

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SUNSPEC ALLIANCE,
Petitioner,

v.

TIGO ENERGY, INC.,
Patent Owner.

IPR2021-01287
Patent 10,256,770 B2

Before KRISTINA M. KALAN, WESLEY B. DERRICK, and
JULIA HEANEY, *Administrative Patent Judges*.

KALAN, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining Some Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

SunSpec Alliance (“Petitioner”) filed a Petition requesting *inter partes* review of claims 12–16 of U.S. Patent No. 10,256,770 B2 (Ex. 1001, “the ’770 patent”). Paper 2 (“Pet.”). Tigo Energy, Inc. (“Patent Owner”) waived the filing of a Preliminary Response. Paper 6 (“Waiver”).

We instituted *inter partes* review of claims 12–16 of the ’770 patent on the grounds of unpatentability alleged in the Petition. Paper 7 (“Dec.”). After institution of trial, Patent Owner filed a Patent Owner Response. Paper 14 (“PO Resp.”). Petitioner filed a Reply. Paper 20 (“Reply”). Patent Owner filed a Sur-Reply. Paper 23 (“Sur-Reply”). We held an oral hearing on November 9, 2022, and a transcript of the hearing is included in the record. Paper 26 (“Tr.”).

This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a). For the reasons that follow, we determine that Petitioner has shown by a preponderance of the evidence that claims 12 and 13 of the ’770 patent are unpatentable, but has not shown by a preponderance of the evidence that claims 14–16 of the ’770 patent are unpatentable.

A. *Related Proceedings*

The parties identify a number of terminated federal district court litigations involving the ’770 patent and one IPR filed against the ’770 patent that was terminated before institution, as well as IPR2021-01286, filed against related U.S. Patent No. 8,933,321 B2 (“the ’321 patent”). Pet. 73–74; Paper 3, 2–3.

B. *Real Parties-in-Interest*

Petitioner “identifies the following as the real parties-in-interest: SunSpec Alliance, Fronius USA LLC, MidNite Solar, Inc., SMA

Technology AG, Zerun Co., Ltd., and Zhejiang Jiaming Tianheyuan Photovoltaic Technology Co., Ltd. (d/b/a ‘JMTHY’).” Pet. 73. Patent Owner “identifies Tigo Energy, Inc. as the real party-in-interest.” Paper 3, 2 (Patent Owner’s Mandatory Notices).

C. The ’770 Patent

The ’770 patent, titled “System and Method for Enhanced Watch Dog in Solar Panel Installations,” relates to a “system and method for automated shutdown, disconnect, or power reduction of solar panels” including “one or more master management units (MMUs) and one or more local management units (LMUs).” Ex. 1001, codes (54), (57). The patent relates to “the field of electrical safeguards for photovoltaic systems,” more specifically, “a system and method to monitor one or more sensors for anomalies in the operation of a photovoltaic system” and a “watchdog system to monitor communication signals between a central controller and a local controller.” *Id.* at 1:51–52, 2:40–42; 2:45–47. Figure 21 of the ’770 patent is reproduced below:

