

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SEMICONDUCTOR COMPONENTS INDUSTRIES, LLC
(d/b/a ON SEMICONDUCTOR),
Petitioner,

v.

POWER INTEGRATIONS, INC.,
Patent Owner.

Case IPR2018-00166
Patent 6,297,623 B1

Before THOMAS L. GIANNETTI, BRIAN J. McNAMARA, and
LYNNE E. PETTIGREW, *Administrative Patent Judges*.

GIANNETTI, *Administrative Patent Judge*.

FINAL WRITTEN DECISION
35 U.S.C. § 318(a) and 37 C.F.R. 42.73

I. INTRODUCTION

Semiconductor Components Industries, LLC, d/b/a ON Semiconductor (“Petitioner”) filed a Petition (Paper 1, “Pet.”) seeking *inter partes* review of claims 1–7 of U.S. Patent No. 6,297,623 B1 (Ex. 1001, “the ’623 patent”) pursuant to 35 U.S.C. §§ 311–319. Power Integrations, Inc. (“Patent Owner”) filed a Patent Owner Preliminary Response (Paper 6, “Prelim. Resp.”).

We determined that there was a reasonable likelihood that the Petitioner would prevail with respect to at least one claim challenged in the Petition. 35 U.S.C. § 314(a). We therefore granted the Petition and instituted *inter partes* review for claims 1–7. Paper 7 (“Institution Dec.”).

Following institution, Patent Owner filed a Response to the Petition (Paper 9, “PO Resp.”), Petitioner filed a Reply (Paper 23, “Pet. Reply”)¹, and Patent Owner filed a Sur-reply (Paper 29, “PO Sur-reply”). An Oral Hearing was held on February 13, 2019.² The Hearing Transcript (“Hearing Tr.”) is included in the record as Paper 35.

Having considered the evidence of record, and for the reasons set forth below, we determine that Petitioner has demonstrated by a preponderance of the evidence that claims 1 and 2 of the ’623 patent are unpatentable. Petitioner has failed to demonstrate by a preponderance of the evidence that claims 3–7 are unpatentable.

¹ Petitioner’s Reply (Paper 23) was filed under seal. A public (redacted) version was filed as Paper 22. Our citations in this Decision are to Paper 23.

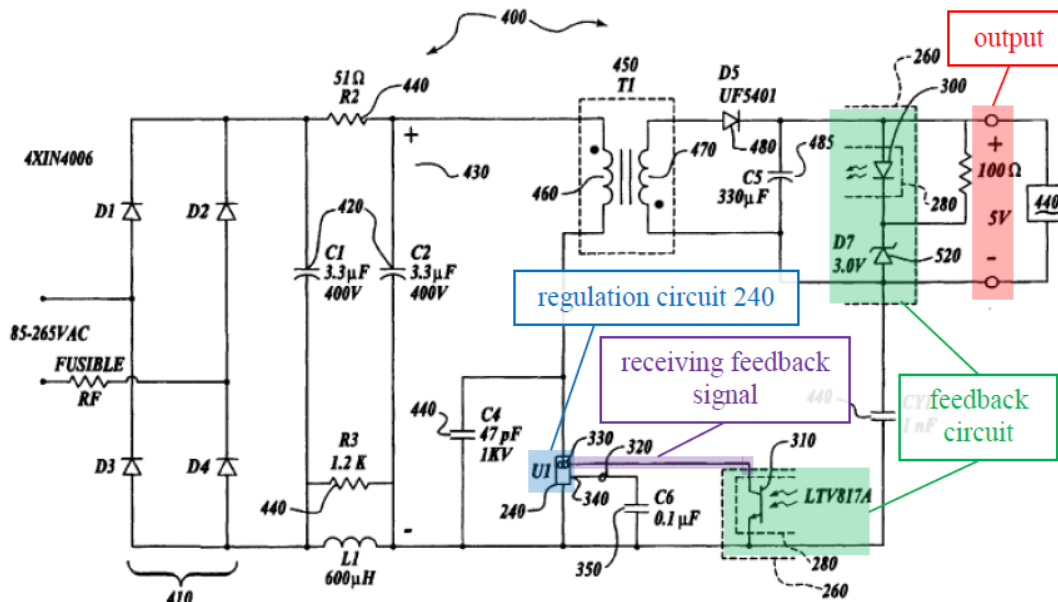
² The hearing was consolidated with IPR2018-00165. The transcript caption page incorrectly states the hearing date as February 22, 2019.

II. BACKGROUND

A. The '623 Patent (Ex. 1001)

The '623 patent is titled “Off-Line Converter with Digital Control.” The patent is directed to regulation of power supplies. Ex. 1001, 1:11–13. Accurate regulation of power supplies is important in many areas. For instance, in sensitive electronic devices such as computers and televisions, maintaining a constant power supply is important for the operation of the computer or television. *Id.* at 1:16–20. Power supplies are regulated by keeping either a current or voltage delivered to a load within a specified range. *Id.* at 1:24–25.

The subject matter of the '623 patent is illustrated by Figure 3, which is reproduced here from the Petition with annotations provided by Petitioner:



Pet. 21. Figure 3 of the '623 patent (annotated) is a circuit diagram of a DC-DC power supply. Ex. 1001, 3:38–39. The operation of the circuit will now be described with reference to the figure.

1. Feedback Circuit

The power supply makes use of a feedback circuit to regulate the output voltage and keep it constant within a range. Ex. 1001, 4:35–37. Feedback circuit 260 includes optocoupler 280, phototransistor 310, and Zener diode 290.³ *Id.* at 4:37–38. The output of feedback circuit 260 is coupled to feedback terminal 320 of regulator circuit 240, as shown in Figure 3, *supra*. *Id.* at 5:27–29. As described in the patent, “the output of feedback circuit 260 is utilized to enable or disable operation of the regulation circuit 240.” *Id.* at 4:28–30.

Feedback circuit 260 will trigger when the second DC voltage 220 is above a threshold level that is a combination of the voltage drop across light emitting diode 300 of optocoupler 280 (preferably one volt) and the reverse break down voltage of Zener diode 290. *Id.* at 4:37–42. Upon triggering, feedback circuit 260 will activate phototransistor 310 of optocoupler 280. *Id.* at 4:43–44. The activation of phototransistor 310 causes a current to flow into feedback terminal 320. The current input into feedback terminal 320 is utilized to disable regulation circuit 240. *Id.* at 4:44–47.

2. Regulating Circuit

Figure 6 of the '623 patent, illustrating features of the regulating circuit, is reproduced here from the Petition, with annotations provided by Petitioner:

³ In Figure 3, the Zener diode is labeled with reference numeral 520.

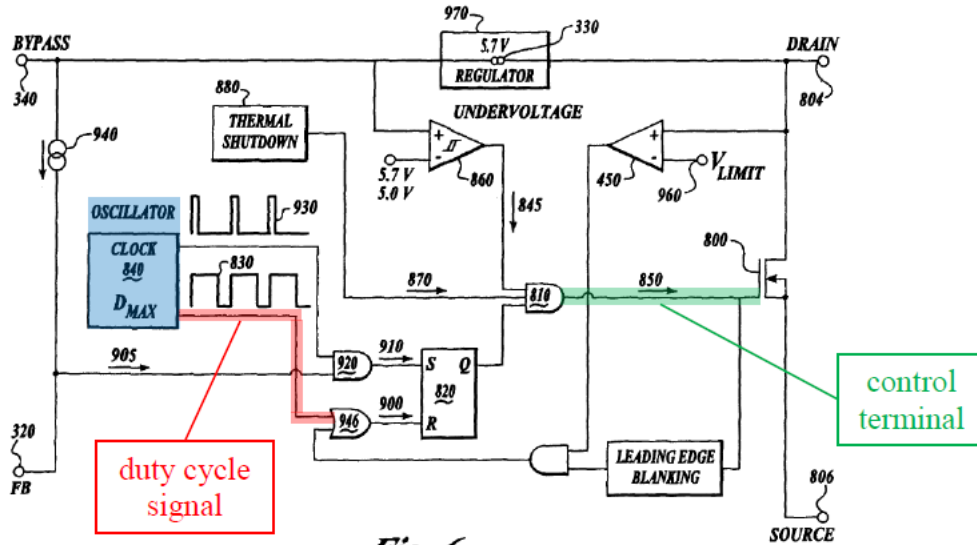


Fig. 6

Pet. 71. Figure 6 of the '623 patent (annotated) is a functional block diagram of the power supply regulation circuit. Ex. 1001, 3:45–47. The operation of the circuit will now be described with reference to the figure.

As shown in Figure 6, the on and off states of MOSFET switch 800 are controlled by latch 820 (assuming no thermal or undervoltage faults). Oscillator 840 provides a maximum duty cycle signal 830 to OR gate 946, which in turn drives the reset input (R) of latch 820. Feedback signal FB present at feedback input 320 is fed to feedback gate 920, which in turn drives the set input (S) of the latch. *Id.* at 8:16–41.

In operation, when enable signal 905 is high, clock signal 930 is transferred to latch 820 by AND gate 920, thereby setting latch 820 and enabling that cycle to go through and turn on MOSFET switch 800. Conversely, when enable signal 905 is low, it blocks the clock signal from setting latch 820 and keeps MOSFET switch 800 off during that cycle. *Id.* at 8:41–47.

B. Real Parties-in-Interest

Petitioner identifies the following real parties-in-interest: (i) ON Semiconductor Corporation, (ii) Semiconductor Components Industries, LLC, doing business as ON Semiconductor, (iii) Fairchild Semiconductor International, Inc., (iv) Fairchild Semiconductor Corporation, (v) Fairchild (Taiwan) Corporation, and (vi) System-General Corporation. Pet. 1. Patent Owner identifies itself as the only real party-in-interest. Paper 3, 2.

C. Related Matters

The parties identify a pending lawsuit involving the '623 patent: *Power Integrations, Inc. v. ON Semiconductor Corp., et al.*, No. 5:16-cv-06371-BLF (N.D. Cal.). Pet. 1; Paper 3, 2. In addition, the parties identify several petitions for *inter partes* review filed by Petitioner seeking review of patents held by Patent Owner, including IPR2018-00165, involving U.S. Patent 6,414,471. The '471 patent is a continuation of the '623 patent. Pet. 2; Paper 3, 2.

D. Illustrative Claim

Claim 1, the only independent claim, is reproduced here:

1. A regulator circuit comprising:

a feedback input;

a switch comprising a first terminal, a second terminal and a control terminal, said switch coupling said first and second terminals when a control signal is received at said control terminal;

an oscillator comprising an oscillator output that provides a duty cycle signal comprising a high state and a low state;

said control signal being provided when no feedback signal is provided at said feedback input and said duty cycle signal is in said high state.

E. References and Other Evidence

Petitioner relies on the following patent references:

Barbehenn	US 5,914,865	June 22, 1999	Ex. 1004
Balakrishnan '369	US 5,285,369	Feb. 8, 1994	Ex. 1007

Petitioner also relies on (1) a 1984 textbook by Grebene titled “*Bipolar and MOS Analog Integrated Circuit Design*,” Ex. 1005 (“Grebene”); and (2) a Motorola data sheet titled “*Power Switching Regulators:MC34163, MC33163*,” Ex. 1008 (“Motorola”).

In addition, both parties rely on expert testimony. Petitioner relies on Declarations of Dr. Vijay Madiseti (Ex. 1002, “Madiseti Decl.”) and Dr. Douglas Holberg (Ex. 1033 “Holberg Decl.”) as support for the various contentions. Patent Owner relies on the Declaration of William Bohannon (Ex. 2022, “Bohannon Decl.”).

Petitioner relies also on testimony from Balu Balakrishnan, Patent Owner’s President and CEO, and one of the co-inventors named in the ’623 patent (Ex. 2002, “Balakrishnan Decl.”). In addition, Patent Owner relies on testimony from David Kung, another of its employees (Ex. 2021, “Kung Decl.”).

The record also includes deposition transcripts for several of these witnesses.⁴ In addition, the parties have submitted testimony and other materials from parallel district court litigation.

F. Grounds Asserted

The Petition challenges the patentability of the ’623 patent claims on the following grounds:

⁴ Ex. 1040 (“Bohannon I Dep.” taken Nov. 27, 2018), Ex. 1041 (“Bohannon II Dep.” taken Nov. 28, 2018), Ex. 1042 (“Kung Dep.”), Ex. 1043 (“Balakrishnan Dep.”).

