit board was created in 1997.



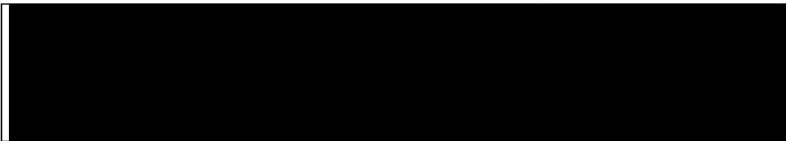
No Evidence of meeting all claimed features

3

Claim 1 requires “a first switch coupled to a first control signal” (1[b]) and “a second switch coupled to a second control signal” (1[d])

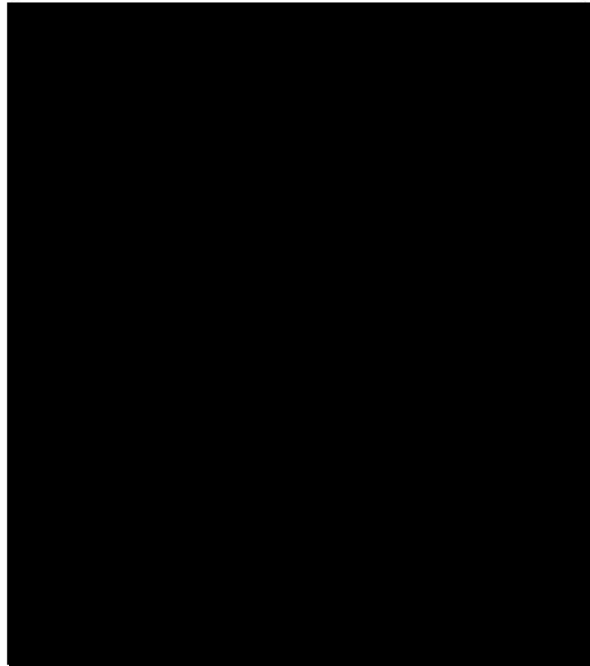
TI-1001, cl.1

Dr. Ricketts' Deposition



TI-1065, 78:6-12 (cited by Pet. Reply at 8-9)

Dr. Dickens' Declaration



TI-1067, ¶13 (annotating EX2015, 5) (cited by Pet. Reply at 7-8)

No Evidence of meeting all claimed features

3

Asserted energy storage device under (1[c] and 1[e] would have not worked

Pet. Reply, 9-12

Dr. Dickens' Declaration

TI-1067, ¶16 (annotating EX2011) (cited by Pet. Reply at 10-11)

TI-1067, ¶¶ 17-20 (cited by Pet. Reply at 11-12)

No Evidence of meeting all claimed features

3

If the circuit worked, the alleged capacitors would have accumulated/stored charge when the switch is open (off) and transferred charge when the switch is closed (on), opposite to 1[a]/[1b], and 1[c]/1[d]

Dr. Dickens' Declaration

Pet. Reply, 9-12



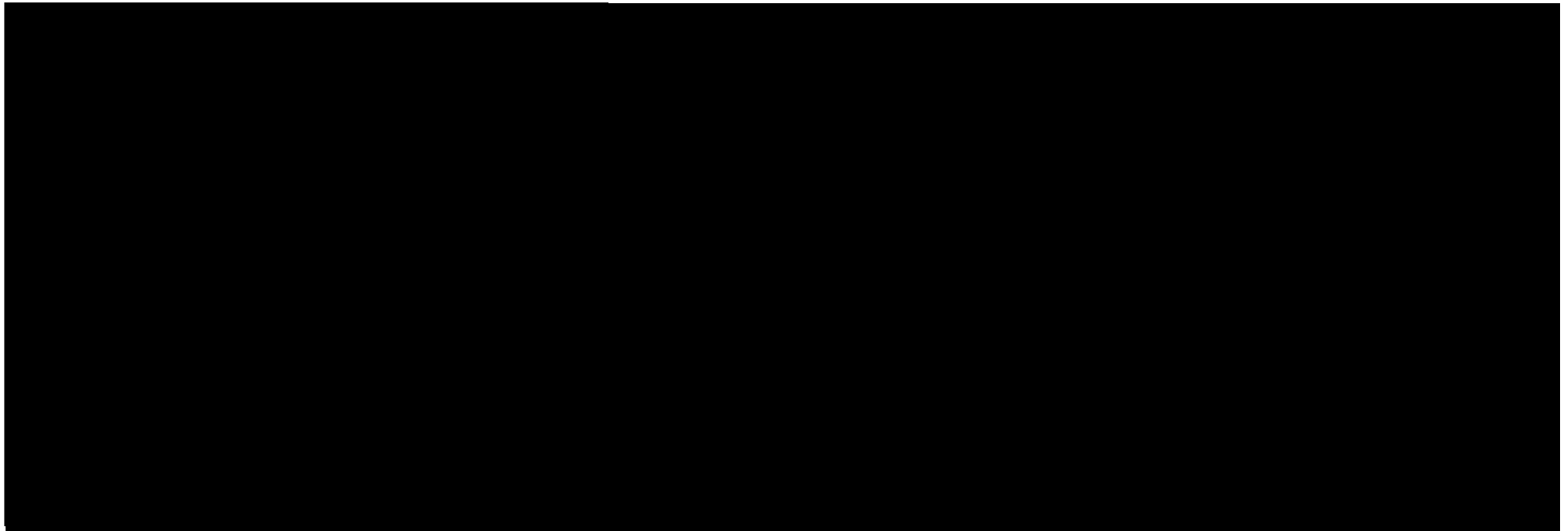
No Evidence of meeting all claimed features

3

If the circuit worked, the alleged capacitors would have accumulated/stored charge when the switch is open (off) and transferred charge when the switch is closed (on), opposite to 1[a]/[1b], and 1[c]/1[d]

Pet. Reply, 9-12

Dr. Dickens' Declaration

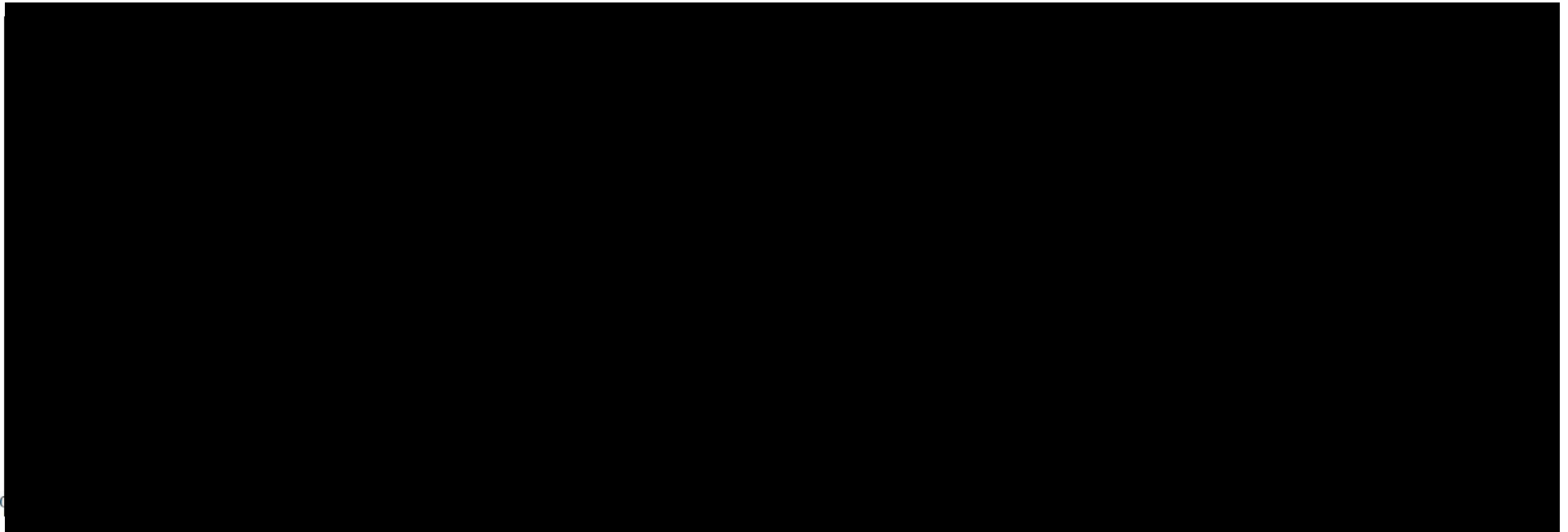


No Evidence of meeting all claimed features

3

No differential amplifier for combining (1[g]) *Pet. Reply, 12-13*

Dr. Dickens' Declaration



Ex.-20

TI-1067, ¶24 (annotating EX2011) (cited by Pet. Reply at 12)

No Evidence of meeting all claimed features

3

No differential amplifier for combining (1[g]) *Pet. Reply, 12-13*

Dr. Dickens' Declaration

Ex.-20

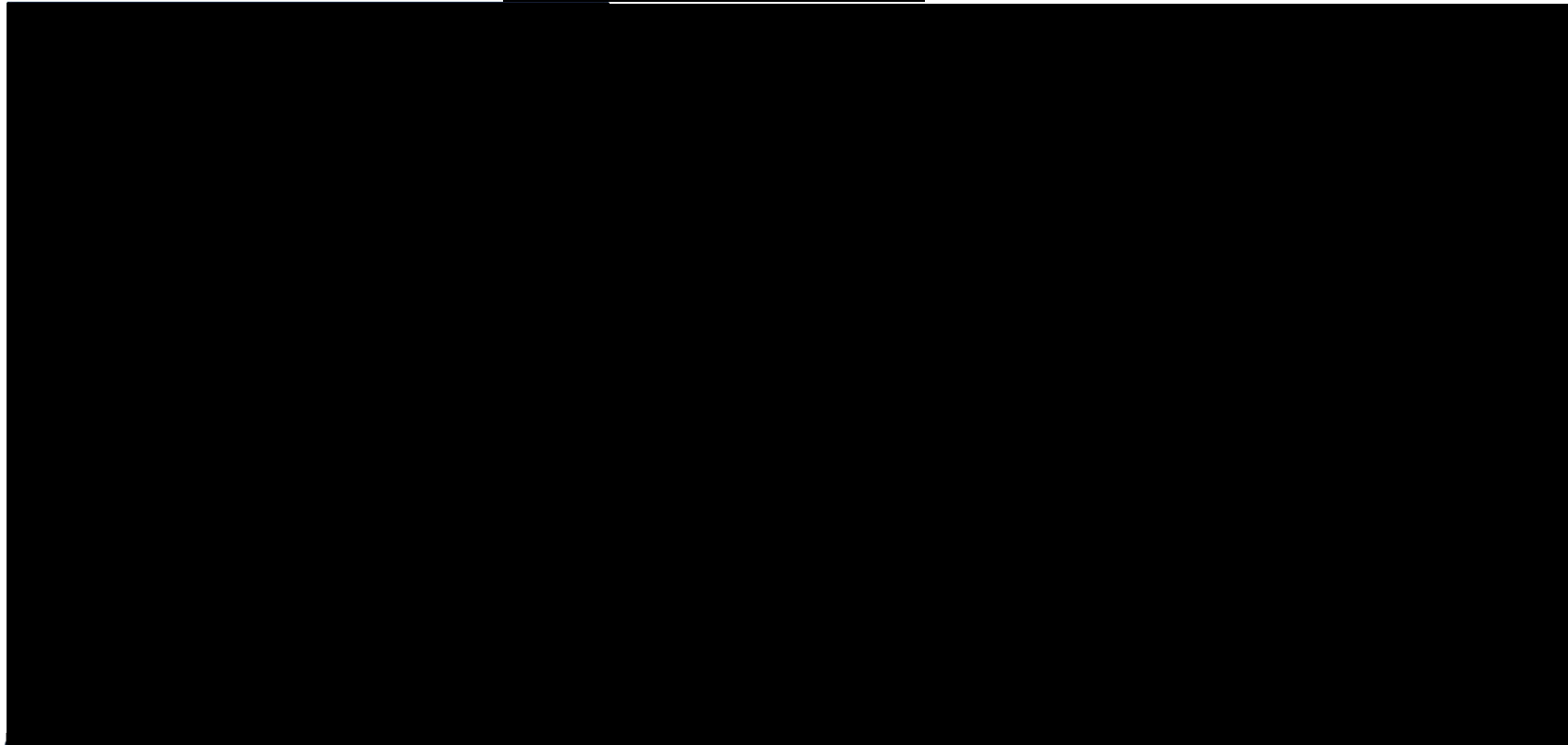
No Evidence of meeting all claimed features

3

undisputed No outputting a differential output (1[g])

Pet. Reply, 12-13

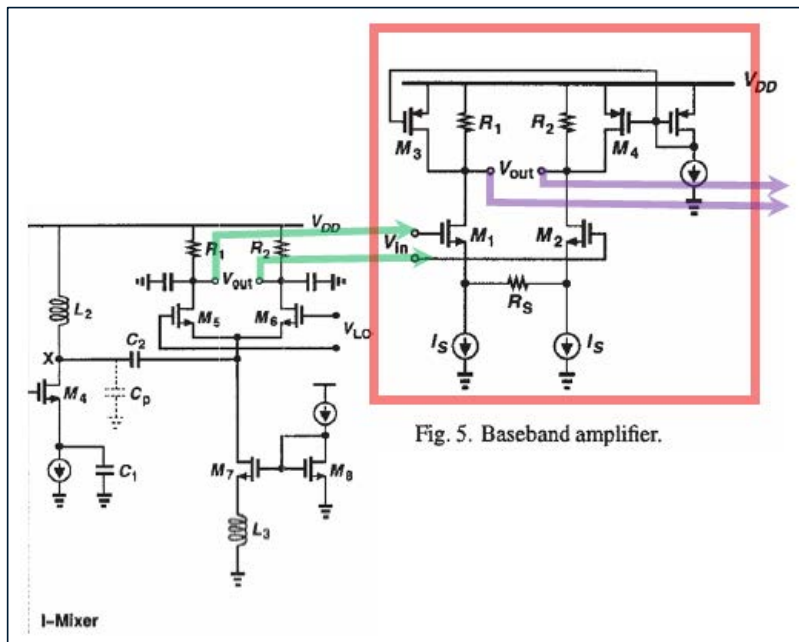
Dr. Dickens' Declaration



No Evidence of meeting all claimed features

3

PO Fails to Link Galton's Discussion of Razavi to the Operation of EX.-2011 Circuitry



POR, 113 (citing TI-1003, ¶187)

No Evidence of Constructive Reduction to Practice

4

file listing (EX2029) does not show diligence

Sorrels Declaration

28. From at least March 6, 1997 through the filing of U.S. Patent No. 6,061,551 (from which the '177 patent claims priority) on October 21, 1998, ParkerVision employees worked consistently on the design, development, testing, and/or evaluation of the Eddie Chip. From at least January 20, 1998 through October 21, 1998, ParkerVision employees worked consistently on the design, development, testing, and/or evaluation of the Eddie Chip and the circuit board into which the Eddie chip was incorporated.