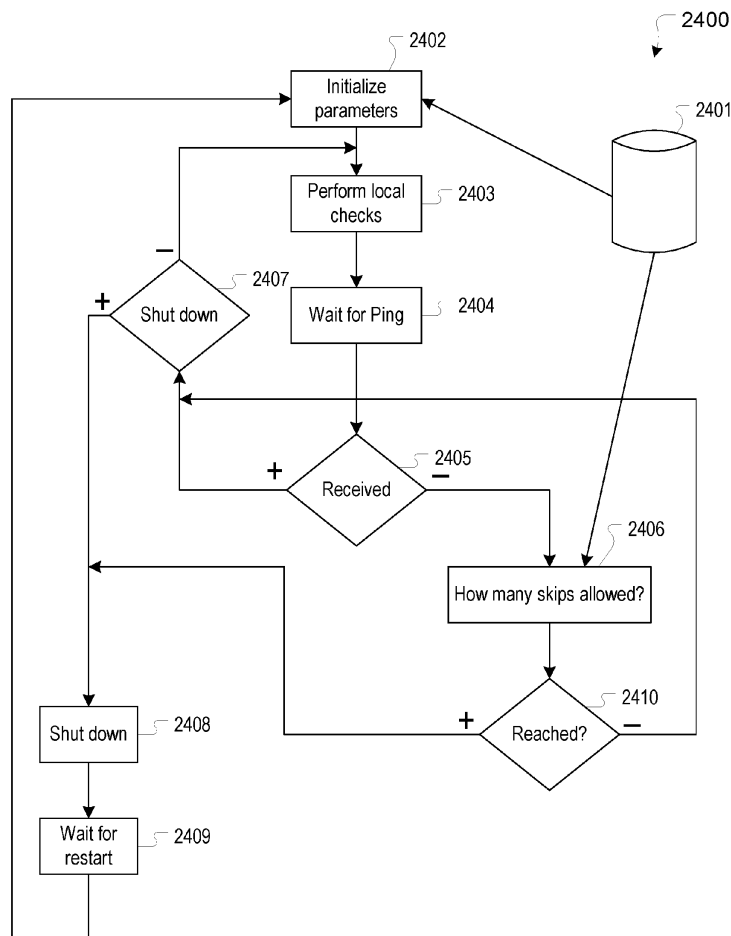


FIGURE 21

Figure 21 “illustrates an embodiment of a method of controlling the output of a solar module” and “an exemplary process 2400 for implementation of the watch dog code 2308.” *Id.* at 3:27–28, 17:49–51. In Figure 21, the software waits for a “ping” (2404) from a main controller, and may allow a certain number of skips (2406), but if there is “no response by the time/count the skip limit is reached,” the software will shut down the system (2408). *Id.* at 17:49–18:18.

D. Illustrative Claim

Claim 12 is the only independent claim challenged, and is reproduced below:

- 12(a). A photovoltaic panel, comprising:
- (b) at least one photovoltaic cell;
- (c) a local unit configured on the photovoltaic panel, the local unit having:
 - (d) a voltage regulator coupled to the at least one photovoltaic cell to receive electric power generated by the at least one photovoltaic cell; and
 - (e) a controller coupled to the voltage regulator;
- (f) wherein the voltage regulator provides a power output of the photovoltaic panel using the electric power generated by the at least one photovoltaic cell;
- (g) wherein the controller communicates with a remote unit, disposed at a location remote from the local unit, to control operations of the voltage regulator;
- (h) wherein the controller detects an anomaly in heartbeat signals from the remote unit; and
- (i) wherein in response to the anomaly, the controller causes the voltage regulator to reduce the power output of the photovoltaic panel.

Ex. 1001, 20:49–67 (bracketing and lettering added).

E. Instituted Grounds of Unpatentability

We instituted *inter partes* review of claims 12–16 of the ’770 patent on the following grounds:

Ground	Reference(s)/Basis ¹	35 U.S.C. § ²	Claims Challenged
1	Adest '055 ³	§ 102(e)	12–15
2	Adest '055, Kronberg ⁴	§ 103(a)	12–15
3	Adest '178, ⁵ Moine ⁶	§ 103(a)	12–16
4	Adest '178, Moine, Kronberg	§ 103(a)	14–16

Petitioner relies on the declaration testimony of Randy R. Dunton in support of its arguments. Ex. 1002. Patent Owner relies on the declaration testimony of Dr. Robert S. Balog Jr. Ex. 2003.⁷

¹ In the Institution Decision, we found that, in the absence of arguments to the contrary, the evidence and comparison of the respective priority dates of Adest '055 and the '770 patent would appear to qualify Adest '055 as prior art (Dec. 11), and a comparison of the respective priority dates of Adest '178 and the '770 patent would appear to qualify Adest '178 as prior art (Dec. 19–20). We invited the parties to develop further at trial their assertions regarding priority dates. The parties do not appear to have made any further assertions regarding priority dates. *See generally* PO Resp.; Reply; Sur-Reply. During the hearing, Patent Owner agreed that it was not challenging the priority date of any of the relied-upon prior art. Tr. 64:12–18. Accordingly, our findings from the Institution Decision stand.