References	Basis	Challenged Claims
Barbehenn and Grebene	103(a)	1, 2, and 5
Barbehenn, Grebene, and Balakrishnan '369	103(a)	5–7
Barbehenn	103(a)	1, 2, and 5
Barbehenn and Balakrishnan '369	103(a)	5–7
Motorola	102(b)	1–5
Motorola	103(a)	1–5
Barbehenn, Grebene, and Motorola	103(a)	3 and 4
Barbehenn and Motorola	103(a)	3 and 4

III. ANALYSIS

A. *Level of Ordinary Skill*

We assess obviousness in view of the understanding of a person of ordinary skill in the art at the time of the invention. *Graham v. John Deere Co.*, 383 U.S. 1, 17 (1966). Dr. Madisetti testifies that a person of ordinary skill in the art “would be a person having a B.S. in Electrical Engineering or a related field with at least two years of experience in designing power electronics, or having an M.S. in Electrical Engineering or a related field.” Madisetti Decl. ¶ 25. Patent Owner does not challenge this assertion. Mr. Bohannon provides a similar formulation:

In my opinion, at the time of invention of the '623 patent, people of ordinary skill in the art of developing and implementing switching regulators and their control circuits were people with at least a B.S. degree, or its equivalent, in electrical engineering or physics and approximately two years of practical experience working with switching regulators and analog/mixed signal circuit design, or an equivalent combination of academic study and work experience.

Bohannon Decl. ¶ 33.

We do not discern that our analysis of the evidence in light of the parties' arguments would change depending on the level of ordinary skill in the art. On this record, therefore, we accept Dr. Madisetti's definition, which we also determine to be consistent with the level of skill reflected in the asserted prior art references. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (the prior art itself can reflect the appropriate level of ordinary skill in the art).

B. Claim Construction

The parties inform us that the '623 patent expired on February 27, 2018. *See* Pet. 10; Prelim. Resp. 9. For claims of an expired patent, the Board's claim construction analysis is similar to that of a district court. *See In re Rambus Inc.*, 694 F.3d 42, 46 (Fed. Cir. 2012). In this context, claim terms "are generally given their ordinary and customary meaning" as understood by a person of ordinary skill in the art in question at the time of the invention. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–13 (Fed. Cir. 2005) (en banc). "In determining the meaning of the disputed claim limitation, we look principally to the intrinsic evidence of record, examining the claim language itself, the written description, and the prosecution history, if in evidence." *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 469 F.3d 1005, 1014 (Fed. Cir. 2006) (citing *Phillips*, 415 F.3d at 1312–17). Extrinsic evidence is "less significant than the intrinsic record in determining 'the legally operative meaning of claim language.'" *Phillips*, 415 F.3d at 1317.

1. "comprises a monolithic device"

Petitioner proposed a construction for the term "comprises a monolithic device" appearing in claim 5. Pet. 10–12. According to Petitioner, "[c]onsistent with the traditional meaning of 'comprising' in

patent claims, the phrase ‘comprises a monolithic device’ should thus be construed as ‘*including* a monolithic device.’” *Id.* at 11 (citation omitted). Patent Owner’s Preliminary Response focused on the broader phrase “said regulator circuit comprises a monolithic device” in claim 5. Prelim. Resp. 12. Patent Owner contended that the phrase means: “the elements of the regulator circuit form or constitute a monolithic device.” *Id.* Further, Patent Owner asserted that the term “monolithic” means “all the recited components of the circuit are fabricated on a single chip.” *Id.*

In our Institution Decision, we were persuaded to adopt Patent Owner’s proposed construction. Institution Dec. 9–10. We determined that Patent Owner’s construction is more consistent with the language of the claims and with the specification. *Id.* Claim 1 states that the “regulator circuit” comprises the elements that follow (the feedback input, switch, and oscillator). Claim 5 states that the “regulator circuit” comprises a monolithic device. We concluded that Petitioner’s proposed construction ignores the plain language of the claim. *Id.* at 10. We observed that the “monolithic device” in claim 5 is not recited as an additional component of the regulator circuit, e.g., “the regulator circuit *further comprises* a monolithic device.” If it were, Petitioner’s argument might be more persuasive. Instead, the claim indicates that the regulator circuit is itself a monolithic device. *Id.*

Petitioner’s construction is also contradicted by the specification. The specification, like the claims, describes regulation circuit 240 as “comprising a monolithic device.” Ex. 1001, 10:52–53. Figure 6, reproduced *supra*, is identified as a diagram of the regulation circuit. *Id.* at 3:45–47. Figure 6 shows all the components recited in claim 1, and therefore incorporated into its dependent claim 5, namely, feedback input 320, switch 800, and oscillator 340, as part of the regulator circuit. Neither Figure 6 nor the

accompanying description suggests that the “monolithic device” in the specification and recited in claim 5 is separate from or in addition to these components. *See* Prelim. Resp. 13.

Patent Owner’s Response urges us to maintain this construction from our Institution Decision. PO Resp. 11. Patent Owner contends, “As the Board found, the proper construction of this phrase is ‘the elements of the regulator circuit form or constitute a monolithic device,’ with ‘monolithic’ meaning that all the recited components are fabricated on a single chip.” *Id.* (citing Bohannon Decl. ¶¶ 40–41). Petitioner’s Reply does not respond to this argument.

For the reasons given in our Institution Decision and summarized above, we maintain our earlier construction for this phrase, and therefore construe claim 5 as requiring the “monolithic device” to include all the components recited in claim 1, namely, the feedback input, switch, and oscillator.

2. “no feedback signal . . .”

In its Preliminary Response, Patent Owner urged us to construe the phrase “no feedback signal is provided at said feedback input” in claim 1 to mean “no feedback information is present at the feedback input.” Prelim. Resp. 9. Patent Owner explained further that “no feedback information” means “no current is flowing”:

The meaning of “no feedback signal is provided at said feedback input” is clear in light of the language of the claims and in light of the specification, which describes a single embodiment for implementing the feedback signal and corresponding regulation, namely one in which *no feedback information is present (e.g., no current is flowing)* at the feedback input when the power converter output reaches a level below the threshold level.

Id. at 10 (citing *Phillips*, 415 F.3d at 1315) (emphasis added). For several reasons, we were not persuaded to adopt this proposed construction.

Institution Dec. 10–13.

We observed that *Phillips* cautions us to first focus on the language in the claims themselves:

It is a “bedrock principle” of patent law that “the claims of a patent define the invention to which the patentee is entitled the right to exclude.” *Innova*, 381 F.3d at 1115; *see also Vitronics*, 90 F.3d at 1582 (“we look to the words of the claims themselves . . . to define the scope of the patented invention”); *Markman*, 52 F.3d at 980 (“The written description part of the specification itself does not delimit the right to exclude. That is the function and purpose of claims.”).

Id. at 11 (quoting *Phillips*, 415 F.3d at 1312). We concluded that Patent Owner’s proposed construction violates this “bedrock principle,” as it is not consistent with the language of the claims. *Id.* Nowhere do the claims refer to “feedback information,” much less require that “no feedback information is present at the feedback signal input.” Instead, the claims refer to a “feedback signal,” as in the following recitation from claim 1:

said control signal being provided when no *feedback signal* is provided at said feedback input and said duty cycle signal is in said high state.

Id. (emphasis added). We concluded that Patent Owner’s argument glosses over the differences in claim language. *Id.* For example, Patent Owner argued:

[T]he Specification “repeatedly, consistently, and exclusively” describes that the absence of *feedback information (e.g., no current flowing)* on the feedback input represents the claimed “no feedback signal is provided at said feedback input.”

Prelim. Resp. 11 (emphasis added). We observed that the ’623 patent specification, like the ’623 patent claims, does not use the term “feedback

information.” Institution Dec. 12. Instead, the specification, like the claims, refers to a “feedback signal.” *See, e.g.*, Ex. 1001, 2:48–51 (“When a feedback signal is above a threshold the regulator circuit is disabled and when the feedback signal is below said threshold level the regulator circuit is enabled.”). This distinction is significant, because Patent Owner relied on the absence of “feedback information” at the input to the voltage regulator as a way to distinguish the claims from the prior art. Prelim. Resp. 20–21.

We determined that Patent Owner’s claim construction argument failed for a second reason. It was inconsistent with (and in fact contradicted by) the ’623 patent specification. Institution Dec. 12. Patent Owner argued the specification “‘repeatedly, consistently, and exclusively’ describes the absence of feedback information (*e.g., no current flowing*) on the feedback signal input represents the claimed ‘no feedback signal is provided at said feedback input.’” Prelim. Resp. 11 (emphasis added). But the ’623 patent specification explicitly states that “other feedback circuits” can be used “without departing from the spirit and scope of the present invention.” Ex. 1001, 6:40–42. One example presented in the specification as an alternative to the current mode cited by Patent Owner is “voltage mode” regulation: “Either current or voltage mode regulation may be utilized by the present invention without departing from the spirit and scope of the present invention.” *Id.* at 6:35–37. Moreover, in this discussion of alternative feedback circuits there is no reference to “zero current.” The only requirement is that “a signal indicative of the power supplied to the load is supplied to the feedback terminal 320 of the regulation circuit 240.” *Id.* at 6:38–40.

Patent Owner’s Response presents a variation on the claim construction we rejected in our Institution Decision. PO Resp. 7–10. Patent

Owner's new argument emphasizes the "zero current" aspect of its previous construction. Now Patent Owner contends "the proper construction of this phrase under *Phillips* is no current (for current-based feedback) or no voltage (for voltage-based feedback) is present at the feedback input." PO Resp. 7 (citing Bohannon Decl. ¶ 35).

Patent Owner relies on a definition of "signal" from the IEEE Standard Dictionary as a "measurable quantity (e.g., *a voltage*) which varies in time in order to transmit information." PO Resp. 8 (citing Ex. 2024, 2). Patent Owner relies also on the '623 patent specification. *Id.* According to Patent Owner, "[t]he mechanism described for implementing the feedback signal is one in which *no current* is flowing at the feedback input when the power converter output dips below the threshold level." *Id.* Specifically, Patent Owner relies on the disclosure in the specification describing the condition where the voltage supplied to the load falls below a threshold value determined by a combination of the voltage drop across the light emitting diode 300 of optocoupler 280 (preferably one volt) and the reverse break down voltage of Zener diode 290. *See discussion supra.* In that situation, the current ceases to flow through the optocoupler, which is coupled to feedback terminal 320 of regulator circuit 240. PO Resp. 8–9.

Patent Owner's construction of this term goes further, however. Patent Owner contends that "the '623 patent expressly distinguishes its 'digital' control signal, which either has a signal (current or voltage) present or not, from an analog feedback signal, which is a feedback signal having a varying current or voltage level that is continuously present." *Id.* at 9. To support its "digital feedback signal" theory, Patent Owner relies on a generalized description of prior conventional regulation and also the

statement in the '623 patent referring to a “‘digital’ on off for the power supply.” *Id.* (citing Ex. 1001, 1:66–2:8, 6:43–58).

Petitioner responds that “[n]o feedback signal” should be interpreted simply as ‘absence of a feedback signal.’” Pet. Reply 2.

For reasons discussed *supra*, we are no more persuaded by Patent Owner’s “zero current” argument now than we were at the institution stage. While the claims must be read in view of the specification, “limitations from the specification are not to be read into the claims.” *Teleflex, Inc. v. Ficosa N. Am. Corp.*, 299 F.3d 1313, 1326 (Fed. Cir. 2002) (citations omitted). Even when the specification describes only a single embodiment, the claims of the patent will not be read restrictively unless the patentee has demonstrated a clear intention to limit the claim scope using words or expressions of manifest exclusion or restriction. *Liebel-Flarsheim Co. v. Medrad, Inc.*, 358 F.3d 898, 906 (Fed. Cir. 2004) (citing *Teleflex*, 299 F.3d at 1327). As noted *supra*, the '623 patent describes alternative embodiments with no requirement of “zero current” or “zero voltage.”

We find that Mr. Bohannon’s testimony on this issue (Bohannon Decl. ¶¶ 35–39), which tracks closely the language of Patent Owner’s Response, is contrary to the above principles of proper claim construction, and we therefore do not find it convincing. Likewise, we do not find persuasive Patent Owner’s IEEE dictionary definition of “signal.” The fact that the IEEE definition uses a varying voltage as an example of a signal does not mean that if the varying voltage assumes a value of zero, there is no signal

present. Thus, this definition for “signal” does not shed light on the claim construction issue before us here.⁵

Nor are we persuaded by Patent Owner’s reliance on the reference in the specification to “a ‘digital’ on and off for the power supply.” PO Resp. 9 (citing Ex. 1001, 6:43–46). From the context in which it appears, we find that this generalized description applies to the power supply as a whole, not the feedback signal specifically. Nor are we convinced by the argument that the claims require digital signals for the power supply. PO Resp. 10.

We are not persuaded by Patent Owner’s attempt to distinguish the feedback signal in the ’623 patent from prior art feedback signals (e.g., Barbehenn) on the ground that the signal in the ’623 patent is “digital.” See, e.g., Hearing Tr. 66:5–21. We see little material difference, if any, between the feedback signals in Barbehenn and the ’623 patent. We address this and other related arguments *infra*, in connection with our discussion of Patent Owner’s contentions regarding the prior art.

In sum, we are not persuaded to adopt Patent Owner’s proposed construction for this phrase as being limited to “zero current,” “zero voltage,” or “digital,” as it is contrary to the ’623 patent claims and specification.

⁵ The same is true of Patent Owner’s citation to *Webster’s Universal College Dictionary*, which defines signal as “an electrical quantity . . . that can be varied.” PO Resp. 8 (citing Ex. 2023, 2). Nothing in this definition precludes a varying quantity whose value may at times be zero from being a signal.

