

Mediatek, Inc. v. ParkerVision, Inc., IPR2025-00030
January 7, 2026 Oral Hearing
MediaTek's Demonstratives

Roadmap

- Overview
- Claim Construction
- Hau + Yoshida (Grounds 1A-1C)
- Canyon + Ranjan (Grounds 2A-2C)

Overview

MediaTek's Combinations

Ground (all under 35 U.S.C. § 103)	Claims	References
1A	1-2, 5-7, 9, 11-12, 15	Hau and Yoshida
1B	3-4, 8, 10, 13-14, 17-20	Hau, Yoshida, and Sahu
1C	16	Hau, Yoshida, and Lejon
2A	1-5, 9-11, 15, 19-20	Canyon and Ranjan
2B	6-8, 12-14	Canyon, Ranjan, and Hau
2C	16-18	Canyon, Ranjan, and Lejon

- Main combinations include a power supply with a *switching DC-DC converter* (Yoshida, Canyon) and a *bypass switch* (Hau, Canyon) to bypass the DC-DC converter at a *power efficiency threshold* (Hau, Ranjan)

Person of Ordinary Skill in the Art (POSITA)

- Petitioner: “at least a bachelor’s degree in electrical engineering or a related subject and two or more years of experience in the field of RF circuit design ***and/or power supplies for RF circuits***, or at least five years of work experience and training in the design and development of RF circuits ***and/or power supplies for RF circuits***. Less work experience may be compensated by a higher level of education, such as a master’s degree”
- Patent Owner: “a Bachelor of Science degree in electrical ***or computer engineering*** (or a related academic field), and at least two (2) additional years of work experience in the design and development of radio frequency circuits and/or systems, or (b) at least five (5) years of work experience and training in the design and development of radio frequency circuits and/or systems”
- Minor differences do not impact outcome

Independent Claim 1

1[pre] A power supply, comprising:

- 1[a]: a switching device configured to down-convert an input voltage and pass the down-converted input voltage to an output voltage node; and
- 1[b1] an aperture generator and control module configured to control the switching device,
- 1[b2] wherein, in response to a power efficiency of the power supply exceeding a predetermined threshold, the aperture generator and control module deactivates the switching device and passes the input voltage to the output voltage node

Independent Claim 9

- 9[pre] A method for controlling a power supply comprising:
- 9[a] down-converting, with a switching device, an input voltage to generate a down-converted voltage;
 - 9[b] passing the down-converted voltage to an output voltage node; and
 - 9[c] in response to a power efficiency of the power supplying exceeding a predetermined threshold, de-activating the switching device and passing the input voltage to the output voltage node.

Independent Claim 15

15[pre] A system comprising:

- 15[a] an electronic device; and
- 15[b] a power supply coupled to the electronic device, wherein the power supply comprises:
 - 15[c] a switching device configured to down-convert an input voltage and pass the down-converted input voltage to an output voltage node; and
 - 15[d1] an aperture generator and control module configured to control the switching device,
 - 15[d2] wherein, in response to a power efficiency of the power supply exceeding a predetermined threshold, the aperture generator and control module deactivates the switching device and passes the input voltage to the output voltage node.

Shorthand for key limitations

“efficiency threshold”

- 1[b2], 9[c], 15[d2]: “in response to a power efficiency of the power supply exceeding a predetermined threshold”

“bypass function”

- 1[b2], 15[d2]: “the aperture generator and control module deactivates the switching device and passes the input voltage to the output voltage node”
- 9[c]: “de-activating the switching device and passing the input voltage to the output voltage node”

Key issues

What is the plain and ordinary meaning of “power efficiency”?

- Whether power efficiency can be measured indirectly (e.g. voltage, current)
- Whether claims require “determining the power efficiency characteristics of the power supply and setting a threshold based on that determination” (EX2001, ¶ 74)

Relationship between power supply, amplifier output power

Motivation to combine ground 2A references (Canyon, Ranjan)

Claim Construction

Claim Construction

- Only dispute concerns plain meaning of “power efficiency” and related phrase “in response to a power efficiency of the power supply exceeding a predetermined threshold”
- “Aperture generator and control module” should not be construed as means-plus-function
 - ParkerVision does not argue for means-plus-function construction in POR, nor dispute that term is met even if it is

Claim construction- “power efficiency”

Proposed constructions are not the actual dispute:

ParkerVision	MediaTek
Plain and ordinary meaning	The output power of the power supply compared to its input power

Actual disputes relate to longer phrase “in response to a power efficiency of the power supply exceeding a predetermined threshold”:

- Can power efficiency be indicated indirectly by output current or voltage?
- Does claim require “determining the power efficiency characteristics of the power supply and setting a threshold based on that determination?” (EX2001, ¶ 74)

Claim construction- “in response to a power efficiency of the power supply exceeding a predetermined threshold”

First dispute (if still disputed): whether threshold used to trigger bypass function can be indirect indicator of power efficiency (*e.g., voltage, current*)

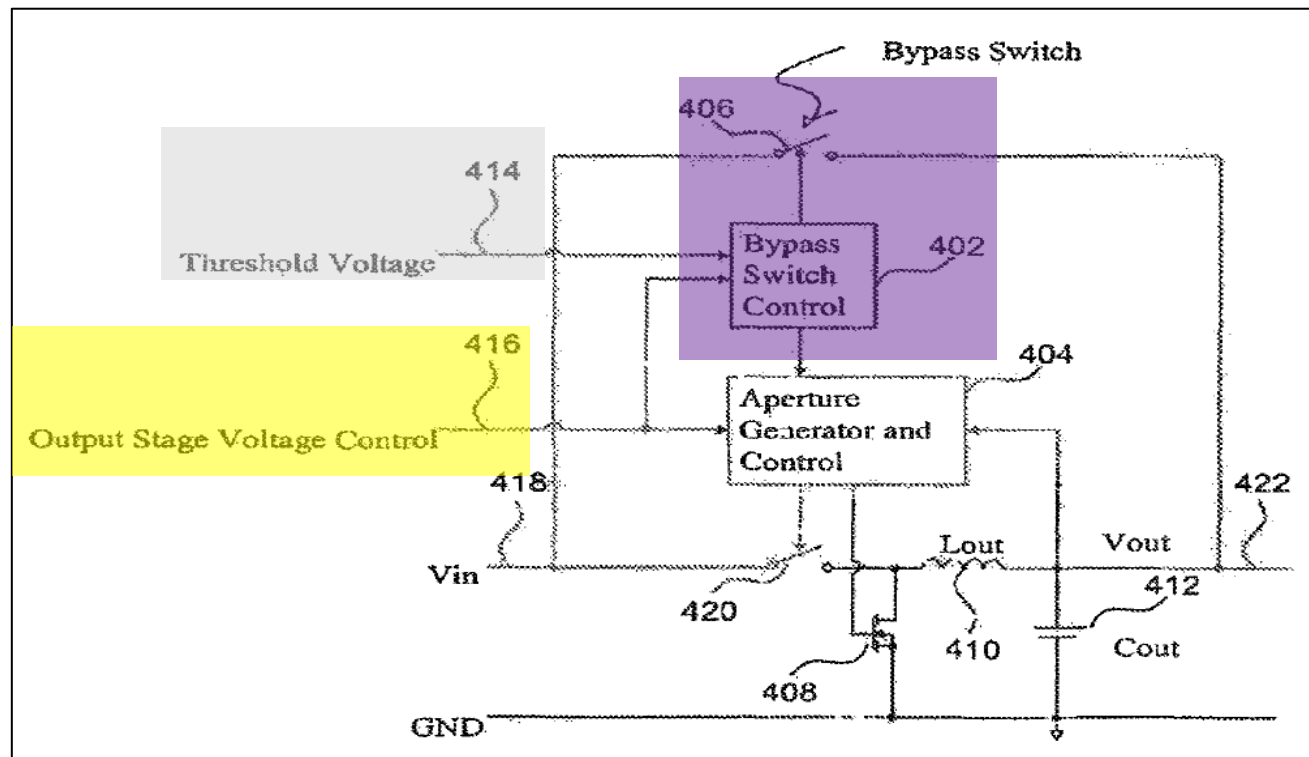
Claim construction- “in response to a power efficiency of the power supply exceeding a predetermined threshold”

Preferred embodiments in specification use voltage or current measurements for threshold

Systems implementing some of the above described embodiments include a mechanism to bypass the power supply circuitry at a pre-determined threshold, further increasing the system efficiency. In an implementation, a bypass switch control circuitry is used together with the power supply circuitry, to cause the bypass of the power supply circuitry when the pre-determined threshold is exceeded. In an embodiment, the threshold is defined in terms of output power, and the bypass switch is engaged or disengaged when the output power exceeds or falls below the threshold. In another embodiment, the power supply is bypassed when the noise power on or near the output frequency (frequency of the output signal) exceeds a threshold.

Claim construction- “in response to a power efficiency of the power supply exceeding a predetermined threshold”

Preferred embodiments in specification use voltage or current measurements for threshold



EX1001, Fig. 4

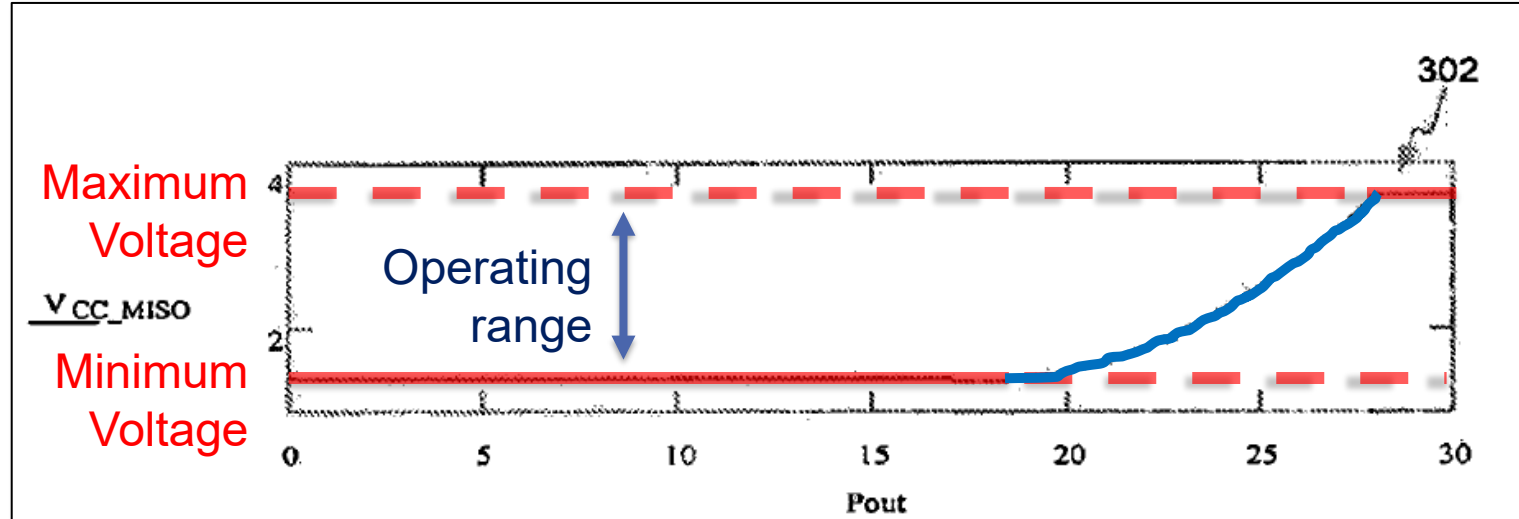
Bypass Switch Control module 402 receives Threshold Voltage signal 414 and Output Stage Voltage Control signal 416. Threshold Voltage signal 414 determines at which value of the power supply output voltage power supply 400 switches to bypass mode. Output Stage Voltage Control signal 416 includes information about the target power supply output voltage and thus allows Bypass Switch Control module 402 to determine the value of the power supply output voltage.

Bypass Switch Control module 402 compares Threshold Voltage 414 and the value of the power supply output voltage to determine whether power supply 400 should switch to bypass mode. When the power supply output voltage exceeds Threshold Voltage 414, Bypass Switch Control module 402 controls Bypass Switch 406 to couple input voltage signal V_{IN} 418 to the power supply output node. At the same time, Bypass Switch Control module 402 controls Aperture Generator and Control module 404 to cause it to de-couple input voltage signal V_{IN} 418 from the collector/drain node of switching transistor 408 and to shut off switching transistor 408.

EX1001, 7:50-8:3

Claim construction- “in response to a power efficiency of the power supply exceeding a predetermined threshold”

Preferred embodiments in specification use voltage or current measurements for threshold



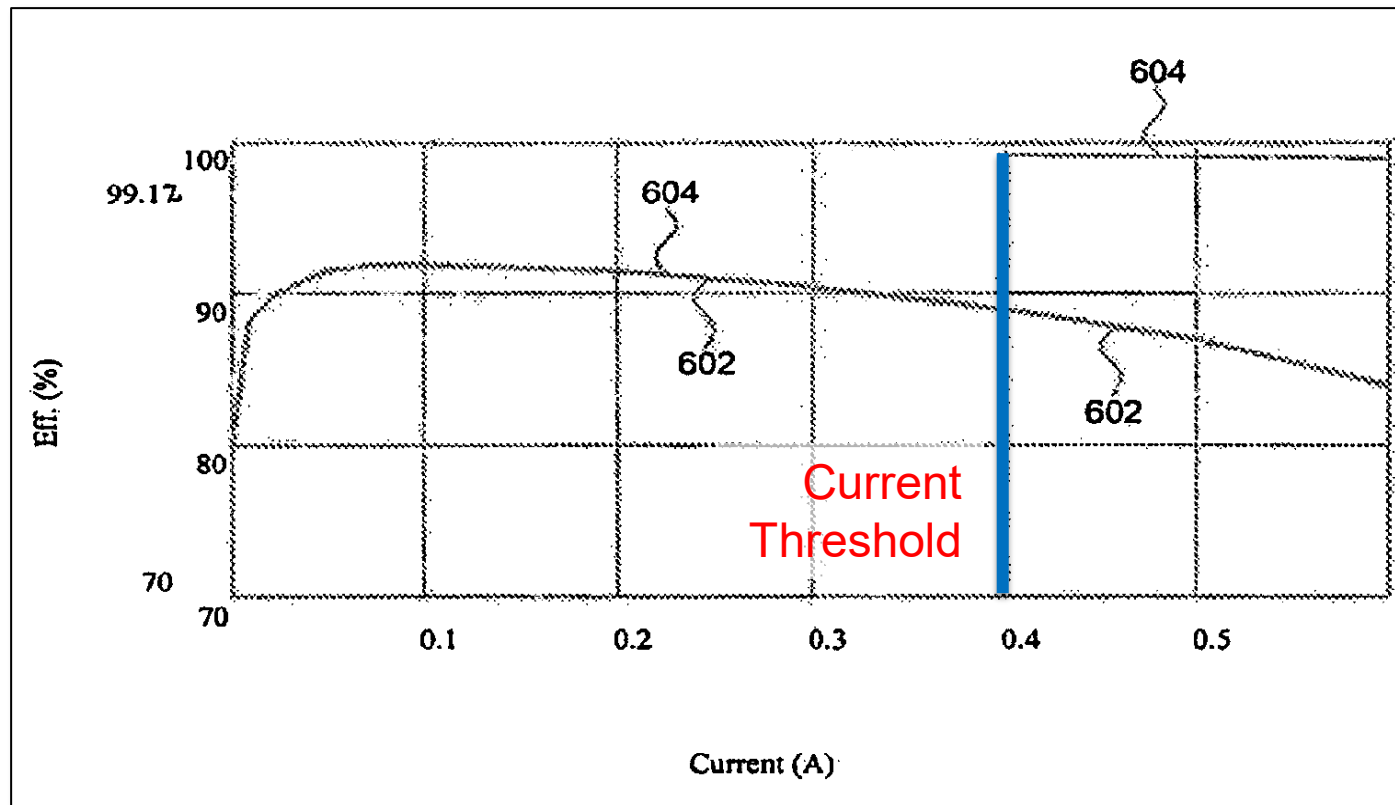
EX1001, Fig. 3

pre-determined threshold. For example, referring to exemplary plot 302, an optional power supply bypass switch can be used to bypass the power supply when the power supply output voltage required by the MISO amplifier reaches 3.6V, which corresponds to an output power of +26 dBm or 400 mW. By bypassing the power supply, any loss in system efficiency due to the power supply efficiency can be eliminated.

EX1001, 6:28-35

Claim construction- “in response to a power efficiency of the power supply exceeding a predetermined threshold”

Preferred embodiments in specification use voltage or current measurements for threshold



Without a bypass switch, as illustrated by efficiency curve 602, the switching power supply has its highest efficiency between 70 and 100 mA of output current, which renders the highest system efficiency of the exemplary MISO amplifier in the example network statistics.

On the other hand, with a bypass switch architecture, as illustrated by efficiency curve 604, the power supply efficiency can be further increased when the output current exceeds 400 mA. This in turn increases the network system efficiency when the required output power is equal to or greater than 400 mW (+26 dBm).

EX1001, 9:32-42

EX1001, Fig. 6

Pet. 12-13; Reply 2-4; EX1001, Fig. 6, 9:32-42

Claim construction- “in response to a power efficiency of the power supply exceeding a predetermined threshold”

ParkerVision’s expert agrees threshold can be measured by indirect indication of power efficiency such as voltage, current

17 Could the threshold that's assessed at
18 run time be a -- an indicator such as voltage?

20 A. I would say that is not correct, but to
21 provide a little clarification, the threshold can
22 be predetermined from the efficiency
23 understanding and communication waveform,
24 distributions, et cetera. And once that
25 threshold is understood, that can be represented
1 by a signal and the signal could be a voltage or
2 the signal could be a current, but the threshold
3 is really from the power efficiency
4 understanding.

a voltage, for instance. The voltage is just how
they're representing the signal of the threshold
and so that can be determined ahead of time.

EX1030
(Ricketts. Tr.),
51:18-52:6

EX1030
(Ricketts. Tr.),
41:17-42:4

Claim construction- “in response to a power efficiency of the power supply exceeding a predetermined threshold”

Experts agree that power supply circuit does not need to directly measure or calculate power efficiency to determine the “threshold”

- “Nowhere in its specification does the ’593 Patent [] teach that the circuitry directly calculates the power efficiency (e.g., by comparing input and output power), much less does it teach whether to bypass the down-converter based on such a calculation.”
 - EX1003 (Larson Decl.), ¶85
- “[T]he claims do not require a calculation of power efficiency by the circuitry.”
 - EX2001 (Ricketts Decl.), ¶74

Claim construction- “in response to a power efficiency of the power supply exceeding a predetermined threshold”

District Court *Markman* ruling: claims are silent on how “power efficiency” is measured

Third, a POSITA would understand that the term “power efficiency” is simply the ratio of the output power of a component as compared to its input power. Defendants’ proposed construction reflects this plain-and-ordinary meaning. How “power efficiency” is measured is outside of the scope of the term. The language of Claim 9 also does not specify how “power efficiency” should be measured, and Defendants’ proposed construction is likewise silent.

EX1037 (*Markman* ruling), 35

ParkerVision never raised its present “determining the power efficiency characteristics of the power supply and setting a threshold based on that determination” argument (EX2001, ¶ 74) in District Court (EX1031, ¶ 37; EX1034, EX1035).