² The Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) (“AIA”), included revisions to 35 U.S.C. §§ 102 and 103 that became effective on March 16, 2013. Because the '770 patent has an effective filing date prior to the effective date of the applicable AIA amendments, we refer to the pre-AIA version of § 102 and § 103.

³ U.S. Patent No. 8,531,055 B2, issued September 10, 2013 (Ex. 1007).

⁴ U.S. Patent No. 5,054,023, issued October 1, 1991 (Ex. 1006).

⁵ U.S. Patent No. 9,088,178 B2, issued July 21, 2015 (Ex. 1008).

⁶ French Patent App. Pub. FR2894401A1, published June 8, 2007 (Ex. 1005).

⁷ The parties each argue that the other party’s expert’s declaration is entitled to little or no weight. PO Resp. 50–53; Reply 29–30. We acknowledge

II. ANALYSIS

A. Legal Standards

“A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference.” *Verdegaal Bros., Inc. v. Union Oil Co. of Cal.*, 814 F.2d 628, 631 (Fed. Cir. 1987). A “prior art reference—in order to anticipate under 35 U.S.C. § 102—must not only disclose all elements of the claim within the four corners of the document, but must also disclose those elements ‘arranged as in the claim.’” *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1369 (Fed. Cir. 2008) (quoting *Connell v. Sears, Roebuck & Co.*, 722 F.2d 1542, 1548 (Fed. Cir. 1983)). Although the elements must be arranged or combined in the same way as in the claim, “the reference need not satisfy an *ipsissimis verbis* test,” i.e., identity of terminology is not required. *In re Gleave*, 560 F.3d 1331, 1334 (Fed. Cir. 2009).

A claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious to a person of ordinary skill in the art at the time the invention was made. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). Obviousness is resolved based on underlying factual determinations, including: (1) the scope and content of the prior art; (2) differences between the prior art and the claims at issue; (3) the level of ordinary skill in the art; and (4) when in evidence, objective

these arguments and, in our analysis, accord the parties’ declarations and testimony the appropriate weight.

evidence of nonobviousness, i.e., secondary considerations.⁸ *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). Subsumed within the *Graham* factors are the requirements that all claim limitations be found in the prior art references and that the skilled artisan would have had a reasonable expectation of success in combining the prior art references to achieve the claimed invention. *Pfizer, Inc. v. Apotex, Inc.*, 480 F.3d 1348, 1361 (Fed. Cir. 2007). A decision on the ground of obviousness must include “articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006). The obviousness analysis “should be made explicit” and it “can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does.” *KSR*, 550 U.S. at 418.

Petitioner bears the burden of proving unpatentability of the challenged claims, and the burden of persuasion never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015). Petitioner must demonstrate unpatentability by a preponderance of the evidence. 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d); *see also Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (2012) (requiring *inter partes* review petitions to identify “with particularity . . . the evidence that supports the grounds for the challenge to each claim”)).

⁸ Neither Patent Owner nor Petitioner appear to present any evidence directed to objective indicia. *See generally* Pet., PO Resp., Reply, Sur-Reply.

B. Level of Ordinary Skill in the Art

In our Institution Decision, we accepted Petitioner’s undisputed contention that a person of ordinary skill in the art “would have had a bachelor’s degree or similar degree in electrical engineering and one year of experience in the design of solar power systems, power control systems, and/or power safety systems” or “could have also obtained similar knowledge and experience through other means.” Dec. 6. Patent Owner does not appear to dispute this definition. *See generally* PO Resp; *see also id.* at 51 (employing Petitioner’s definition of a person of ordinary skill in the art in discussing Mr. Dunton’s testimony). In its Reply, Petitioner argues that “Patent Owner does not challenge but *adopts* Petitioner’s proposed level of skill for a POSITA for the relevant time period.” Reply 1 (citing Ex. 2003 ¶ 28; Ex. 1030, 119:25–120:14).