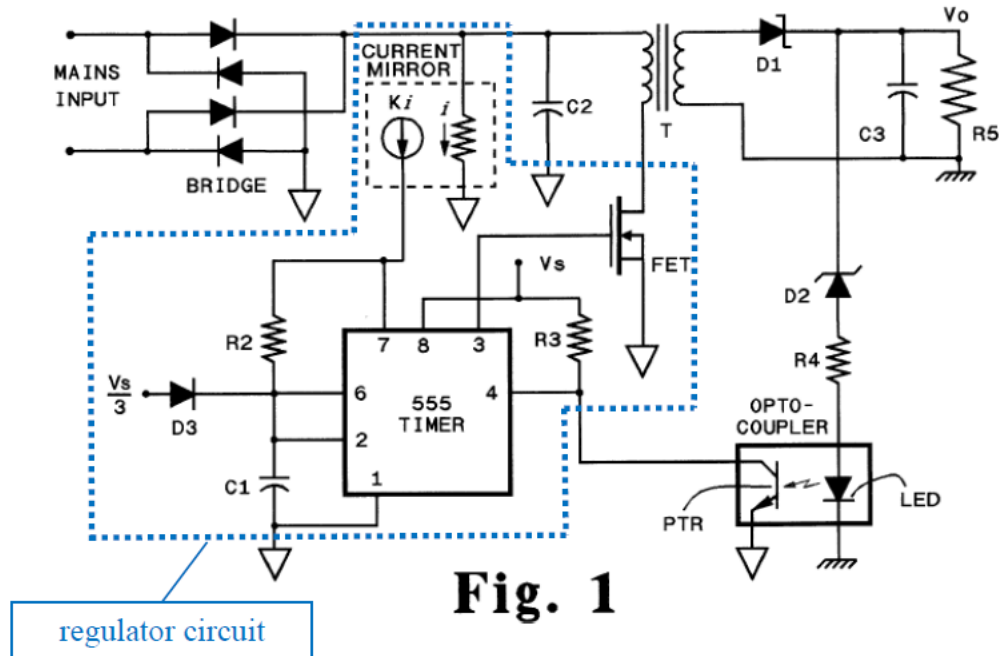
C. Prior Art

1. Barbehenn (Ex. 1004)

Barbehenn is a patent titled “Simplified AC-DC Switching Converter with Output Isolation.” Barbehenn describes the operation of such a converter using a “bang-bang” control:

The invention disclosed herein operates in a non-linear, limit cycle mode, sometimes called “bang-bang” control. This means that the applied power is either furnished at maximum rate to the load filter, or it is turned off altogether.

Ex. 1004, 1:61–64. Figure 1 of Barbehenn, annotated by Petitioner, follows:



Pet. 14. Figure 1 of Barbehenn is a circuit diagram of an AC-DC converter. Ex. 1004, 2:38–39. As shown in Figure 1, Barbehenn’s feedback loop includes Zener diode $D2$, resistor $R4$, and an optocoupler. *Id.* at 3:29–32. Barbehenn’s output voltage threshold level is set by “the sum of the Zener voltage of diode $D2$ and the turn-on voltage of the light emitting diode LED in the OPTO-COUPLER.” *Id.* at 3:58–61.

The converter alternates between states by using an inhibit connection to the oscillator supplying the switching signal. *Id.* at 1:65–67. The optocoupler is used to generate the inhibit signal such that a small variation in the load will turn the oscillator on or off. The oscillator is implemented with a standard 555 timer configured as a free-running oscillator. *Id.* at 1:67–2:4. A voltage applied to the inhibit line of the timer causes the oscillator to switch states. *Id.* at 2:4–7.

The operation of the circuit is described as follows. When the level of the output voltage (V_o) exceeds the output voltage threshold, the LED in the optocoupler conducts and “causes the adjacent photo-transistor PTR to begin conduction.” *Id.* at 3:60–63. When the photo-transistor current flows through resistor R3, the voltage at reset pin 4 is lowered and the oscillation of the 555 timer is inhibited. *Id.* at 3:63–67. When the level of the output voltage falls below the output threshold, the photo-transistor current ceases conduction through resistor R3, the voltage at reset pin 4 returns high, and the duty cycle signal provided at pin 3 of the 555 timer resumes oscillating. *Id.* at 3:67–4:4.

2. *Grebene (Ex. 1005)*

Grebene is a textbook titled “Bipolar and MOS Analog Integrated Circuit Design.” Grebene shows the internal circuitry of the industry standard 555 timer used in Barbehenn.

3. *Balakrishnan ’369 (Ex. 1007)*

Balakrishnan ’369 is a patent titled “Switched Mode Power Supply Integrated Circuit with Start-up Self-Biasing.” The patent indicates that it is commonly owned with the ’623 patent. Pet. 9. The Balakrishnan ’369 patent discloses a technique whereby a low-voltage tap point in the power

switch of a switching converter is used as a current source to provide power for the internal circuitry of a regulator chip. Ex. 1007, Abstract, Fig. 3.

4. *Motorola (Ex. 1008)*

Motorola is a datasheet describing a series of monolithic power switching regulators for use in DC-to-DC converters. Ex. 1008, 1. The devices include a voltage feedback comparator. *Id.* The feedback comparator determines whether the output voltage is above or below a desired threshold. Madisetti Decl. ¶ 42 (citing Ex. 1008, 8). Based on this comparison, Motorola determines whether to allow or inhibit pulses from an oscillator to switch the output switch. *Id.* (citing Ex. 1008, 7 (Fig. 18)).

D. *Patent Owner's Challenge to Barbehenn's Status as Prior Art*

Patent Owner asserts that Barbehenn does not qualify as prior art because the invention of the '623 patent was conceived by the inventors prior to Barbehenn's filing date of October 23, 1997, and the inventors exercised reasonable diligence in reducing the invention to practice. PO Resp. 11–19.

1. *Applicable Law — Joint Inventorship*

To antedate a reference, a patentee must establish that it invented the subject matter recited in the patent claims before the reference's effective date as prior art. Prior invention can be established by showing "either an earlier reduction to practice, or an earlier conception followed by a diligent reduction to practice." *Purdue Pharma L.P. v. Boehringer Ingelheim GmbH*, 237 F.3d 1359, 1365 (Fed. Cir. 2001). A patent owner bears the burden to establish the facts necessary to overcome the reference's filing date. *In re Magnum Oil Tools Int'l, Ltd.*, 829 F.3d 1364, 1375–1376 (Fed. Cir. 2016).

"Conception is the touchstone of inventorship." *Acromed Corp. v.*

Sofamor Danek Grp., Inc., 253 F.3d 1371, 1379 (Fed. Cir. 2001) (quoting *Burroughs Wellcome Co. v. Barr Labs., Inc.*, 40 F.3d 1223, 1227 (Fed. Cir. 1994); accord *Fina Oil & Chem. Co. v. Ewen*, 123 F.3d 1466, 1473 (Fed. Cir. 1997)). To prove conception, a patent owner is required to show “formation in the mind of the inventor, of a definite and permanent idea of the complete and operative invention, as it is hereafter to be applied in practice.” *Dawson v. Dawson*, 710 F.3d 1347, 1352 (Fed. Cir. 2013) (internal citations and quotations omitted).

In the case of a joint invention, each joint inventor must contribute to the invention’s conception. See, e.g., *Eli Lilly & Co. v. Aradigm Corp.*, 376 F.3d 1352, 1358–59 (Fed. Cir. 2004); *Ethicon, Inc., v. U.S. Surgical Corp.*, 135 F.3d 1456, 1460–61 (Fed. Cir. 1998); *Fina Oil*, 123 F.3d at 1473 (“[T]o be a joint inventor, an individual must make a contribution to the conception of the claimed invention that is not insignificant in quality, when that contribution is measured against the dimension of the full invention.”). He or she need not “make the same type or amount of contribution” to the invention nor contribute to every claim – a contribution to one claim is enough. *Ethicon*, 135 F.3d at 1460 (quoting 35 U.S.C. § 116).

To establish joint inventorship, there must be “some quantum of collaboration.” *Kimberly-Clark Corp. v. Procter & Gamble Distrib. Co.*, 973 F.2d 911, 917 (Fed. Cir. 1992) (“[T]here must be some element of joint behavior, such as collaboration or working under common direction, one inventor seeing a relevant report and building upon it or hearing another’s suggestion at a meeting.”); see also *Eli Lilly*, 376 F.3d at 1359 (referring to the inventors having “some open line of communication during or in temporal proximity to their inventive efforts”).

In proving conception, “an inventor’s testimony, standing alone, is

insufficient.” *Price v. Symsek*, 988 F.2d 1187, 1194 (Fed. Cir. 1993).

“[S]ome form of corroboration must be shown.” *Id.* Proof of conception must be by “corroborating evidence which shows that the inventor disclosed to others his ‘completed thought expressed in such clear terms as to enable those skilled in the art’ to make the invention.” *Coleman v. Dines*, 754 F.2d 353, 359 (Fed. Cir. 1985) (citing *Field v. Knowles*, 183 F.2d 593, 601 (CCPA 1950)); *see also Mahurkar v. C.R. Bard, Inc.*, 79 F.3d 1572, 1577 (Fed. Cir. 1996) (corroboration requirement “arose out of a concern that inventors testifying in patent infringement cases would be tempted to remember facts favorable to their case by the lure of protecting their patent or defeating another’s patent”).

The sufficiency of corroboration is determined according to a “‘rule of reason’ analysis, in which ‘an evaluation of all pertinent evidence must be made so that a sound determination of the credibility of the inventor’s story may be reached.’” *Singh v. Brake*, 317 F.3d 1334, 1341 (Fed. Cir. 2003) (quoting *Price*, 988 F.2d at 1195). This, however, does not dispense with the requirement that some independent evidence provide corroboration. *Coleman*, 754 F.2d at 360. The requirement of “independent” corroboration requires evidence other than the inventor’s testimony. *In re NTP, Inc.*, 654 F.3d 1279, 1291–92 (Fed. Cir. 2011).

2. Patent Owner’s Contentions

Patent Owner asserts that the three inventors named in the ’623 patent, Balakrishnan, Djenguerian, and Lund, jointly conceived of the claimed invention at least by October 9, 1997, and diligently reduced it to practice by filing U.S. Application No. 09/032,520 (“the ’520 application”). PO Resp. 11–12. The ’520 application is a parent to the application for the ’623 patent and shares the same specification and figures. *Id.*

To establish the joint conception date of October 9, 1997, Patent Owner relies on several allegedly contemporaneous documents and declaration testimony from two employee fact witnesses: Balu Balakrishnan, one of the co-inventors listed on the '623 patent and Patent Owner's President and CEO (Ex. 2002, "Balakrishnan Decl."); and David Kung, Patent Owner's Director of Design Engineering (Ex. 2021, "Kung Decl."). Petitioner cross-examined both witnesses and submitted the transcripts as exhibits. Exs. 1042 ("Kung Dep."), 1043 ("Balakrishnan Dep.").

Balakrishnan testifies that "[n]o later than October 9, 1997, Alex Djenguerian, Leif Lund, and I *collectively conceived* of the regulator circuits and methods claimed in the PI On/Off Control Patents." Balakrishnan Decl. ¶ 10 (emphasis added). He further testifies that he "was responsible for conceiving of the overall concept of the On/Off control methodology [of the '623 patent] as well as preparing preliminary circuit designs for implementing" the "power supply architecture." *Id.* ¶ 9. Referring to Exhibit 2003, Balakrishnan describes the document as "[a] schematic of a circuit used to provide a proof of concept for the operation of the inventive ON/OFF control regulator circuit, in the context of a switching power supply." *Id.* ¶ 10.

Balakrishnan's declaration testimony is directed to claim 1 of the '623 patent. *Id.* ¶ 16. He testifies that Exhibit 2003 "shows each element of at least claim 1 of the '623 patent." *Id.* To establish reduction to practice, he compares Exhibit 2003 to claim 1. *Id.* ¶ 17. He does not provide analysis for any other claims of the '623 patent.

Exhibit 2003 bears a date of October 9, 1997, and contains various handwritten annotations, but does not indicate an author or mention any of the co-inventors. Balakrishnan testifies on cross-examination that this

schematic was not one he prepared, but was instead an “implementation” by an applications engineer, Derek Kroes. Ex. 1043, 69:7–70:5. Balakrishnan claims that Kroes implemented the circuit based on guidance Balakrishnan and Djenguerian provided about how the circuit should work. *Id.* at 70:6–71:13.

Kung testifies that he was at the time Director of Design Engineering reporting to Balakrishnan. Kung Decl. ¶ 7. Both Djenguerian and Lund were design engineers reporting to Kung. *Id.* Kung testifies he “was aware of the underlying invention of PI’s On/Off Control Patents from the very beginning” and “recall[s] discussing with Mr. Balakrishnan his original ideas for the On/Off control scheme.” *Id.* ¶ 12. Kung further testifies that Balakrishnan worked with Kroes “to put together a power supply circuit as proof of concept” and “instructed Mr. Kroes on how to build a ‘breadboard’ design that would embody the concept of On/Off control that Mr. Balakrishnan had come up with.” *Id.* ¶ 13.