Claim construction- “in response to a power efficiency of the power supply exceeding a predetermined threshold”

ParkerVision’s evolving arguments

- First: Threshold **can’t** be indirect indicator of power efficiency
 - EX2001, ¶¶69-70
- Then: Threshold **can** be indirect (e.g., voltage, current), but has to be “from the power efficiency understanding”
 - EX1030 (Ricketts. Tr.), 41:17-42:4

Claim construction- “in response to a power efficiency of the power supply exceeding a predetermined threshold”

Actual claim language: “...in response to a power efficiency of the power supply exceeding a predetermined threshold”

- ParkerVision’s interpretation: “**determining the** power efficiency **characteristics** of the power supply and **setting** a threshold **based on that determination**” (EX2001, ¶ 74)
- Inconsistent with ’593 patent specification: voltage, current thresholds in specification are not “based on” power efficiency calculations

Claim construction- “in response to a power efficiency of the power supply exceeding a predetermined threshold”

Power efficiency *calculations* (e.g. Fig. 1) are never directly used to set thresholds

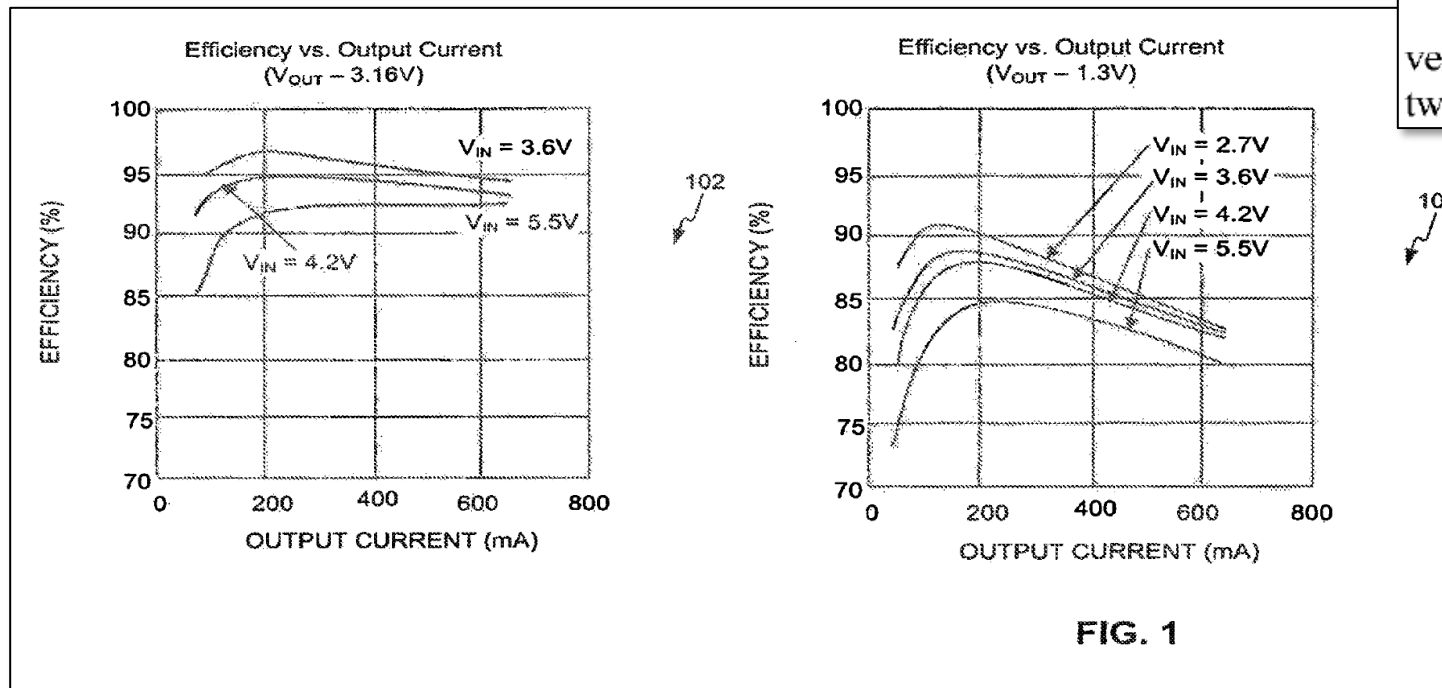


FIG. 1 illustrates exemplary plots 102 and 104 of efficiency versus output current of a typical switching power supply for two exemplary values of output power.

EX1001 ('593
Pat.) 4:15-17

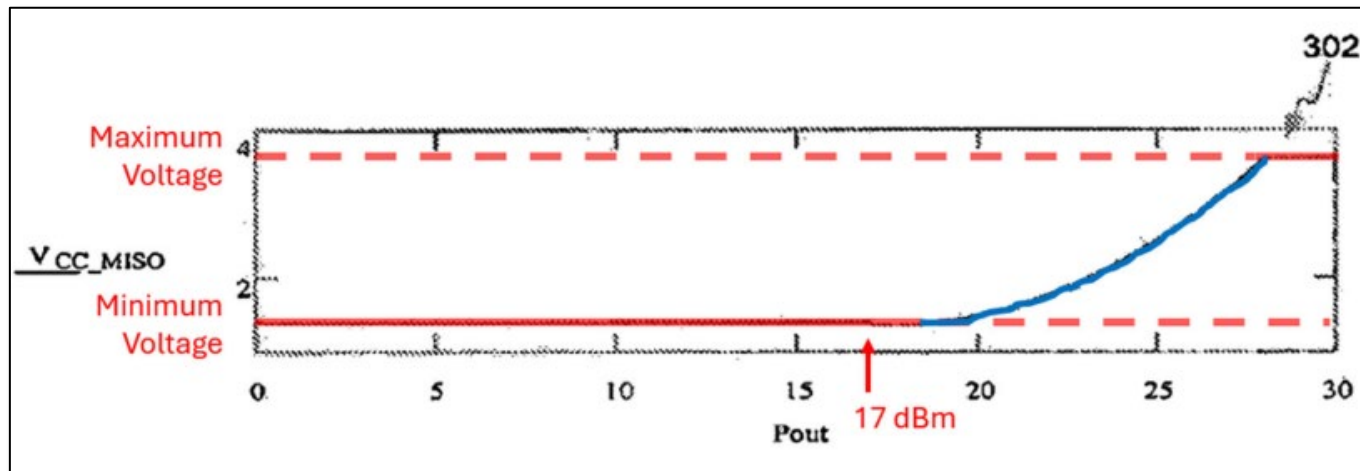
“[T]he specification *never* says that [bypass thresholds] are calculated **based on** the efficiency charts in Fig. 1.”

- EX1031 (Larson Reply Decl.), ¶21

Claim construction- “in response to a power efficiency of the power supply exceeding a predetermined threshold”

Bypass thresholds are not set at maximum efficiency, nor based on efficiency

- Fig. 3: maximum efficiency occurs at minimum voltage input to PA, bypass at maximum voltage of PA



“..the collector/drain voltage range of the MISO amplifier is +1.39V to 3.6V. Also, for an output power of +17dBm, the collector/drain voltage... is approximately +1.39V. Accordingly... the switching power supply should be designed to operate at its highest efficiency when its output voltage is approximately 1.39V”

- EX1001 ('593 Pat.), 5:40-50

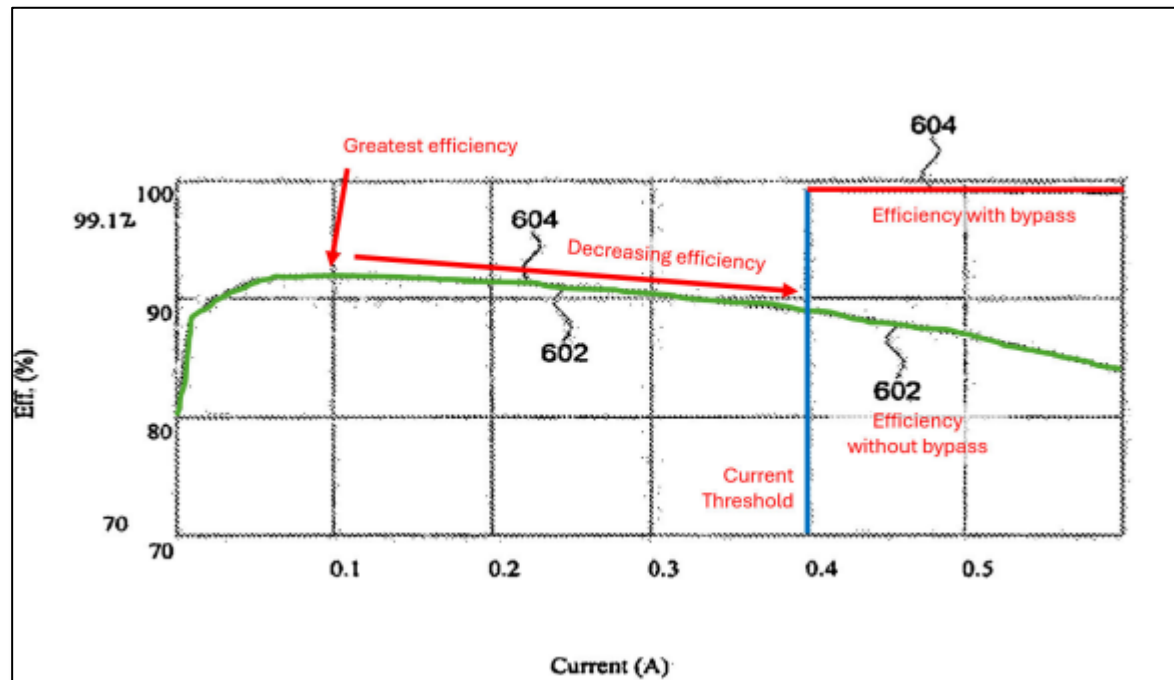
“an optional power supply bypass switch can be used to bypass the power supply when the power supply output voltage required by the MISO amplifier reaches 3.6V”

- EX1001, 6:28-33

Claim construction- “in response to a power efficiency of the power supply exceeding a predetermined threshold”

Bypass thresholds are not set at maximum efficiency, nor based on efficiency

- Fig. 6: maximum efficiency occurs at 0.1A, then decreases before bypass threshold at 0.4A



Without a bypass switch, as illustrated by efficiency curve 602, the switching power supply has its highest efficiency between 70 and 100 mA of output current, which renders the highest system efficiency of the exemplary MISO amplifier in the example network statistics.

On the other hand, with a bypass switch architecture, as illustrated by efficiency curve 604, the power supply efficiency can be further increased when the output current exceeds 400 mA. This in turn increases the network system efficiency when the required output power is equal to or greater than 400 mW (+26 dBm).

EX1001 ('593
Pat.) 9:32-42

Claim construction

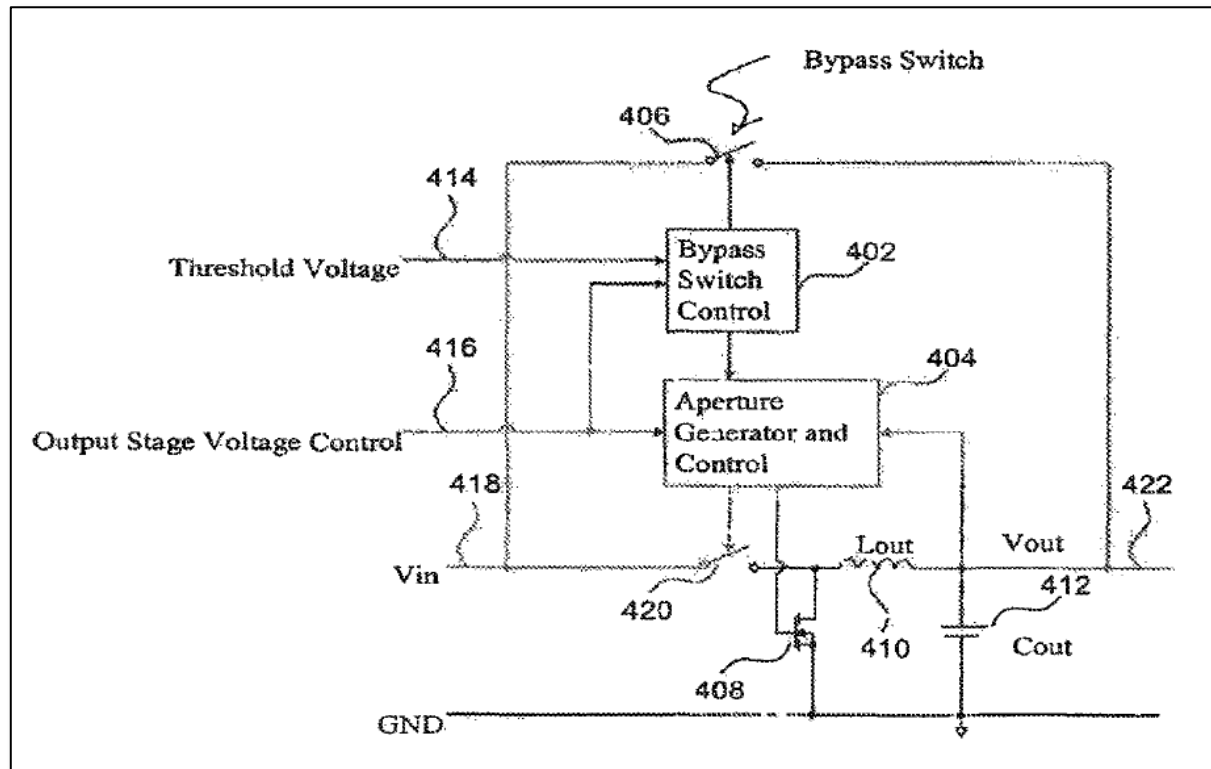
Construing based on designer's intention in setting threshold is improper



“We are not prepared to assign a meaning to a patent claim that depends on the state of mind of the accused infringer”

- *Amazon.com, Inc. v. Barnesandnoble.com, Inc.*, 239 F.3d 1343, 1353 (Fed. Cir. 2001)

Claim Construction



“Under [ParkerVision’s and Dr. Ricketts’] interpretation, two devices could have identical circuits (such as the circuit shown in Fig. 4) with identical voltage or current thresholds, yet one might practice the patent and the other would not based solely on whether the designer had calculated the efficiency at some point.”

- EX1031 (Larson Reply Decl.), ¶32

Response to Sur-Reply Arguments: Claim Construction

ParkerVision argument: Power efficiency must be a “ratio” or expressed as percentage (SR 1-2)

- Response: plain language of claims cover a power supply (claim 1), a method (claim 9), and a system (claim 15)
- No claim requires “power efficiency” to be calculated or expressed, so a “ratio” or “percentage” is irrelevant

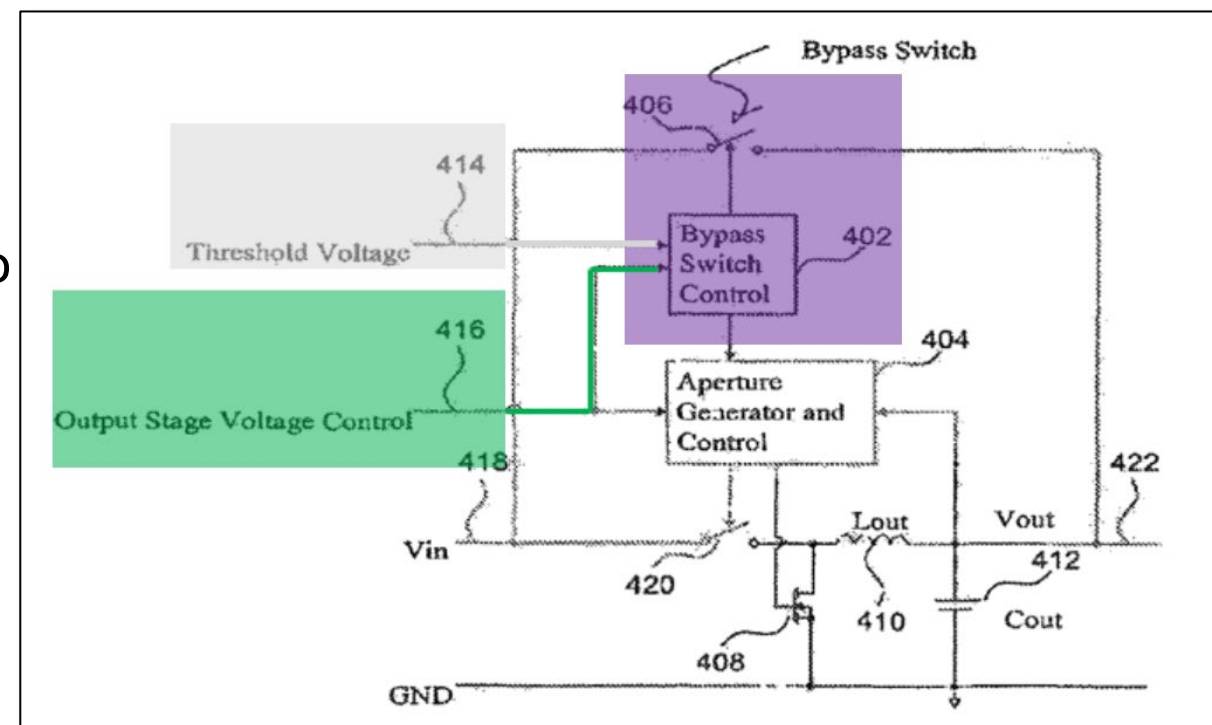
1[pre] A **power supply**, comprising:

- 1[a]: a switching device configured to down-convert an input voltage and pass the down-converted input voltage to an output voltage node; and
- 1[b1] an aperture generator and control module configured to control the switching device,
- 1[b2] wherein, **in response to a power efficiency of the power supply exceeding a predetermined threshold**, the aperture generator and control module deactivates the switching device and passes the input voltage to the output voltage node

Response to Sur-Reply Arguments: Claim Construction

ParkerVision argument: “a measurement of voltage or current alone is not sufficient to calculate power, let alone to compare output power to input power” (SR 2-3)

- Response: Claims only require performing bypass function when efficiency threshold is exceeded; claims do not require efficiency to be measured or calculated
- District Court: claims are silent on how threshold is measured (EX1037, 35); ParkerVision ignores in SR (filed after the ruling)
- Argument reads out preferred embodiment: Fig. 4 just compares Output Stage Voltage Control signal to reference voltage for bypass



Response to Sur-Reply Arguments: Claim Construction

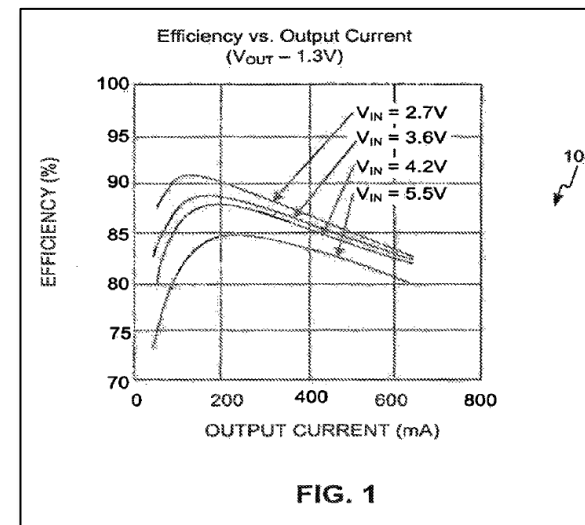
Specification does not support ParkerVision's interpretation of "determining the power efficiency characteristics of the power supply and setting a threshold based on that determination"

- Repeated assertions by ParkerVision that efficiency threshold is "based on" Fig. 1 have never identified any support for this assertion

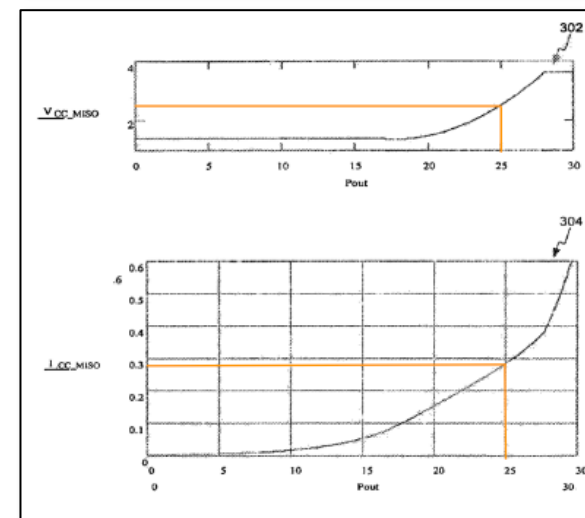
Response to Sur-Reply Arguments: Claim Construction

ParkerVision's new attempt to argue that thresholds are set based on Fig. 1 because a different output voltage would have a different threshold (SR 4-8) fails

- New argument in sur-reply, not supported by Ricketts or presented before Ricketts deposition or Larson reply declaration
- This new argument makes no sense:
 - Fig. 1 shows efficiency curves for **fixed** input and output voltages
 - Fig. 3 shows a curve with **variable output** voltage
 - ParkerVision compares the Fig. 1 curve showing a 2.7V **input** voltage to the point on Fig. 3 where the power supply **output** voltage V_{CC} reaches 2.7V.
 - ParkerVision says (SR, 7) that "Figure 1 shows that, for optimal performance at **+17 dBm**, the power supply should be configured to have an **input voltage** of 2.7V," then highlights a point in Fig. 3 with **output voltage** V_{CC} at **+25 dBm**.