29. ParkerVision files related to the design, development, testing, and/or evaluation of the Eddie chip and circuit board discussed above are maintained in a Relativity database. The Relativity database shows the metadata including file extension, file name, and last modified date of these files. A search of the database was run. Below is an excerpt from the search.

EX2016, ¶¶28-29

Pet. Reply, 18

Sorrels' Deposition

Q. The list in Exhibit 2029, did you check the date on the document relative to the metadata for each of those documents?

A. Not for each one, no, sir. You know, it forked over a lot of them and so the decision was made to put everything that it forked over into the database. So, no, sir, I did not check each individual entry.

Q. Okay. Do you know if Relativity was used by ParkerVision in 1997-98?

A. I'm pretty comfortable with the answer of no.

Q. Do you know how the files got from ParkerVision into Relativity?

A. The answer is I do not know specifically.

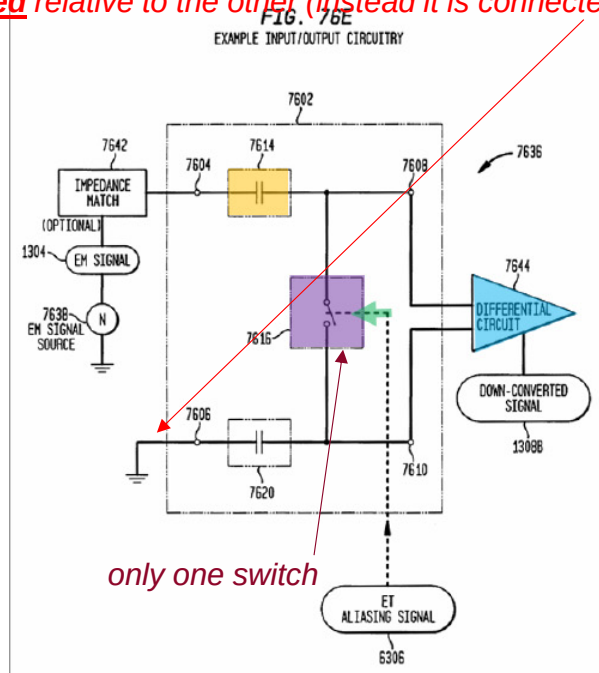
TI-1068, 21:5-21 (cited by Pet. Mot. to Exclude 8-9)

4

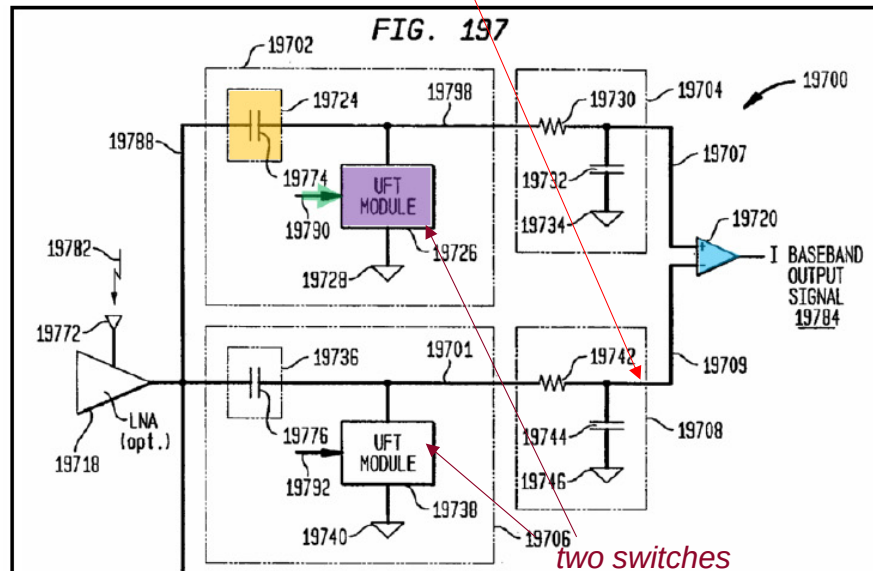
No Evidence of Constructive Reduction to Practice

'551 application (left) does not support claimed features, as alleged by PO SurReply

'551 application does not show one input to circuit 7644 is inverted relative to the other (instead it is connected to ground)



'528 patent requires both "down-converted in-phase baseband signal portion" and "down-converted inverted baseband signal portion" for amp 19720 (claim 1)



PO SurReply at 23

FISH.

Claim Construction

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

Claim Terms for Construction

- Undisputed:
 - Aperture
 - Switch
- Disputed:
 - Energy Storage Element/Storage Element

TI's proposal: energy storage element/storage element

Petition

The two terms are synonyms and should be construed to mean “*an element of a system that stores non-negligible amounts of energy from an input EM signal*,” as determined by the Board and affirmed by the Federal Circuit. IPR2020-01265, Paper 44 (invalidating claim 3 of US, 7,110,444); *ParkerVision, Inc. v. Vidal*, 88 F.4th 969, 976 (Fed. Cir. Dec. 15, 2023) (holding “ParkerVision acted as its own lexicographer to define the term ‘storage element’” and “the Board’s construction of ‘storage element’ [quoted above] correctly tracks the lexicography provided by [ParkerVision]”) (citing US6,061,551 (“551 patent), 66:55-67).

Pet., at 3 (‘528 patent also incorporating by reference US6,061,551)

‘528 patent

1[c] a first *energy storage element* that stores the transferred energy from the modulated carrier signal and outputs a down-converted in-phase baseband signal portion of said modulated carrier signal;

1[e] a second *energy storage element* that stores the transferred energy from the modulated carrier signal and outputs a down-converted inverted in-phase baseband signal portion of said modulated carrier signal;

TI-1001, cl.1

TI's proposal: energy storage element/storage element

The Board construed “storage element” in US 7,110,444 (incorporating US6,061,551 by reference)

capacitance 8208.” *Id.* at 66:56–59. Critically, the '551 patent states:

The terms storage module and storage capacitance, as used herein, are distinguishable from the terms holding module and holding capacitance, respectively. Holding modules and holding capacitances, as used above, identify systems that store negligible amounts of energy from an under-sampled input EM signal with the intent of “holding” a voltage value. *Storage modules and storage capacitances, on the other hand, refer to systems that store non-negligible amounts of energy from an input EM signal.*

Id. at 66:59–67 (emphasis added).

IPR2020-01265, Paper 44 at 36 (cited by Pet. 3)

This portion of the '551 patent specification provides a lexicographic definition of the systems to which the terms refer. In particular, “holding modules” “identify systems that store negligible amounts of energy from an under-sampled input EM signal with the intent of ‘holding’ a voltage value” whereas “storage modules” “refer to systems that store non-negligible amounts of energy from an input EM signal.” *Id.* (emphasis added). Because the parties agree that “storage element” and “storage module” are synonymous, we determine that the patentees acted as their own lexicographers and deliberately defined the systems to which “storage element” refers as “systems that store non-negligible amounts of energy from an input EM signal.” *Id.* As reflected in the parties’ proposed constructions above, the parties also agree that the meaning of “storage element” includes the term “element.” Thus, applying the lexicographic definition of the systems to which “storage element” refers, we determine that one of ordinary skill in the art would have understood “storage element” to mean “an element of a system that stores non-negligible amounts of energy from an input EM signal.”

TI's proposal: energy storage element/storage element

The Federal Circuit affirmed the Board

The critical paragraph clearly expresses an intent to define the term "storage element" in sentence 5. Sen-

...

ParkerVision, Inc. v. Vidal, 88 F.4th 969, 976 (Fed. Cir. Dec. 15, 2023) (holding "ParkerVision acted as its own lexicographer to define the term 'storage element'" and "the Board's construction of 'storage element' [quoted above] correctly tracks the lexicography provided by [ParkerVision]") (citing US6,061,551 ("551 patent"), 66:55-67)

In the critical paragraph in the '551 patent incorporated into the '444 patent, ParkerVision acted as its own lexicographer to define the term "storage element." The critical paragraph recites:

[1.] FIG. 82A illustrates an exemplary energy transfer system 8202 for down-converting an input EM signal 8204. [2.] The energy transfer system 8202 includes a switching module 8206 and a storage module illustrated as a storage capacitance 8208. [3.] The terms storage module and storage capacitance, as used herein, are distinguishable from the terms holding module and holding capacitance, respectively. [4.] Holding modules and holding capacitances, as used above, identify systems that store negligible amounts of energy from an under-sampled input EM signal with the intent of "holding" a voltage value. [5.] *Storage modules and storage capacitances, on the other hand, refer to systems that store non-negligible amounts of energy from an input EM signal.*

'551 patent col. 66 ll. 55–67 (emphasis added) (numbering added).

PO's proposal: energy storage element/storage element

POR

For the foregoing reasons, the term “*energy storage element*” should be construed as “an element of **an energy transfer system** that stores non-negligible amounts of energy from an input EM signal.”

POR, 56

Ricketts Declaration

121. In ParkerVision’s energy transfer system, non-negligible amounts of energy from an input signal (a radio frequency (RF) signal) pass through the switch and the energy transferred itself to a load forms the down-converted (baseband) signal. **In an energy transfer system, energy is integrated in a storage module and a low impedance load is used.** The low impedance load allows energy to be transferred through the system. This configuration allows energy to continuously flow to the low impedance load and forms the baseband signal. In particular, the RF signal drives the low impedance load when the switch is closed (ON), and the storage module continues to drive the low impedance load when the switch is opened (OFF). So energy flows from the switch when the switch is closed (ON) and from the storage module when the switch is opened (OFF).

EX2024, 121 (cited by POR, 11-12)

PO's proposal must fail

Ricketts' Declaration

181. The term used in the claims of the '528 patent, however, is “energy storage element,” not just “storage element.” A POSITA reading the patents understands that an “energy” storage element is a particular type of storage element – one that is used in an energy transfer system.

EX2024, ¶181 (not cited by POR)

Dr. Galton's Declaration

claims, which is unnecessary. This is because the terms of “storage element” and “energy storage element” are used interchangeably by ParkerVision. TI-1003, ¶¶74-75. While claim 1 recites “a first energy storage element” and “a second energy storage element,” dependent claim 18, which depends directly from claim 1, recites “said first and second storage elements.” *Id.* Other dependent claims, for example, dependent claims 8 and 9 recite both terms interchangeably. If the distinction between “energy storage element” and “storage element” were so significant, as alleged by Dr. Ricketts in his declaration, then the claims would not have recited the two terms interchangeably.

TI-1066, ¶15 (cited by Reply, 21)

'528 uses storage element and energy storage element interchangeably

'528 patent at claim 18

18. The system of claim 1, wherein said first and second storage elements are capacitive storage circuits, and wherein said portions of transferred energy from each of the first and second switch which are integrated over time to accumulate said portions of transferred energy are integrated by the capacitive storage circuits as they accumulate charge during successive sampling apertures.

TI-1001, cl. 18 (reciting said storage element based on independent claim 1)

'528 patent at claim 1

a first energy storage element that stores the transferred energy from the modulated carrier signal and outputs a down-converted in-phase baseband signal portion of said modulated carrier signal;

a second energy storage element that stores the transferred energy from the modulated carrier signal and outputs a down-converted inverted in-phase baseband signal portion of said modulated carrier signal;

TI-1001, cl. 1

PO's proposal must fail

POR

The construction of “storage element” already includes “non-negligible amounts of energy.” Thus, a POSITA would understand that an “*energy storage* element” must be something more than just an element that *stores energy*. Otherwise, the term “energy” in “*energy storage element*” would be meaningless.

POR, 53

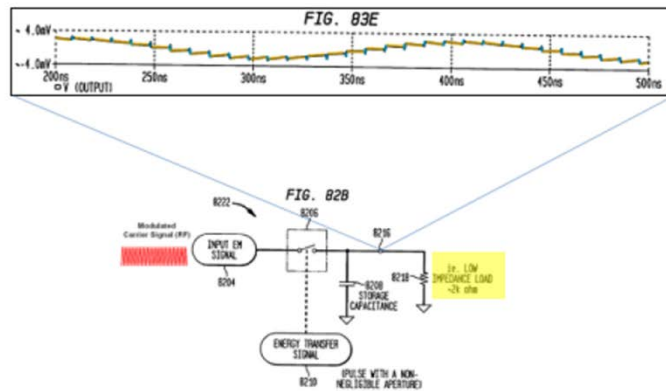
By the same logic, “*storage*” is also rendered redundant by “energy storage element *stores* energy”

Pet. Reply, 21

PO's proposal must fail

Ricketts' Declaration

passing through the switch. Since the load is low impedance, when the switch is OFF (opened), as shown in Figure 82B above (right), energy (orange) stored in the “storage” capacitor 8208 is discharged to the low impedance load 8218. For this reason, the “storage” capacitor is said to “drive the load.” Ex.-1001, 73:65-74:2.