Neither party argues that the outcome of this case would differ based on our adoption of any particular definition of one of ordinary skill in the art. Accordingly, we adopt Petitioner’s definition, because it is consistent with the cited prior art. We further note that the prior art itself demonstrates the level of skill in the art at the time of the invention. *Cf. Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (explaining that “specific findings on the level of skill in the art . . . [are not required] ‘where the prior art itself reflects an appropriate level and a need for testimony is not shown’” (quoting *Litton Indus. Prods., Inc. v. Solid State Sys. Corp.*, 755 F.2d 158, 163 (Fed. Cir. 1985))).

C. Claim Construction

We apply the claim construction standard articulated in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). 37 C.F.R.

§ 42.100(b). Under *Phillips*, claim terms are afforded “their ordinary and customary meaning.” *Phillips*, 415 F.3d at 1312. The “ordinary and customary meaning of a claim term is the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention.” *Id.* at 1313. Only terms that are in controversy need to be construed, and only to the extent necessary to resolve the controversy. *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999).

Petitioner “believes that no express constructions of the claims are necessary to assess whether the prior art reads on the challenged claims” and “has given the terms of the claims their plain and ordinary meanings.”

Pet. 15. Patent Owner discusses “the plain meaning” of two terms: “heartbeat signals” and “skips.” PO Resp. 6–12. Petitioner replies to Patent Owner’s discussion, and further discusses the term “photovoltaic panel.” Reply 1–7. Patent Owner presents additional arguments regarding the terms “heartbeat signals,” “skips,” and “photovoltaic panel,” which terms we discuss in more detail below. Sur-Reply 1–7.

1. Heartbeat Signals

Patent Owner argues that term “heartbeat signals” “is used in normal parlance and is familiar to lay people in reference to, e.g., the reoccurring pulse of a human’s heart.” PO Resp. 7. The specification of the ’770 patent “describes the ‘heartbeat’ in relation to a ‘ping’ that is expected to arrive at a given rate”: “Depending on the circumstances, a certain number of skips may be allowed, particularly *if the ‘heartbeats’ of the ping are set at a high rate, such as 100 or even 1000 per second.* In such cases, *the software may allow two, five, or even 100 skips . . .*” *Id.* at 8 (quoting Ex. 1001, 18:7–13). Accordingly, Patent Owner argues, the plain meaning of a “heartbeat

signal” is “a reoccurring signal that beats at a certain pulse rate, such that an anomaly indicative of a problem can be detected when beats (or pulses) are skipped.” *Id.* at 8–9 (citing Ex. 2003 ¶¶ 33–40).

Petitioner replies “that ‘heartbeat signals’ is never even mentioned in the ’770 patent outside of the claims. The only mention of any variant of ‘heartbeat’ outside the claims” comes from the portion of the ’770 patent also quoted by Patent Owner and reproduced above. Reply 2 (quoting Ex. 1001, 18:4–13). According to Petitioner, this section of the ’770 patent does not require that the “heartbeat signals” “must be intentional and have pulses,” as argued by Patent Owner. *Id.* at 3. Petitioner relies on the IEEE Authoritative Dictionary’s definition of “heartbeat” as a “signal or a message passed between cooperating processes to indicate continuing proper operations” (quoting Ex. 1041, 7) and “communication” as the “transmission of information from one point to another by means of electromagnetic waves” (quoting Ex. 1041, 4, 6). *Id.* Petitioner also relies on the ’321 patent, which is incorporated into the ’770 patent by reference, and defines communication: “The communication can take *any form* that can be recognized by the watchdog unit 210. For instance, the communication can be *continuous or* pulsed, or *periodic* or nonperiodic.” *Id.* (quoting Ex. 2005, 1:7–37; 4:33–36.) Petitioner argues that the plain meaning of “heartbeat signal” is “a periodic signal or communication that indicates continuing proper operations.” *Id.* at 4.

Patent Owner responds that its own proposed definitions are not inconsistent, and that Petitioner’s nested dictionary definitions read “heartbeat” out of the claim. Sur-Reply 2–5.