EX1001, Fig. 1

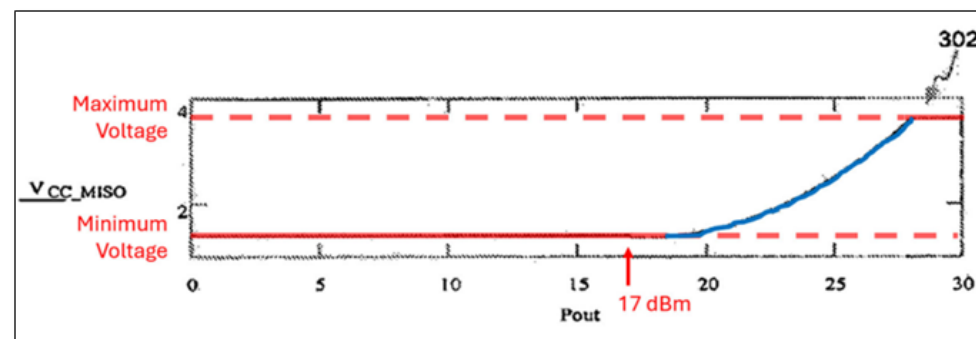


Response to Sur-Reply Arguments: Claim Construction

ParkerVision's new sur-reply argument (that thresholds in Figs. 3, 6 are set based on Fig. 1) makes no sense, continued

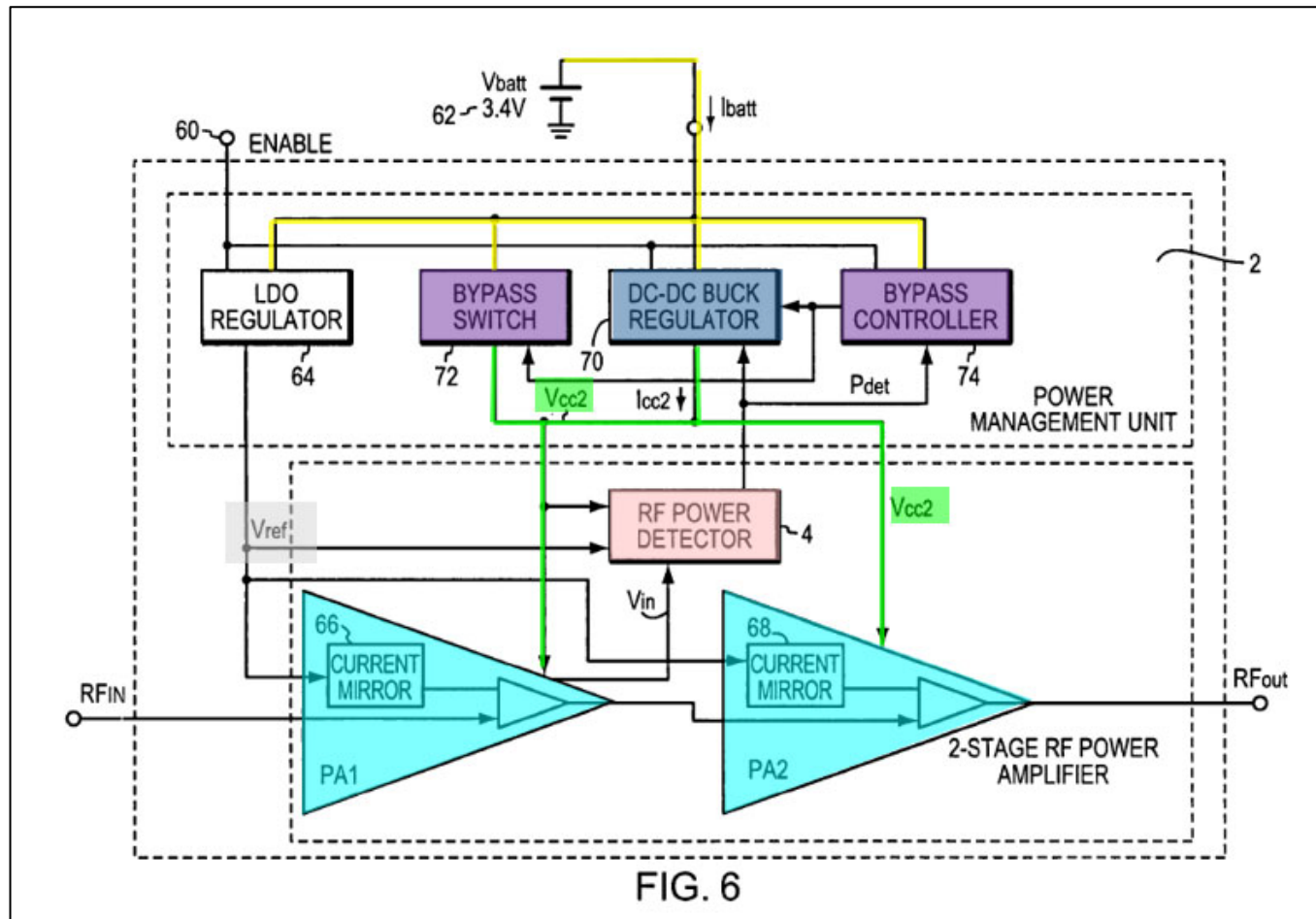
- ParkerVision's original argument was that Figs. 3, 6 **were** based on Fig. 1; now arguing that the thresholds in those figures would **change** based on something in Fig. 1
- Optimal output power is not the bypass threshold
- No logical reason why bypass threshold would change based on change in optimal output power or corresponding voltage
- Bypass threshold based on 3.6V max voltage of amplifier would still be 3.6V
 - Same with 400 mA current threshold in Fig. 6

EX1001, Fig. 3
(annotated)



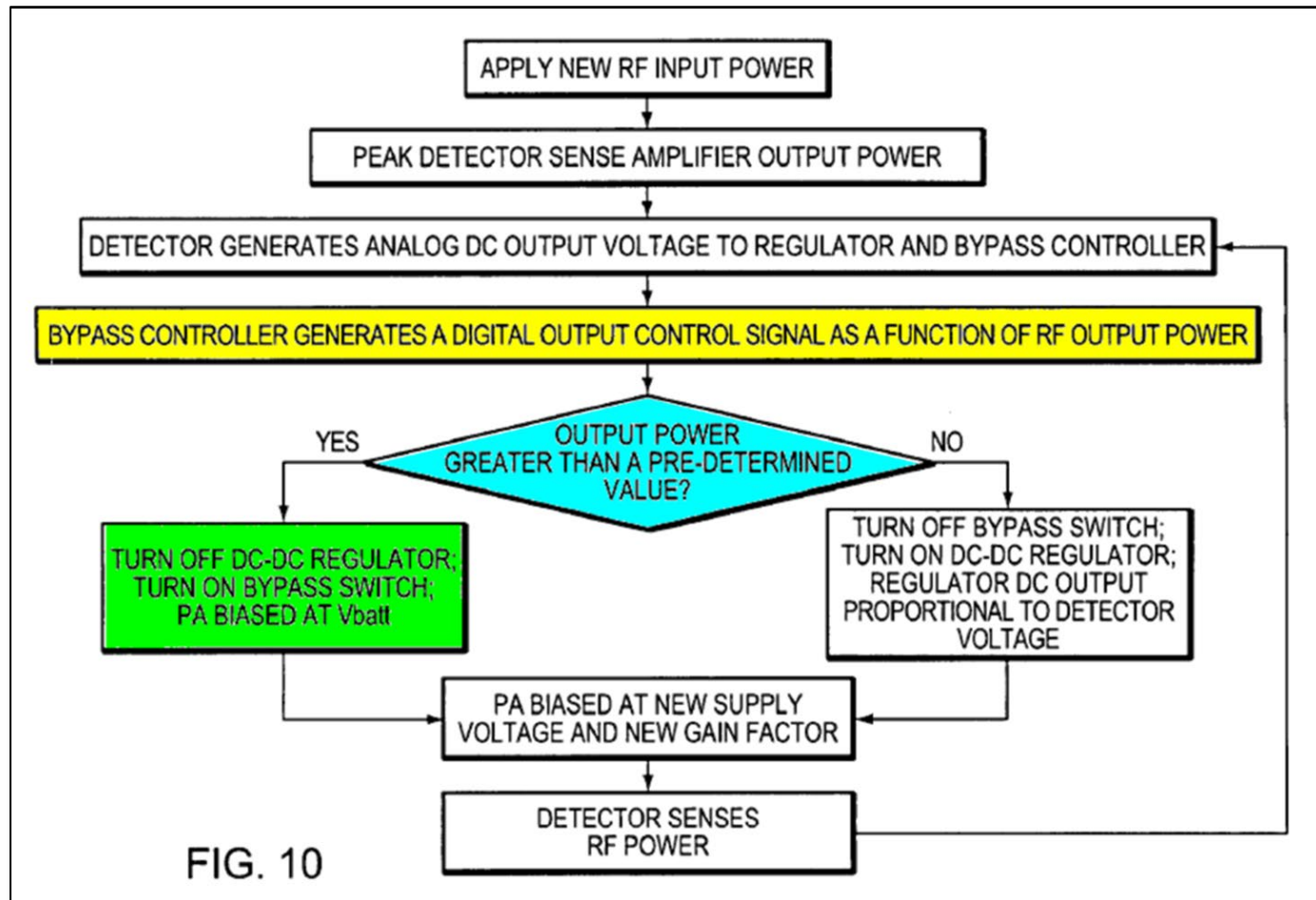
Ground 1A- Hau + Yoshida

Ground 1A references- Hau (EX1007)



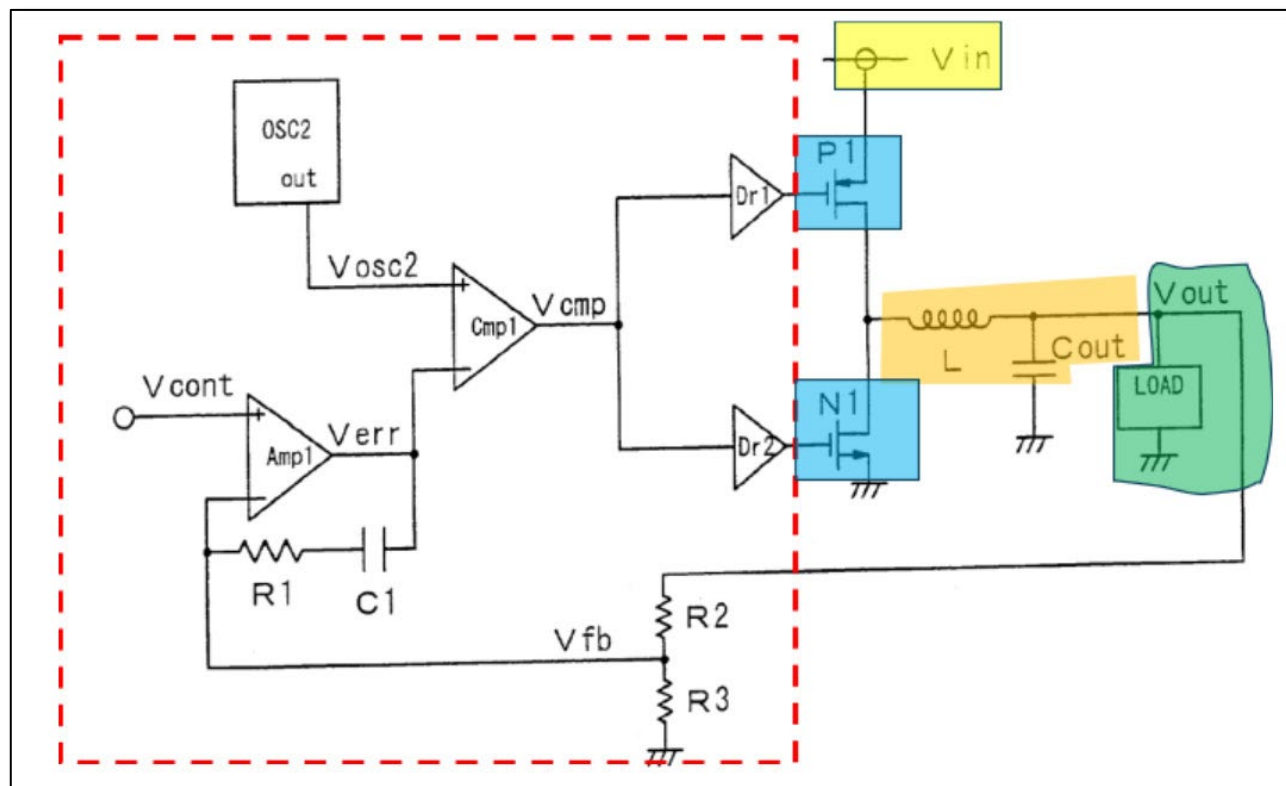
Hau teaches a power supply for an RF system with a DC-DC regulator, a bypass controller, and a bypass switch

Ground 1A references- Hau (EX1007)



Hau teaches bypassing the DC-DC regulator at a pre-determined output power level

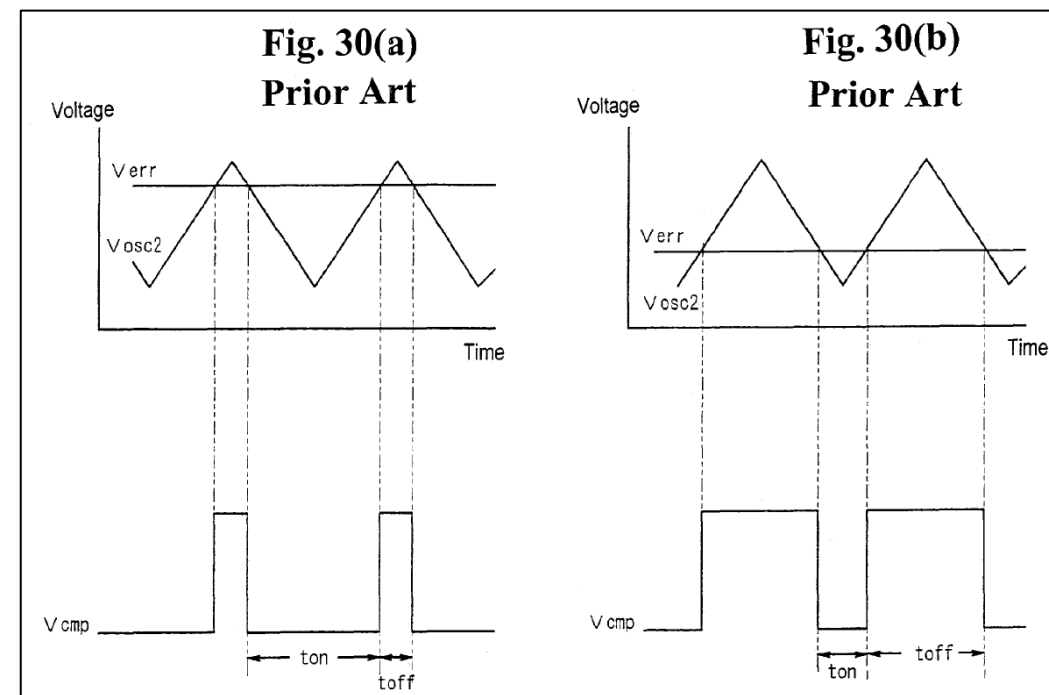
Ground 1A references- Yoshida (EX1008)



EX1008, Fig. 29 (annotated)

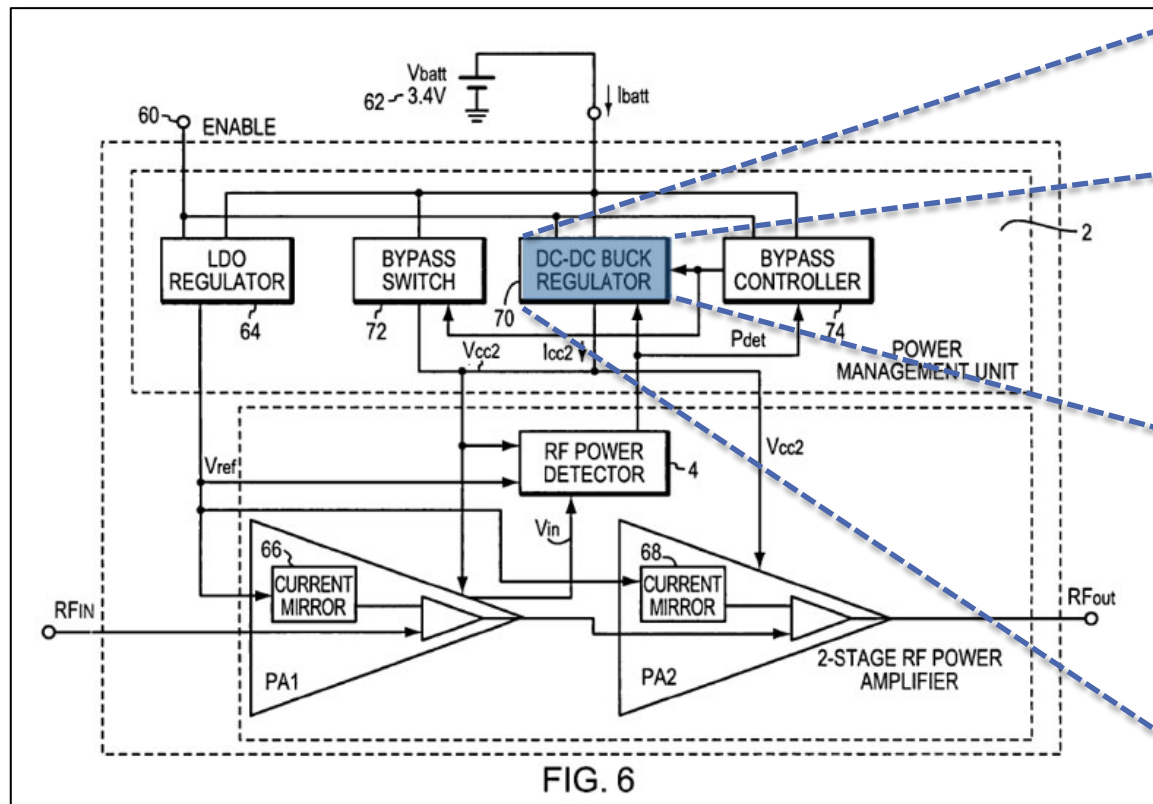
Yoshida teaches a DC-DC converter that down-converts a voltage by varying the “on” time of a switch

Petition, 18-21

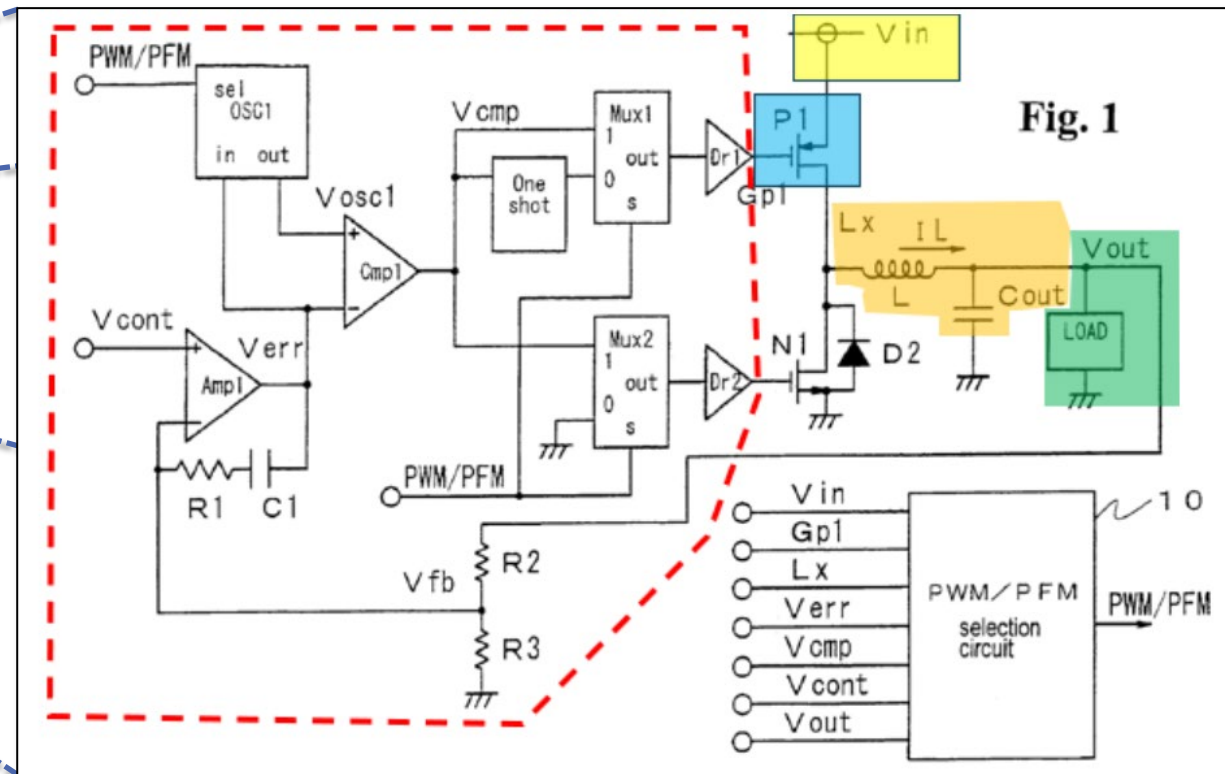


EX1008, Fig. 30

Ground 1A Motivation to Combine (not disputed)



EX1007, Fig. 6
(annotated)



EX1008, Fig. 1
(annotated)

Hau teaches that DC-DC buck regulator is “known to those in the art” (EX1007, 5:39-40), while Yoshida explains details of DC-DC buck regulator

Ground 1A: Disputed Claim Element

Efficiency Threshold (elements 1[b2], 9[c], 15[d2]) is only disputed element regarding Ground 1A independent claims