EX2024, ¶159

Dr. Galton's Declaration

9. At best, the '528 patent states that a benefit of the energy transfer system is the ability to drive low-impedance loads. The '528 patent states: “the non-negligible amounts of transferred energy ensure that, *even for low impedance loads*, the storage capacitance 8208 accepts and maintains sufficient energy or charge to drive the load.” TI-1001, 73:65-74:1 (emphasis added). In my view, this statement implies that a benefit of the energy transfer system is the ability to drive low-impedance loads. But energy transfer in the context of the alleged invention is achieved independent of the load.

TI-1066, ¶19 (cited by Reply, 21)

'528 patent

systems. In other words, the non-negligible amounts of transferred energy ensure that, *even for lower impedance loads*, the storage capacitance 8208 accepts and maintains sufficient energy or charge to drive the load 8202. This is illustrated below in the timing diagrams of FIGS. 83A-F.

TI-1001, 73:65:74:1 (cited by Reply, 21)

PO's proposal must fail

POR

The Federal Circuit recently held: “ParkerVision’s down-converting system uses a technique called ‘energy sampling,’ which differs from the technique of ‘voltage sampling,’ which was used in conventional down-converting systems.”
ParkerVision v. Qualcomm, 116 F.4th 1345, 1349 (Fed. Cir. 2024).

POR, 54

The Federal Circuit actually held:

Because the district court's application of collateral estoppel is legal error, the district court abused its discretion in excluding the testimony of ParkerVision's validity expert. Thus, we reverse the trial court's grant of Qualcomm's *Daubert* motion.

ParkerVision v. Qualcomm, 116 F.4th 1345, 1362

Thus, we conclude that the district court abused its discretion by excluding the testimony of ParkerVision's infringement experts. We reverse the grant of Qualcomm's *Daubert* motions. We likewise vacate the district court's grant of summary judgment of non-infringement of the transmitter claims of the '940 patent, which was based on the exclusion of ParkerVision's infringement experts.

ParkerVision v. Qualcomm, 116 F.4th 1345, 1364

FISH.

The Tayloe-Based Ground

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

Tayloe-Based Ground: issues raised by PO

- I. Whether TI's application of prior art meets all claim limitations.
- II. Whether TI has proffered sufficient motivation to combine
- III. Whether Tayloe and Macnally are compatible
- IV. Whether TI has proffered reasonable expectations of success

Undisputed:

Claimed features such as switches and differential amplifiers are met by prior art.

Disputed:

What is the input impedance of Tayloe's summing amplifier box 50?

What is a single-chip implementation?

I. TI's application of prior art meets all claim limitations

1

“energy storage element”

Pet. Reply at 23

2

deriving a baseband signal portion

Pet. Reply at 24

3

outputting a differential baseband signal

Pet. Reply at 25

I. PO alleges three claim limitations remain unmapped

Patent Owner's Response

Petitioner cannot map numerous claim elements to Tayloe/TI Datasheet. In particular, Tayloe/TI Datasheet does not disclose/teach/suggest (1) a “energy storage element” that stores transferred energy and outputs a baseband signal portion, (2) deriving a baseband signal portion from accumulated transferred energy, or (3) outputting a differential baseband signal (claims 1, 19). Tayloe/TI Datasheet also does not disclose/teach/suggest transferred energy being discharged when a switch is OFF (claims 8, 9, 26, 27). Ex.-2024, ¶¶279-284; compare Ex.-1004, Fig. 3 with Ex.-2037, pp. 523 (Fig. 10.1-3(a) sample-and-hold circuit) (Tayloe and Fig. 10.1-3(a) both show a switch and the output of a capacitor directly connected into an amplifier).

POR at 77

1

I. Tayloe, as applied in the combination, teaches “energy storage element”

Ricketts’ Declaration

279. But, as discussed in Section VII.A above, the alleged energy storage elements in Tayloe (capacitors 72, 76 of Figure 3; or capacitors 175, 177 in Figure 6) do not discharge energy to generate the baseband signal and thus cannot output any baseband signal portion, as required by the claims. Tayloe explicitly states that the voltage on the capacitors charge to voltage points 105, 110, 115, and 120. Ex.-1004, 3:40–48. A POSITA would understand that in order for the capacitors to maintain those voltage level, the capacitors must retain charge and cannot discharge energy to form an output signal. Because there is no discharge of energy from the capacitors to the load in Tayloe, the baseband signal portion cannot be derived from the accumulated transferred energy.

EX2024, ¶279 (cited by POR, 77)

Dr. Galton’s Declaration

40. I disagree with Dr. Ricketts because his analysis is flawed. For example, he did not acknowledge that Tayloe teaches generating baseband signals using the accumulated charges, as I had explained earlier. TI-1003, ¶¶153-158 (citing, among others, TI-1004, 2:56-59 (“...producing baseband in-phase signal”), 5:1-16 (“0 degree output [is] used to generate baseband in-phase...signal”)). Additionally, Dr. Ricketts did not account for Tayloe’s capacitor, which, as applied in the combination, is coupled to a “low impedance load” provided by “the differential amplifier circuit of Macnally.” TI-1003, §VI.D. As I discussed *supra* §IV.A.1(a)(i), two of the four capacitors are coupled to the negative input terminals of Tayloe’s summing amplifiers, each of which presents a low-impedance load (e.g., in the kilo ohm range).

TI-1066, ¶40 (cited by Pet. Reply, 23-24)

1

I. Tayloe, as applied in the combination, teaches “energy storage element”

Ricketts’ Declaration

230. As shown above, Figure 7 of Tayloe discloses another alternative embodiment of a product detector. Ex.-1004, 5:1-2. An analog multiplexer (MUX) 202 is used instead of commutating switch 38 of Figure 3; a digital counter 220 provides control signals to the analog MUX 202. Id. at 5:1-16. Tayloe refers to Figure 7 as the product detector and Tayloe explains that the receiver design of Figure 7 is “the same as direct conversion receiver 30 (FIG. 3)” (other than the analog MUX 202 and a digital counter 220) (id. at 5:31-34).

EX2024, ¶230 (cited as Section VII.A by ¶279)

Tayloe

FIG. 7 shows a product detector in accordance with an alternate embodiment of the present invention. Product detector **200** includes analog multiplexer **202** and digital counter **220**. Input signal f_1 is received at resistor **204** and is then input to analog multiplexer **202**. Analog multiplexer **202** is controlled by control signals **214** which are generated by digital counter **220**. Digital counter **220** runs at a clock frequency of substantially $4f_1$. One skilled in the art of analog and digital circuit design will readily understand that input signal f_1 is connected to each of the four outputs of analog multiplexer **202** for substantially 90 degrees of the input signal. As embodied in FIG. 7, 0 degree output **210** and 90 degree output **212** are used to generate baseband in-phase and quadrature signals. Of course, the remaining two outputs (180 degrees and 270 degrees) can be utilized as embodied in FIG. 3 to achieve greater gain.

TI-1004, 5:1-16 (cited by Pet. Reply, 23)

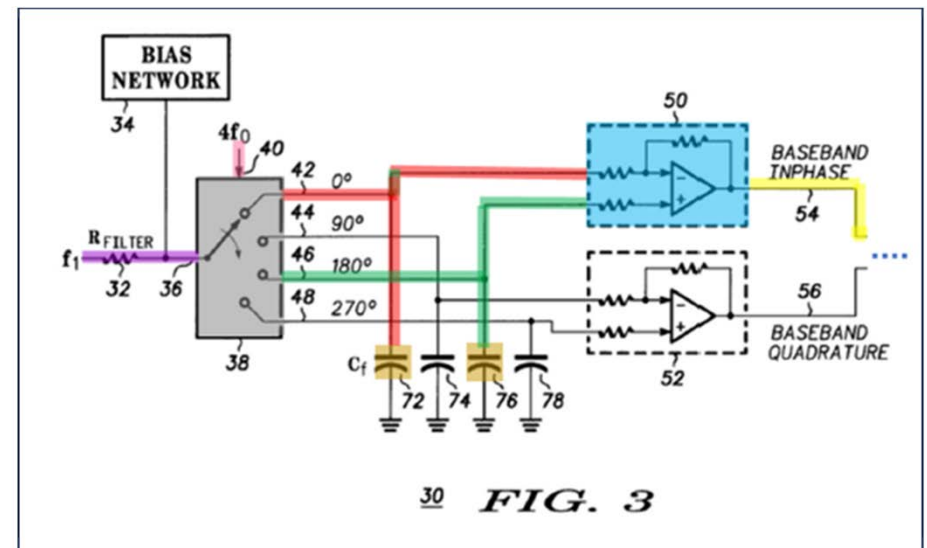
I. Tayloe, as applied in the combination, teaches “energy storage element”

1

Tayloe

The outputs of commutating switch 38 are input to summing amplifiers 50 and 52. Summing amplifier 50 differentially sums the 0 degree output and the 180 degree output, thereby producing baseband in-phase signal 54. Summing amplifier 52 differentially sums the 90 degree output and the 270 degree output, thereby producing baseband quadrature signal 56. Baseband in-phase signal 54 and

TI-1004, 2:56-59 (discussing FIG. 3) (cited by Pet. Reply, 23)



TI-1004, Fig. 3 (cited by Pet. at 11)

I. The Tayloe-Based combination teaches deriving a baseband signal portion

2

Ricketts' Declaration

279. But, as discussed in Section VII.A above, the alleged energy storage elements in Tayloe (capacitors 72, 76 of Figure 3; or capacitors 175, 177 in Figure 6) do not discharge energy to generate the baseband signal and thus cannot output any baseband signal portion, as required by the claims. Tayloe explicitly states that the voltage on the capacitors charge to voltage points 105, 110, 115, and 120. Ex.-1004, 3:40–48. A POSITA would understand that in order for the capacitors to maintain those voltage level, the capacitors must retain charge and cannot discharge energy to form an output signal. Because there is no discharge of energy from the capacitors to the load in Tayloe, the baseband signal portion cannot be derived from the accumulated transferred energy.

EX2024, ¶279 (cited by POR, 77)

Dr. Galton's Declaration

43. I disagree with Dr. Ricketts because his analysis is deficient. For example, Dr. Ricketts failed to address that Tayloe teaches generating baseband signals using the accumulated charges, as I had explained earlier. TI-1003, ¶¶153–158. Moreover, in the Tayloe combination, Taylor's capacitors are each coupled to “the differential amplifier circuit of Macnally [which] provides low impedance load,” as I had explained earlier. TI-1003, §VI.D. In the combination, Taylor's capacitors will thus each discharge energy to the low impedance load, i.e., the differential amplifier circuit of Macnally, even under the low impedance requirement imposed by Dr. Rickett and ParkerVision.

TI-1066, ¶¶ 41-43 (cited by Pet. Reply, 24)

I. The Tayloe-Based combination teaches outputting a differential baseband signal

3

Ricketts' Declaration

282. But, as shown above, the op-amp (red) in Tayloe's amplifier 50 (as well as amplifier 51) provides a *single*-ended (non-differential) output (blue arrow). Thus, Tayloe by itself does not disclose, teach, or suggest outputting a *differential* baseband signal from a differential amplifier circuit. And because Tayloe fails to disclose any output of baseband signal portions from energy transferred from the RF input in the first place, it necessarily also fails to disclose, teach, or suggest a differential amplifier circuit that combines baseband signal portions formed from energy transferred from the RF input signal to form a differential output.

EX2024, ¶1282 (cited by POR, 77)

Dr. Galton's Declaration

46. In his declaration, however, Dr. Ricketts has not addressed the combination system. Instead, Dr. Ricketts merely dwelled on Tayloe's amplifier. See EX2024, ¶¶280-282. Because Tayloe's amplifier is not part of the proposed combination, Dr. Ricketts' arguments are moot. Additionally, Dr. Ricketts' analysis of Tayloe's amplifier circuitry is loaded with inaccuracies, which I have discussed above under Section IV.A.1(a)(i).

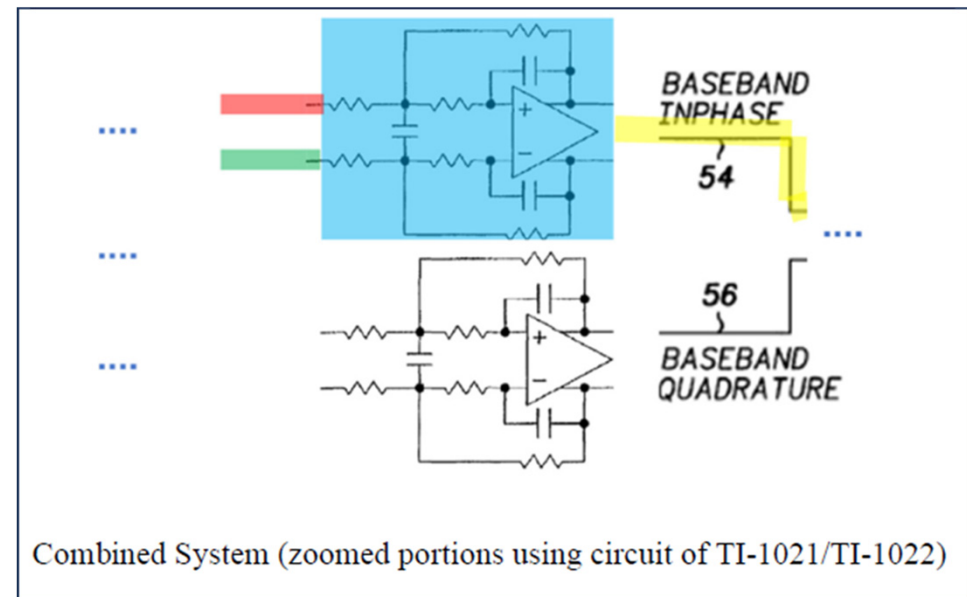
TI-1066, ¶144 (cited by Pet. Reply 25)

I. The Tayloe-Based combination teaches outputting a differential baseband signal

Dr. Galton's Declaration

167. As explained *supra* §§III.A.1-4 and annotated below, the combination system includes a *first differential amplifier circuit* (light blue) that *combines said down-converted in-phase baseband signal portion* (red portion feeding into Macnally's circuit) *with said down-converted inverted in-phase baseband signal portion* (green portion feeding into Macnally's circuit) *and outputs a first channel down-converted differential in-phase baseband signal* (yellow).