Kung describes the Exhibit 2003 schematic as “a version of the breadboard circuit built at Mr. Balakrishnan’s direction,” and testifies that “it shows a circuit using discrete components that operates according to what [he] understand[s] is disclosed in PI’s On/Off control patents.” *Id.* ¶ 14. Kung explains that Kroes, Djenguerian, and Lund were all engineers that reported to him in his group. *Id.* ¶¶ 7, 13. Djenguerian and Lund worked closely with Balakrishnan, and “developed schematics for an integrated circuit chip that would implement the new On/Off control invention” after the concept was proven. *Id.* ¶ 15.

Balakrishnan testifies that he and his colleagues “worked to implement the inventive regulator circuit” and revised the design of the regulator circuit “[b]etween October 9, 1997 and October 23, 1997.”

Balakrishnan Decl. ¶ 19 (citing Ex. 2004). Exhibit 2004, a second schematic, bears a date of October 23, 1998, but does not indicate an author or mention the inventors. Balakrishnan further testifies that he and his colleagues “continued to work on testing the performance of the regulator circuit” between October 23, 1997 and October 28, 1997, and “conducted a series of tests of the performance of the prototype regulator circuit and recorded the performance on an oscilloscope” on October 28, 1997. *Id.* ¶ 20 (citing Ex. 2005). Exhibit 2005, the test results from October 28, 1997, contains various handwritten annotations, but does not indicate an author or mention the inventors.

Patent Owner contends that Balakrishnan and the other two inventors “jointly conceived of the regulator circuit disclosed and claimed in the ’623 patent by no later than October 9, 1997.” PO Resp. 12–13. Patent Owner contends that Exhibit 2003 “establishes *the inventors* had a ‘definite and permanent’ grasp of the invention at least as of [October 9, 1997].” PO Resp. 14 (emphasis added). In addition, Patent Owner has submitted various other schematics (Ex. 2006; Ex. 2009; Ex. 2010; Ex. 2014), test results and simulations (Ex. 2006; Ex. 2009; Ex. 2010; Ex. 2013; Ex. 2014), presentations (Ex. 2007; Ex. 2011; Ex. 2015; Ex. 2018), and status reports, meeting minutes, and agendas (Ex. 2008; Ex. 2012). Patent Owner contends that these exhibits demonstrate that the inventors exercised reasonable diligence in reducing the invention to practice. *Id.* at 15–18.

3. *Petitioner’s Contentions*

Petitioner disputes Patent Owner’s claimed conception date and argues that Barbehenn is not antedated by Patent Owner’s alleged prior invention. Pet. Reply 2–9. Petitioner argues that in a previous district court litigation, Patent Owner alleged an October 28, 1997 conception date for the

'623 patent, which differs from Patent Owner's contention here of an October 9, 1997, joint conception date by 19 days. *Id.* at 8 (citing Ex. 1015, 9).

Petitioner further argues that Patent Owner's October 9, 1997 joint conception date lacks proper evidentiary support. Among other reasons, Petitioner contends there is no corroboration for the claim that Djenguerian or Lund contributed to the alleged joint conception by the asserted date of October 9, 1997. *Id.* at 3. Petitioner explains that "[t]he earliest date on any document referencing Mr. Lund or Mr. Djenguerian is December 1997. *See* Ex. 2018, 11 (dated December 22, 1997 (Djenguerian)) and 15 (dated December 19, 1997 (Lund))." *Id.* at 4. Relying on Kung's testimony, Petitioner contends that the printed date on the Exhibit 2003 schematic (October 9, 1997) may have been the date the engineer first started drawing the schematic, not the date the engineer completed the schematic. *Id.* at 5–6 (citing Kung Dep. 51:4–24).

Petitioner contends that "the earliest possible date any functioning idea became definite and permanent was October 28, 1997," which is "consistent with PO's original assertion in District Court." *Id.* at 8. Petitioner contends that because this date falls after the filing date of Barbehenn, on October 23, 1997, Barbehenn is prior art to all challenged claims. *Id.* at 9.

4. Analysis

We have considered all of the arguments and evidence set forth by the parties on this issue. For the reasons explained below, we determine that Patent Owner has failed to carry its burden of proving that the alleged joint conception date for the invention claimed in the '623 patent antedates Barbehenn.

At the oral hearing, Patent Owner's counsel confirmed that the alleged conception on October 9, 1997 was joint. Hearing Tr. 40:17–41:1. As discussed above, Patent Owner attempts to prove prior joint conception and reasonable diligence in reducing the claimed invention to practice by relying on testimony from two interested employee witnesses, Balakrishnan and Kung. Patent Owner does not provide testimony from any of the others allegedly involved in the joint conception and reduction to practice of the invention; there is no testimony from either of the other co-inventors, Djenguerian and Lund, or from Kroes, the engineer who allegedly prepared the schematic of October 9, 1997.

Patent Owner tries to corroborate Balakrishnan's and Kung's testimony on joint conception with several documents, but these do not sufficiently prove that the invention was jointly conceived by the inventors as of the asserted date of October 9, 1997. The main document relied upon by Patent Owner is the schematic identified as Exhibit 2003. Patent Owner argues that this schematic shows that the claimed invention was "jointly conceived" by October 9, 1997. PO Resp. 12–13.

While this document bears the asserted date, it has no information to corroborate the involvement of any of the alleged joint inventors in its preparation. *Id.* Moreover, we are persuaded by Petitioner's argument that based on Kung's testimony, there is lack of certainty that the October 9, 1997, date represents the date the schematic was completed as opposed to the date it was started. *See* Pet. Reply 5. This lack of certainty is heightened by the statement of Patent Owner's counsel at the oral hearing that the October 9, 1997 schematic was part of a multipage document that bears a different date (October 28) on the cover page. Hearing Tr. 49:21–24. In light of this evidence, we find that the October 9, 1997 date on the schematic

is not a reliable indicator of when the circuit design was completed.

Balakrishnan testifies that he worked with Djenguerian and Lund to conceive of the invention, but none of the joint inventors' names appear on the alleged conception document. Balakrishnan Decl. ¶ 10. In fact, both Balakrishnan and Kung testify that Kroes was responsible for creating the October 9 schematic, not any of the joint inventors. Balakrishnan Dep. 71:4–8; Kung Dep. 52:8–20.

Balakrishnan confirms that Kroes implemented the circuit, but says it was based on guidance he and Djenguerian provided about how the circuit should work. Balakrishnan Dep. 71:7–13. But there is no evidence to corroborate this statement by Balakrishnan. “[A]n alleged co-inventor must supply evidence to corroborate his testimony. *Ethicon, Inc.*, 135 F.3d at 1461 (citing *Price*, 988 F.2d at 1194).

Patent Owner offers no explanation as to why it did not provide testimony from Djenguerian, Lund, or Kroes. Presumably, they were available to testify. According to Kung, Djenguerian is still employed by Patent Owner. Kung Dep. 100:4–6. Lund is retired from the company, and Kroes left sometime after the year 2000. *Id.* at 99:18–100:24.

Similar to the earlier-dated Exhibit 2003, Exhibit 2004 is a schematic that includes a date, but lacks any information to corroborate the identities of the inventors. As noted, Exhibit 2004 bears a date of October 23, 1997. However, there is no documentary proof that Djenguerian or Lund played a role in the conception of the circuit shown in Exhibit 2004. As pointed out by Petitioner, Djenguerian's and Lund's names do not appear on any of the documents submitted to corroborate Patent Owner's conception story until December 1997. Pet. Reply 4.

Djenguerian and Lund also are mentioned in Kung's weekly reports,

but the earliest date on a report submitted in this proceeding is January 9, 1998 — several months after Patent Owner’s purported conception date. Balakrishnan Decl. ¶ 25. Balakrishnan and Kung both testified that the earlier reports were lost due to a storage error and could not be found. *Id.* ¶ 25 n.2; Kung Decl. ¶ 10. Thus, there is no mention of Djenguerian or Lund in a contemporaneous document that would corroborate a joint conception date of October 9, 1997.

By a preponderance of the evidence, based upon the foregoing, we find that Patent Owner has not shown that Djenguerian and Lund began participating in the development program before December 1997, the earliest date their names appear on a document. Despite his claim of no “current financial interest” in the outcome of this case (Balakrishnan Decl. ¶ 3), we find that Balakrishnan, Patent Owner’s President and CEO, is an interested witness. We do not credit Balakrishnan’s uncorroborated testimony that he, Djenguerian, and Lund, conceived of the claimed invention “collectively” as of October 9, 1997. Balakrishnan Decl. ¶ 6. While there is some evidence that Balakrishnan was working on the project as of that date, there is no credible evidence that either Djenguerian or Lund was involved, and certainly no credible evidence that they made an inventive contribution to the joint conception as of that date. Without corroborated evidence of their involvement and contribution, Patent Owner’s claim of a joint conception on October 9, 1997 fails. *See Kimberly-Clark Corp.*, 973 F.2d at 917; *Eli Lilly*, 376 F.3d at 1359.

Patent Owner responds that it “is not required to demonstrate that the inventors ‘jointly conceived’ of the invention by October 9, 1997.” PO Sur-reply 1. Patent Owner attempts to distinguish the cases relied on by Petitioner: *Ethicon, Inc. v. U.S. Surgical Corp.* 135 F.3d 1456, 1460 (Fed.

Cir. 1998) and *Apator Miitors ApS v. Kamstrup A/S*, 887 F.3d 1293, 1295–96 (Fed. Cir. 2018). Patent Owner argues that neither *Ethicon* nor *Apator Miitors* “require corroborating evidence of joint conception to swear behind a reference.” PO Sur-reply 1–2. In support of this position, Patent Owner cites the Board’s non-precedential panel decision in *LG Electronics, Inc. v. ATI Technologies ULC*, IPR2015-00325, slip op. at 16 (PTAB April 14, 2016) (Paper 62). According to Patent Owner’s account of the case:

The patent in *LG* named three inventors. The patent owner provided a declaration of one of the three inventors along with a specification authored by the one inventor was as corroborating that “the named inventors conceived the claimed subject matter no later than [the critical date].” *Id.* Based on the declaration and corroborating evidence, the Board found patent owner “has demonstrated by a preponderance of the evidence that the named inventors ... conceived the claimed system ... prior to the U.S. filing dates of [the prior art references].”

PO Sur-reply 1–2 (citing *LG Electronics*, slip op. at 16 (emphasis and alterations in original). Patent Owner also responds that the corroborating evidence as a whole supports prior conception and that the “[e]valuation of all pertinent evidence shows that Mr. Balakrishnan ‘had the idea’ before Barbehenn’s October 23, 1997, filing date. *Burroughs Wellcome Co. v. Barr Labs., Inc.*, 40 F.3d 1223, 1228 (Fed. Cir. 1994)). That is all that is required [for conception].” PO Sur-reply 2–3.

We are not persuaded by Patent Owner’s reliance on the panel decision in *LG Electronics*, or its argument based on the “evidence as a whole.” *LG Electronics* is not precedential authority, and therefore does not bind this panel. But even if it were, that decision would be distinguishable on its facts. In that proceeding, the sufficiency of the corroborating documents showing conception was not disputed by the parties. The panel’s

analysis, therefore, focused on actual reduction to practice. *LG Electronics*, slip op. at 16. This is confirmed by the decision itself, where the panel commented: “LG does not dispute the sufficiency of the R400 Sequencer Specification for showing conception.” *Id.* Here, in contrast, Petitioner disputes the sufficiency of Patent Owner’s evidence of joint conception, and Patent Owner has not argued that the inventors actually reduced the invention to practice before Barbehenn’s filing date.

Patent Owner has alleged here that a joint conception of the invention of claim 1 occurred by October 9, 1997. *See supra.* Contrary to Patent Owner’s argument based on *LG Electronics*, we determine that Patent Owner’s alleged joint conception requires corroborated evidence that the joint inventors (not just Balakrishnan) contributed to that conception. *See, e.g., Eli Lilly*, 376 F.3d at 1358–1359; *Ethicon*, 135 F.3d at 1460–1461; *Fina Oil*, 123 F.3d at 1473.

Patent Owner’s argument that Balakrishnan’s testimony alone is sufficient is contradicted by Patent Owner’s assertion that Balakrishnan and the two other inventors “jointly conceived of the regulator circuit disclosed and claimed in the ’623 patent by no later than October 9, 1997.” PO Resp. 12–13. Moreover, it is contrary to such cases as *Woodland Trust v. Flowertree Nursery, Inc.*, 148 F.3d 1368, 1371 (Fed. Cir. 1998) (“Throughout the history of the determination of patent rights, oral testimony by an alleged inventor asserting priority over a patentee’s rights is regarded with skepticism, and as a result, such inventor testimony must be supported by some type of corroborating evidence.”) (internal quotes omitted).