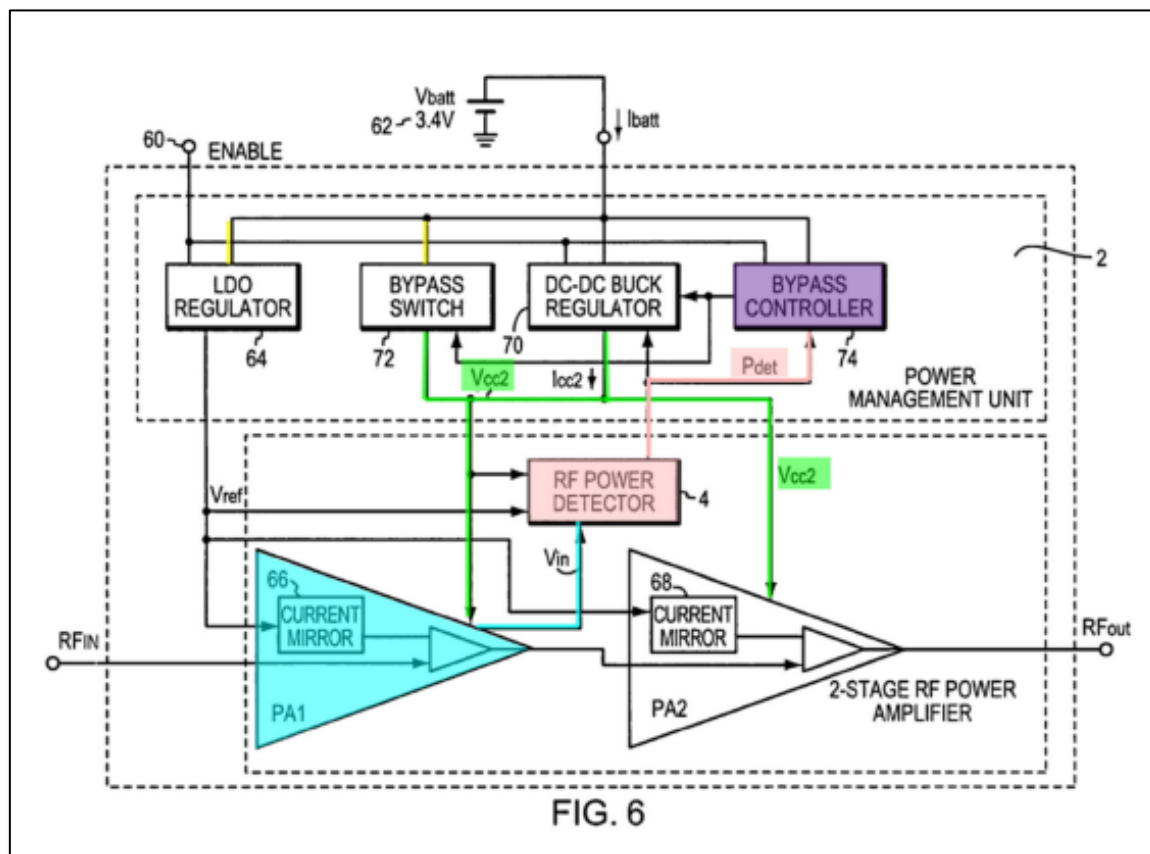
- Patent Owner's Arguments:
 - Petition “conflates RF power and supply power” (POR, 29)
 - Accounting for “variation[s] in input and output current” (POR, 29-30)
 - Bypass function does not “involve power efficiency determinations” (POR, 31)

Ground 1A: Disputed Claim Element

- Patent Owner's Arguments:
 - Petition “conflates RF power and supply power” (POR, 29)
 - Accounting for “variation[s] in input and output current” (POR, 29-30)
 - Bypass function does not “involve power efficiency determinations” (POR 31)

Ground 1A: Efficiency Threshold

Hau's bypass uses a signal (P_{det}) proportional to supply power (V_{cc2})



EX1007, Fig. 6
(annotated)

Petition 29-30; EX1003, ¶¶123; Reply 8-10; EX1031, ¶¶40-43

The output power of the power amplifier is proportional to the square of the voltage V_{in} . The power detector 4 outputs an DC voltage, P_{det} , which is proportional to the voltage V_{in} . The DC to DC converter outputs a supply voltage V_{cc2} , which is linearly related to the voltage V_{in} . The maximum output voltage signal swing of the power amplifier is proportional to the square of the supply voltage V_{cc2} . The maximum output power from the power amplifier is therefore directly proportional to the square of V_{cc2} . Thus, the linear relationship between P_{det} and V_{cc2} is achieved, and the optimum output power of the power amplifier is controlled by V_{cc2} accordingly. With this linear output relationship, the detector DC

EX1007, 6:26-37

Ground 1A: Efficiency Threshold

“A POSITA would have understood that this relationship occurs because Vcc2 is the supply voltage that provides power for the power amplifier PA1. Therefore, the power output from PA1, which is measured by Pdet, is proportional to the supply voltage Vcc2, and Pdet is also an indicator of the Vcc2.”

- EX1031, ¶41

“[B]oth [ParkerVision and Dr. Ricketts] argue... that... the Petition ‘conflates RF power and supply power.’ This argument is misplaced... [t]he RF power signal RFin is the signal being amplified by PA1, while Vcc2 provides the power for PA1.”

- EX1031, ¶42

Response to Sur-Reply Arguments: Ground 1A

“Hau’s Figure 5 shows the output power of the ***amplifier***, not the output power of the ***power supply***.” (SR 11)

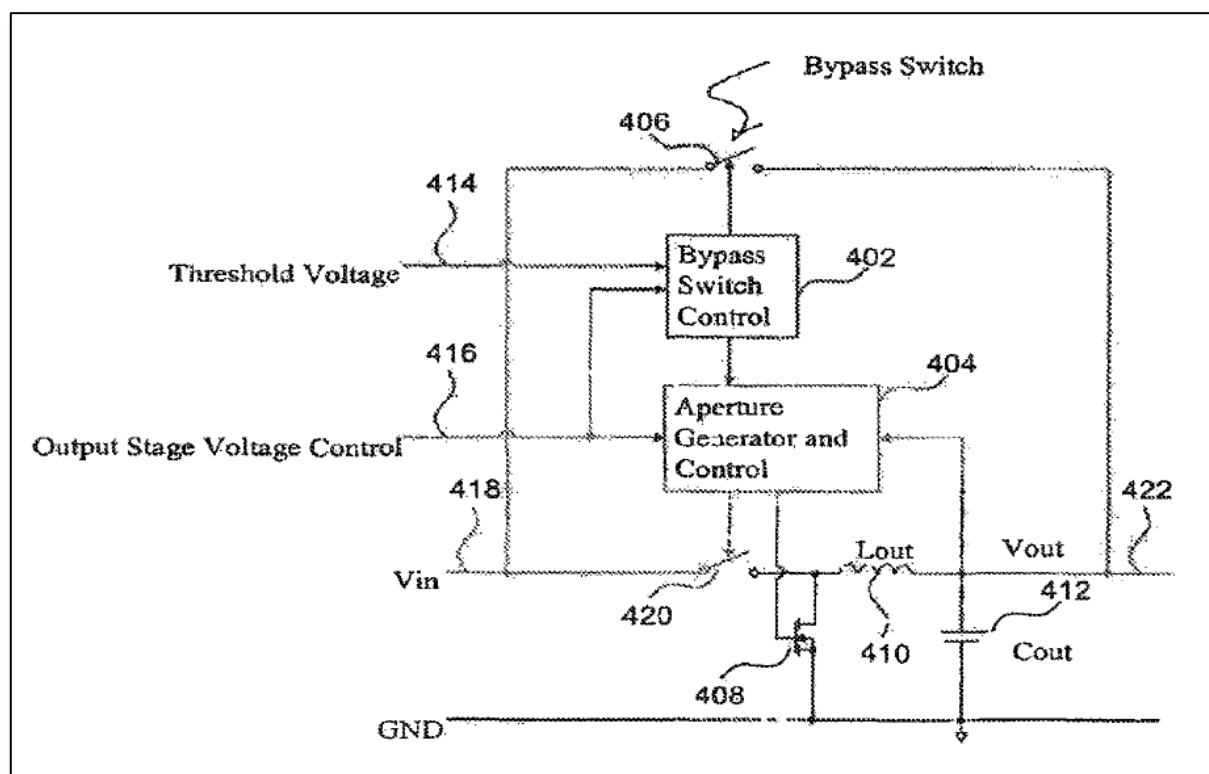
- Response: Hau teaches that power ***output*** from the amplifier is directly related to power ***input*** to the amplifier (that is, output from power supply). See EX1007, 6:26-37
- “[t]he power supply and power amplifier are not ‘separate’ because Vcc2 provides the power for the power amplifier, whose power output is in turn related to Vcc2.” (EX1031, ¶43)
- Claims have no requirement to measure output power directly or measure input power at all, nor does the specification support such a requirement

Ground 1A: Disputed claim element

- Patent Owner's Arguments:
 - Petition “conflates RF power and supply power” (POR, 29)
 - Accounting for “variation[s] in input and output current” (POR, 29-30)
 - Bypass function does not “involve power efficiency determinations” (POR 31)

Ground 1A: Efficiency Threshold

Claims do not require bypass to account for “variation[s] in input and output current” (POR 29-30), nor does specification support that interpretation

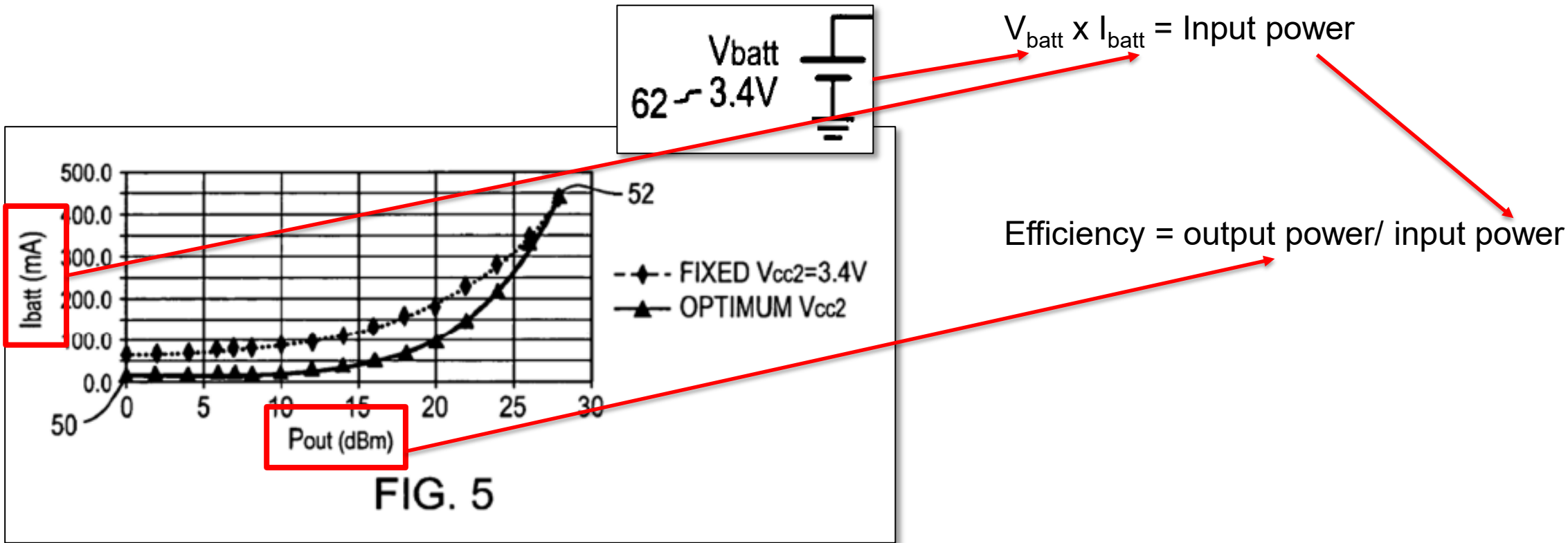


'593 Patent Fig. 4: only compares “output stage voltage control” to threshold voltage; no input or output current signal

- EX1001, 7:46-8:8
- EX1031, ¶ 44

Ground 1A: Efficiency Threshold

Hau teaches correlation between efficiency and output power, even if accounting for “variation[s] in input and output current” is claimed (it isn’t)



Reply 10-11; EX1007, Figs. 5,6; EX1031, ¶¶ 45-47

Response to Sur-Reply Arguments: Ground 1A

Sur-reply misrepresents the Reply:

- Reply at 11-12: “All that matters is that [the bypass function] is activated ‘in response to a power efficiency of the power supply exceeding a predetermined threshold,’ which in Hau (as in the preferred ’593 embodiments) is identified by voltage.”
- As “quoted” in the Sur-Reply at 12: “All that matters is that [the bypass] function is activated... by [a] voltage [threshold].”

Ground 1A: Disputed claim element

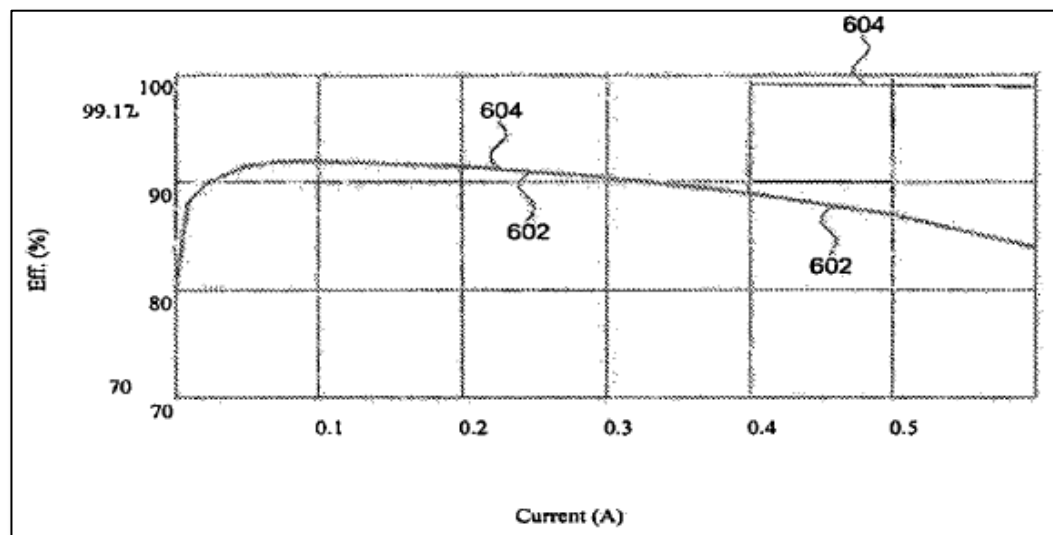
- Patent Owner's Arguments:
 - Petition “conflates RF power and supply power” (POR, 29)
 - Accounting for “variation[s] in input and output current” (POR, 29-30)
 - Bypass function does not “involve power efficiency determinations” (POR 31)

Ground 1A: Efficiency Threshold

Efficiency threshold element does not require:

- A “determination” during the design process (EX1031, ¶ 49)
- Linear relationship between efficiency, value used to measure threshold (EX1031, ¶ 48)
- Particular purpose for setting threshold at a given value (EX1031, ¶¶ 50-51)

Ground 1A: Efficiency Threshold



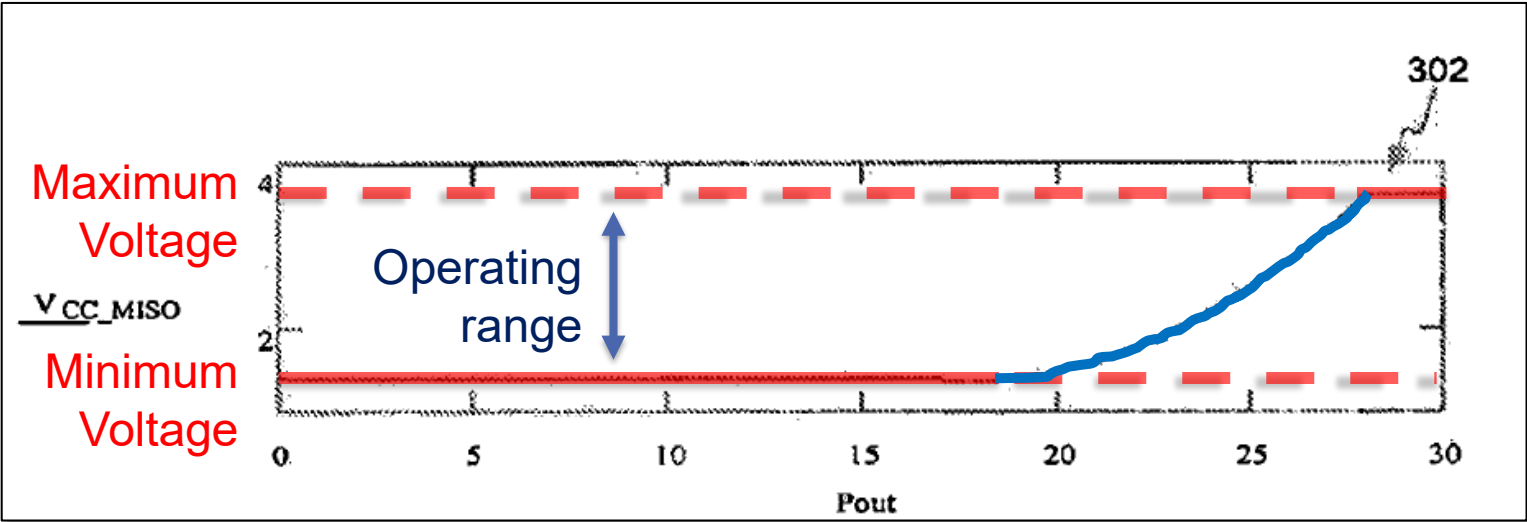
EX1001, Fig. 6

“The fact that the **'593 patent itself** teaches that [voltage and current] values do not have a linear relationship with power efficiency... actually goes to show that a POSITA reading the claims in view of the specification would not interpret the claims to require such a limitation”.

- EX1031, ¶ 48

Ground 1A: Efficiency Threshold

'593 Patent's preferred embodiment sets threshold based on limitations of hardware



EX1001, Fig. 3

depending on the MISO amplifier configuration used. As illustrated in exemplary plot 302, the collector/drain voltage range of the MISO amplifier is +1.39V to +3.6V. Also, for an

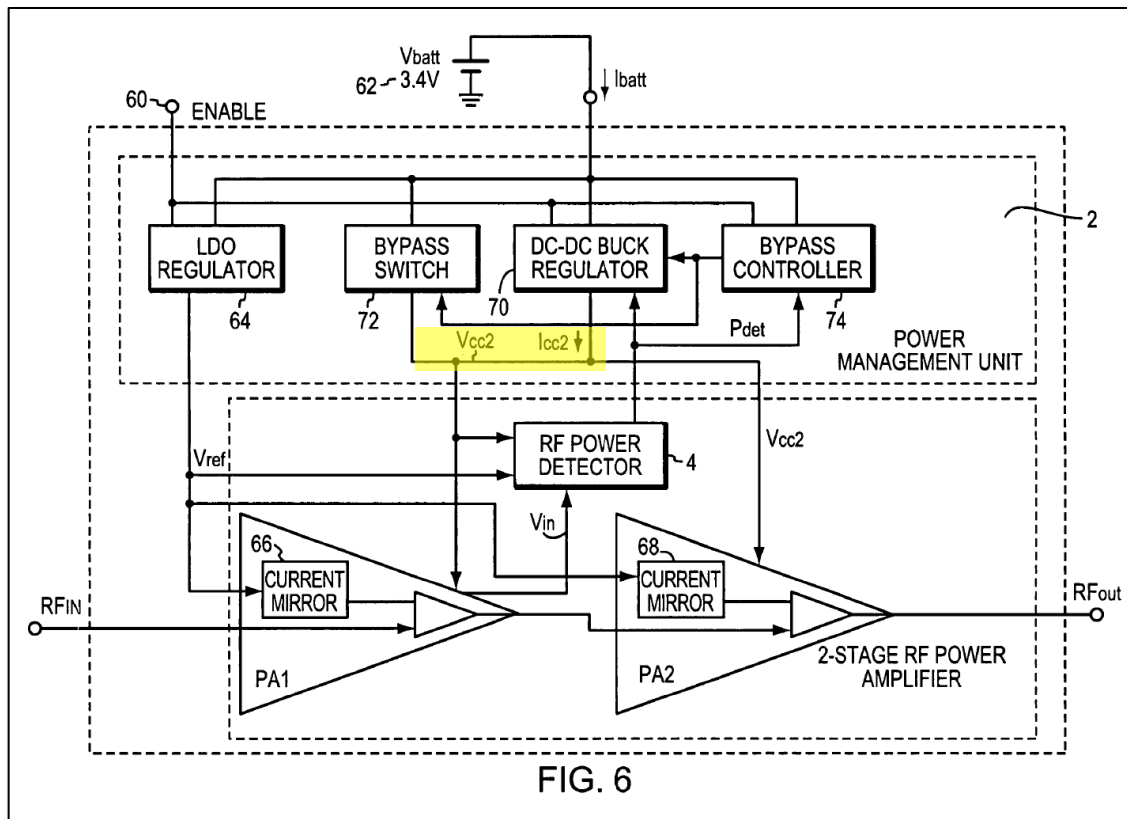
EX1001, 5:40-42

pre-determined threshold. For example, referring to exemplary plot 302, an optional power supply bypass switch can be used to bypass the power supply when the power supply output voltage required by the MISO amplifier reaches 3.6V, which corresponds to an output power of +26 dBm or 400 mW. By bypassing the power supply, any loss in system efficiency due to the power supply efficiency can be eliminated.

EX1001, 6:28-35

Ground 1A: “deactivate the switching device based on a load current at the output voltage node” (Claim 2)

Hau teaches that monitoring output power of power supply via output current was known



or complicated controller circuits used in the prior art. In addition, the prior art related the output current to the output power from the $(I)(V)$ =power relationship, whereas the present invention relies on the $(V_{cc2})^2/R$ =power relationship.