TI-1003, ¶¶167-169 (cited by Pet., 40-41)



TI-1003, ¶167(cited by Pet. Reply 25)

II. TI has proffered sufficient motivation to combine

1

Tayloe does not teach away from using Fig. 6

Pet. Reply at 25-27

2

Tayloe does not teach away from the combination

Pet. Reply at 27-28

3

Manally and TI-datasheet are combinable

Pet. Reply at 28

4

PO misconstrues Macnally

Pet. Reply at 28

5

Reasons for combining Tayloe and Macnally

Pet. Reply at 28-29

II. Tayloe does not teach away from using Fig. 6

1

Ricketts' Declaration

301. Figure 6 also introduces substantial practical complications. In an integrated circuit context, using Figure 6 would require precise matching of the four resistors (171–174) in order to maintain equal time constants across signal paths which is necessitated by Petitioner's proposed combination. This level of matching is difficult to achieve due to variation in IC fabrication processes. A mismatch would introduce distortion or imbalance in the signals. Achieving such matching would necessitate larger resistors (increasing die area) and/or post-fabrication calibration—both of which run counter to the alleged design goals of cost and simplicity. But these burdens are not present in Figure 3's shared-resistor design, which does not require matched per-path resistors. That Petitioner instead relies on Figure 6 contradicts the very design tradeoffs Petitioner alleges would motivate the combination with Macnally.

EX2024, ¶301

Dr. Galton's Declaration

56. Nevertheless, even if the system of Figure 6 is used instead of Figure 3, I disagree with Dr. Ricketts' point about resistor matching being an issue in Fig. 6 of Tayloe because Tayloe's *per-path* resistor configuration does not contradict the motivation to combine with Macnally. Based on my experience, it was general knowledge to match resistors during IC fabrication, as evidenced by prior art demonstrating on-chip resistors matched to a fraction of a percent of accuracy. In Wittmann, it is demonstrated that "layout of the resistors...optimized with respect to area and matching requirements to yield relative accuracy better than 0.25%." TI-1058, 935. When combining Tayloe's Figure 6 (rather than Figure 3) with the TI datasheet multiplexer, using matched resistors on each path on the IC would be standard practice when using "standard CMOS and BiCMOS processes," as shown in Wittmann. TI-1058, 935, 939. Hence, the matched resistors on each branch would not contradict the "size, packaging advantages, and low unit cost" for IC implementation, as I had explained in my First 528 Declaration. TI-1003, ¶141. TI1066, ¶156 (cited by Reply at 26)

II. Tayloe does not teach away from using Fig. 6

1

Ricketts' Declaration

300. If, as Petitioner contends, a POSITA is considering “size, packaging advantages, and low unit cost” (Ex.-1003, ¶141; Pet. 28) of an IC, then the shared-resistor configuration of Figure 3 is more suitable than the more complex per-path resistor architecture of Figure 6. A POSITA seeking a single-chip IC would prefer the simpler architecture of Figure 3—which uses fewer components, reduces layout complexity, and minimizes die area and power consumption—compared to Figure 6’s per-path resistor structure—which introduces greater component count, routing complexity, and cost.

EX2024, ¶1300

Dr. Galton's Declaration

88. Dr. Ricketts has neglected that what matters in an integrated circuit are the amount of area and the amount of power a circuit consumes. Simply tallying up the number of inputs and outputs of a circuit or trying to “eyeball” whether one implementation of a circuit seems more complicated than another, as Dr. Ricketts appears to have done, rarely gives insight into which of the two circuits consume less circuit area and/or power.

89. A POSITA at the time of the '528 priority date would understand that using a fully differential amplifier generally reduces area and power consumption relative to those of a comparable single-ended amplifier, even though the circuit diagram of the former is “more complicated” than that of the latter. TI-1060. The

TI-1066, ¶¶88-89 (cited by Pet. Reply at 26, 30)

II. Tayloe does not teach away from the combination

1

PO SurReply

As shown above, when discussing his motivation to combine Tayloe/Macnally, Galton identified the components in Tayloe's Figure 3 as the relevant "system" to be adapted. *Id.* The proposed combination would therefore need to implement all switches/resistors/capacitors of Tayloe, along with Macnally's filter (blue box, above right), on a single IC.

PO SurReply, 25

Dr. Galton's Declaration

63. In fact, it was common practice to use off-chip capacitors for modern chips. For example, Abidi (TI-1059) describes one example of "single-chip FM mono receiver [which] requires only 15 small [off-chip] capacitors and two inductors, making it possible to fit the entire system within a wristwatch" and "Yet greater miniaturization is attained at Alcatel by integrating the transmitter and receiver sections together on one silicon bipolar chip" using "Large (650 pF) off-chip capacitors constitute an anti-alias filter"). Here, "large" refers to the value of the capacitance, not the physical size of the capacitor. Also note that the "greater miniaturization" occurs despite the off-chip capacitors).

TI-1066, ¶63 (cited by Reply at 27-28)

II. Tayloe does not teach away from the combination

1

Ricketts Declaration

312. Macnally is realized in integrated circuit technology, in part, because it operates at high frequencies, e.g., 915 MHz, which enables the use of smaller component values (and thus, physically smaller sized components), making it feasible for an integrated circuit.

EX2024, ¶¶306-312

Dr. Galton’s Declaration

61. The proposed combination is not limited to **bodily incorporating Tayloe’s capacitor to handle “higher frequency signals (the types of signals that would be used for cellular/WiFi communications),”** as alleged by Dr. Ricketts. EX2024, ¶306. In fact, using **different component values** than those disclosed in Tayloe’s prototype example does not “depart from the spirit and scope of this invention.” TI-1001, 6:5-8.

TI-1066, ¶61 (cited by Reply at 27)

Macnally

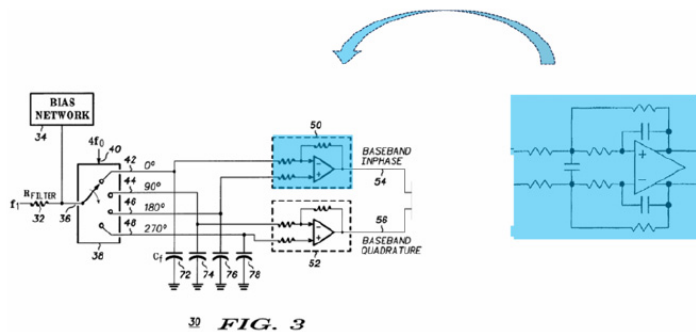

US007065327B1

(12) United States Patent Macnally et al.	(10) Patent No.: US 7,065,327 B1
	(45) Date of Patent: Jun. 20, 2006
(54) SINGLE-CHIP CMOS DIRECT-CONVERSION TRANSCEIVER	(58) Field of Classification Search 370/280, 370/294; 455/73, 76, 78, 82, 83, 183.1 See application file for complete search history.
(75) Inventors: Donald Evan Macnally, San Francisco.	TI-1007 (cited by Pet., at 20-22)

II. PO mischaracterizes “single-chip” implementation

2

PO SurReply, 24-25



TI-1004, Fig. 3 (left)

TI-1021/TI-1022, Fig. 3 (right)

As shown above, when discussing his motivation to combine Tayloe/Macnally, Galton identified the components in Tayloe's Figure 3 as the relevant “system” to be adapted. *Id.* The proposed combination would therefore need to implement all switches/resistors/capacitors of Tayloe, along with Macnally's filter (blue box, above right), on a single IC.

Dr. Galton's Deposition

Q. (BY MR. CHARKOW) All right. A chip design that requires large off-chip capacitors that are part of a filter is incompatible with a single-chip IC implementation, correct?

A. No.

Q. So a single-chip IC, the fact that you have fundamental components that are located off-chip, you still say that's a single-chip IC? That's your position?

A. Yeah, because there are always off-chip components.

EX2042, 48:6-16

II. Dr. Galton provided the only definition of “single-chip”

2

PO SurReply, 24

“Single-chip” is exactly what it sounds like: a *single* chip that contains all essential functionality. Galton admitted this, stating that for Tayloe, a *single*-chip means that “the essential functionality of Tayloe’s system [is] on a single IC.” Ex.-2042,50:11-16.

Ricketts Declaration

5:50-51. Thus, a POSITA would recognize Tayloe’s capacitors would be off chip, not integrated. Notably, Dr. Galton ignores this and offers no rationale as to how Tayloe’s large capacitors could be implemented in silicon. Instead, he simply states that “[a] POSITA would have been motivated to adapt Tayloe’s *system* as a single-chip (i.e. integrated circuit known as an IC) ...” (Ex.-1003, ¶141, emphasis added), without addressing this fundamental incompatibility. Dr. Galton’s proposal of adapting Tayloe’s entire system, including the large capacitors, into an integrated circuit does not work, given the large size of Tayloe’s capacitors.

EX2024, ¶306

Dr. Galton’s actual explanation

The essential functionality that you state that would be implemented on a single-chip for Tayloe would be transistors, the resistors, and any passives that are small enough to fit on the chip?

A. Yes.

And to add to that, the -- the -- where the definition in this context of a single-chip would fail is if you needed multiple chips. So the -- so the point is that you're going to build a board that has one chip on it and a bunch of supporting passives.

Q. Okay. What -- when you say “passives,” what do you mean?

EX2042, 53:18-54:10

A. Things that don't contain transistors.

II. Dr. Galton did not change his position

2

PO SurReply, 25-26

Ricketts's un rebutted testimony eviscerates Petitioner's only stated motivation to combine. Faced with this fatal problem, Petitioner *changes* positions in the Reply. Galton now conveniently carves out the capacitors from "Taylor's system," claiming Taylor/Macnally can still be considered a single-chip IC even with off-chip capacitors. Reply, 27-28 (citing Ex.-1066, ¶¶58-63). But moving Taylor's capacitors (essential components) off-chip defeats the entire purpose of the *single-chip* IC rationale. Galton's new position simply seeks to salvage Grounds 1A/1B after the fact. He is simply not a credible witness.

Dr. Galton's Declaration

63. In fact, it was common practice to use off-chip capacitors for modern chips. For example, Abidi (TI-1059) describes one example of "single-chip FM mono receiver [which] requires only 15 small [off-chip] capacitors and two inductors, making it possible to fit the entire system within a wristwatch" and "Yet greater miniaturization is attained at Alcatel by integrating the transmitter and receiver sections together on one silicon bipolar chip" using "Large (650 pF) off-chip capacitors constitute an anti-alias filter"). Here, "large" refers to the value of the capacitance, not the physical size of the capacitor. Also note that the "greater miniaturization" occurs despite the off-chip capacitors).

TI-1066, ¶63 (cited by Reply at 27)

2. II. Tayloe does not teach away from the combination

Ricketts Declaration

307. Moreover, Tayloe specifically states that a “*prototyped* direct conversion receiver” was built using the circuit of Figure 3. Ex.-1004, 5:49-50. However, Tayloe admits that, as of the time of the patent, the prototype could not handle higher frequency signals (the types of signals that would be used for cellular/WiFi communications) which were “many orders of magnitude greater than the prototyped unit.” *Id.*, 5:34-59. While Tayloe states that higher-frequency receivers were possible to build, it provides no example or guidance on how to achieve this with its disclosure. Critically, the TI Datasheet multiplexer cannot support higher frequencies because it cannot switch fast enough, as discussed further below.

EX2024, ¶307(cited by POR, 83-84)

Dr. Galton's Declaration

61. The proposed combination is not limited to bodily incorporating Tayloe’s capacitor to handle “higher frequency signals (the types of signals that would be used for cellular/WiFi communications),” as alleged by Dr. Ricketts. EX2024, ¶306. In fact, using different component values than those disclosed in Tayloe’s prototype example does not “depart from the spirit and scope of this invention.” TI-1001, 6:5-8.

62. Dr. Ricketts also overlooked the general knowledge and capability of a person of ordinary skill. While the challenged claims do not recite any operating frequency or a particular capacitance, a person of ordinary skill would have known a suitable capacitance for a given frequency and would have been capable of using a different component value (e.g., the suitable capacitance). Even if Tayloe’s

TI-1066, ¶¶ 61-62 (cited by Reply at 27-28)

II. Macnally and TI-datasheet are combinable

3

Ricketts Declaration

313. Indeed, Macnally's circuit operates at 915 MHz (Ex.-1021, Figs. 6 and 10). At this frequency, the signal period is approximately 1.09 nanoseconds. The TI Datasheet multiplexer, however, cannot switch quickly enough to function at that rate.¹² The switches in the TI Datasheet cannot turn ON and OFF fast enough to handle 915 MHz.

EX2024, ¶1313 (cited by POR, 85-86)

Dr. Galton's Declaration

to it) consists of just four separately-operating MOS transistors, and a POSITA at the time of the priority date of the '528 patent would understand that it is possible to custom-design an on-chip multiplexer with switches that turn off and on at a high-enough speed to implement a 900 MHz direct-conversion receiver (a POSITA would have recognized that if this were not the case, neither the Macnally circuit nor the Razavi circuit would function, as both utilize MOS transistors as comparably high-speed switches). Therefore, the fact that Mr. Tayloe chose a catalog part that was fast enough for his application but happens not to be fast enough for higher-frequency applications in no way implies that a multiplexer with the same general circuit schematic could not be made to operate at much higher frequencies when custom implemented in an appropriate integrated circuit technology.