After considering all pertinent evidence, and under the rule of reason, we find that Patent Owner has failed to sufficiently corroborate its

contention that the inventors jointly conceived of the claimed invention by October 9, 1997. Thus, as to claim 1, the only claim analyzed by Patent Owner, we find that the evidence of joint conception is insufficiently corroborated.

As to claims 2–7 not addressed by Balakrishnan, Patent Owner presents no evidence of conception prior to the filing date of the '623 patent. In view of this determination that there is insufficient proof of joint conception on the dates alleged by Patent Owner, we need not reach the issue of reasonable diligence, as both an earlier date of conception and reasonable diligence are required to antedate a prior art reference. We, therefore, do not rely on Patent Owner's proofs of diligence. Thus, we find that Patent Owner has failed to antedate Barbehenn, and we will, therefore, consider Petitioner's challenges applying Barbehenn.

E. Challenges Based on Barbehenn

1. Claims 1, 2, and 5 (Barbehenn and Grebene)

Petitioner challenges claims 1, 2, and 5 as (1) obvious over the combination of Barbehenn and Grebene, and (2) obvious over Barbehenn alone. Pet. 12–29; 39–48. We first focus our discussion on claim 1, and on Barbehenn and Grebene. We agree with Petitioner that a person of ordinary skill would have looked to the Grebene textbook for further information concerning the industry standard 555 timer disclosed in Barbehenn, including the internal block diagrams and circuit schematics. *Id.* at 13.

a. Claim 1

Petitioner's detailed element-by-element obviousness analysis of claim 1 in relation to Barbehenn and Grebene appears at pages 13–26 of the Petition. Petitioner also provides supporting testimony from its expert,

Dr. Madiseti. Madiseti Decl. ¶¶ 52–62. We have considered Petitioner’s analysis as well as Patent Owner’s contentions, as discussed *infra*.

Patent Owner’s responsive arguments to Petitioner’s analysis focus on two limitations of claim 1. We address those two limitations of claim 1 here.

“said control signal being provided when no feedback signal is provided at said feedback input”

To meet this limitation, Petitioner identifies the operation of the photo-transistor PTR in Barbehenn with the “no feedback signal” condition in the patent claims:

In sum, when Barbehenn’s photo-transistor PTR ceases conducting (i.e., when “no feedback signal” is received at the feedback input), the voltage at reset pin 4 goes high, and the 555 timer oscillates without restraint. *Id.*, 3:41-43, 4:1-4; Ex. 1002, ¶ 62.

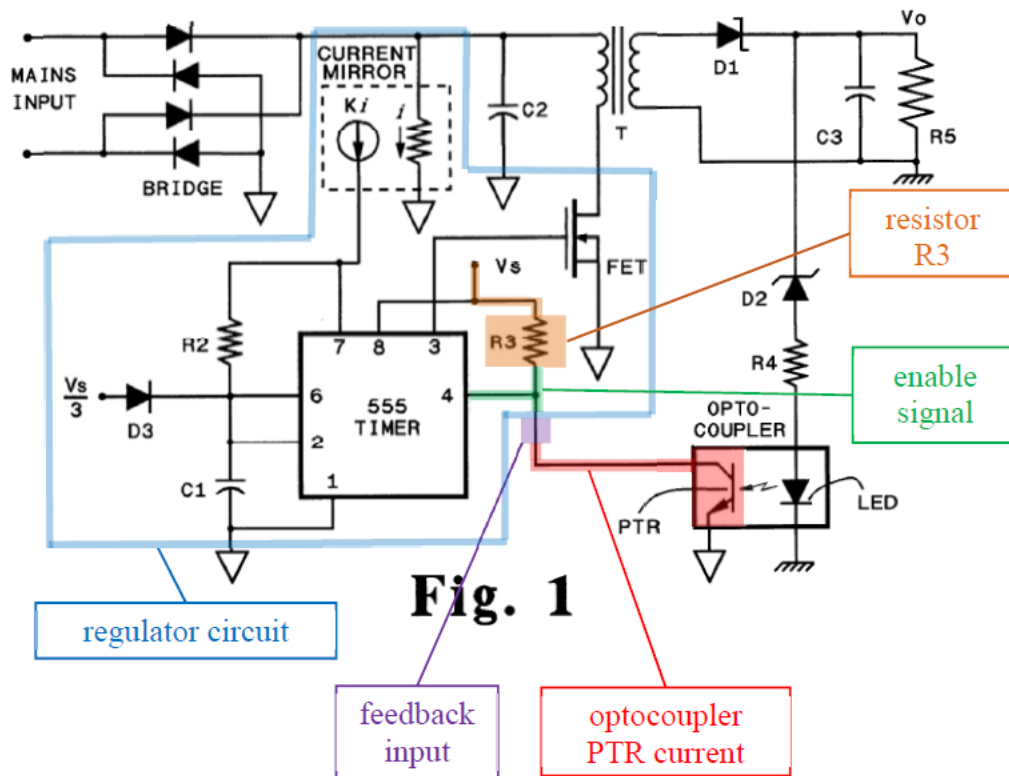
Pet. 24. Patent Owner challenges Petitioner’s assertion that this claim element is met by Barbehenn. PO Resp. 23–29. Patent Owner reverts to its earlier arguments equating “no feedback signal” with “no voltage or current” and requiring the feedback signal to be “digital”: “Nowhere does Barbehenn disclose providing a control signal when no feedback signal is present at the feedback input. Rather, Barbehenn uses a *varying and continuously present feedback voltage* at the reset pin to control the 555 timer.” *Id.* at 24 (emphasis added). Elsewhere, Patent Owner argues: “Barbehenn’s feedback loop never provides ‘no feedback signal,’ i.e., no feedback current or voltage, at the feedback input to the reset pin 4 of the 555 timer. . . . To the contrary, a signal – an *analog* voltage – is *always* present at Barbehenn’s feedback input (i.e., reset pin 4) because Barbehenn’s feedback loop components result in a *continuously present analog feedback signal*.” PO Resp. 26 (emphasis added). Patent Owner’s argument continues:

“Petitioner’s argument based on photo-transistor PTR reinforces that Barbehenn’s feedback signal is the voltage at the reset pin, not the photo-transistor PTR current. . . . Nowhere does Barbehenn disclose a condition where no voltage (i.e., the claimed ‘no feedback signal’) is present at the reset pin. Rather, Barbehenn’s feedback loop *continuously provides a varying analog voltage* at reset pin 4.” *Id.* at 28–29 (emphasis added).

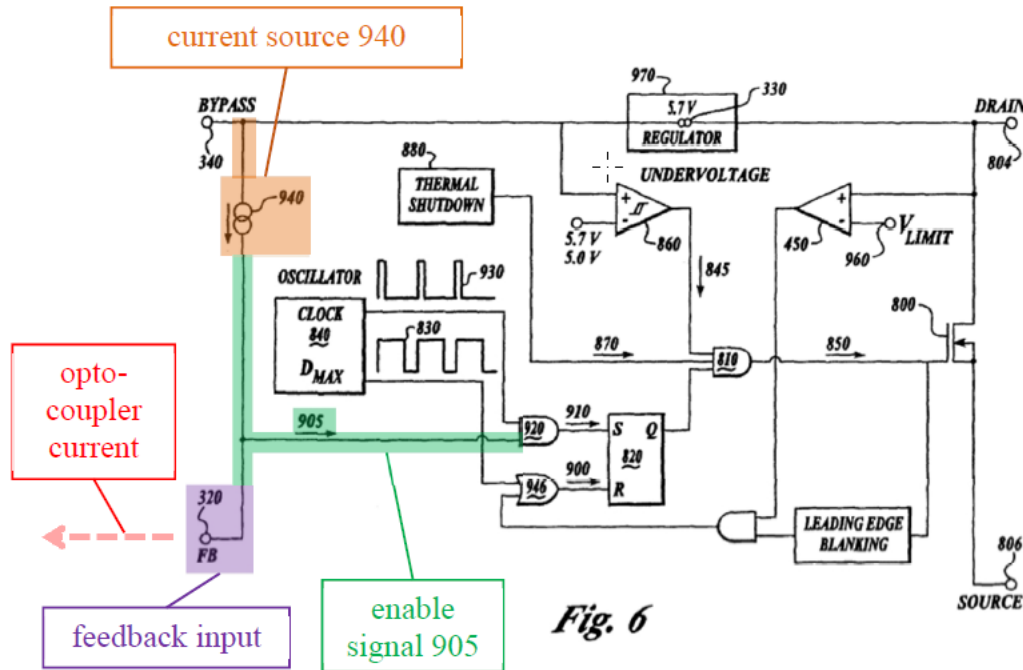
Petitioner responds by challenging Patent Owner’s assertion identifying the claimed feedback signal in Barbehenn as a voltage rather than a current. Pet. Reply 9. We find that Patent Owner’s argument is not consistent with the record, nor does it accurately address Petitioner’s contentions. Petitioner has consistently identified the current through Barbehenn’s phototransistor PTR as the claimed feedback signal. *See, e.g.*, Pet. 24 (“In sum, when Barbehenn’s photo-transistor PTR ceases conducting (i.e., when ‘no feedback signal’ is received at the feedback input), the voltage at reset pin 4 goes high, and the 555 timer oscillates without restraint.”). We therefore do not credit Patent Owner’s argument based upon voltages in Barbehenn because it is a mischaracterization of Petitioner’s contentions. We agree with Petitioner that Patent Owner does not persuasively answer Petitioner’s assertion that the absence of PTR current in Barbehenn meets the “no feedback signal” limitation. Pet. Reply 12. We find, therefore, that this limitation is met by Barbehenn for the reasons given by Petitioner.

We are not persuaded by Patent Owner’s related argument suggesting that Barbehenn teaches only “voltage-based feedback.” PO Resp. 28–29 (“Because Barbehenn’s feedback signal (i.e., the signal provided by the feedback control loop to pin 4 of the 555 timer) has a voltage that varies above and below a threshold region, a feedback signal is always present.”).

As discussed *supra*, Petitioner relies on the current through photo-transistor PTR as the feedback signal. This is illustrated by the following Figure 1 of Barbehenn, annotated by Petitioner:



Pet. Reply 10. Figure 1 of Barbehenn (annotated by Petitioner) is a circuit diagram of an AC-DC converter. Ex. 1004, 2:38–39. Figure 1 shows the relation of the current through the optocoupler and the feedback input at pin 4 of the 555 timer. As Petitioner explains, the voltage at pin 4, which enables and disables the control signal, results from the feedback current from phototransistor PTR through resistor R3 in Figure 1. Pet. Reply 10. In this respect, we find that Barbehenn is similar to the '623 patent, where an optocoupler provides feedback current to feedback input 320. *Id.* at 11 (citing Ex. 1001, Fig. 3; 5:26–29; 8:38–41). This is further illustrated by the following Figure 6 of the '623 patent, annotated by Petitioner:



Id. Figure 6 of the '623 patent (annotated by Petitioner) shows the optocoupler providing feedback current to feedback input 320. Ex. 1001, 8:33–36. The voltage of enable signal 905, which is the direct result of whether the feedback current is greater than or less than the current from current source 940, is provided to logic circuitry to enable or disable the control signal. *Id.* at 8:33–47; Ex. 1002 ¶ 58. Thus, in both Barbehenn and the '623 patent, an optocoupler provides a feedback current that results in a voltage at the feedback input. This in turn causes the enablement and disablement of the control signal. Pet. Reply 11–12.

Patent Owner's argument based on feedback voltage vs. feedback current is contrary to the teachings of the '623 patent. The '623 patent does not require a state with "no feedback voltage." Instead, it states: "Either current or voltage mode regulation may be utilized by the present invention without departing from the spirit and scope of the present invention so long as a signal indicative of the power supplied to the load is supplied to the

feedback terminal 320 of the regulation circuit 240.” Id. at 6:32–37

(emphasis added). Thus, the only restriction placed on the signal (voltage or current) applied to the feedback terminal is that it be “indicative of the power supplied to the load.” We, therefore, are not persuaded by Patent Owner’s arguments on this point.

Finally, we are not convinced by Patent Owner’s argument based on the asserted fact that Barbehenn’s feedback loop produces a “varying analog voltage” (PO Resp. 29), in contrast to the “digital” feedback signal described in the ’623 patent. As discussed *supra*, we see little difference between the optocoupler output identified as the feedback signal in the ’623 patent and the phototransistor output identified by Petitioner as the feedback signal in Barbehenn.