EX1007, 6:40-44

U.S. Pat. No. 6,081,161 ('161) to F. L. Dacus et al. and U.S. Pat. No. 6,646,511 ('511) to J. C. Canyon et al. provide other solutions. Both of these patents teach monitoring the output power of the power amplifier through the current in the voltage bias line to the power amplifier. The detected current sets the optimized bias voltage for the power amplifier. However,

EX1007, 2:1-6

Ground 1A: “deactivate the switching device based on a load current at the output voltage node” (Claim 2)



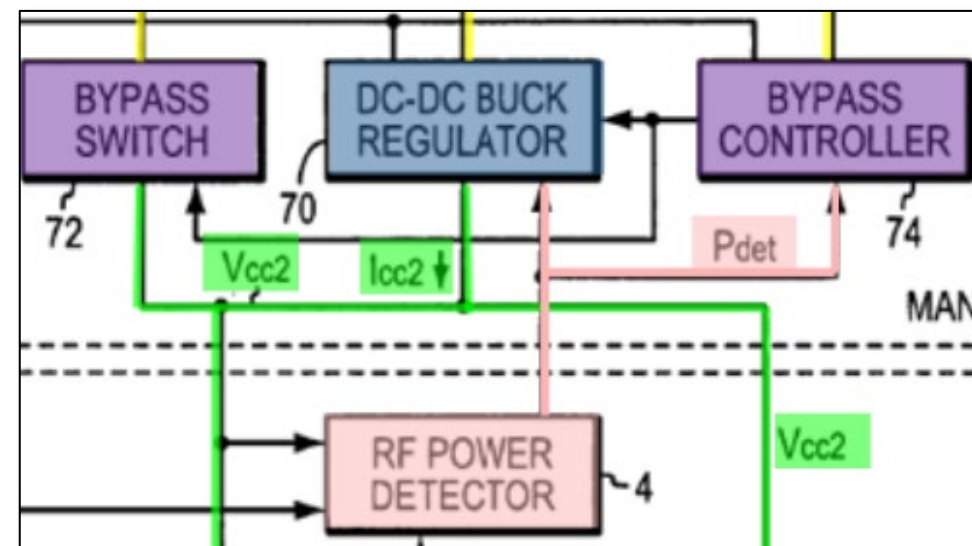
“A known or obvious composition does not become patentable simply because it has been described as somewhat inferior to some other product for the same use.”

- *In re Gurley*, 27 F.3d 551, 553 (Fed. Cir. 1994)

Response to Sur-Reply Arguments: Ground 1A, claim 2

New argument from ParkerVision (SR, 13; not made in POR, 33-37):

- “As a threshold matter, Hau merely discloses that it was known to **optimize the bias voltage** of power amplifier [sic] based on current measured in the voltage bias line to the power amplifier... Neither Hau nor the prior art referenced therein discloses **controlling a bypass switch** based on current measured at the output voltage node, as required by the claims” (emph. in original)
- Responses (if argument considered): Hau teaches controlling both DC-DC buck regulator (which controls bias voltage) and bypass controller based on the same signal indicative of power. It would be obvious to do the same if power was measured at I_{cc2} , as taught by prior art cited in Hau (Pet. 33-34)



EX1007, Fig. 6
(excerpt, annotated)

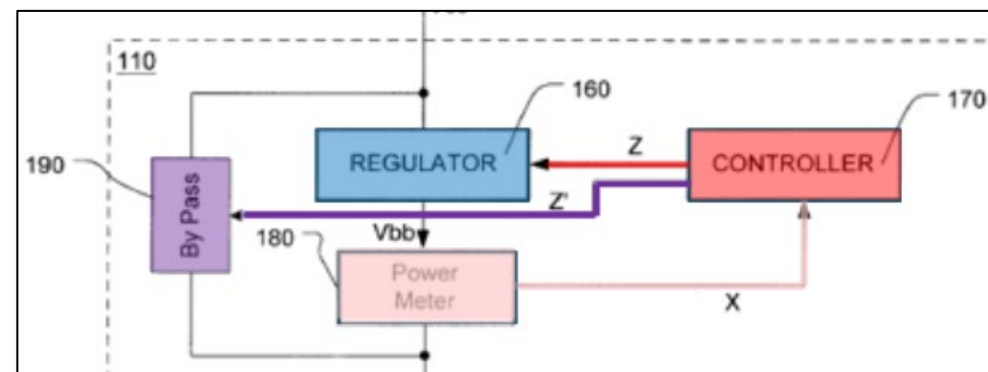
Response to Sur-Reply Arguments: Ground 1A, claim 2

New argument from ParkerVision (SR, 13; not made in POR, 33-37):

- “As a threshold matter, Hau merely discloses that it was known to optimize the bias voltage of power amplifier [sic] based on current measured in the [] voltage bias line to the power amplifier... Neither Hau ***nor the prior art referenced therein*** discloses controlling a bypass switch based on current measured at the output voltage node, as required by the claims” (emphasis added)
- Bolded statement is wrong: cited art in Hau includes Canyon (EX1011), which teaches that both bias voltage (via regulator 160) and bypass 190 are controlled based on signal X from power/current meter 180

U.S. Pat. No. 6,081,161 ('161) to F. L. Dacus et al. and U.S. Pat. No. 6,646,511 ('511) to J. C. Canyon et al. provide other solutions. Both of these patents teach monitoring the output power of the power amplifier through the current in the voltage bias line to the power amplifier. The detected current sets the optimized bias voltage for the power amplifier. However,

EX1007, 2:1-6

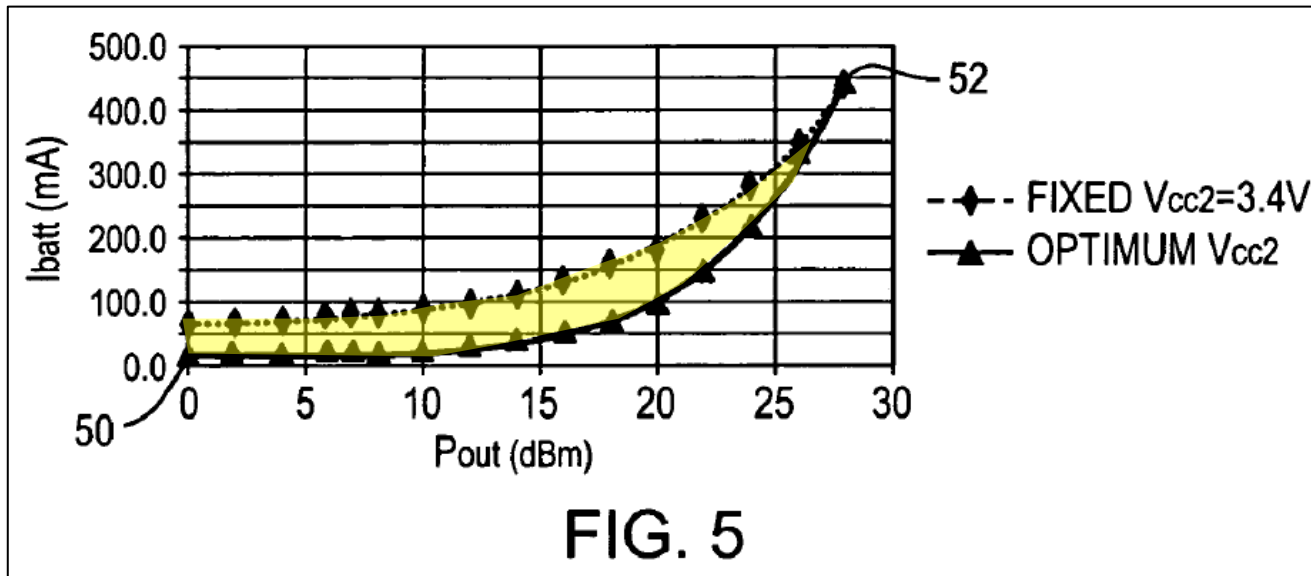


EX1011, Fig. 1
(excerpt, annotated)

Ground 1A: “an output current at a maximum power efficiency associated with the down-converted input voltage” (claims 5,11)

maximum output power. The optimum bias voltage operation provides the most efficient current consumption for each power output level while satisfying the linearity requirements. The abscissa (horizontal axis) is in dBm and the ordi-

EX1007, 4:51-54

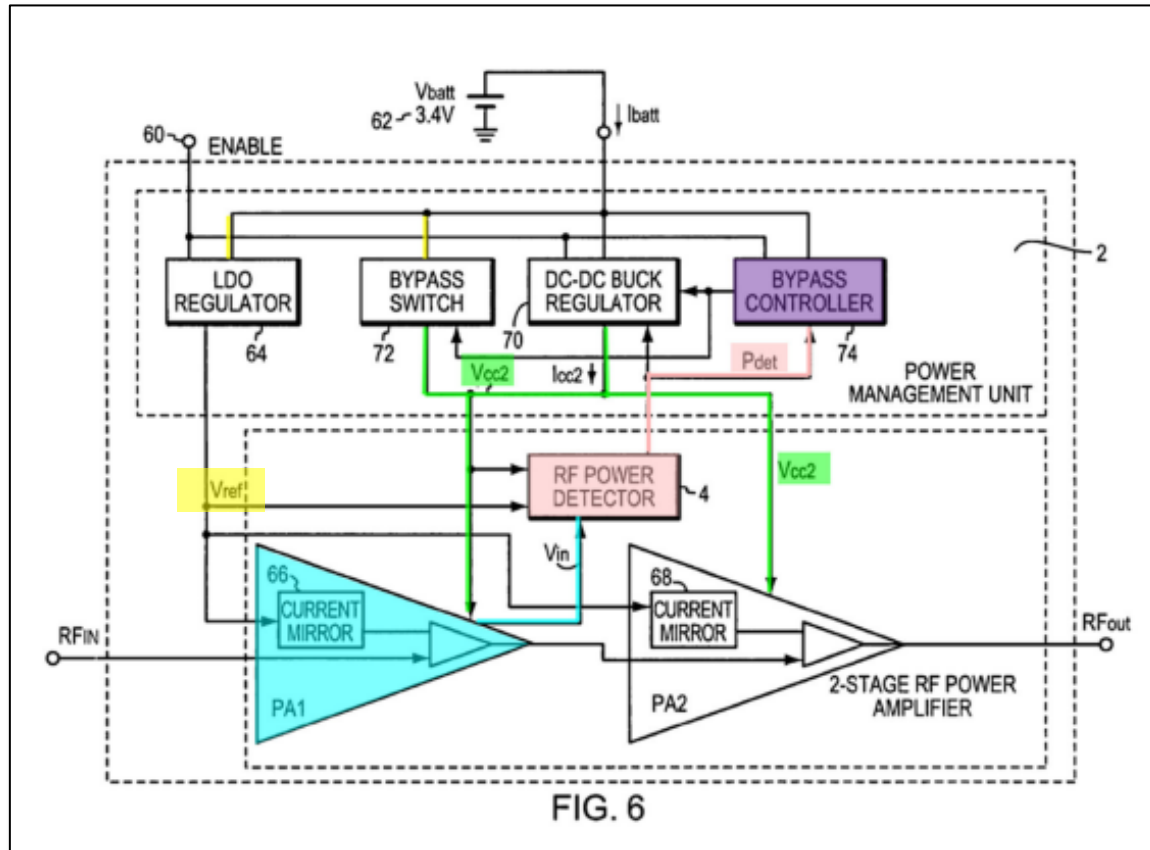


$$Efficiency = \frac{P_{OUT}}{V_{BATT} \times I_{BATT}}$$

Therefore, minimizing I_{BATT} results in maximum efficiency

- EX1031, ¶ 57

Ground 1A: “deactivat[e/ing] the switching device and pass[ing] the input voltage to the output voltage node [based on a/comprises] compar[ison of/ing] the down-converted [input] voltage to a threshold voltage” (claims 6-8, 12-14)



EX1007, Fig. 6
(annotated)

Petition, 35, 37; EX1003, ¶ 134; Reply, 14-16

Hau teaches that Bypass Function is performed based on comparison of P_{det} (pink) to reference voltage V_{ref} (yellow); P_{det} is proportional to down-converted voltage V_{cc2}

- EX1007, 5:48-51, 6:63-66

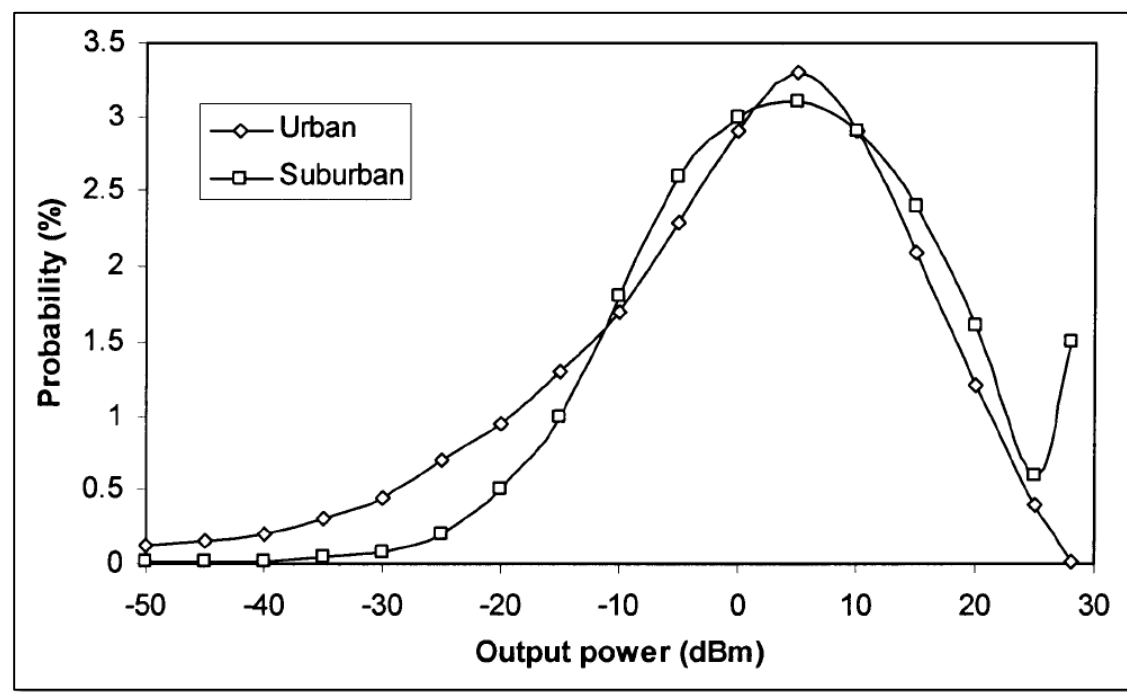
Claim does not require comparison to be direct

- EX1031, ¶¶ 58, 61

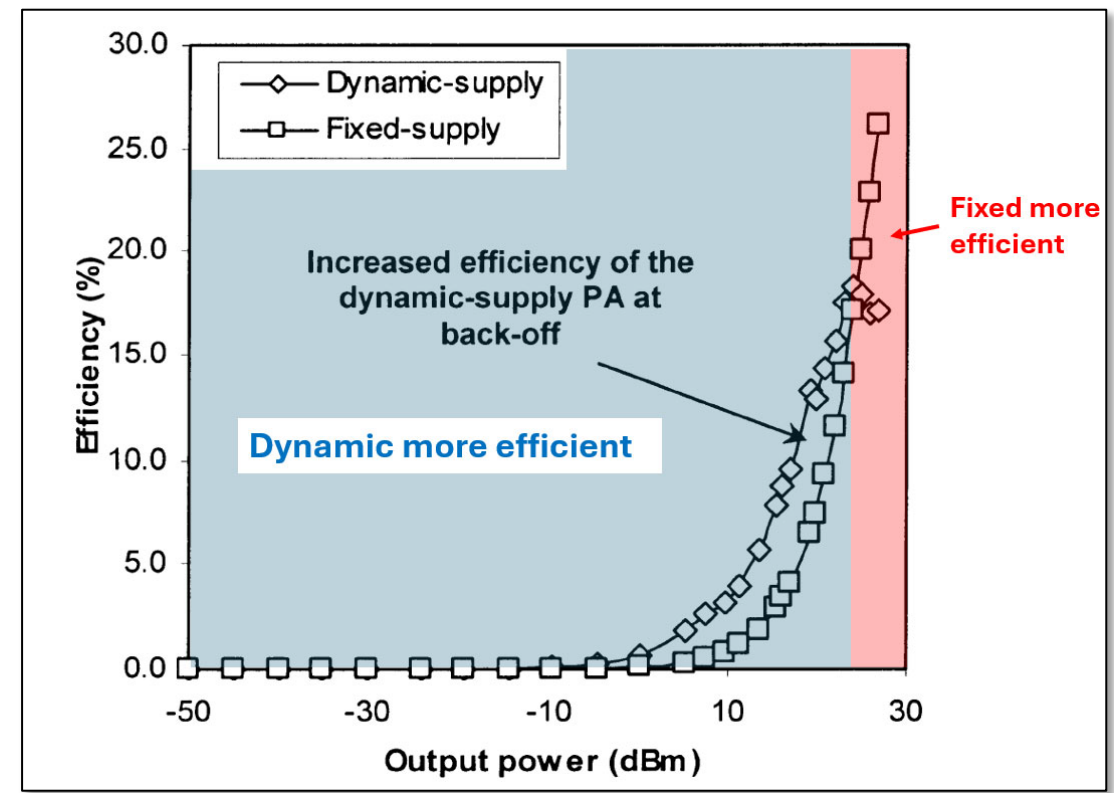
Ground 1B- Hau + Yoshida + Sahu

Ground 1B Additional Reference: Sahu (EX1009)

Sahu teaches: (1) optimizing power supply efficiency based on probability of operating at given power level; (2) “dynamic” power supply with DC-DC converter more efficient at most power levels, fixed power supply more efficient at high power levels



EX1009, Fig. 1



EX1009, Fig. 8a (annotated)

Ground 1B Motivation to Combine

1. Sahu's teaching to optimize performance based on likely operating power applies to Hau/Yoshida combination
2. Hau's bypass switch obtains best efficiency between fixed and down-converted power supply

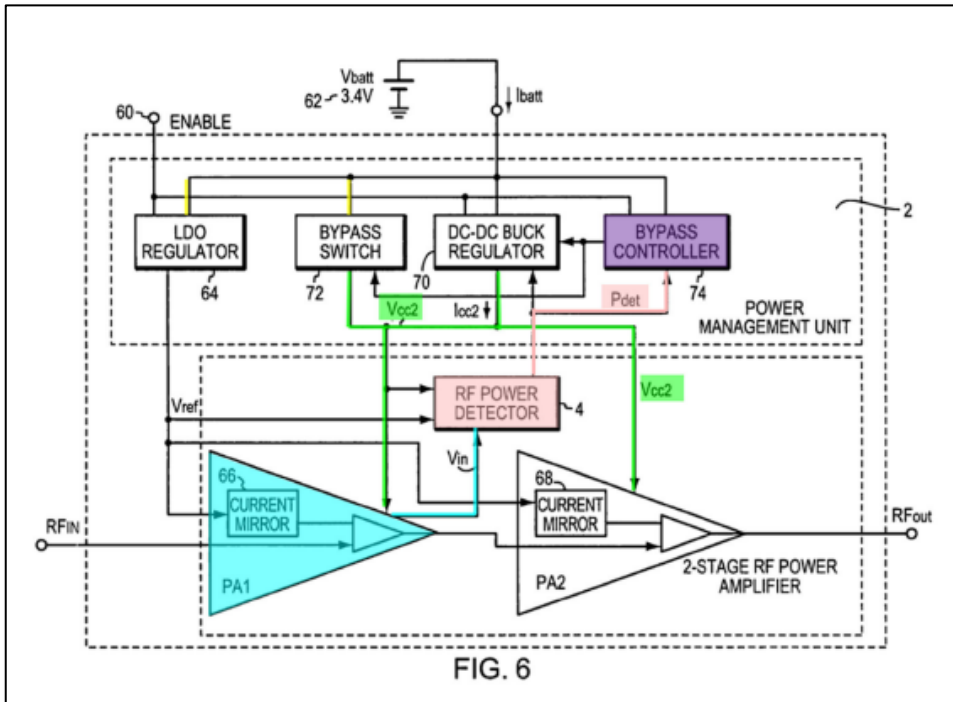
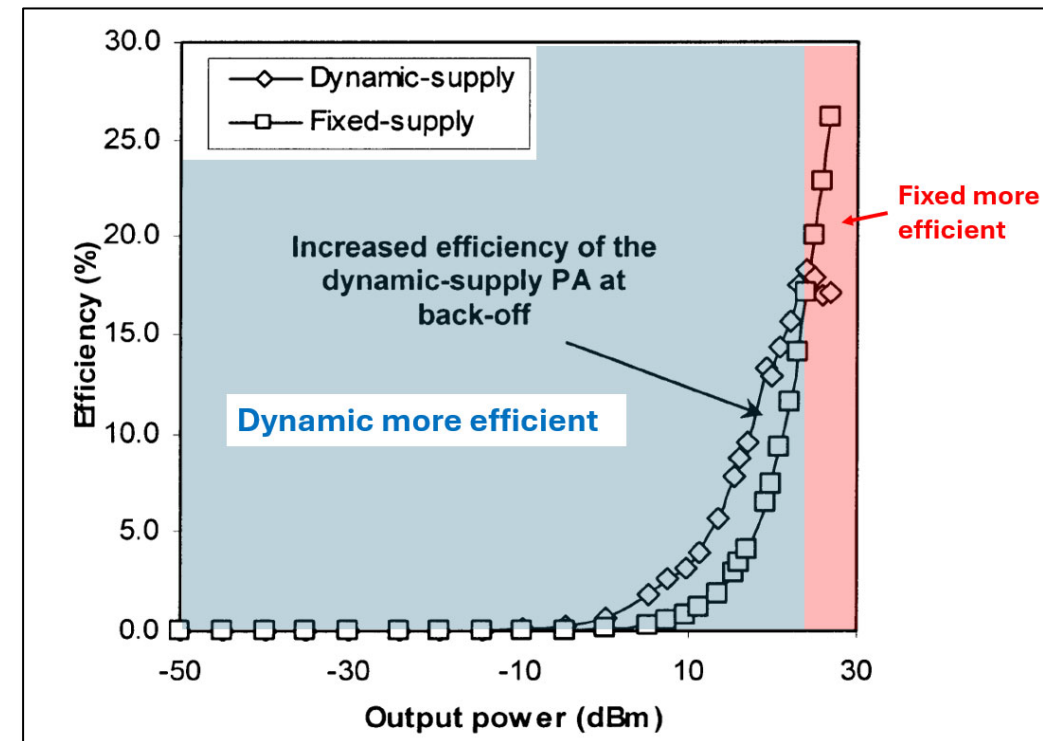