TI-1066 at ¶168 (cited by Reply at 28)

II. PO misconstrues Macnally

4

Ricketts' Declaration

317. Macnally discloses a high-performance mixer, namely an active double balanced mixer that achieves high gain. Ex.-1021, 7:8-10 (“The mixer’s conversion gain is 14.3 dB. The mixer uses a double balanced structure without a tail current source to increase headroom...”); *see also* Section XII.D. Tayloe, on the other hand, discloses a mixer with a -1 dB conversion loss, which is 15 dB less gain (worse) than Macnally. Ex.-1004, 1:65; 3:5-6, 9-11. I note that **the gain achieved in Macnally is not due to the biquad two-pole filter** signal.

EX2024, ¶317 (cited by POR, 86)

Dr. Galton's Declaration

73. Dr. Ricketts’ assertions regarding the gain provided by various portions of Macnally’s circuitry are predicated on two misunderstandings. One misunderstanding is that “The gain achieved in Macnally is not due to the biquad two-pole filter.” As I show in my First 528 Declaration, together the two biquad two-pole filters actually introduce 15.1 dB of gain and the mixer introduces 14.3 dB of gain. TI-1021, 7:7-20, FIG. 3/TI-1022, page 8, lines 3-12, FIG. 3. Therefore, **over half of the gain comes from the pair of biquad two-pole filters, suggesting significant contributions from the biquad filters and highlighting Dr. Ricketts’ erroneous representation that “[t]he gain achieved in Macnally is not due to the biquad two-pole filter.” EX2024, ¶317.**

TI-1066 at ¶73 (cited by Reply at 28)

II. Reasons for combining Tayloe and Macnally

5

Ricketts' Declaration

321. Tayloe's amplifier 50, 52 are used to amplify the signal and provide gain. In particular, Tayloe's amplifiers 50, 52 receive two inputs and produce a single-ended, amplified output. Because Tayloe's amplifiers already accomplish the intended goal of providing gain, a POSITA would not have any reason to replace Tayloe's amplifiers with a different type of circuit. Thus, a POSITA would not be motivated to look to Macnally and use Macnally's biquad two-pole filter to perform amplification.

EX2024, ¶321 (cited by POR, 87)

Dr. Galton's Declaration

80. In his declaration, Dr. Ricketts further asserts that "[b]ecause Tayloe's amplifiers already accomplish the intended goal of providing gain, a POSITA would not have any reason to replace Tayloe's amplifiers with a different type of circuit." EX2024, ¶321. In my opinion, this is a ridiculous assertion. Exactly the same flawed logic could be applied to incorrectly argue that there was never a reason to invent differential amplifiers in the first place, given that single-ended amplifiers were well-known and widely used prior to the invention of differential amplifiers. Such a conclusion would be absurd. A POSITA understands that differential amplifiers, and, more generally, differential signaling, offer major advantages in systems implemented as integrated circuits.

TI-1066 at ¶80; see also Reply at 29 (citing Pet. 28 (Macnally's amplifier topology offers "advantages...for baseband processing on an IC" over a single ended amplifier); TI-1003, ¶34 (cited by Reply at 29, Pet. 1)

II. Reasons for combining Tayloe and Macnally

5

Institution Decision

We recognize that Tayloe touts these advantages of its product detector, but that does not necessarily mean that the benefits asserted by Petitioner would not have led one of ordinary skill in the art to make the modifications proposed. For example, just because Tayloe has a simple and inexpensive product with performance benefits does not mean that one of ordinary skill in the art would not seek to continue to improve Tayloe further by reducing product size, increasing performance, and reducing unit cost. These factors are relative in nature and it is against this relative comparison that one of ordinary skill in the art would have considered whether to modify Tayloe/TI Datasheet in light of Macnally. But, in order to adequately weigh the relative scale of potential benefits that may result from Petitioner's proposed modification, the record needs to be further developed during trial to better understand the baseline from which Tayloe begins its description and the potential benefits—even if related to the same characteristics of size, performance, and cost—of modifying Tayloe in light of Macnally.

Inst. Decision, 31

Dr. Galton's Declaration

78. Regarding item (i), I explained in my First 528 Declaration that fully differential amplifiers using Macnally's topology offer "advantages...for baseband processing on an IC." TI-1003, ¶141. Additionally, I explained "the intended goal of providing gain" when using a fully differential amplifier with differential circuits to "process pairs of signals wherein the signal information is represented as the difference between the two signals of each pair." TI-1003, ¶34. This differential signal representation "has twice the signal range" of a single-ended output, such as the Tayloe's op-amp example with a single-ended output. *Id.*, ¶36. When compared to this baseline, the differential output of a fully differential amplifier "quadruples the signal power, whereas it only doubles power of the noise introduced by the circuit, which corresponds to a signal-to-noise ratio (SNR) improvement of 3 dB." *Id.*

TI-1066 at ¶78; see also Reply at 29 ("this differential signal enables reducing the size of the fully-differential amplifier and its bias current while achieving the same signal-to-noise ratio")

II. Reasons for combining Tayloe and Macnally

5

Ricketts' Declaration

325. Tayloe does not identify or discuss any need for any additional filtering or anti-aliasing components. This is because Tayloe's existing design already performs the function of an anti-aliasing filter—removing aliasing artifacts. Thus, a POSITA would not be motivated to look at filtering technology such as Macnally's biquad two-pole filters to incorporate into Tayloe's circuit. And a POSITA would certainly not look to replace an amplifier with a filter, regardless of whether that filter also happens to amplify a signal.

EX2024, ¶325 (cited by POR, 88)

Dr. Galton's Declaration

filters. TI-1050. Therefore, single pole lowpass filters are rarely sufficient in wireless receivers, and in most such applications additional filtering is required. In short, Dr. Ricketts' claim that "Tayloe already performs the function of an anti-aliasing filter" so "a POSITA would not be motivated to look at filtering technology such as Macnally's biquad two-pole filters to incorporate into Tayloe's circuit" ignores the facts that not all lowpass filters are created equally and that more filtering is generally needed than that offered by a single pole filter. Macnally is hardly alone. In Razavi, Fig. 2 shows a first-order (RC) filter built in to the mixer while Fig. 4 shows additional lowpass filtering (i.e., the channel select filters) to supplement the first-order RC filter already built in the mixer. TI-1017, Figs. 2 and 4. Moreover, Chang (TI-1064) implements a sixth-order channel select filter. Which has far more attenuation than the first-order RC filter. Chang also points out that "The channel-select filter must satisfy some exacting requirements. The first and most important is selectivity." TI-1064, 722. The

TI-1066 at ¶81 (cited by Reply at 29)

II. Reasons for combining Tayloe and Macnally

5

Ricketts' Declaration

receiver noise figure. The noise figure improvement results in substantial receiver performance gains, in part because a pre-amplifier may become unnecessary as a result. The use of a pre-amplifier, while improving receiver noise figure by overcoming front end receiver loss.”). These are precisely the performance concerns Petitioner claims would motivate a POSITA to seek alternatives. But Tayloe already solves them. A POSITA would not be motivated to look for a solution to something that was already addressed. Accordingly, a POSITA would not think to look to Macnally's biquad two-pole filter.

EX2024, ¶329 (cited by POR, 89-90)

Inst. Decision, 31

Dr. Galton's Declaration

86. Dr. Ricketts also represents that “Tayloe already addresses the issue of noise.” EX2024, ¶329. This is another absurd assertion by Dr. Ricketts. Just because the Tayloe patent points to a particular aspect of the invention as beneficial from a noise point of view, it does not mean that no additional steps to reduce noise would be beneficial. A POSITA knows that any design option that offers a noise benefit without a significant disadvantage should be taken, and fully-differential amplifiers are such an option when implemented as part of an integrated circuit implementation of a system. Furthermore, as I explained in my expert declaration, fully-differential amplifiers also offer a major advantage with respect to reducing nonlinear distortion, which a POSITA would recognize is both advantageous and distinct from reducing noise.

TI-1066 at ¶86 (cited by Reply at 30 (further citing TI-1003, ¶¶34-35 (benefits of fully differential circuits))

II. Reasons for combining Tayloe and Macnally

5

Ricketts' Declaration

331. In fact, using Macnally's biquad two-pole filter in Tayloe's circuit would require *more* components (not fewer) than Tayloe's existing amplifier design.

EX2024, ¶¶ 331 (cited by POR, 90)

336. Fourth, Petitioner asserts that, in developing an integrated circuit, a POSITA would consider "size, packaging advantages, and low unit cost" (Ex.-1003, ¶141; Pet. 28) of an IC. Using Tayloe Figure 6 and Macnally's biquad two-pole filter, however, would significantly increase (not decrease) the number of components need to achieve the same result. For example, Figure 6 uses more

EX2024, ¶¶ 336 (cited by POR, 91)

Inst. Decision, 31

Dr. Galton's Declaration

89. A POSITA at the time of the '528 priority date would understand that using a fully differential amplifier generally reduces area and power consumption relative to those of a comparable single-ended amplifier, even though the circuit diagram of the former is "more complicated" than that of the latter. TI-1060. The reason for this apparent paradox is that the signal swing of the of the fully-differential amplifier is approximately double that of the single-ended amplifier, which allows for the fully-differential amplifier to handle four times more noise power than the single-ended amplifier for the same single-to-noise ratio (which is what matters in signal processing circuits). This allows the designer to reduce the size of most of the components that make up the fully-differential amplifier and reduce its bias current relative to those of the single-ended amplifier yet achieve the same signal-to-noise ratio as that of the single-ended amplifier. Consequently, the fully-differential amplifier generally consumes less power than the single-ended amplifier while consuming no more (and often less) area than the single-ended amplifier.

TI-1066 at ¶89 (cited by Reply at 30 (also citing TI-1066 ¶¶ 87-90, TI-1003, ¶¶ 34-37))

II. Reasons for combining Tayloe and Macnally

5

Ricketts' Declaration

337. Fifth, Tayloe describes the invention as “a simple and inexpensive product detector,” with performance benefits such as “low conversion loss” and “substantial receiver performance gains.” Ex.-1004, 1:65; 3:5-6, 9-11. These performance characteristics address the very issues that Petitioner alleges would drive a POSITA to incorporate Macnally.

EX2024, ¶ 337 (cited by POR, 92)

Institutions Decision

We recognize that Tayloe touts these advantages of its product detector, but that does not necessarily mean that the benefits asserted by Petitioner would not have led one of ordinary skill in the art to make the modifications proposed. For example, just because Tayloe has a simple and inexpensive product with performance benefits does not mean that one of ordinary skill in the art would not seek to continue to improve Tayloe further by reducing product size, increasing performance, and reducing unit cost. These factors are relative in nature and it is against this relative comparison that one of ordinary skill in the art would have considered whether to modify Tayloe/TI Datasheet in light of Macnally. But, in order to adequately weigh the relative scale of potential benefits that may result from Petitioner’s proposed modification, the record needs to be further developed during trial to better understand the baseline from which Tayloe begins its description and the potential benefits—even if related to the same characteristics of size, performance, and cost—of modifying Tayloe in light of Macnally.

Inst. Decision, 31

III. Tayloe and Macnally are not incompatible

Ricketts' Declaration

340. As explained in Section XII.A above, Tayloe's amplifiers (summing amplifiers 50 and 52 in Figure 3) operate as *high impedance loads*. This high input impedance is critical to the operation of Tayloe's circuit—it ensures Tayloe's capacitors retain charge during the sampling cycle and establish a stable voltage that represents the down-converted signal.

341. Petitioner and Dr. Galton, however, propose replacing Tayloe's summing amplifiers with Macnally's biquad two-pole filter. But according to Petitioner, Macnally's filter presents a *low impedance* load—“typically in the kilo-ohm range.” See Pet. 35, 70, 72; Ex.-1003 ¶ 240. A POSITA would understand that substituting a low impedance load in place of a high impedance load would fundamentally alter the operation of Tayloe's circuit. In particular, a low impedance load would draw current from Tayloe's capacitors during the sampling cycle, altering voltage levels in the capacitors, thereby corrupting the sampled voltage.

EX2024, ¶¶340-341 (cited by POR, 92-93)

Dr. Galton's Declaration

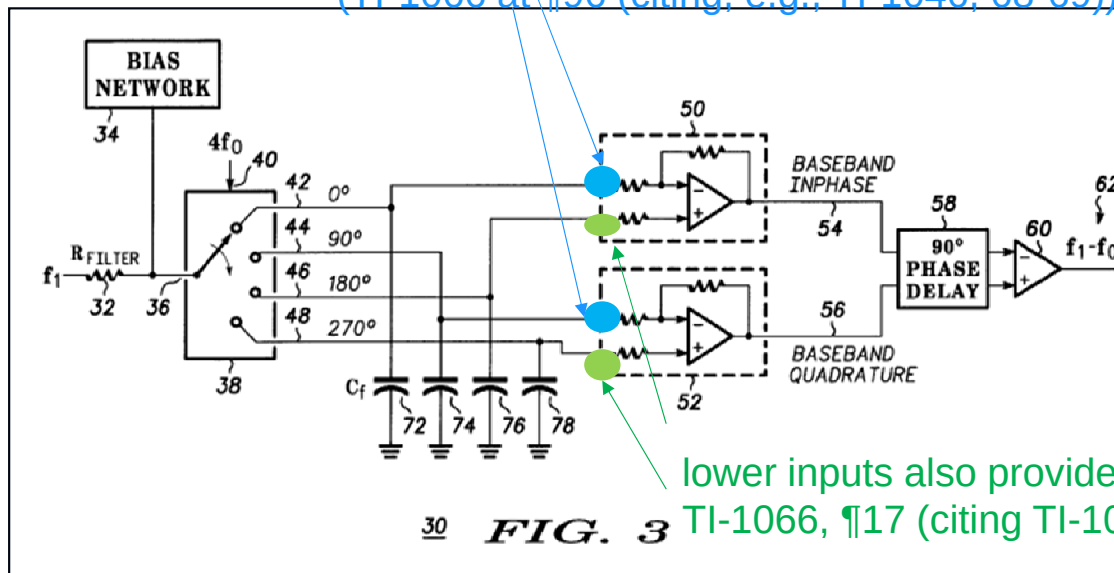
96. I disagree with Dr. Ricketts because his assertion defies fundamental principles of circuit operation. As a factual matter, the top inputs of Tayloe's summing amplifiers 50 and 52 have low impedances despite Dr. Ricketts' arguments to the contrary. *Supra*, IV.A.1(a)(i). Therefore, replacing Tayloe's summing amplifiers 50 and 52 with fully differential amplifiers with input impedances comparable to that of the top inputs of amplifiers 50 and 52 would not significantly alter the behavior of Tayloe's circuit with respect to the 0 degree and 90 degree outputs of commutating switch 38. *Supra*, ¶IV.A.1(a)(i).