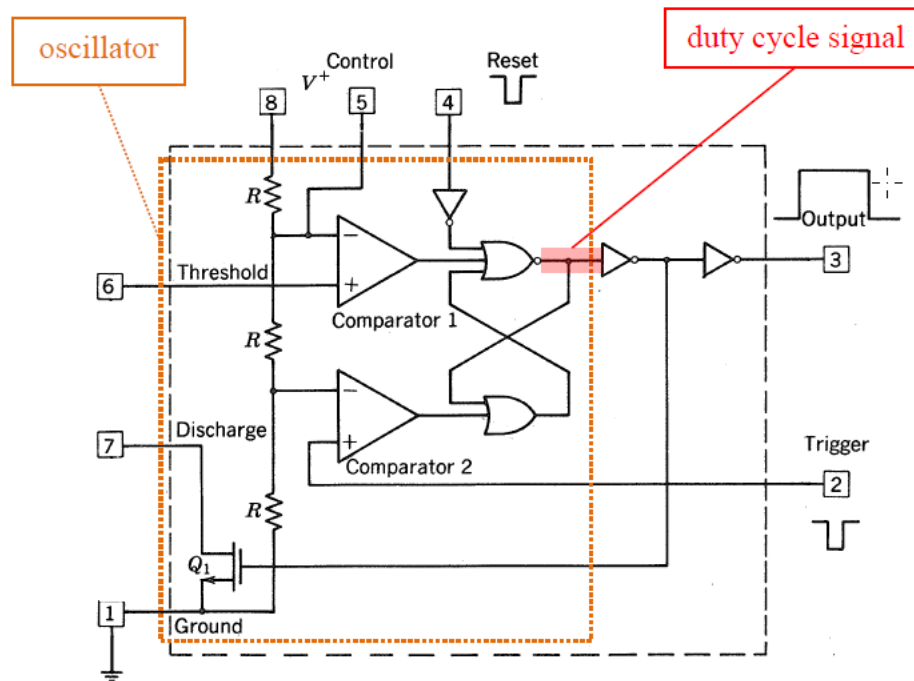
“said control signal being provided when . . . said duty cycle signal is in said high state”

Patent Owner also challenges Petitioner’s identification of the above claim element involving the control signal duty cycle in its analysis of Barbehenn and Grebene. PO Resp. 30–34. Petitioner’s obviousness analysis for this element states:

[T]he recited “high state” of the duty cycle signal corresponds to the high portion of the square wave (i.e., the control signal) provided to the FET when the 555 timer is oscillating. . . . Thus, the high portion of the square wave driving the FET (i.e., the control signal) is provided when (i) no feedback signal is provided to Barbehenn’s feedback input by photo-transistor PTR, and (ii) the duty cycle signal is in a high state.

Pet. 24 (citations omitted). In Petitioner’s analysis, the “control signal” results from twice inverting the “duty cycle signal” provided by the oscillator in Barbehenn. *Id.* at 18. This is illustrated in the following Figure

11.48(a) of Grebene (annotated by Petitioner) showing the internal circuit of the 555 timer:



Pet. 18. In the internal circuitry of the 555 timer, shown above, a duty cycle signal (annotated in red) is provided at an output of the oscillator. The duty cycle signal passes through two inverters to provide a square wave control signal at Pin 3. *Id.* (citing Ex. 1005, 37)

Patent Owner responds: “Petitioner’s reliance on a twice-inverted duty cycle signal as the control signal results in the purported control signal *always* having the identical state, and thus precludes any dependence on the alleged feedback input.” PO Resp. 33. Patent Owner’s argument continues: “Because claim 1 requires that the control signal is provided ‘when said duty cycle signal is in said high state,’ Petitioner’s contention that the claimed control signal is the same signal as the claimed duty cycle signal would render the claim limitation ‘when said duty cycle signal is in said high state’ superfluous.” *Id.* at 34.

We are persuaded by Petitioner’s analysis that this limitation is met by the operation of the 555 timer and associated circuitry shown in Barbehenn and Grebene. Pet. 17–19. The claim itself requires only that the control signal be “provided when no feedback signal is provided at said feedback input and said duty cycle signal is in said high state.” Patent Owner does not persuade us that because two signals have the same state, they are the same signal, or that this would “render the claim limitation superfluous.” PO Resp. 34. As we stated in our Institution Decision (at p. 17), we find that the mere fact that two signals have the same state does not make them the same signal. Furthermore, crediting the testimony of Dr. Madisetti, we find (and Patent Owner does not dispute) that the duty cycle signal in Barenhenn-Grabene is responsive to the condition where the feedback signal is present or absent: “Thus, the control signal is provided to turn on the FET when (i) no feedback signal is received from the optocoupler at Barbehenn’s feedback input, and (ii) the duty cycle signal is in a high state.” Madisetti Decl. ¶ 56.

As a further demonstration that neither signal in Barbehenn identified by Petitioner is “superfluous,” the duty cycle signal is inverted to provide a signal to trigger transistor Q1 before again being inverted again to produce the control signal at pin 3. See Grebene Fig. 11.48(a), reproduced *supra*; and Pet. 18.

We disagree also with Patent Owner’s related argument that two signals that “always must share the same state” are “indistinguishable.” PO Resp. 34. Patent Owner presents no persuasive authority for this assertion. The fact that, in the ’623 patent, the duty cycle signal may, in some instances, be “high” when the control signal is “low” (see annotated Fig. 12 at PO Resp. 32) does not convince us that this is a requirement for all

signals. Moreover, Petitioner cites an alternative embodiment in the '623 patent illustrated in Figure 14, where the control signal and duty cycle signals have the same state over time. Pet. Reply 13–14.

Patent Owner has not disputed Petitioner's analysis of the other claim elements. We have considered and adopt Petitioner's analysis for those elements. Pet. 12–19. Having considered Petitioner's arguments and evidence regarding claim 1 in relation to Barbehenn and Grebene and Patent Owner's responses, for the reasons given we determine that Petitioner has demonstrated that the Barbehenn-Grebene combination meets all limitations of claim 1.

In view of these findings, we do not address Petitioner's obviousness challenge based on Barbehenn alone.

b. Claims 2 and 5

Claim 2 depends from claim 1 and adds the limitation that “said switch comprises a transistor.” Petitioner identifies the “switching device FET” in Barbehenn as meeting this limitation. Pet. 26. Patent Owner does not challenge this assertion. We find that this limitation in claim 2 is met by Barbehenn for the reasons given by Petitioner.

Claim 5 also depends from claim 1 and adds the limitation that the regulator circuit “comprises a monolithic device.” Petitioner asserts the 555 timer integrated circuit in Barbehenn meets this limitation. Pet. 26–27. Petitioner states: “As widely recognized in the art, an ‘integrated circuit’ is by definition a monolithic device.” *Id.* at 27. Petitioner also relies on Grebene's disclosure of “multiple semiconductor components” incorporated in the 555 timer. *Id.* at 27–28. Patent Owner responds: “Petitioner's argument is based on its incorrect interpretation” of claim 5. PO Resp. 43. Patent Owner continues: “Nowhere does Barbehenn and Grebene describe

the FET of the regulator circuit and the 555 timer as forming or constituting a monolithic device.” *Id.* We agree with Patent Owner. Previously, we construed claim 5 as requiring the “monolithic device” to include all the components recited in claim 1, namely, the feedback input, switch, and oscillator. *See supra.* The regulator circuits in Barbehenn and Grebene are made up of two or more discrete components, e.g., the 555 timer and the FET switch. We find that Petitioner has failed to prove that Barbehenn or Grebene meets this limitation of claim 5.

2. Claims 1, 2, and 5 (Barbehenn alone)

According to Petitioner, this challenge to claims 1, 2, and 5 based on Barbehenn alone relies on an “additional embodiment” disclosed in Barbehenn. Pet. 39–40. In this embodiment, Barbehenn suggests using a logic gate in place of the oscillator’s inhibit control line to control oscillation in the converter. *Id.* at 40 (citing Ex. 1004, 5:33–37). There is no further description of this embodiment in Barbehenn. Petitioner’s expert, Dr. Madisetti, provides the following version of Barbehenn’s Figure 1, which he has altered and annotated to reflect his understanding of this additional embodiment:



Pet. 41 (citing Madisetti Decl. ¶ 87). Figure 1 of Barbehenn (annotated and modified by Dr. Madisetti) is a circuit diagram of an AC-DC converter. Ex. 1004, 2:38–39. As explained by Dr. Madisetti, the modifications he made include the following:

[T]he output of the optocoupler is coupled to an input of a logic gate instead of the inhibit control line (i.e., reset pin 4) of the 555 timer. . . . And instead of coupling Pin 3 of the oscillator directly to the FET, Pin 3 is coupled to another input of the logic gate.

Madisetti Decl. ¶ 87 (citations omitted). He further explains: “Importantly, a [person of ordinary skill] would understand that the ‘logic gate’ inserted in Barbehenn’s additional embodiment would be an AND gate (or its functional equivalent). Indeed, this is necessary to maintain the control over the ‘duration of the positive portion of the FET drive waveform’ (i.e., the on-time of the FET during each cycle).” *Id.* ¶ 88. In a footnote Dr.

Madisetti provides even further details on his modifications: “In my opinion, a [person of ordinary skill] would also understand that reset Pin 4 would be tied high to allow the industry-standard 555 timer to function as a “continuously running oscillator.” *Id.* ¶ 87 n.8.

Patent Owner responds that Petitioner has failed to provide “an articulated reasoning with some rational underpinning to justify the legal conclusion of obviousness.” PO Resp. 37 (citing *KSR*, 550 U.S. at 418). We agree with Patent Owner that Petitioner has not provided sufficient evidence of a motivation to make these proposed modifications to Barbehenn. Petitioner’s argument amounts to a showing that Barbehenn could have been modified to use an AND gate. The law does not give weight to this type of modification as evidence of obviousness. Showing that a reference “could” have been modified does not demonstrate a motivation or rationale for making the modification or combination. *See Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1073 (Fed. Cir. 2015) (“[O]bviousness concerns whether a skilled artisan not only *could have made* but *would have been motivated to make* the combinations or modifications of prior art to arrive at the claimed invention.”); *Fresenius USA, Inc. v. Baxter Int’l, Inc.*, 582 F.3d 1288, 1299, 1301 (Fed. Cir. 2009).

We find this testimony from Dr. Madisetti concerning his modifications to the “additional” embodiment in Barbehenn to be speculative. We, therefore, do not find that Petitioner has demonstrated by a preponderance of the evidence that these claims would have been obvious over Barbehenn alone.

3. *Claims 5–7 (Barbehenn, Grebene, and Balakrishnan ’369; Barbehenn and Balakrishnan ’369)*

Petitioner challenges claims 5–7 as obvious over (1) Barbehenn, Grebene, and Balakrishnan ’369; and (2) Barbehenn and Balakrishnan ’369. Pet. 29–39; 48–49. We focus our discussion first on Barbehenn, Grebene, and Balakrishnan ’369.

As discussed above, we agree with Petitioner and find that a person of ordinary skill would have looked to the Grebene textbook for further information concerning the industry standard 555 timer described in Barbehenn, including the internal block diagrams and circuit schematics. *Id.* at 13. We are not persuaded, however, by Petitioner’s argument that it would have been obvious to further combine those references with the teachings of Balakrishnan ’369, and specifically, that a person of ordinary skill “would have been motivated to substitute the bang-bang controller taught by Barbehenn in place of the pulse-width modulator 104 utilized in the [Balakrishnan] ’369 Patent.” Pet. 31.

Patent Owner provides several persuasive reasons why a person of ordinary skill would not have substituted Barbehenn’s optocoupler and 555 timer for Balakrishnan ’369’s PWM (pulse width modulator):

1. Petitioner relies on the Balakrishnan ’369 patent itself to provide the motivation.

2. Petitioner ignores the disadvantages of “bang-bang” type controllers as compared to PWM control.

3. There are “significant design and functional differences” between the two designs that “teach against” the combination.

4. Balakrishnan ’369 is implemented as a monolithic integrated circuit (IC) while Barbehenn uses discrete components.

Petitioner responds that “[t]he combination is motivated by numerous advantages (described in Barbehenn) of replacing PWM control circuitry with Barbehenn’s bang-bang control.” Pet. Reply 23 (citing Pet. 30–31; Ex. 1046 ¶¶ 10–13). For the reasons that follow, we do not find Petitioner’s argument convincing.

Claims 5–7 all depend directly or indirectly from claim 1. All recite specific additional features. Claim 5 adds to claim 1 the limitation that the regulator circuit comprises a monolithic device. As discussed, we construed claim 5 as requiring the “monolithic device” to include all the components recited in claim 1, namely, the feedback input, switch, and oscillator. Claim 6, which depends from claim 5, requires the additional components of “a bypass output, a capacitor coupled to the bypass output and a current source coupled between said first terminal of said switch and said bypass output.” Claim 7 requires the current source of claim 6 to provide current to charge the capacitor of claim 1 “when said switch does not couple said first terminal to the second terminal.”

Petitioner relies on teachings of Balakrishnan ’369 to meet each of these limitations. See Pet. 35–39. But Petitioner’s argument fails to provide a persuasive explanation of why a person of ordinary skill would have looked to Balakrishnan ’369 for these specific features. Instead, Petitioner’s argument is based on the generalized motivation to substitute Barbehenn’s control circuitry for Balakrishnan’s PWM control circuitry. *Id.* at 29–34.