FIG. 6

EX1009, Fig. 8a
(annotated)



Ground 1B: “controlling the switching device based on a probable output power point of operation for a selected modulation scheme based on one or more power efficiency characteristics of an electronic device coupled to the power supply” (claims 3-4, 10, 19)

- Sahu suggests that efficiency should be optimized for a particular system operating in a particular modulation scheme.
- “[A] POSITA would understand from [Sahu’s] teachings that Sahu teaches to optimize the performance of a system based on its efficiency at the power levels at which it is most likely to operate” (EX1003, ¶ 159)

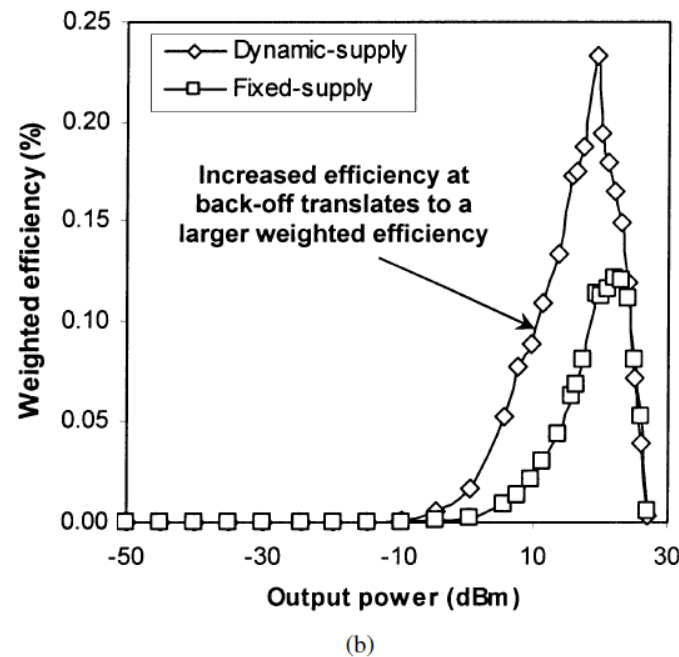


Fig. 8. Comparison of: (a) efficiency and (b) weighted efficiency of the dynamic- and fixed-supply PA.

Ground 1B: “controlling the switching device based on a probable output power point of operation for a selected modulation scheme based on one or more power efficiency characteristics of an electronic device coupled to the power supply” (claims 3-4, 10, 19)

- Dr. Ricketts admits that a POSITA would know how to optimize the efficiency of a power supply for a given power level:

24 Q. How would a person of ordinary skill in
25 the art optimize the efficiency of a -- of a
1 power supply for a given power level?

3 A. So there's a tradeoff in power supply
4 design between conduction currents and switching
5 currents, and the peak of that can be shifted by
6 your component choice. So you can move it to
7 peak at a different current depending upon your
8 component choice.

9 Q. And would a person of ordinary skill in
10 the art understand that tradeoff?

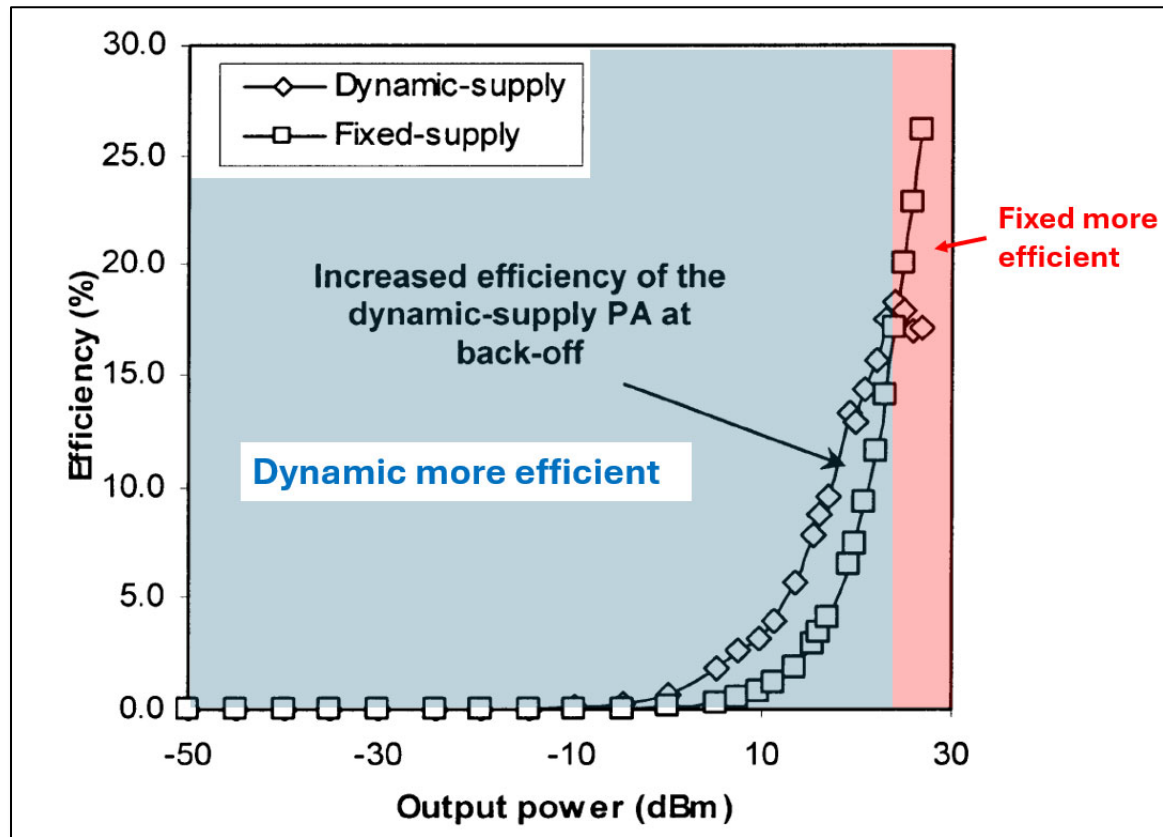
11 A. Yes. That's a common tradeoff that we
12 discuss in power -- what do you call it -- power
13 supply design.

14 Q. Does the '593 patent itself
15 specifically describe that tradeoff?

16 A. No. That's something a POSITA would
17 just know from basic power supplies.

EX1030
(Ricketts. Tr.),
113:24-114:17

Ground 1B: “wherein the threshold voltage is programmed based on a communication waveform efficiency, battery life associated with an electronic device coupled to the power supply, or a combination thereof” (claim 8)



EX1009, Fig. 8(a)
(annotated)

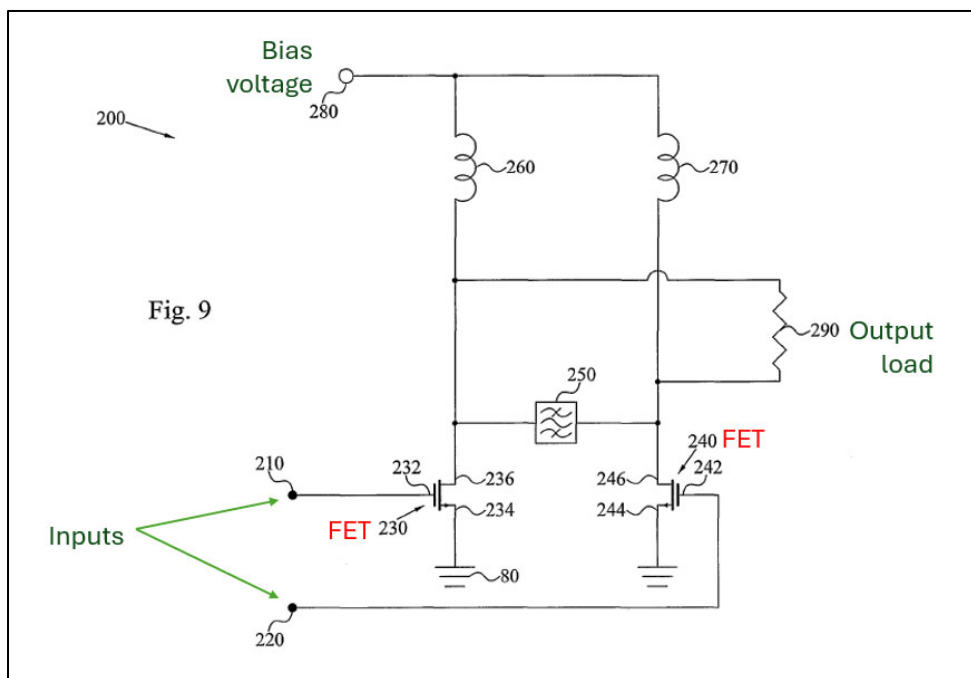
“The efficiency of an amplifier varies with characteristics of the waveform itself (that is, ‘a communication waveform efficiency’) because the shape of the waveform impacts how much power is carried by the waveform... A POSITA would accordingly have understood that the efficiency diagram in Fig. 8(a) of Sahu reflects efficiency obtained with a particular waveform and a particular amplifier.”

- EX1003, ¶¶ 167-168 (citing EX1028, pp. 507-511)
- ParkerVision fails to rebut Dr. Larson’s testimony or supporting evidence

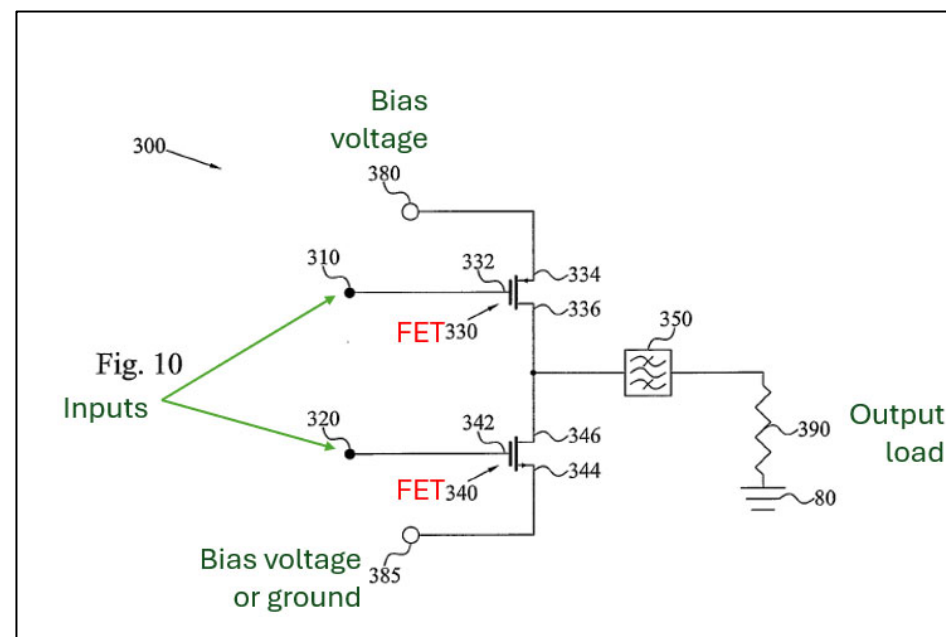
Ground 1C- Hau + Yoshida + Lejon

Ground 1C Additional Prior Art: Lejon

Lejon teaches an “out-phasing” amplifier system for amplifying a quadrature signal, including examples of amplifiers with two inputs to FET gates (*multiple inputs*) and a single output



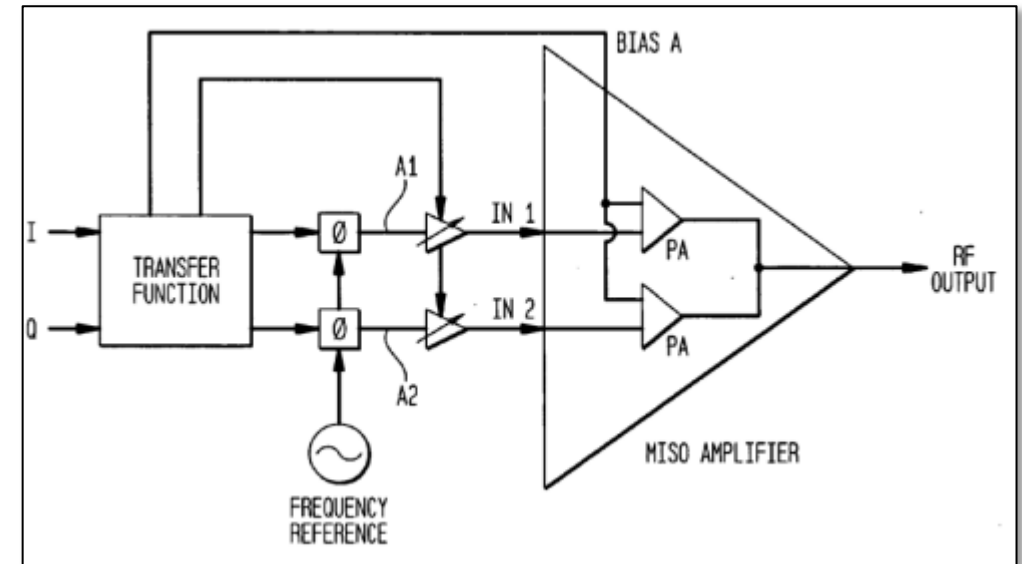
EX1013, Fig. 9 (annotated)



EX1013, Fig. 10 (annotated)

Ground 1C: “wherein the electronic device comprises a multiple-input-single-output (MISO) amplifier”

- ParkerVision does not dispute that Lejon Figs. 9, 10 have two inputs and a single output
- Claim 16 is silent about source of inputs, does not exclude phasor components from a source signal (EX1031, ¶74)
- Application incorporated by reference (EX1033) also shows a MISO amplifier with phasor components as an input

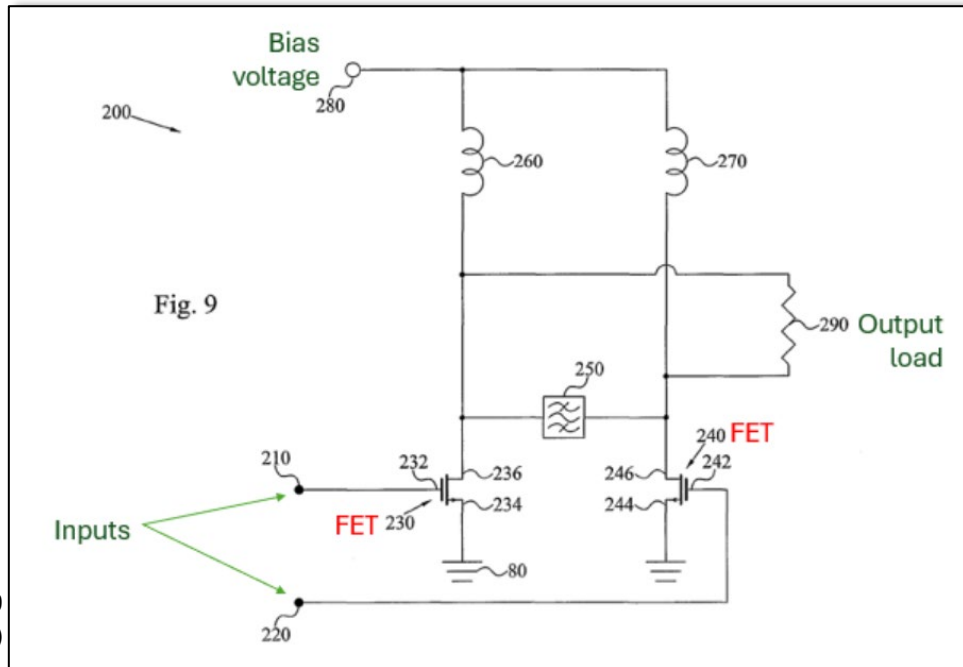


EX1033, Fig. 71

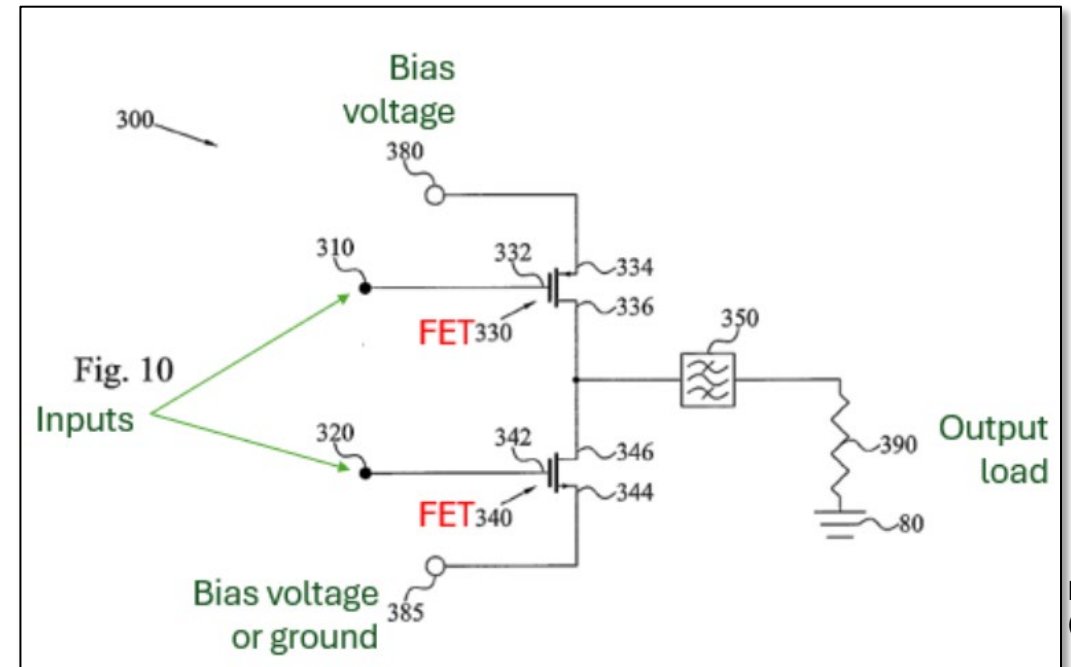
Response to sur-reply arguments: Ground 1C

Sur-reply argument (at 21): “[Lejon’s] input ports (210, 220 in Figure 9; 310, 320 in Figure 10) collectively receive a single differential input RF signal”

- Response:
 - Claim only requires an amplifier with multiple inputs and a single output
 - The source of the signal(s) applied to those inputs is unclaimed and irrelevant
- ParkerVision has never disputed that Lejon Figures 9 and 10 each show multiple input ports



EX1013, Fig. 9
(annotated)

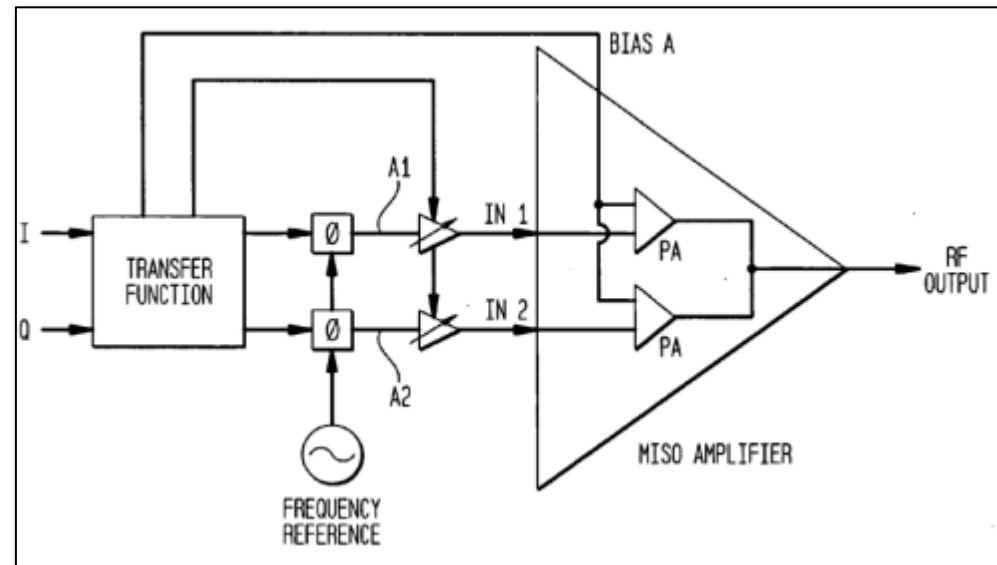


EX1013, Fig. 10
(annotated)

Response to sur-reply arguments: Ground 1C

The MISO amplifier in the incorporated '217 application (EX1033) also amplifies phasor fragments from a single signal.