TI-1066 at ¶96 (cited by Reply at 31)

III. Tayloe's amplifier with feedback is low impedance

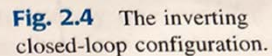
Tayloe (TI-1004)

top inputs (boxes 50 and 52) provide low-impedance load
(TI-1066 at ¶96 (citing, e.g., TI-1046, 68-69))



lower inputs also provide low-impedance load
TI-1066, ¶17 (citing TI-1046, 65 (virtual ground))

32. The following amplifier configuration is shown in TI-1046:



TI-1046 (Sedra/Smith), FIG. 2.4

TI-1066, ¶¶32-33 (cited by Reply at 23);

[illegible]

Figure 130. Tayloe quadrature detector and I/Q audio preamplifier schematic

TI-1047, Fig. 130

Discussed at TI-1066 at ¶22 (noting low resistance)(cited by Reply at 23)

III. Galton Confirmed that Tayloe's Circuitry Operates Like Sedra

Dr. Galton's Declaration

34. The Figure shown above differs from summing amplifier 50 in Fig. 3 of the Tayloe patent in that '+' terminal of the op-amp in the latter is connected to capacitor 74 and the 180° output of commutating switch 38 through the positive input resistor, whereas in the former it is connected to ground. However, these differences do not affect the reasoning behind the TI-1046 textbook's conclusions stated above for two reasons. One reason is that negligible current flows through

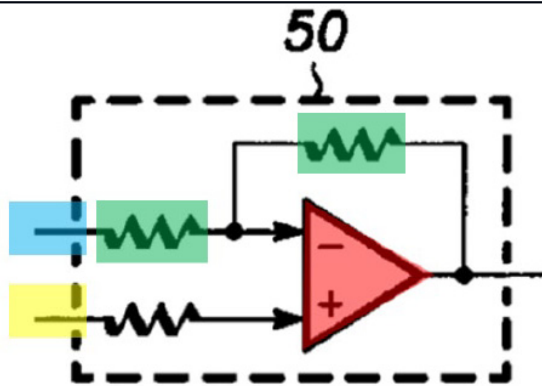
TI-1066, ¶34 (cited by Reply at 23)

the positive input resistor because of the high input impedance looking into the '+' terminal of the op-amp, which essentially negates the effect of the positive input resistor. The other reason is that the analysis used to show that a virtual ground occurs at the '-' terminal of the op-amp in the figure above does not require that the '+' terminal is held at ground; it is simply necessary for the '+' terminal to be held at a fixed voltage for the analysis to be valid. As the voltage across capacitor 76 in Fig. 3 of the Tayloe patent only changes when commutating switch 38 closes, and this happens only for a quarter of each period, it follows that the '+' terminal of the op-amp is held at a constant voltage for three quarters of each period. Hence, the TI-1046 textbook's conclusions mentioned above hold for three quarters of each period. As the resistor values are fixed, it follows from the TI-1046 textbook's conclusion that a negative input resistor in summing amplifier 50 of Fig. 3 in the Tayloe patent with a resistance of a few mega-ohms would be "impractically large."

TI-1066, ¶34 (continued) (cited by Reply at 23)

III. Tayloe and Macnally are not incompatible

Ricketts' Declaration



capacitors and the balance of the 90 and 270 degree capacitors. As discussed above, the “+” input is extremely high impedance (e.g., 2 meg ohm or $2M\Omega$) and, thus, the impedance looking into the resistor of 50, 52 connected to the “+” input must also be extremely high impedance (e.g., 2 $M\Omega$). Therefore, to keep the inputs of 50 or 52 balanced, the input resistance of the resistor connected to the “-” input must also be very high impedance.

EX2024, ¶¶219-220 (annotating TI-1004 at Fig. 3)
(cited by Reply at 61)

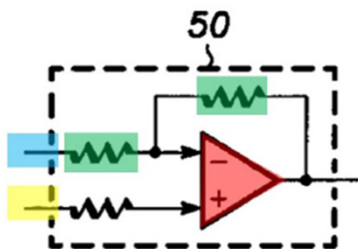
Dr. Galton's Declaration

35. Consequently, Dr. Ricketts is wrong in representing that the resistance of the negative input resistor of summing amplifier 50 in Fig. 3 of the Tayloe patent “must...be very high impedance” (e.g., in the 2 mega-ohm).
EX2024, ¶219, FN9.

TI-1066 at ¶35 (cited by Reply at 23)

III. Petitioner demonstrated low input impedance in Tayloe

PO SurReply



Not true

As shown above, the experts agree that the yellow input has high resistance/impedance. Ricketts explains that the blue input must match the yellow input's impedance/resistance, meaning it also must be high.¹¹ POR,61 (citing Ex.-2024, ¶220). The Reply fails to address this argument. Thus, the POR/Ricketts remain unrebutted on this point.¹²

No support

¹¹ Because there is no mechanism in Tayloe's amplifier to change the high impedance "+" input to low impedance, the only way to match inputs is to make the green resistors high resistance.

¹² The Reply generally discusses Sedra (TI-1046). But Sedra, which has its "+" input connected to ground, is not the same configuration as shown in Tayloe. Ex.-2042,15:5-11.

Virtual ground

TI-1066 at ¶35 (cited by Reply at 23)

EX2024, ¶¶219-220 (annotating TI-1004 at Fig. 3)
(cited by Reply at 61)

III. Petitioner demonstrated low input impedance in Tayloe

Dr. Galton's Deposition

In Figure 3 of Tayloe, the positive terminal of the op-amp circuits are not connected to ground, correct?

A. That is correct; but from a analysis point of view, as long as that voltage is held constant, it's equivalent to being connected to ground, as far as the -- the impedance goes and as far as the -- the small signal behavior of the circuit goes.

EX2042, 17:7-15

Dr. Galton's Declaration

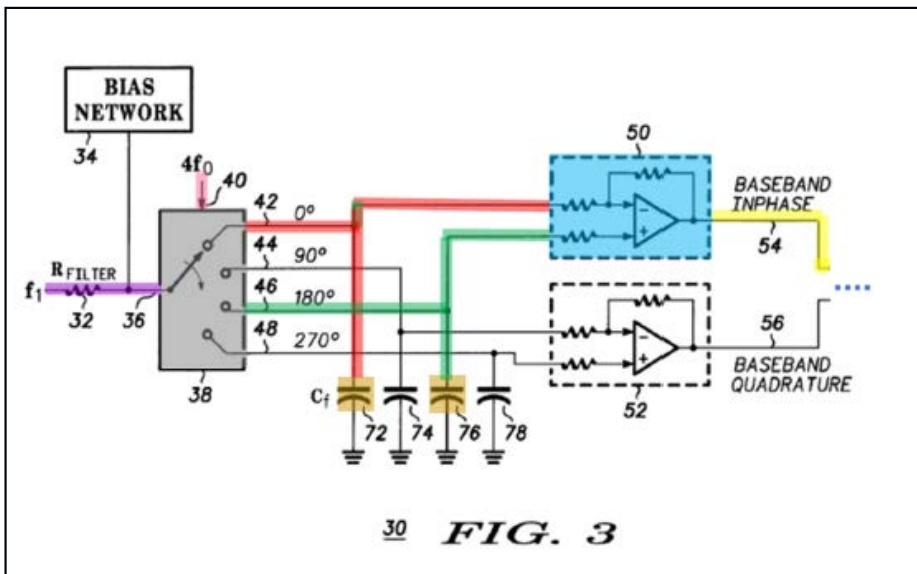
in claiming that the “-” terminal node would have a high impedance. However, the feedback resistor in conjunction with the high open loop gain that op-amps have by design cause the node at the “-” terminal to have a very low impedance. As a POSITA would have first learned in their freshman or sophomore undergraduate circuits courses, this node is referred to as a virtual ground precisely because the feedback changes the impedance at that node from having a very high value to having a very low value (a ground terminal ideally has zero impedance, so the term “virtual ground” is meant to signify that the node has such a low impedance that it virtually behaves as a ground connection). TI-1046, Page 65.

Virtual ground

TI-1066 at ¶17 (cited by Reply at 23)

III. Tayloe and Macnally are not incompatible

Tayloe (TI-1004)



TI-1004, Fig. 3 (annotated) (cited by Pet., 11)

Dr. Galton's Declaration

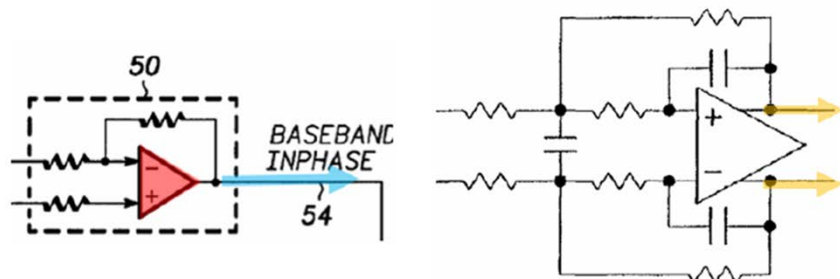
and 270 degree paths of the circuit. However, the Tayloe patent only uses the 180 degree and 270 degree paths to improve gain and considers them to be optional. For example, it states "As embodied in FIG. 7, 0 degree output 210 and 90 degree output 212 are used to generate baseband in-phase and quadrature signals. Of course, the remaining two outputs (180 degrees and 270 degrees) can be utilized as embodied in FIG. 3 to achieve greater gain" (TI-1001, Column 5, Lines 12-16, emphasis added). Although matching of the different paths is not necessary, and the Tayloe patent does not address the question of matching, it is the case that matching the 180 degree path to the 0 degree path and matching the 270 degree path to the 90 degree path as would be accomplished by replacing summing amplifiers 50 and 52 with fully differential amplifiers, such as the Macnally biquads, would yield a slight improvement in the system's overall signal to noise ratio (which even Dr. Ricketts seems to believe based on his prior comments on the subject of matching). The improvement would not be significant, but the point is that a POSITA would understand that matching the impedance seen by the 180 degree and 270 degree paths of the circuit to those seen by the 0 degree and 90 degree paths of the circuit would not cause any degradation and would even be slightly beneficial.

TI-1066 at ¶97 (cited by Reply at 31)

IV. TI has proffered reasonable expectations of success

Ricketts' Declaration

345. Replacing Tayloe's single-ended amplifiers with Macnally's biquad two-pole filter requires fundamental restructuring of Tayloe's circuit that will not produce predictable results or have a reasonable expectation of success.



346. First, Tayloe's amplifiers 50, 52 (above left) use a differential input and a *single-ended* output. In contrast, Macnally's filters (above right) use differential inputs and *differential* outputs. Incorporating Macnally's biquad two-pole filter into Tayloe's circuit would **fundamentally change the signal paths and negate the gain** benefits that Tayloe describes.

EX2024, ¶¶345-346 (cited by POR, 94-95)

Dr. Galton's Declaration

and 270 degree paths of the circuit. However, the Tayloe patent only uses the 180 degree and 270 degree paths to improve gain and considers them to be optional. For example, it states "As embodied in FIG. 7, 0 degree output 210 and 90 degree output 212 are used to generate baseband in-phase and quadrature signals. Of course, the remaining two outputs (180 degrees and 270 degrees) *can* be utilized as embodied in FIG. 3 to achieve greater gain" (TI-1001, Column 5, Lines 12-16, emphasis added). Although matching of the different paths is not necessary, and the Tayloe patent does not address the question of matching, it is the case that **matching the 180 degree path to the 0 degree path and matching the 270 degree path to the 90 degree path** as would be accomplished by replacing summing amplifiers 50 and 52 with fully differential amplifiers, such as the Macnally biquads, **would yield a slight improvement in the system's overall signal to noise ratio** (which even Dr. Ricketts seems to believe based on his prior comments on the **subject of matching**). The improvement would not be significant, but the point is that a POSITA would understand that matching the impedance seen by the 180 degree and 270 degree paths of the circuit to those seen by the 0 degree and 90 degree paths of the circuit would not cause any degradation and would even be slightly beneficial.

TI-1066 at ¶97 (cited by Reply at 31-32 (further citing ¶¶ 98-101))

IV. TI has proffered reasonable expectations of success

Ricketts' Declaration

350. Second, replacing Tayloe's single-ended amplifier with Macnally's filter amplifier would alter the fundamental operation of Tayloe's circuit.