Petitioner then picks and chooses certain features from the combination while ignoring others. For example, Petitioner argues that Balakrishnan ’369 meets claim 5’s recitation of a “monolithic device” because it discloses a switching power supply that includes “a switch mode

power supply chip that includes an integrated high voltage power MOSFET.” Pet. 35 (citing Ex. 1007, 2:19–32) (emphasis omitted). But Barbehenn’s power supply controller uses discrete components. See discussion *infra*. Petitioner’s obviousness combination would, therefore, replace Balakrishnan ’369’s integrated circuit PWM controller with Barbehenn’s discrete components. Petitioner does not provide any persuasive explanation why a person of ordinary skill would have looked at this scenario as teaching use of a monolithic circuit. In fact, the substitution proposed by Petitioner points in the direction of using discrete components in place of a monolithic device. By focusing on a single feature in Barbehenn, the controller, while ignoring the rest of the patent, Petitioner is violating the prohibition against picking and choosing from a reference only the favorable parts and ignoring the rest. *In re Hedges*, 783 F.2d 1038, 1041 (Fed. Cir. 1986) (“It is impermissible within the framework of section 103 to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art.” (citation and inner quotes omitted)).

We find that it is more likely that a person of ordinary skill, aware of Barbehenn’s teachings of the disadvantages of PWM, would have avoided looking to Balakrishnan 369’s disclosure for any of these features in claims 5–7. Further, Petitioner confirms that Balakrishnan ’369 “does not show the feedback mechanism used by the PWM to regulate the output.” Pet. 30. The operation of the feedback circuit in the ’623 patent is a critical issue in this case. See *supra*. We find that this is further reason a person of ordinary skill would not have looked to Balakrishnan ’369. Thus, we find that only through hindsight would a person of ordinary skill have looked to the

combination of Balakrishnan '369 and Barbehenn for the features of claims 5–7.

We find also that Petitioner's argument for combining the references based on the teachings of the '623 patent itself is unavailing. *See* Pet. 30; PO Resp. 20. "Obviousness may not be established using hindsight or in view of the teachings or suggestions of the inventor." *Para-Ordnance Mfg. v. SGS Importers Int'l*, 73 F.3d 1085, 1087 (Fed. Cir. 1995) (citing *W.L. Gore & Assocs., Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1551, 1553 (Fed. Cir. 1983)).

For the reasons given, we find that Petitioner has not provided a sufficient motivation for making the modifications to the references Barbehenn, Grebene, and Balakrishnan '369 required in Petitioner's obviousness analysis directed to these claims.

As noted above, Petitioner also challenges claims 5–7 as obvious over Barbehenn and Balakrishnan '369, without the addition of Grebene. Pet. 48. For the motivation to combine those two references, Petitioner relies on the same arguments presented for combining Barbehenn, Grebene, and Balakrishnan '369 discussed *supra*. *See id.* For the reasons given above, we find that Petitioner has not established a sufficient motivation to combine Barbehenn and Balakrishnan '369.

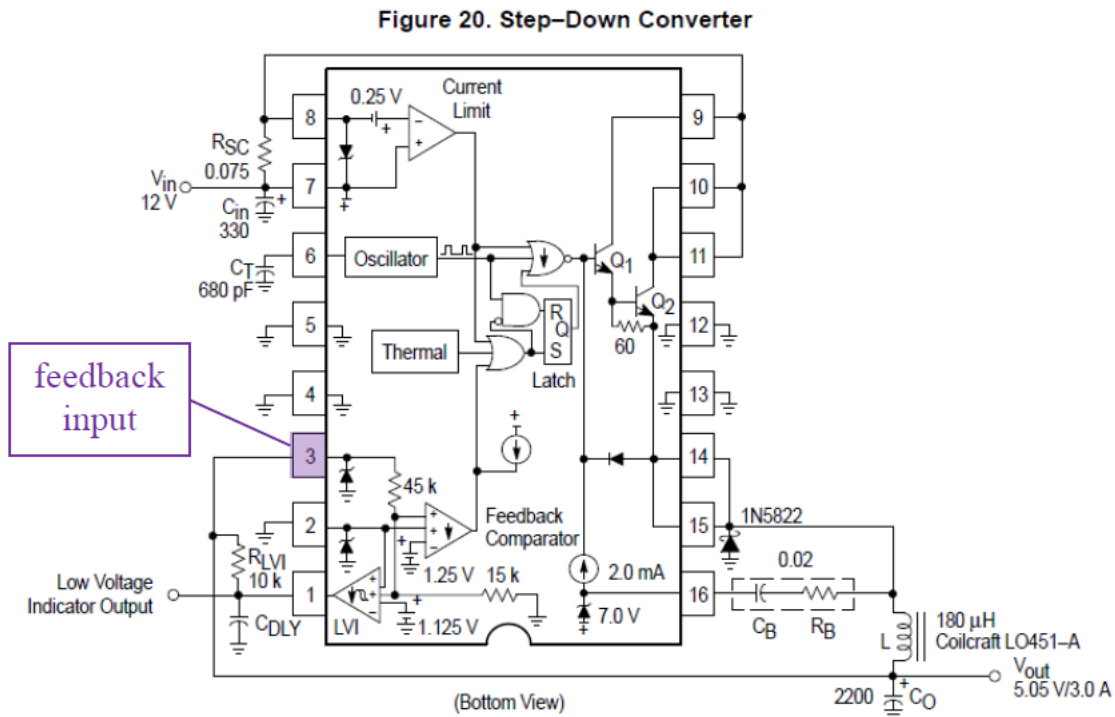
F. Challenges Based on Motorola

1. Claims 1–5 (Motorola)

Petitioner challenges claims 1–5 as anticipated by and obvious over Motorola. Pet. 49–73. We first focus our discussion on anticipation of claim 1. Petitioner's element-by-element of claim 1 anticipation analysis in relation to Motorola appears at pages 49–58 of the Petition.

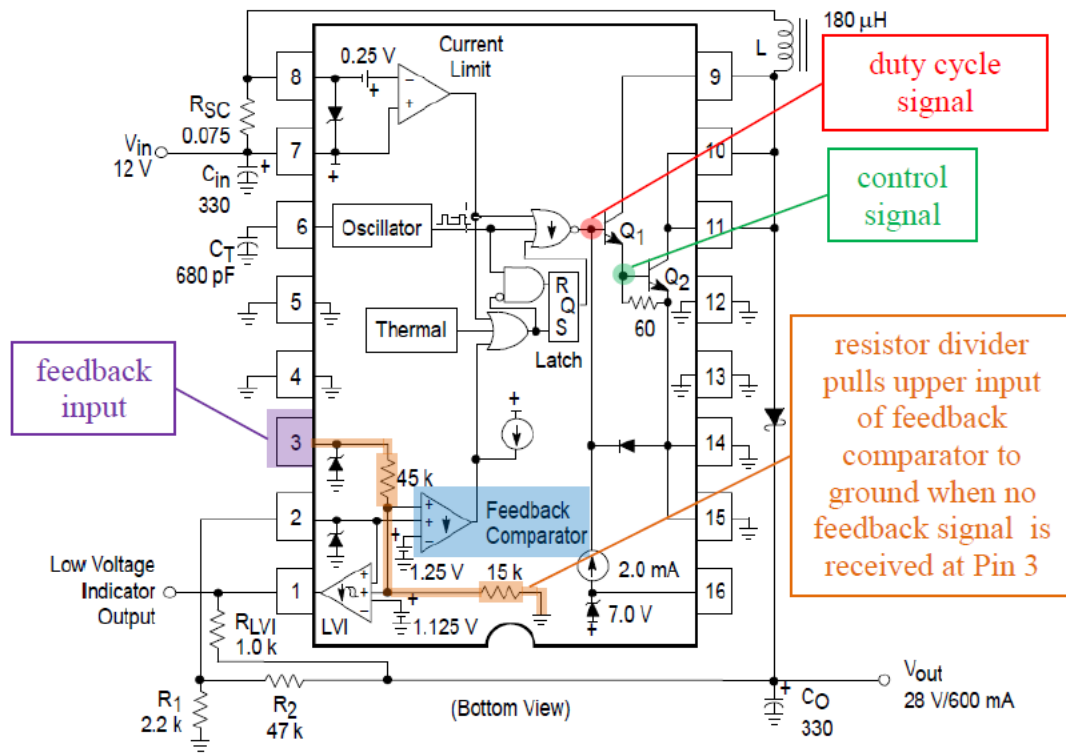
Motorola is a data sheet describing a series (designated MC34163) of monolithic power switching regulators for DC-DC conversion having similar structures. Madisetti Decl. ¶ 102. The figures show various applications. *See, e.g.,* Ex. 1008, Figs. 20 (Step-Down Converter), 22 (Step-Up Converter), 24 (Voltage-Inverting Converter).

Petitioner relies mainly on Figures 20 and 22 of Motorola, which appear below as annotated by Petitioner:



Pet. 50. Figure 20 (annotated by Petitioner) illustrates Pin 3 of the MCM34163 regulator receiving feedback directly from the output voltage (V_{out}) in a step-down converter configuration.

Figure 22. Step-Up Converter



Pet. 56. Figure 22 of Motorola (annotated by Petitioner) discloses a step-up power converter configuration where the power converter provides no feedback signal to Pin 3.

Petitioner contends that each element of claim 1 is met by Motorola. Pet. 49. For example, Petitioner contends Figure 20, *supra*, shows “[a] regulator circuit comprising a feedback input.” *Id.* Petitioner identifies Pin 3 as the claimed feedback input. *Id.* Petitioner contends the claim limitation “when no feedback signal is provided at said feedback input and said duty cycle signal is in said high state” is met in Figure 22. *Id.* at 56. According to Petitioner, “[a person of ordinary skill] would thus recognize that Motorola discloses a condition whereby a control signal is provided to turn on switch Q2 when (i) no feedback signal is received at Pin 3 (i.e., the

feedback input), and (ii) the duty cycle signal is in a high state.” *Id.* at 57–58 (citing Madisetti Decl. ¶ 109 n.10).

Patent Owner responds that Motorola “fails to disclose or suggest ‘said control signal being provided when no feedback signal is provided at said feedback input’ as recited in claim 1.” PO Resp. 44. Referring to Figure 22, Patent Owner argues “Petitioner relies on a configuration . . . where Pin 3 is *unconnected* and thus cannot receive any signal, much less a feedback signal.” *Id.* at 46 (emphasis original). Patent Owner explains: “If Pin 3 is not connected so that it could receive a feedback signal, it cannot reasonably be considered as a feedback input.” *Id.* Patent Owner’s Sur-reply makes the further point that “[w]hile Motorola shows different power supply configurations, nothing in Motorola’s circuit responds to the absence of a feedback signal. There is always an analog feedback signal provided to either Pin 2 or Pin 3.” PO Sur-reply 5.

We find merit in Patent Owner’s argument that this limitation is not met. Motorola’s regulator chip has two separate voltage feedback inputs, one at Pin 2 and the other at Pin 3. See Ex. 1008, 1 (Representative Block Diagram). Petitioner relies on two different configurations of the Motorola MC34163 regulator to meet the claim limitation. In one (Fig. 20), a feedback signal is supplied to Pin 3 but not Pin 2. Pet. 50. In the other (Fig. 22), no feedback signal is applied to Pin 3 but a signal is applied to Pin 2. *Id.* at 56. These two separate configurations represent two different applications of the Motorola regulator: one is described as a “Step-Down Converter,” the other as a “Step-Up Converter.”

Patent Owner contends Petitioner “is improperly mixing different embodiments in Motorola for its anticipation challenge.” PO Resp. 45. We are not convinced by Petitioner’s response that “the same MC34163 chip

(i.e., the same regulator circuit) is used in each figure.” Pet. Reply 24.

While it is true that the configurations shown in Figures 20 and 22 use the same regulator chip, the external circuits are different, reflecting two different applications. As discussed *supra*, Figure 20 depicts a step-up converter; Figure 22 depicts a step-down converter.

We agree with Patent Owner that Petitioner’s anticipation challenge to claim 1 based on Motorola fails. A prior art reference anticipates a claim only if it discloses all the elements “in the same form and order as in the claim.” *Abbott Labs. v. Sandoz, Inc.*, 544 F.3d 1341, 1345 (Fed. Cir. 2008); *NetMoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1371 (Fed. Cir. 2008) (“[I]t was error for the district court to find anticipation by combining different parts of the separate protocols in the iKP reference simply because they were found within the four corners of the document.”). Petitioner violates this principle by relying on two separate circuits in Motorola. We find that Petitioner has failed to prove by a preponderance of the evidence that Motorola anticipates claim 1.

Claims 2–5 depend from claim 1, and therefore incorporate all limitations of claim 1. Petitioner’s anticipation analysis of claims 2–5 relies on its analysis of claim 1 for those limitations that are common. Pet. 59–64. For the reasons given for claim 1, we find that Petitioner has failed to prove by a preponderance of the evidence anticipation of claims 2–5 by Motorola.