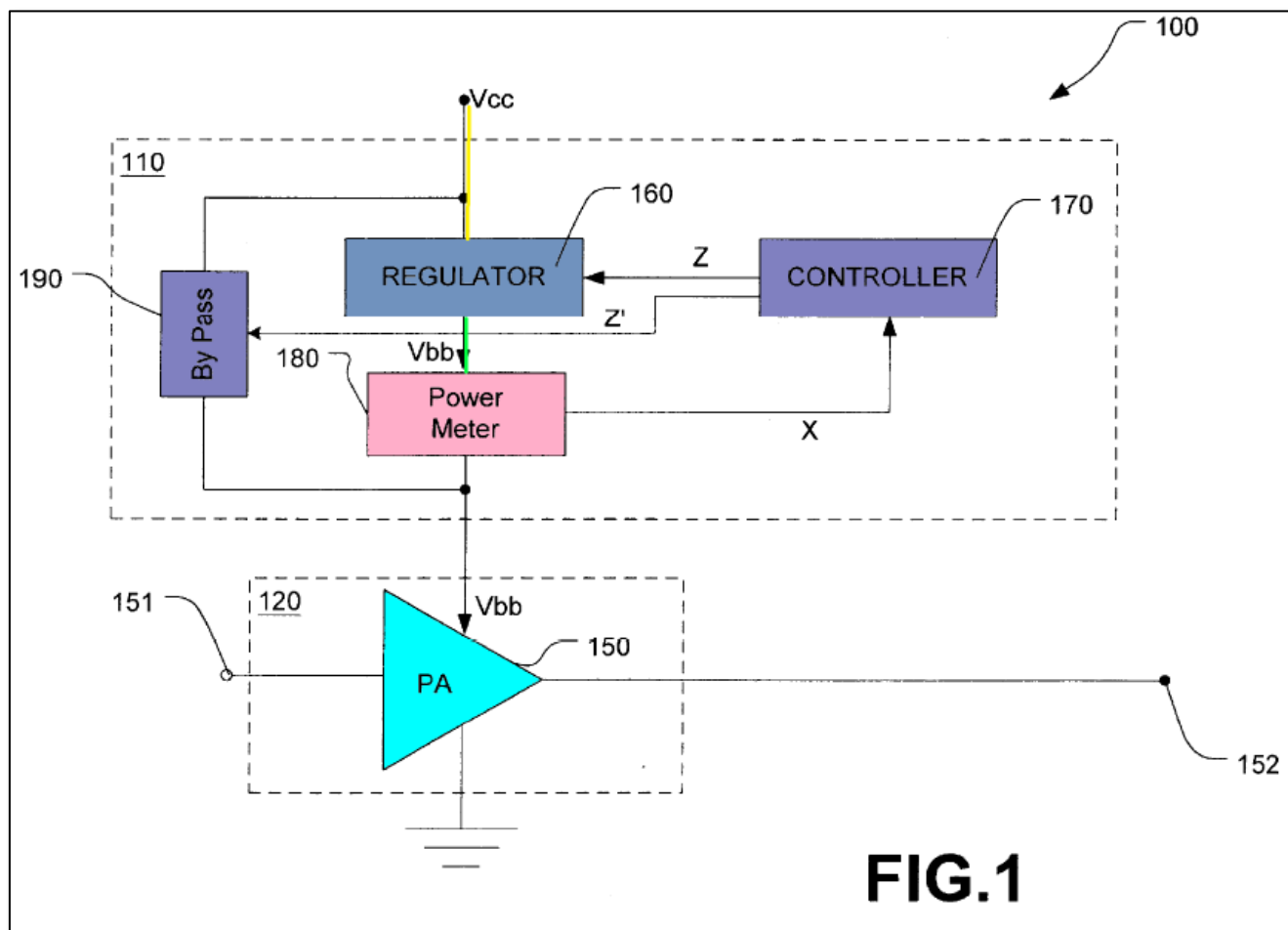
- POR, 52 (quoting EX1013, 2:16-17): “As Lejon explained, in LINC amplifiers like those described in Lejon, ‘an input signal [single] is provided, ***e.g. as an in-phase (I) and quadrature phase (Q) signal.***” (emphasis added)
- The incorporated '217 patent is the same: “Fig. 71... shows a ‘MISO amplifier’ which takes ‘I’ and ‘Q’ channels (that is, the in-phase and quadrature components of a signal) as its inputs in the left side of the figure:” (EX1031, ¶75)



EX1033, Fig. 71

Ground 2A- Canyon + Ranjan

Ground 2A references: Canyon (EX1011)

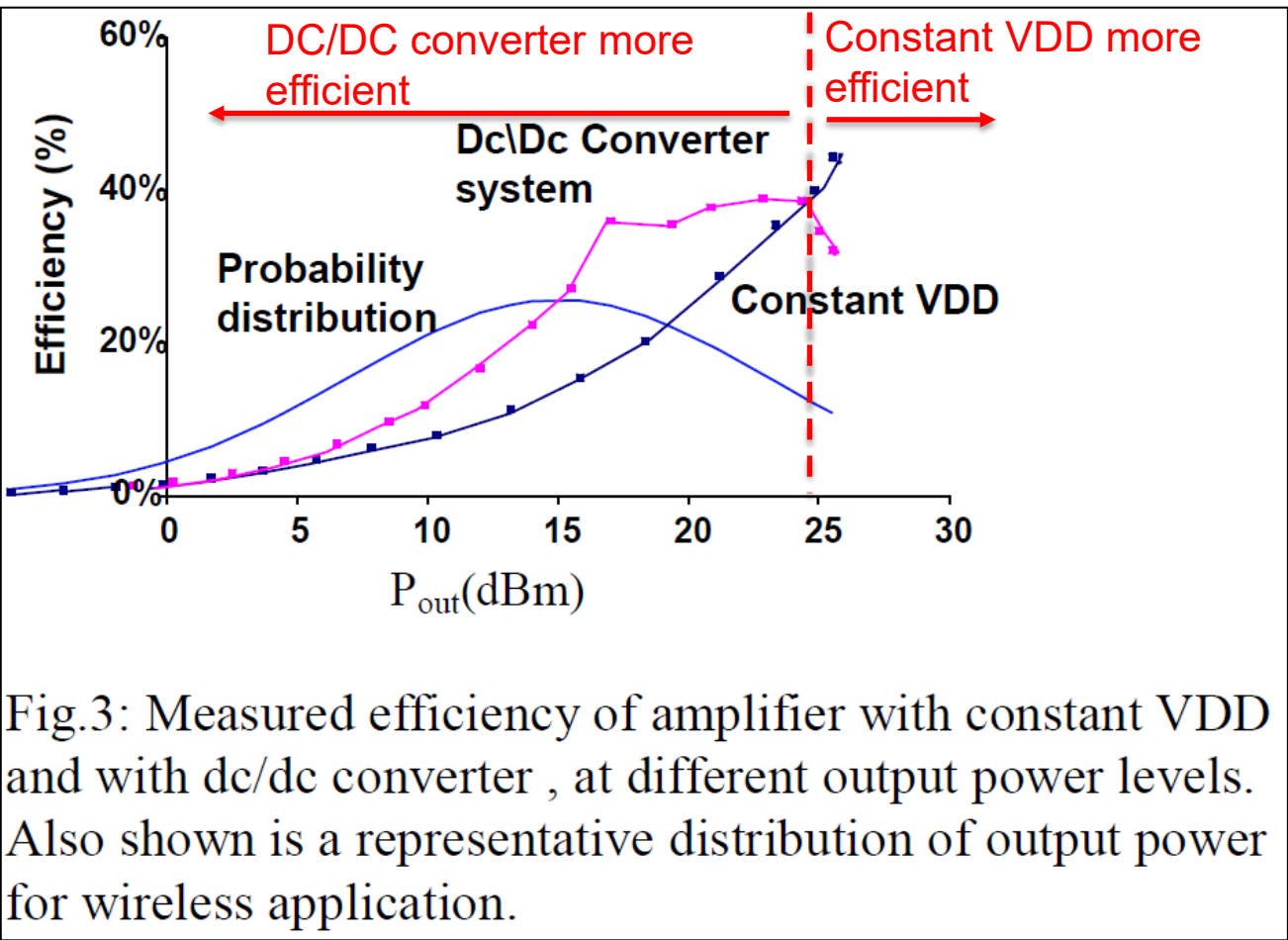


Canyon teaches a power supply with a bypass switch controlled based on a signal from a power meter/ current meter 180

FIG.1

EX1011, Fig. 1
(annotated)

Ground 2A references: Ranjan (EX1012)

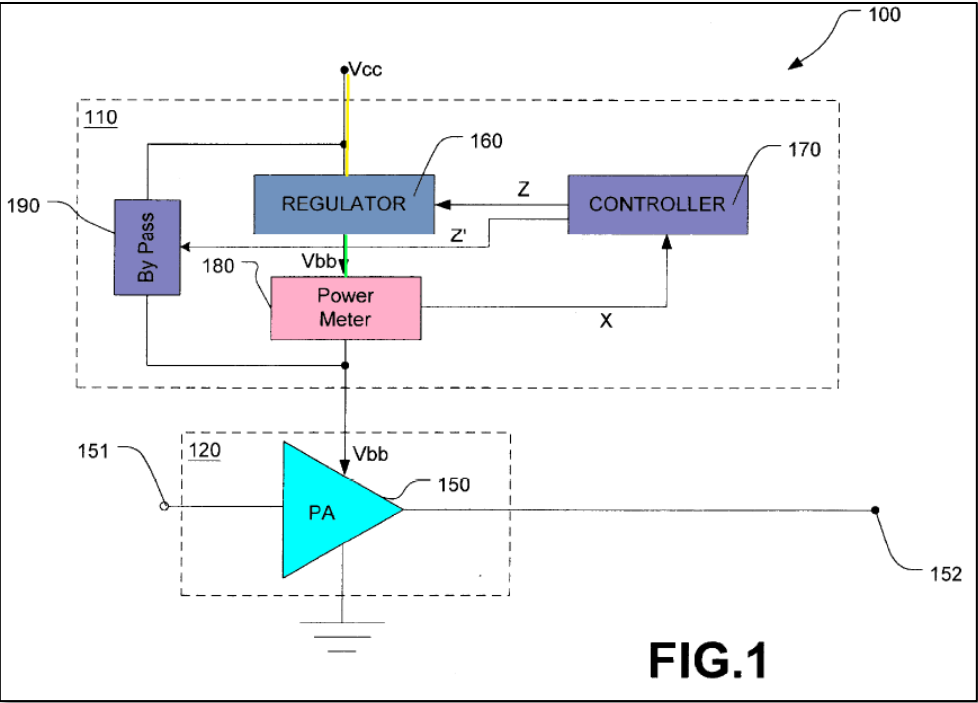


Ranjan teaches calculating efficiency for RF power supply using given modulation scheme; shows that DC-DC converter more efficient at lower power, constant voltage more efficient at high power

EX1012, Fig. 3
(annotated)

Ground 2A: Motivation to Combine

A POSITA would recognize that Canyon’s bypass system would achieve greatest efficiency by setting bypass threshold at the power setting where constant voltage becomes more efficient



EX1011, Fig. 1
(annotated)

Petition, 65-68

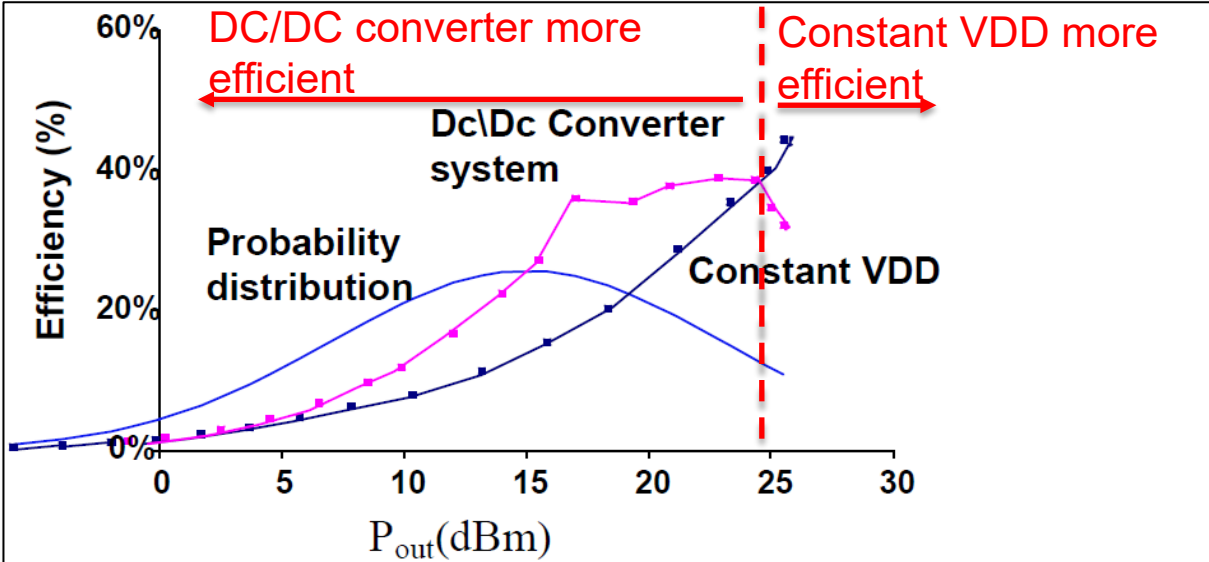


Fig.3: Measured efficiency of amplifier with constant VDD and with dc/dc converter , at different output power levels. Also shown is a representative distribution of output power for wireless application.

EX1012, Fig. 3
(annotated)

Ground 2A: Disputes Regarding Motivation to Combine

1. Whether Ranjan's amplifier configuration is relevant to the combination
2. Whether Canyon's bypass threshold can be improved
3. ParkerVision's misreading of Canyon Figs. 1-2 and power/current meter 180

Ground 2A: Disputes Regarding Motivation to Combine

1. Whether Ranjan's amplifier configuration is relevant to the combination
2. Whether Canyon's bypass threshold can be improved
3. ParkerVision's misreading of Canyon Figs. 1-2 and power/current meter 180

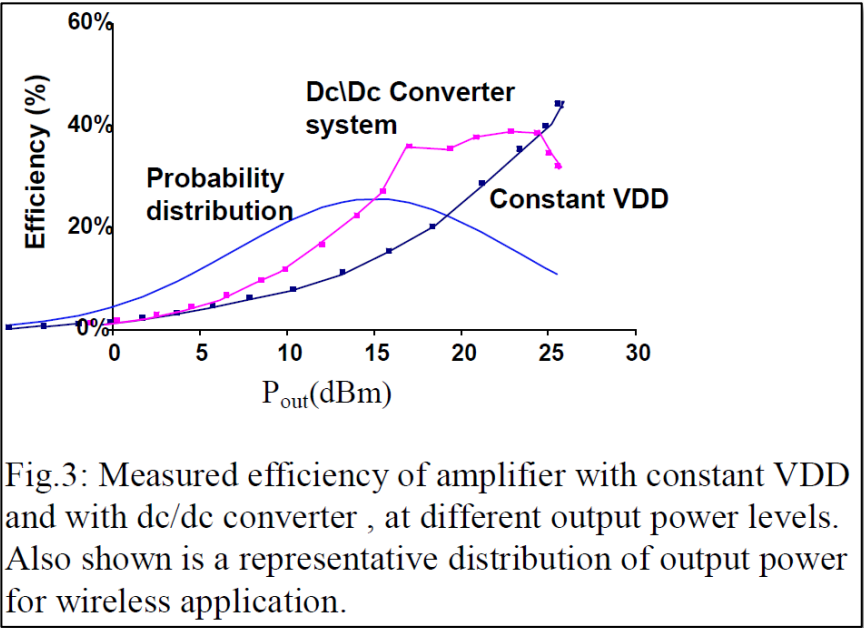
Ground 2A: Disputes Regarding Motivation to Combine

ParkerVision’s arguments about Ranjan’s amplifier configuration (POR 53-56) are irrelevant to motivation to combine

- Combination does not rely on how DC/DC converter in Ranjan is controlled, nor physically combining circuits
- Canyon cites Ranjan, which teaches that DC-DC conversion may be more efficient at low power, “detrimental to efficiency” (EX1012, p. 494) at high power

(12) United States Patent Canyon et al.	(10) Patent No.: US 6,646,511 B2 (45) Date of Patent: Nov. 11, 2003
(54) POWER AMPLIFIER FOR VARYING OUTPUT POWER BASED UPON POWER	M. Ranjan, K. H. Koo, G. Hanington, C. Fallesen and P. Asbeck, “Microwave Power Amplifiers with Digitally-Controlled Power Supply Voltage for High Efficiency and High Linearity”.
(75) Inventors: James C. Canyon , San Diego, CA (US); Klaus D. Buchring , Agoura Hills, CA (US)	6,047,108 A 4/2000 Carsson et al. 453/120 6,081,161 A 6/2000 Dacus et al. 330/297
(73) Assignee: Skyworks Solutions, Inc. , Newport Beach, CA (US)	OTHER PUBLICATIONS M. Ranjan, K. H. Koo, G. Hanington, C. Fallesen and P. Asbeck, “Microwave Power Amplifiers with Digitally-Controlled Power Supply Voltage for High Efficiency and High Linearity”. G. Hanington, A. Metzger, P. Asbeck and H. Finlay, “Integrated DC-DC converter using GaAs HBT technology” Electronics Letters, Nov. 25th, 1999, vol. 35, No. 24. * cited by examiner
(*) 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.: 10/292,606	

EX1011, Cover



EX1012, Fig. 3

Fig.3: Measured efficiency of amplifier with constant VDD and with dc/dc converter , at different output power levels. Also shown is a representative distribution of output power for wireless application.