354. Third, Petitioner asserts that "a POSITA would have recognized that the lowpass filtering function of the Macnally differential amplifier is beneficial in the Tayloe's circuits as lowpass filtering of the baseband signals in direct conversion receives is beneficial." Ex.-1003, ¶143. As discussed above, Tayloe already incorporates a low-pass filter and achieves low-pass filtering. There is no additional benefit to using Macnally's biquad two-pole filters. Petitioner never explains how adding a second filtering stage—or replacing Tayloe's RC filtering with Macnally's filters—would affect the circuit's frequency response

EX2024, ¶¶350, 354 (cited by POR, 94-95)

Dr. Galton's Declaration

99. I disagree with Dr. Ricketts for the same reasons as I have explained above and in my First 528 Declaration. For example, I have addressed these points above regarding the results being predictable, having reasonable expectation of success, and having better performance (reduced power consumption, better linearity, etc.) Any time a circuit is developed, a design process must occur. The process is not "experimentation" as Dr. Ricketts puts it, but a reasoned and systematic process by which different circuit topologies for implementing each of the required circuit blocks are evaluated and circuit component values are optimized. These tasks are done by a POSITA via a combination of hand analysis and computer simulation. Even Mr. Tayloe made several changes between the embodiments shown in the Tayloe patent and the circuit he designed as presented in TI-1047 (and he describes this circuit as Version 5, so presumably he previously

TI-1066 at ¶99 (cited by Reply at 31-32 (further citing ¶¶ 100-101)); see also Inst. Decision, 31

FISH.

The Razavi-Based Ground

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

Razavi-Based Ground: Issues Raised by PO

I. Whether Razavi teaches various features:

1. transferring energy when the switch is ON
2. storing transferred energy (claims 1/19)
3. transferring energy from the modulated carrier signal to the storage element when the switch is ON (claims 8/26)

II. Whether TI has shown sufficient motivation to combine:

1. Where Razavi teaches away
2. Whether Razavi is compatible with Macnally
3. Where there is reasonable expectations of success
4. Whether the combination is an energy transfer system

Undisputed:

Claimed features such as switches and differential amplifiers are met by prior art.

Disputed:

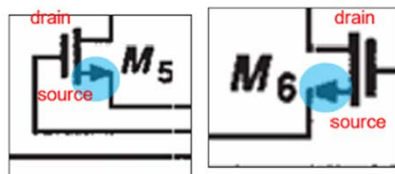
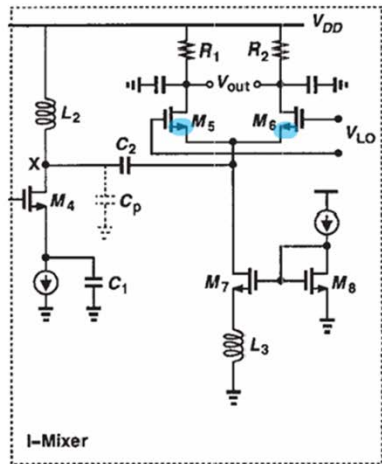
Does Razavi charge its capacitor when the switch is ON?

Is Macnally's low input impedance load compatible with Razavi's mixer?

I. Razavi teaches transferring energy when the switch is ON

Ricketts' Declaration

to the source. Current (and energy) does not move upward towards R_1 or R_2 or the capacitors next to V_{out} (which Dr. Galton denotes as C_p and C_m). This unidirectional current flow is *opposite* to the direction needed for the RF input signal to pass through the transistors. Since the RF input signal cannot propagate through M_5 or M_6 , it cannot be sampled and energy is not transferred to the output of M_5 or M_6 even if M_5 or M_6 are ON.



EX2024, ¶ 362 (cited by POR, 99)

Dr. Galton's Declaration

103. I disagree with Dr. Ricketts because his description of Razavi's circuit operation ignores the laws of physics. Specifically, in Razavi's Figure 2, electrons actually flow from the RF input signal through the transistors (i.e., transistors M_5 and M_6) toward the positive supply terminal (V_{DD}). This is because the flow of electrons, which is the actual current of electrons that flow, runs upward through M_5 and M_6 from both the ground terminal of the supply as well as from the RF input signal. *Id.* (citing EX1045 (Johnson) ("...we should distinguish *conventional* current ([which can be thought of as] the movement of positive charges), which is used in electric network theory, and *electron* current").

TI-1066, ¶103 (cited by Reply, 32)

I. Experts agree on actual electron flow

Ricketts' Declaration

44. Charge: Charge is a fundamental property of matter. There are two physical types of charge: positive and negative. Protons carry a positive charge (+), while electrons carry a negative charge (-).

45. The operation of electrical circuits depends on the movement of electrons (not protons), which in turn facilitates the transfer of energy and information. An electron has potential energy, also called electric potential energy or just electrical energy. When charges move, both energy and charge are

EX2024, ¶¶ 44-45 (cited by POR, 3)

Dr. Galton's Declaration

107. Thus, the fact that *conventional* current is defined by convention to be positive in the downward direction is not relevant given that the actual electron flow, i.e., the actual current, is toward V_{DD} , so it flows from the source to the drain of each of transistors M_5 and M_6 . Therefore, electrons flow from the RF input signal upward through transistors M_5 and M_6 .

TI-1066, ¶ 107 (cited by Reply, 32)

I. Razavi teaches storing transferred energy

Ricketts' Declaration

378. But, as explained above in Section IX.C.1 above, no current—and therefore no energy—from the RF input signal passes through M5 or M6 towards the capacitors Cp/Cm. Thus, no energy from the RF input signal can ever make its way to the capacitors to be stored and accumulated/integrated.

EX2024, ¶378 (cited by POR, 104)

Dr. Galton's Declaration

141. This is yet another rehash of Dr. Ricketts' incorrect view that actual current, i.e., the flow of electrons, flow toward ground, not toward V_{DD} in the Razavi circuit. I have addressed his misunderstandings, as I have explained *supra* §VI.A. Hence, Razavi teaches transferring energy from the RF input signal. In the Razavi-Macnally combination, the transferred energy is stored and accumulated/integrated “in the same manner as described by the '528 patent.” EX1003, ¶¶239-241; *see also* Petition, 69-70, 83-84, 86.

TI-1066, ¶ 141 (cited by Reply, 33-34)

I. Razavi teaches transferring energy from the modulated carrier signal to the storage element when the switch is ON (claims 8/26)

Ricketts' Declaration

382. Critically, Razavi's capacitors do not receive any energy from the modulated carrier signal (RF input signal identified by Petitioner/Dr. Galton). The capacitors receive current/energy only from VDD. As discussed above in Section IX.C.1, no current—and therefore no energy—flows from the RF input signal upward through M5 or M6 toward Cp or Cm.

EX2024, ¶1382 (cited by POR, 105)

Dr. Galton's Declaration

143. As I have explained *supra* §§VI.A-B, Dr. Ricketts' description of Razavi's circuit operation ignores the laws of physics because the flow of electrons (which corresponds to physical charging) runs from ground to VDD. In my First

TI-1066, ¶143, 152 (cited by Reply, 34)

152. Therefore, if we were to apply Dr. Ricketts' reasoning to the embodiment of the alleged invention presented in the '528 patent shown in Fig. 201, we would incorrectly conclude that it is in fact not an embodiment of the alleged invention. In contrast, like the Razavi mixer circuit, when signal voltages are considered instead of absolute voltages, the embodiment of Fig. 201 does indeed satisfy the '528 patent's claim requirement that a "portion of energy" is "transferred from the modulated carrier signal" "to the respective storage element when the switch is on during the charging cycle, and a portion of the transferred energy is discharged during the discharging part of the cycle for each respective switching device when the switching device is off."

II. TI has shown sufficient motivation to combine

Ricketts' Declaration

385. First, Razavi does not simply identify a generic amplifier circuit or use a generic symbol for an op-amp. Instead, as shown in Figure 5, Razavi discloses a fully realized amplifier design (including the length and width of transistors) tailored to meet specific performance goals: to achieve “high gain,” improve linearity, and reduce noise. Ex.-1017, 113 (discussing adding PMOS current sources to provide about 75% of the drain current of M_1 and M_2 thereby allowing a large value for R_1 and R_2 ; discussing increasing the length of transistors M_3 and M_4 and using wide transistors). Petitioner inexplicably removes Razavi’s carefully designed amplifier and replaces it with Macnally’s biquad two-pole filter.

EX2024, ¶385 (cited by POR, 105-106)

Dr. Galton's Declaration

155. Regarding item (i), Razavi’s existing features would not preclude further improvement. As I had explained in my First 528 Declaration: Razavi states “channel-selection filtering is not included,” thus indicating the need for channel-selection filtering, which a POSITA would understand as low-pass filtering because Razavi performs “direction conversion” to baseband. TI-1017, 113.... A POSITA would have recognized the benefits of applying the example circuit of Macnally to complement Razavi’s receiver design and achieve both amplification and “channel-selection filtering” at baseband. TI-1003, ¶¶227-228; TI-1017, 113.

TI-1066, ¶155 (cited by Reply, 34-35)

II. TI has shown sufficient motivation to combine

Ricketts' Declaration

387. Razavi makes no mention of the need for additional filtering or bandwidth narrowing beyond these RC filters at the mixer output. This is because Razavi's architecture is already designed to handle high-frequency content and suppress out-of-band signals. A POSITA would recognize that the existing RC filters found in Razavi already perform the anti-aliasing function—Razavi's RC filters serve the role of aliasing suppression. Thus, a POSITA would not be motivated to add another filtering stage such as Macnally's biquad two-pole filters at the output of the mixer.

EX2024, ¶387(cited by POR, 106-107)

Dr. Galton's Declaration

156. Regarding item (ii), while it is true that the Razavi mixer circuit already performs lowpass filtering, the lowpass filtering is that of an RC filter which has only a single pole, and single pole lowpass filters offer the least suppression of out-of-band signals of all lowpass filters. Therefore, single pole lowpass filters are rarely sufficient in wireless receivers, and in most such applications additional filtering is required. TI-1050. In short, Dr. Ricketts' claim that "A POSITA would recognize that the existing RC filters found in Razavi already perform the anti-aliasing function—Razavi's RC filters serve the role of aliasing suppression" ignores the facts that not all lowpass filters are created equally and that more filtering is generally needed than that offered by a single pole filter. It also ignores the fact that Figures 4(b) and 4(c) of the Razavi paper explicitly show additional filtering (i.e., channel select filters, which, for direct-conversion receivers are always lowpass filters):

TI-1066, ¶156 (cited by Reply, 35)
See also Inst. Decision, 31 fr.com | 92

II. TI has shown sufficient motivation to combine

Ricketts' Declaration

392. Finally, Macnally's biquad two-pole filter includes additional op-amps, resistors, and capacitors that significantly increase the component count over Razavi's amplifier. Using Macnally's biquad two-pole filter would actually require many more components (not fewer components) than using Razavi's amplifier. In particular, Petitioner proposes a one-for-one substitution of Razavi's amplifier with Macnally's biquad filter, yet the latter requires more circuitry, not less. Thus, at the very least, Petitioner's proposal uses the same number of op-amps as already disclosed in Razavi – not less.

EX2024, ¶392 (cited by POR, 108)

Dr. Galton's Declaration

159. Regarding item (iii), it was general knowledge that using a fully differential amplifier can reduce area and power consumption relative to those of a comparable single-ended amplifier, which matters more for IC implementation than the mere number of components. TI-1060, 28-31 (detailed explanation and example).

TI-1066, ¶159 (cited by Reply, 35)

89. A POSITA at the time of the '528 priority date would understand that using a fully differential amplifier generally reduces area and power consumption relative to those of a comparable single-ended amplifier, even though the circuit diagram of the former is "more complicated" than that of the latter. TI-1060. The

TI-1066, ¶89 (cited by Reply, 26)

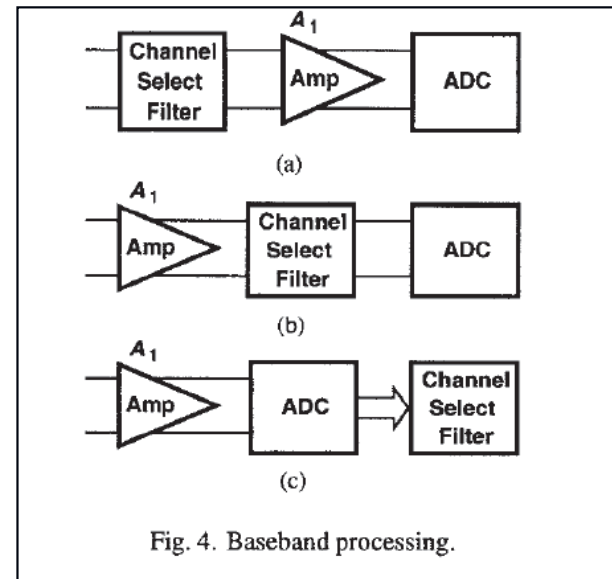
II. Razavi does not teach away

Ricketts' Declaration

402. But Razavi specifically teaches against the use of the permutation depicted in Figure 4(a). Razavi notes that “a low-pass filter suppresses out-of-channel interferers, allowing A_1 , to be a nonlinear, high-gain amplifier and the analog-to-digital converter (ADC) to have a moderate dynamic range (roughly 4 to 8 bits depending on the gain control in the RF domain and the type of modulation).” Ex.-1017, 113. Razavi criticizes (and teaches away from) this permutation because “the low-pass filter design entails severe noise-linearity-power tradeoffs.” *Id.* Indeed, Razavi specifies that “[t]he present design is intended for permutations in Figs. 4(b) and (c),” thereby excluding Figure 4(a) from consideration. *Id.*

EX2024, ¶402 (cited by POR, 110)

Razavi (TI-1017)



TI-1017. Fig. 4

II. Razavi does not teach away

Ricketts' Declaration

397. Razavi explicitly discourages (teaches away from) the use of channel select filtering—such as that performed by Macnally's biquad two-pole filter—after the mixer in its receiver architecture.

EX2024, ¶397 (cited by POR, 109)

*TI-1066, ¶¶ 162-163
(cited by Reply, 35)*

Dr. Galton's Declaration

162. I disagree with Dr. Ricketts because he mischaracterized my First 528 Declaration. Here, the Macnally anti-alias filter simultaneously performs amplification and filtering, so it does not fit the paradigm of either Figure 4(a) or Figure 4(b) above. Moreover, it is most appropriate to realize Fig. 4(c) in that 1) an anti-alias filter is always required before an ADC, 2) the signal component of the Razavi circuit is relatively small (which is why all three configurations include an amplifier) so amplification is required prior to the ADC, and 3) the anti-alias filter relaxes the requirements of the channel select filter after the ADC in Figure 4(c).