Petitioner further asserts claims 1–5 would have been obvious over Motorola “combined with the knowledge of a [person of ordinary skill].” Pet. 64. In this ground Petitioner provides an “alternative mapping” for the oscillator and duty cycle signal. *Id.* at 64–67. However, to meet the requirement of the claims for “said control signal being provided when no feedback signal is provided at said feedback input,” Petitioner relies on the

same analysis as it provided for the anticipation challenge based on Motorola. *Id.* at 70 (“[A]s described above . . . , Motorola expressly discloses the other limitations (e.g., the ‘no feedback signal’ limitation)” of claim 1.) We find that this analysis is not convincing because, as we addressed *supra*, this element is not met by Motorola. Nor does Petitioner provides any additional evidence demonstrating that this limitation that we find is not disclosed by Motorola would have been obvious to a person of ordinary skill. Petitioner’s expert provides no persuasive support, as his testimony, like the Petition, relies on the assertion that the “no feedback signal” limitation is “expressly disclos[ed]” by Motorola. Madisetti Decl. ¶ 126. For the reasons given, we find that it is not.

2. *Claims 3 and 4 (Barbehenn, Grebene, and Motorola; Barbehenn and Motorola)*

Claims 3 and 4 depend from claim 1. These dependent claims recite the additional limitation of an “overcurrent block regulator.” Petitioner contends that they would have been obvious in light of (1) Barbehenn, Grebene, and Motorola; and (2) Barbehenn and Motorola. Pet. 73–78. We address the motivation to combine Barbehenn and Grebene, *supra*. We agree with Petitioner that a person of ordinary skill would have looked to the Grebene textbook for further information concerning the industry standard 555 timer in Barbehenn, including the internal block diagrams and circuit schematics. *Id.* at 13.

We are not persuaded, however, by Petitioner’s argument that it would have been obvious to further combine those references with Motorola, specifically, that a person of ordinary skill “would have been motivated to incorporate the teachings of Motorola (i.e., current limiting) into Barbehenn to provide Barbehenn with the same improvement.” *Id.* at 74. Petitioner

contends: “Based on the benefits described in Motorola (i.e., protection of the power switch), a [person of ordinary skill] would have been motivated to incorporate the teachings of Motorola (i.e., current limiting) into Barbehenn to provide Barbehenn with the same improvement.” Pet. 74. We find that this is an insufficient motivation to combine the references. As discussed *supra*, Barbehenn’s converter uses discrete components while Motorola discloses a monolithic integrated circuit. We do not find Petitioner’s argument convincing that a person of ordinary skill would have redesigned Barbehenn’s controller with discrete components to incorporate the current limit circuit switch and latch from Motorola’s monolithic integrated circuit.

G. Objective Indicia

Patent Owner contends there is “extensive objective indicia of non-obviousness of the ’623 patent.” PO Resp. 52. Patent Owner contends its TINYSwitch products embody the invention of the ’623 patent. *Id.* at 53. Patent Owner argues “before the invention claimed in the ’623 patent and embodied in TINYSwitch existed, there was a long-felt need for an effective solution to energy waste in power converters and, in particular, in low-power power converters.” *Id.* at 54–55. Patent Owner cites a number of articles in technical publications allegedly supporting this assertion. *Id.* at 55–57. Patent Owner also alleges industry praise: “TINYSwitch was recognized for its novel design and praised by others knowledgeable about the technology in the power supply industry.” *Id.* at 57–61. Patent Owner alleges that TINYSwitch was “received with skepticism and achieved unexpected results.” *Id.* at 61–62. Finally, Patent Owner alleges TINYSwitch was a commercial success. *Id.* at 62–66. We consider these assertions, one-by-one.

1. *TINYSwitch Embodies the '623 Patent*

We are persuaded by Patent Owner's analysis at pages 53–54 of its Response and the supporting testimony by Balakrishnan that at least claim 1 of the '623 patent is embodied in the TINYSwitch product. As Petitioner points out, however, Patent Owner's analysis is directed only to the original product, TINYSwitch-I. *See infra*.

2. *Long-felt Need*

We agree with Petitioner that the articles relied on by Patent Owner, at best, establish a generic need for reducing waste in power converters but are not specific enough to the invention of the '623 patent. Pet. Reply 15–16. As the Federal Circuit held in *Perfect Web Technologies, Inc. v. InfoUSA, Inc.*, 587 F.3d 1324, 1332–33 (Fed. Cir. 2009):

Perfect Web provided no evidence to explain how long this need was felt, or when the problem first arose. . . . Nor does the evidence show that the '400 patent met any such “need.” [Perfect Web's expert] made the bare assertion that the patent provided “improved efficiency,” . . . but cited no supporting data to show, for example, that the invention actually reduced marketing costs, time, or the number of consumers who opt out. “Moreover, as we have often held, evidence of secondary considerations does not always overcome a strong prima facie showing of obviousness.” *Asyst Techs., Inc. v. Emtrak, Inc.*, 544 F.3d 1310, 1316 (Fed. Cir. 2008) (affirming judgment as a matter of law of obviousness).

Patent Owner has failed to provide the type of evidence required by *Perfect Web* and other authorities. For example, we agree with Petitioner that Patent Owner has failed to identify or provide evidence of a specific long-felt need in the industry, or show that the claimed invention satisfied that need when others had failed. Pet. Reply 15–16.

We also credit Petitioner's analysis of the articles cited by Patent Owner, demonstrating that much of the content was provided by Patent

Owner itself. Pet. Reply 15–16 (citing Exs. 2016, 2017). For example, on cross-examination, Balakrishnan admitted that Patent Owner was the source of many of the quotes from the articles cited in his declaration as evidence of long-felt need. Balakrishnan Dep. 180:16–201:18.

In sum, for these reasons we give this factor minimal weight as objective evidence of non-obviousness.

3. Industry Praise

We agree with Petitioner that the alleged evidence of industry praise offered by Patent Owner (Exs. 2016–2017) amounts to self-praise. Pet. Reply 17. Patent Owner submits a compendium of articles titled “TinySwitch Press Coverage 1998-1999.” Ex. 2016. Three of the articles were authored by Patent Owner’s director of marketing, Shyam Dujari. *Id.* at 13–18, 25–29, 35–38. Others directly quote Patent Owner’s employees about the TINYswitch product or attribute claims to Patent Owner itself. *Id.* at 6–7, 30–32, 43–44, 62, 68, 78, 79–80, 81, 83, 85–88. Still others rely heavily on text provided by Patent Owner. *See* Pet. Reply 17–18 (comparing Ex. 1037, 42, 57 to Ex. 1016, 25–29, 42).⁶ At his deposition, Balakrishnan confirmed that Patent Owner was the source for much of the information appearing in these exhibits quoted in his declaration. Pet. Reply 18 (citing Balakrishnan Dep. 161:9–167:20).

We give this factor minimal weight as objective evidence of non-obviousness. We are not convinced by Patent Owner’s Sur-reply argument

⁶ We find persuasive Petitioner’s Exhibit 1037, an “abridged, annotated version” of Exhibit 2016, highlighting, in yellow, articles written by Shyam Dujari; in green, quotes from Patent Owner or its employees; in pink, from TINYSwitch data sheets; in blue, from TINYSwitch press releases; and in orange, text that appears in multiple articles.

that “[a]ny articles or portions thereof” that were written by Patent Owner “were still independently reviewed” by the editors of the publication. PO Sur-reply 3-4. Patent Owner provides no proof of this. Nor are we convinced that “[t]hese technical and business journals would not publish inaccurate or false information.” *Id.* at 4. Nothing in the record supports this assertion.

4. Skepticism and Unexpected Results

Patent Owner contends the TINYSwitch product was met with “quite a bit of skepticism.” PO Resp. 61 (citing Balakrishnan Decl. ¶ 59). As Petitioner points out, Balakrishnan does not identify any skeptical customers or provide any further evidence or other information to support this statement. Pet. Reply 19. Nor does he identify any differences in result that were unexpected. *Id.* at 20. Given Balakrishnan’s position as President and CEO of Patent Owner and co-inventor of the ’623 patent, and the lack of supporting detail, we give his testimony on this issue little weight.

We therefore give this factor minimal weight as evidence of non-obviousness.

5. Commercial Success

As evidence of commercial success, Patent Owner points to: (1) the integration of TINYSwitch into products of Nokia and Iomega “within months” of the formal product announcement; (2) predictions by analysts that cellphone makers and other appliance companies “were likely to use TINYSwitch”; and (3) predictions that Patent Owner’s stock “would double over the next six months and annual sales would increase to \$80 million after TINYSwitch’s release.” PO Resp. 62–63. In support of these assertions, Patent Owner relies on brief, conclusory testimony from Balakrishnan (Balakrishnan Decl. ¶ 62), and on Exhibit 2016, the collection

of articles discussed *supra*. *Id.* For reasons discussed *supra*, we give limited weight to these articles, many of which were written by Patent Owner’s employees or based on information obtained from Patent Owner, and to Balakrishnan’s testimony, due to his position as a co-inventor and CEO of Patent Owner.

Patent Owner relies also on sales figures from its 2005 Annual Report and testimony from Balakrishnan regarding sales. PO Resp. 63 (citing Ex. 2020; Balakrishnan Decl. ¶ 63). According to Patent Owner, the report shows that “by 2003, TINYSwitch family products accounted for 51% of the company’s revenue from product sales.” *Id.* Balakrishnan testifies that since 1998, Patent Owner has sold over 4.3 billion units of TINYSwitch products. Balakrishnan Decl. ¶ 63.

As Patent Owner points out, a nexus between commercial success and a patent is presumed where, as here, there is proof that the products practice the patent. PO Resp. 64 (citing *J.T. Eaton & Co., Inc. v. Atl. Paste & Glue Co.*, 106 F.3d 1563, 1571 (Fed. Cir. 1997)). Petitioner responds that the nexus established by Patent Owner relates only to the product analyzed by Balakrishnan, i.e., the original TINYSwitch-I. Pet. Reply 20–21.⁷

We agree that the presumption of nexus should apply only to TINYSwitch-I, for the reason stated by Petitioner. In further support of limiting the nexus, Petitioner points out also that the other TINYSwitch products (with the sole exception of TINYSwitch-I) incorporated a feature (“frequency jitter”) that Balakrishnan has testified in district court is

⁷ Balakrishnan analyzed the schematic appearing at page 5 of Exhibit 2016. Balakrishnan Decl. ¶ 42. He testified that this represents the original TINYSwitch-I product. Balakrishnan Dep. 141:4–17.

important to the success of those products. Ex. 1044, 6:4–15. We find that this testimony reinforces our decision that the presumption of nexus should be limited to TINYSwitch-I. Pet. Reply 21–22.

As Petitioner points out, however, Patent Owner has not introduced any sales figures specific to the TINYSwitch-I product. *Id.* at 21. Patent Owner’s Annual Report for 1999 (Ex. 2019), the year after TINYSwitch-I was introduced, does not break out sales figures that separate that product from others being sold by Patent Owner. Balakrishnan Dep. 202:4–17. Similarly, the financial data in Patent Owner’s 10-K report for 2005 (Ex. 2020) includes two TINYSwitch products (I and II). *Id.* at 203:18–204:25. Other than these annual reports, Balakrishnan provides no underlying data to support his testimony on TINYSwitch sales (Balakrishnan Decl. ¶ 62), and, thus, his testimony does not differentiate between TINYSwitch-I sales and sales of other products of his company. Balakrishnan Dep. 205:2–205:8.

Having considered the objective indicia of non-obviousness and accorded them appropriate weight along with all of the *Graham* factors, we conclude that Petitioner has shown by a preponderance of the evidence that the invention of claims 1 and 2 would have been obvious.

IV. SUMMARY

We find that Petitioner has demonstrated by a preponderance of the evidence that claims 1 and 2 of the ’623 patent would have been obvious over Barbehenn and Grebene,

We further find that Petitioner has failed to prove by a preponderance of the evidence that:

1. Claim 5 would have been obvious over Barbehenn and Grebene;
2. Claims 5–7 would have been obvious over Barbehenn, Grebene and Balakrishnan ’369;

3. Claims 1, 2, and 5 would have been obvious over Barbehenn alone;
4. Claims 5–7 would have been obvious over Barbehenn and Balakrishnan '369;
5. Claims 1–5 are anticipated by Motorola;
6. Claims 1–5 would have been obvious over Motorola alone;
7. Claims 3 and 4 would have been obvious over Barbehenn, Grebene, and Motorola; and
8. Claims 3 and 4 would have been obvious over Barbehenn and Motorola.

V. ORDER

In consideration of the foregoing, it is hereby
ORDERED that claims 1 and 2 of the '623 patent are not patentable;
and

FURTHER ORDERED that, because this is a Final Written Decision, parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

IPR2018-00166
Patent 6,297,623 B1

For PETITIONER:

Roger Fulghum
Brian Oaks
Nick Schuneman
Brett Thompsen
Seth Lindner
Joseph Gray
BAKER BOTTS LLP
roger.fulghum@bakerbott.com
brian.oaks@bakerbotts.com
nick.schuneman@bakerbotts.com
brett.thompsen@bakerbotts.com
seth.lindner@bakerbotts.com
joseph.gray@bakerbotts.com

For PATENT OWNER:

John Phillips
Neil Warren
FISH & RICHARDSON P.C.
phillips@fr.com
warren@fr.com