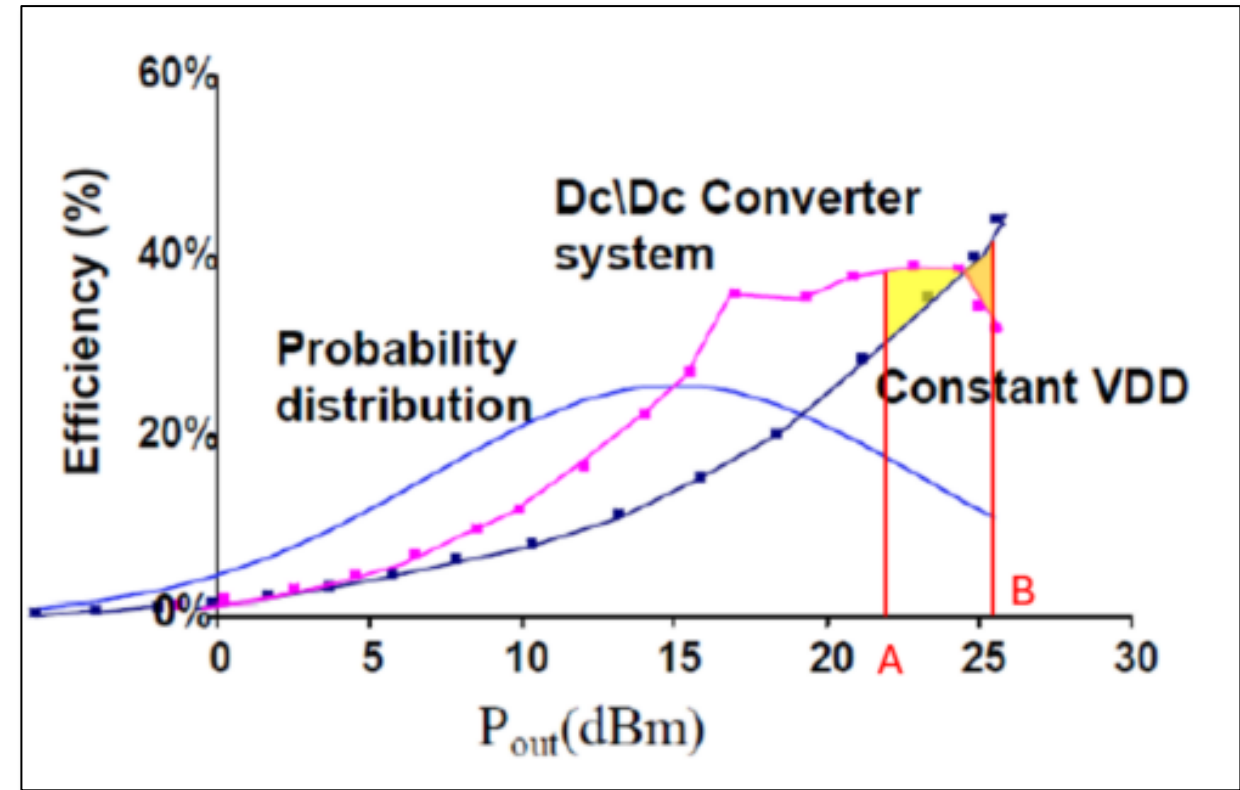
Ground 2A: Disputes Regarding Motivation to Combine

1. Whether Ranjan's amplifier configuration is relevant to the combination
2. Whether Canyon's bypass threshold can be improved
3. ParkerVision's misreading of Canyon Figs. 1-2 and power/current meter 180

Ground 2A: Disputes Regarding Motivation to Combine

ParkerVision's argument that Canyon's bypass teaching is "complete" is both wrong and legally irrelevant

- Canyon's 22-24 dBm bypass range is a nearly 60% difference in mW (EX1031, ¶ 83)
- Setting bypass threshold at the crossover point improves efficiency relative to having threshold even slightly too low (yellow) or high (orange) (EX1031, ¶ 84)
- Efficiency gains significant at high power (EX1031, ¶ 85)
- POSITA would have recognized that optimizing threshold would improve efficiency even if "complete" (EX1031, ¶ 86)



EX1012, Fig. 3
(annotated)

Ground 2A: Disputes Regarding Motivation to Combine

- Combined teachings of references must be considered rather than references in isolation
- POSITA would recognize that bypass threshold taught by Canyon would be most efficient when set at “crossover” point of efficiency between DC-DC converter and constant voltage (EX1031, ¶¶ 89-90)
- “A POSITA would have been able to calculate or empirically determine such a threshold for a given device operating in a given modulation scheme without undue experimentation.” (EX1003, ¶ 196)
 - Never rebutted by ParkerVision or Dr. Ricketts

Ground 2A: Disputes Regarding Motivation to Combine

1. Whether Ranjan's amplifier configuration is relevant to the combination
2. Whether Canyon's bypass threshold can be improved
3. ParkerVision's misreading of Canyon Figs. 1-2 and power/current meter 180

Ground 2A: Disputes Regarding Motivation to Combine

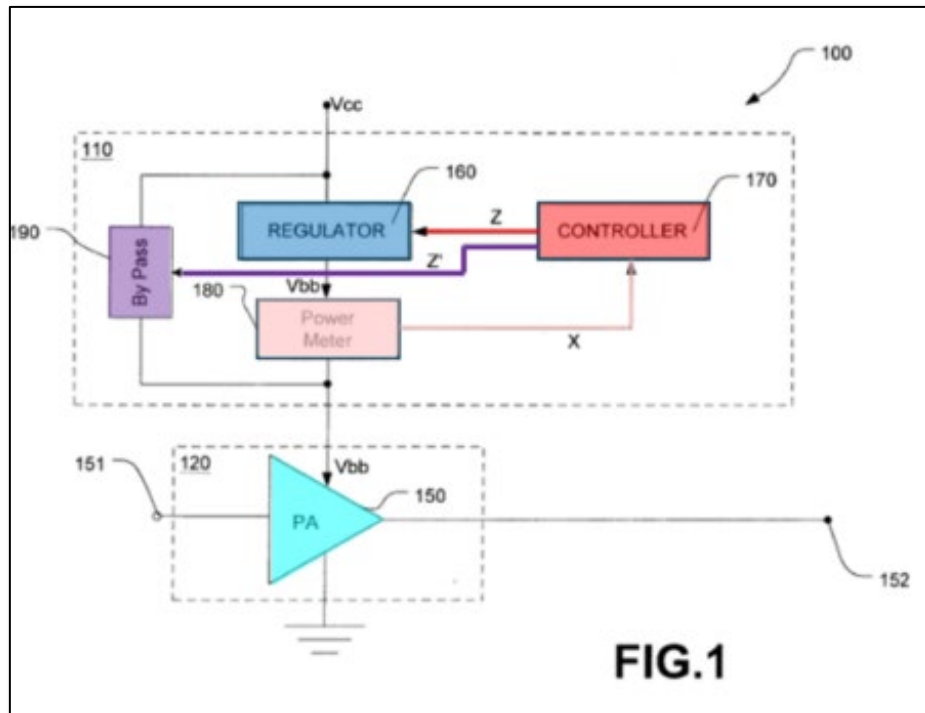
ParkerVision's repeated misreading of Canyon asserts that Canyon **only** describes its bypass switch regarding Figure 2

- “Canyon describes when to open and close its bypass switch in connection with the embodiment of Fig. 2.” (POR, 58, repeated verbatim at 63)
- “...Canyon's description (in connection with the Figure 2 embodiment) of operating its bypass switch... POSITA would not have known how to control the bypass switch of Figure 1 in the manner described for the embodiment of Figure 2...” (POR, 59)
- “With respect to the Figure 1 embodiment, Canyon's teaching is deficient as to how the bypass threshold of the Figure 2 embodiment can be applied...” (POR, 61)
- “For this claim limitation... Petitioner relies on Canyon's descriptions relating to the Figure 2 embodiment.” (POR, 62)
- “...a POSITA would not have known how to control the bypass switch of the Figure 1 embodiment in accordance to [sic] Canyon's description for the Figure 2 embodiment” (POR, 64)

Argument raised for both motivation to combine and efficiency threshold arguments

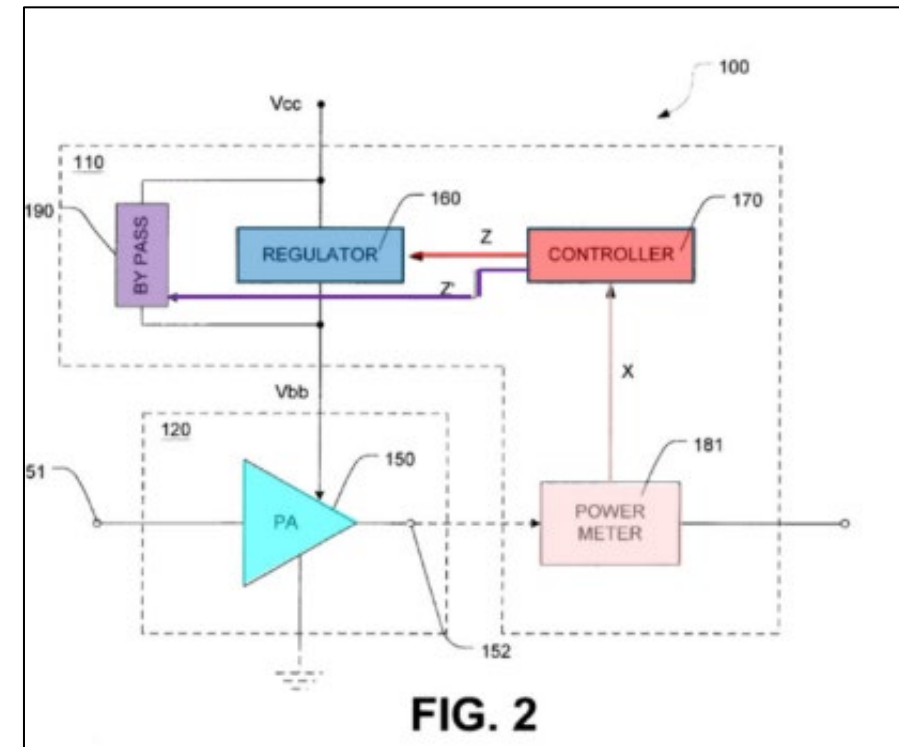
Ground 2A: Disputes Regarding Motivation to Combine

- Figs. 1 and 2 differ only in placement of power meter 180/181
- All other elements, including controller 170, input X to controller, regulator 160, bypass 190, and control signals Z and Z', are identical between both figures
- Description of regulator (3:66-4:13) and bypass switch (4:14-29) apply to both



EX1011, Figs. 1-2
(annotated)

Reply 23-26; EX1031, ¶¶ 91-96



EX1011, 3:14-50

Ground 2A: Disputes Regarding Motivation to Combine

Canyon's description of its bypass switch refers to power ***consumed*** by the amplifier, which its expert admits refers to power supplied to the amplifier

supply voltage Vcc. In a preferred embodiment, bypass switch **190** is closed when the power output indicator signal X indicates that the power amplifier unit **120** is **consuming**, or operating at, a high power level. For example, where the power amplifier unit is **consuming** a power level greater than 22–24 dBm, the bypass signal Z' may be output by the controller **170** to close the bypass switch **190**. Once bypass switch **190** is closed, the operating voltage Vbb applied to the power amplifier unit **120** is effectively taken to a level approximately equal to the supply voltage Vcc.

EX1011, 4:20-29

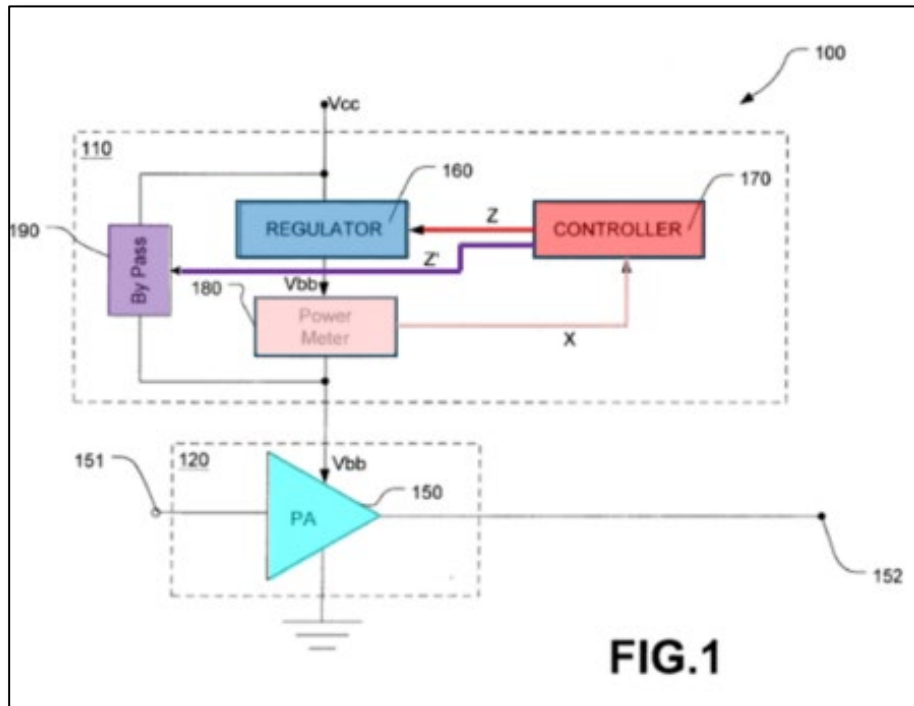
9 The power consumption of a power
10 amplifier would refer to the power entering the
11 power amplifier from the supply; is that right?
14 A. That is correct.

EX1030 (Ricketts Tr.) 28:9-14

Ground 2A: Disputes Regarding Motivation to Combine

Canyon teaches measuring power consumption through current

- Refers to element 180 interchangeably as power meter and current meter
- Power/current meter 180 (pink) indicates power consumed and output by amplifier



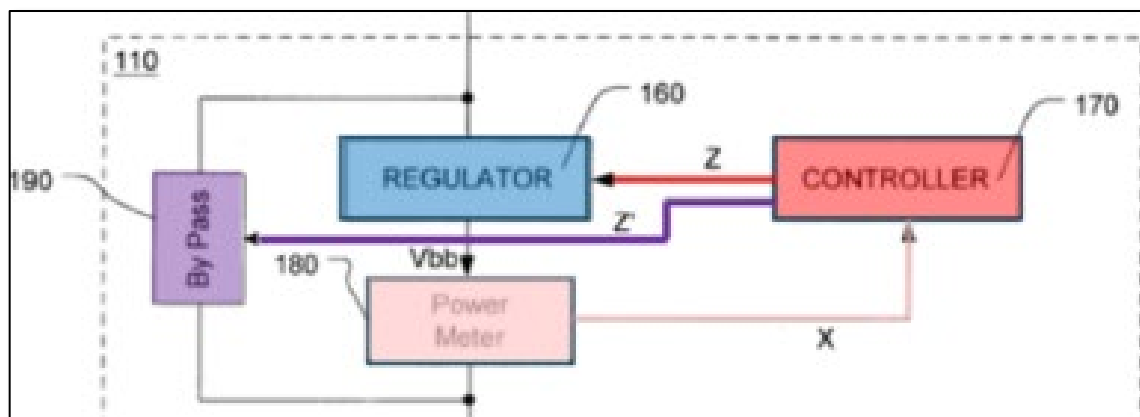
EX1011, Fig. 1
(annotated)

A current meter 180 monitors (measures) the DC current flow of the operating voltage supply Vbb provided to the power amplifier unit 120 and generates a current flow indicator signal X representative of the measured DC current flow of the operating voltage supply applied to the power amplifier unit 120. This current flow indicator signal X is provided to a controller 170. By monitoring the current Ibb drawn by the power amplifier unit 120, it is possible to determine the power output of the power amplifier unit 120. In this way, for a given current flow indicator signal X, there is a corresponding output power level at which the power amplifier unit 120 operates. By monitoring the current Ibb drawn by the power amplifier unit 120, it is possible to determine the power output of the power amplifier unit 120. In this way, the current signal X can also be considered indicative of the power output level of the power amplifier unit 120.

EX1011, 3:14-30

Ground 2A: Efficiency Threshold limitation

- “Threshold” is only dispute raised by ParkerVision for Ground 2A regarding independent claims
- Entire argument relies on misreading of Canyon Figs. 1, 2 and accompanying description (POR 62-64)
 - Even if ParkerVision’s misreading was right (it isn’t), it would still have been obvious to a POSITA to look for description of operation of controller 170, bypass 190, and signals X and Z’



EX1011, Fig 1
(annotated).

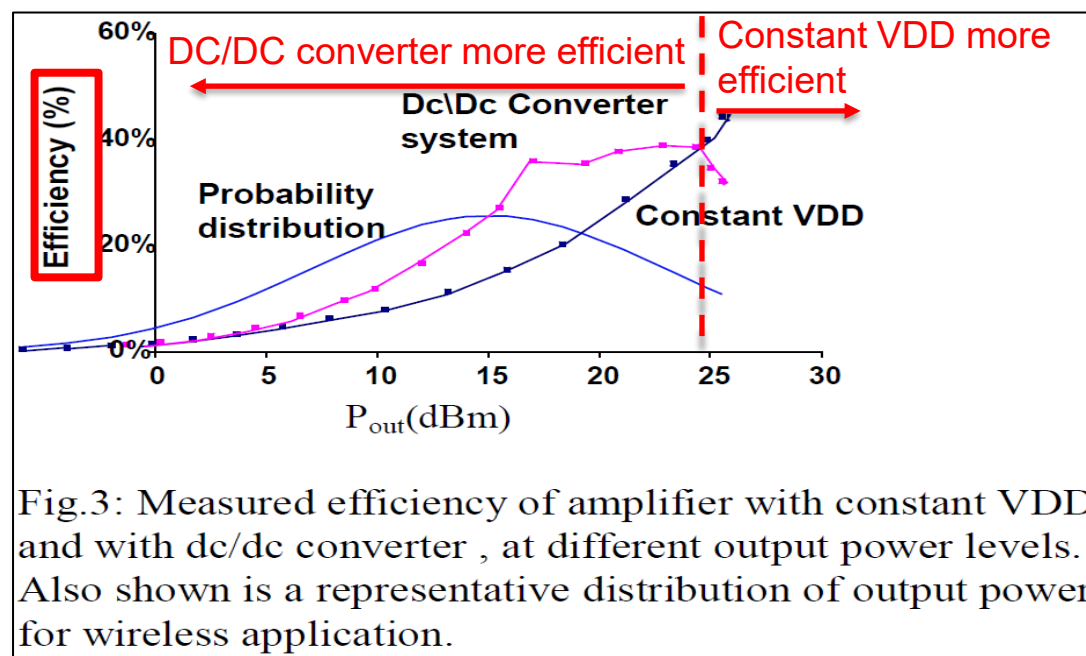
supply voltage Vcc. In a preferred embodiment, bypass switch 190 is closed when the power output indicator signal X indicates that the power amplifier unit 120 is consuming, or operating at, a high power level. For example, where the power amplifier unit is consuming a power level greater than 22–24 dBm, the bypass signal Z' may be output by the controller 170 to close the bypass switch 190. Once bypass switch 190 is closed, the operating voltage Vbb applied to the power amplifier unit 120 is effectively taken to a level approximately equal to the supply voltage Vcc.

EX1011, 4:20-29

Ground 2A: Efficiency Threshold limitation

Canyon + Ranjan combination meets limitation even under ParkerVision's restrictive interpretation of "power efficiency"

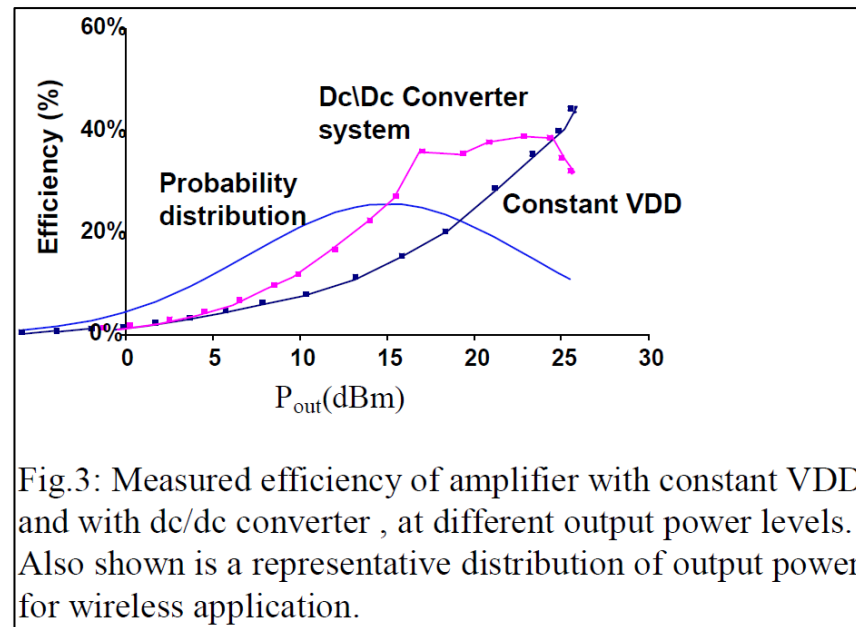
- Ranjan teaches calculating efficiency expressed as a ratio for a given system
- POSITA would have been motivated to set bypass threshold (as taught by Canyon) at "crossover" point for given system based on that calculation
- Canyon teaches that measuring power at output of power supply (Fig. 1) or amplifier (Fig. 2) are known alternatives



EX1012, Fig. 3
(annotated)

Ground 2A: “controlling the switching device based on a probable output power point of operation for a selected modulation scheme based on one or more power efficiency characteristics of an electronic device coupled to the power supply” (claims 3-4, 10, 19)

- Ranjan’s Fig. 3 shows efficiency and probability of operating at given power level for IS-95 CMDA handset application
- “[A] POSITA seeing Ranjan’s explicit comparison in the same graph (Figure 3) of the probability distribution of operating at a given power level with the efficiency of such a power level would have recognized the need to optimize the performance of the system, including controlling the switching device, based on the power levels where it is most likely to operate.” EX1031, ¶ 101.



EX1012, Fig. 3

Ground 2A: “controlling the switching device based on a probable output power point of operation for a selected modulation scheme based on one or more power efficiency characteristics of an electronic device coupled to the power supply” (claims 3-4, 10, 19)

- Dr. Ricketts admits that a POSITA would know how to optimize the efficiency of a power supply for a given power level:

24 Q. How would a person of ordinary skill in
25 the art optimize the efficiency of a -- of a
1 power supply for a given power level?

3 A. So there's a tradeoff in power supply
4 design between conduction currents and switching
5 currents, and the peak of that can be shifted by
6 your component choice. So you can move it to
7 peak at a different current depending upon your
8 component choice.

9 Q. And would a person of ordinary skill in
10 the art understand that tradeoff?

11 A. Yes. That's a common tradeoff that we
12 discuss in power -- what do you call it -- power
13 supply design.

14 Q. Does the '593 patent itself
15 specifically describe that tradeoff?

16 A. No. That's something a POSITA would
17 just know from basic power supplies.

EX1030
(Ricketts. Tr.),
113:24-114:17

Ground 2B- Canyon + Ranjan + Hau

Ground 2B: Canyon + Ranjan + Hau

POR arguments for Ground 2B refer back to or repeat arguments regarding corresponding claims in Grounds 1A, 1B; same reply arguments apply

Ground 2C- Canyon + Ranjan + Lejon

Ground 2C: Canyon + Ranjan + Lejon

POR arguments for Ground 2C refer back to or repeat arguments regarding corresponding claims in Ground 1C; same reply arguments apply