163. Therefore, Dr. Ricketts' comments regarding Figure 4(a) are not relevant. That said, each of the three options in Figure 4 of the Razavi paper represent different tradeoffs, i.e., each has advantages and disadvantages relative to the other options. The fact that Dr. Razavi pointed out these tradeoffs does not mean that he believes that one option is always worse than the other options. Indeed, all three options shown in Figure 4 were known and widely used at the time of the priority date of the '528 patent.

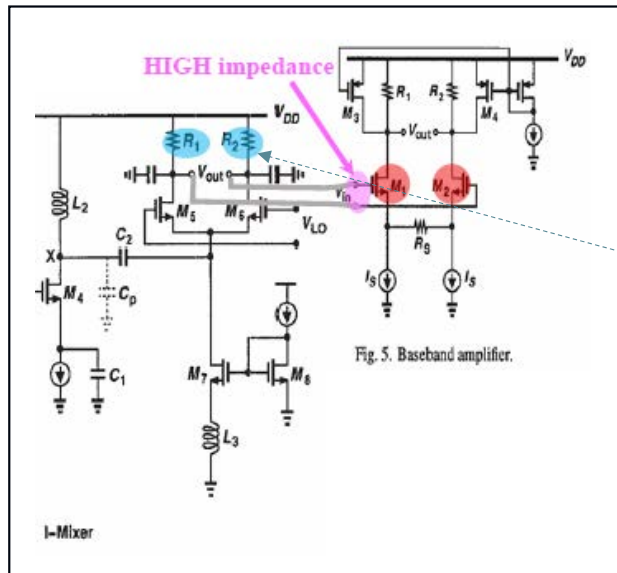
DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

EX2024, ¶405 (cited by POR, 111)

Fig. 1. Receiver architecture.

II. Razavi is compatible with Macnally

PO's SurReply



PO SurReply, 34

Dr. Galton's Declaration

The Razavi paper mentions that the drain to source voltage of M_7 is approximately 0.5 V. Therefore, transistor M_5 and resistor R_1 must together drop $3\text{ V} - 0.5\text{ V} = 2.5\text{ V}$, and the same is true for M_6 and resistor R_2 . It follows that the resistance of R_1 and R_2 must be less than 2.5 V divided by 0.002 amps, which is 1.25 kilo-ohm.

TI-1066, ¶137 (cited by Reply, 32)

II. Razavi is compatible with Macnally

Ricketts' Declaration

187. A POSITA would understand that the matched filter provides improved SNR for a given input signal with a given SNR. In RF systems, a POSITA would know to maximize the input SNR to the matched filter-correlator to obtain the highest SNR of the receiver system by transferring the maximum power from the antenna to the matched filter-correlator. This is achieved by having a matched real input impedance and a real output impedance of the matched filter-correlator. A load allows for a matched input impedance and to transfer maximum power from the antenna to the receiver, thus, enhancing SNR in the receiver.

EX2024 (IPR2024-00935), ¶187

Dr. Galton's Declaration

165. I disagree with Dr. Ricketts because his assertion again defies fundamental principles of circuit operation. I have provided (*supra* §V.A.1) a detailed analysis on Razavi, which reveals the resistance of each of R_1 and R_2 in the Razavi mixer circuit is almost certainly less than 1.25 kilo-ohm, which is low input impedance according to ParkerVision. *See e.g.*, TI-1003, §VI.D, ¶156; TI-1001, Fig. 82B (showing low impedance load as around 2k ohm); IPR2020-01265, Paper 26 (PO Sur-reply) at 13; Paper 18 (POR) at 46-50. This characteristic of Razavi's mixer circuit would be compatible with the low input impedance of Macnally circuit.

TI-1066, ¶165 (cited by Reply, 35-36)

II. Reasonable Expectation of Success

Ricketts' Declaration

410. Replacing Razavi's amplifier with Macnally's biquad two-pole filter requires fundamental restructuring of Razavi's receiver architecture. The proposed substitution would not yield predictable results and, as such, cannot support a reasonable expectation of success.

411. First, Razavi itself demonstrates why there is no reasonable expectation of success. As discussed above, Razavi explicitly criticizes the design permutation shown in Figure 4(a)—which is structurally analogous to Petitioner's proposed combination—because that architecture introduces “severe noise-linearity-power tradeoffs.” Ex.-1017, 113. A POSITA would not ignore Razavi's express warning and adopt the very design Razavi cautions against.

EX2024, ¶¶ 410-411 (cited by POR, 112-113)

Dr. Galton's Declaration

167. I disagree with Dr. Ricketts' assertions. As I have explained *supra* §VI.D.1, Macnally's circuit combines amplification and lowpass filtering, which is consistent with the teachings of all three permutations of Razavi's Figure 4. Replacing any one of the three permutations of Razavi with the Macnally's filter (which has low input impedance) can result in improved matching when R_1 and R_2 in Razavi's amplifier are about 1.5 kilo ohms. §V.A.1.

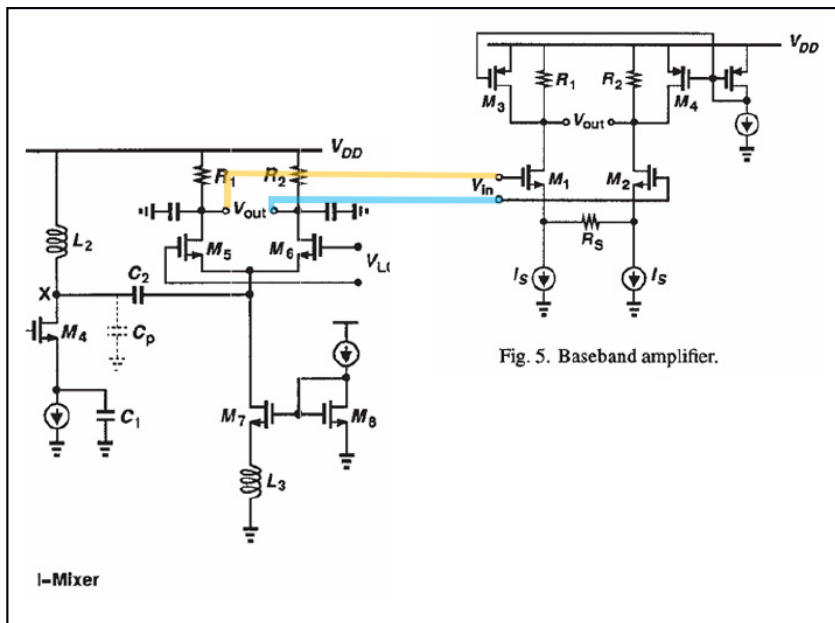
TI-1066, ¶167 (cited by Reply, 36)

162. I disagree with Dr. Ricketts because he mischaracterized my First 528 Declaration. Here, the Macnally anti-alias filter simultaneously performs amplification and filtering, so it does not fit the paradigm of either Figure 4(a) or Figure 4(b) above. Moreover, it is most appropriate to realize Fig. 4(c) in that 1) an anti-alias filter is always required before an ADC, 2) the signal component of the Razavi circuit is relatively small (which is why all three configurations include an amplifier) so amplification is required prior to the ADC, and 3) the anti-alias filter relaxes the requirements of the channel select filter after the ADC in Figure 4(c).

TI-1066, ¶162 (cited by Reply, 35)

II. Reasonable Expectation of Success

Ricketts' Declaration



effects on a circuit. Razavi specifically states, “to achieve a high conversion gain...R1 and R2 must be maximized.” Moreover, a low impedance load in Razavi would lead to an inaccurate measurement of the voltage and Razavi would not be able to accurately reproduce the baseband signal. Specifically, the low impedance would draw current away from the mixer output, disrupting the voltage levels intended to represent the baseband signal.

EX2024, ¶¶ 413-414 (cited by POR, 113-114)

II. Energy Transfer System

Dr. Galton's Declaration

169. I understand Dr. Ricketts asserts incompatibility because “Razavi specifically states, ‘to achieve a high conversion gain... R_1 and R_2 must be maximized.’” EX2024, ¶414. However, this would not be a significant issue because R_1 and R_2 in Razavi have low resistances, i.e., in the kilo ohm range. *Supra* §V.A.1.

TI-1066, ¶169 (cited by Reply, 35-36)

165. I disagree with Dr. Ricketts because his assertion again defies fundamental principles of circuit operation. I have provided (*supra* §V.A.1) a detailed analysis on Razavi, which reveals the resistance of each of R_1 and R_2 in the Razavi mixer circuit is almost certainly less than 1.25 kilo-ohm, which is low input impedance according to ParkerVision. *See e.g.*, TI-1003, §VI.D, ¶156; TI-1001, Fig. 82B (showing low impedance load as around 2k ohm); IPR2020-01265, Paper 26 (PO Sur-reply) at 13; Paper 18 (POR) at 46-50. This characteristic of Razavi's mixer circuit would be compatible with the low input impedance of Macnally circuit.

TI-1066, ¶165 (cited by Reply, 35-36)
see also ¶ 137 (cited by Reply, 32)

FISH.

Motion to Exclude

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

Exhibits 2010-2014, 2019-2022, 2027, 2029 should be excluded

- I. Exhibits 2010-2014, 2019-2022, 2027, 2029 are not authenticated
- II. Exhibits 2010-2014, 2019-2022, 2027, 2029 are inadmissible

I. Sorrels lacks personal knowledge of the Relativity database

Sorrels' Declaration

29. ParkerVision files related to the design, development, testing, and/or evaluation of the Eddie chip and circuit board discussed above are maintained in a Relativity database. The Relativity database shows the metadata including file extension, file name, and last modified date of these files. A search of the database was run. Below is an excerpt from the search.

EX2016, at ¶29

Relativity database was not used by ParkerVision in 1997-1998

Sorrels' Deposition

Q. The list in Exhibit 2029, did you check the date on the document relative to the metadata for each of those documents?

A. Not for each one, no, sir. You know, it forked over a lot of them and so the decision was made to put everything that it forked over into the database. So, no, sir, I did not check each individual entry.

Q. Okay. Do you know if Relativity was used by ParkerVision in 1997-98?

A. I'm pretty comfortable with the answer of no.

Q. Do you know how the files got from ParkerVision into Relativity?

A. The answer is I do not know specifically.

TI-1068, 24:7-21 (cited by Pet. Mot. to Exclude 8-9)

I. Sorrels cannot authenticate documents from the Relativity database

Patent Owner's Response

Mr. Sorrells confirmed that the ParkerVision team continuously worked on the Eddie chip and circuit board through the time it was tested/evaluated. *Id.*, ¶28.

Mr. Sorrells provided a list of ParkerVision files reflecting ParkerVision's continuous work. *Id.*, ¶¶28-30. Ex.-2029.

Mr. Sorrells authenticated all of the files listed or referenced above. *Id.*, ¶¶27,

31.

POR at 27

Mr. Sorrells has no knowledge of the Relativity database

Sorrells' Deposition

Q. And is the -- is it fair to say the Relativity database is stored on a hard drive or a server someplace?

A. I don't know where it's stored. I will tell you that it was readily available when I was looking at it with the attorneys.

Q. Do you know who maintains the server or hard drive that has the Relativity database?

MS. LEPORE: Objection, calls for speculation.

A. This is a deposition, so I can only guess. If you want me to guess, I will, but just know that it's speculation.

BY MR. GRISWOLD:

Q. Understood. So you don't know? You would have to guess?

A. Yes.

TI-1068, 21:5-21 (cited by Pet. Mot. to Exclude 8-9)

I. Inventor's testimony of conception must be corroborated

Pet. Mot to Exclude, 5

1171. Because an inventor tends to “describe his actions in an unjustifiably self-serving manner,” inventor testimony alone, without more, is not considered credible for the purposes of corroborating documentary evidence purporting to show earlier conception/reduction-to-practice to antedate a prior art reference. *Chen v. Bouchard*, 347 F.3d 1299, 1309 (Fed. Cir. 2003); *see also In re NTP, Inc.*, 654 F.3d 1279, 1291 (Fed. Cir. 2011) (“It would be strange indeed to say that [an inventor], who filed the... affidavit that needs corroborating, can by his own testimony provide that corroboration.”). As a result, such uncorroborated inventor testimony is insufficient to satisfy the strict rules pertaining to authentication of business records under FRE 803(6)(E) and 902(11). Accordingly, business records that are only corroborated by inventor testimony are inadmissible hearsay.

II. Unauthenticated documents purporting to antedate are inadmissible

Pet. Reply ISO Mot. to Exclude, 3

None of the exhibits has been properly authenticated by, e.g., someone with “knowledge” of the Relativity database. *Supra* §I; Pet. Mot., 5-11. The Federal Circuit has repeatedly explained that, when, as here, PO attempts to antedate the prior art, PO initially bears “the burden of production” including authenticated documents. *Dynamic Drinkware*, 800 F.3d 1379. PO has not met its burden to produce the requisite authentication.

BACKUP SLIDES

FISH.

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

Use of expert declaration

- The Board has recently endorsed recently endorsed use of expert testimony to further explain the knowledge of a POSITA and support a motivation to combine. See https://www.uspto.gov/sites/default/files/documents/aapa_memo_final_signed.pdf?utm_campaign=subscriptioncenter&utm_medium=email&utm_source=govdelivery

deny an IPR petition that fails to comply with Rule 104(b)(4). General knowledge may still be used in an IPR to support a motivation to combine or to demonstrate the knowledge of a person having ordinary skill in the art. See, e.g., *Unification Techs. LLC v. Micron Tech. Inc.*, 2024 WL 3738401, at *7 (Fed. Cir. Aug. 9, 2024) (affirming use of general knowledge in an IPR proceeding in the form of expert testimony and AAPA to demonstrate how a skilled artisan would have understood a prior art reference's disclosure as teaching a claim limitation).