We interpret the term “heartbeat signals” as “periodic signals.” The term “heartbeat” appears only once in the in the specification outside of the claims: “the ‘heartbeats’ of the ping are set at a high rate, such as 100 or even 1000 per second.” Ex. 1001, 18:7–13. The disclosure of “the heartbeats” having a “rate” defined in “per second” terms indicates that they are periodic, as is generally recognized for heartbeats, i.e. human heartbeats. The term “heartbeat signals” appears in the challenged claims in conjunction with the detection of an anomaly (claim 12, “wherein the controller detects an anomaly in heartbeat signals from the remote unit”) and in conjunction with “skips” (claim 13, “wherein the anomaly includes skips of heartbeat signals”; claim 14, “when the anomaly includes a predetermined number of skips of the heartbeat signals”; claim 15, “when skips of the heartbeat signals are less than the predetermined number”). Accordingly, the heartbeat signals allow for the detection of an anomaly therein, indicating that they are typically predictable, and for the detection of skips of heartbeat signals, indicating that they are periodic. In view of the specification and the claims, and the parties’ arguments, we find that the plain and ordinary meaning of “heartbeat signals” is “periodic signals.”

2. *Skips*

Patent Owner argues that the term “skips” has “its plain meaning, and refers to beats or pulses of a signal that are missed.” PO Resp. 10 (citing Ex. 2003 ¶¶ 41–43). Patent Owner refers to the ’321 patent’s definition: “Skips refers to the event of missing a communication or pulse.” *Id.* at 11 (quoting Ex. 2005, 9:34–45).

Petitioner also relies on the ’321 patent’s definition: “Skips refers to the event of missing a communication or pulse,” arguing that a “skip

happens whether the missed signal is a pulse or a generic communication,” and a communication “can take any form” including “continuous or pulsed, periodic or non-periodic.” Reply 4–5 (quoting Ex. 2005, 1:7–37, 4:33–36, 9:36–37). In sum, Petitioner argues that “a ‘skip’ occurs any time a communication or pulse is missed, and ‘communication’ includes all types of communications.” *Id.* at 6.

Patent Owner responds that Petitioner’s interpretation “reads ‘skips’ out of the dependent claims” and ignores the “intrinsic evidence so the claim covers any communication of any kind when it is interrupted in any possible way.” Sur-Reply 5–6. Patent Owner maintains that “whether a non-periodic signal is a ‘communication’ and whether that ‘communication’ is detectable by a watchdog unit is immaterial” because the challenged claims do not recite a watchdog, but do recite “detecting ‘an anomaly in heartbeat signals’ (claim 12) ‘wherein the anomaly includes skips of heartbeat signals’ (claim 13), as opposed to generic ‘communications’ or ‘signals.’” *Id.* at 7.

Because patentee has acted as its own lexicographer, and because the ’321 patent specification is incorporated by reference into the ’770 patent specification (Ex. 1001, 1:7–37; Tr. 9:10–22), we adopt the construction: “Skips refers to the event of missing a communication or pulse.” Ex. 2005, 9:36–37. *Cont’l Cirs. LLC v. Intel Corp.*, 915 F.3d 788, 796 (Fed. Cir. 2019) (citing *Phillips*, 415 F.3d at 1316) (“When the patentee acts as its own lexicographer, that definition governs.”).

3. *Photovoltaic Panel*

Patent Owner argues the preamble of claim 12, which recites a “photovoltaic panel,” is limiting because the body of the claim refers to the preamble. PO Resp. 13; Sur-reply 1.

Petitioner does not propose a construction of “photovoltaic panel,” and criticizes Dr. Balog’s testimony concerning the preamble. *See* Reply 6.

We agree with Patent Owner that the preamble of claim 12 is limiting. The body of claim 12 recites “photovoltaic panel” and thus refers back to the preamble, and other challenged claims use the term “photovoltaic panel” in the non-preamble portions of the claims. *See, e.g.*, Ex. 1001, 20:51, 20:58, 20:67, 21:5, 21:10.

Aside from the preamble issue, the parties do not dispute the meaning of “photovoltaic panel.” Accordingly, we need not expressly construe the term “photovoltaic panel” for the purposes of this Decision.

We determine that, for purposes of this Decision, no other claim term requires express construction. *See, e.g., Vivid Techs.*, 200 F.3d at 803.

D. Asserted Anticipation based on Adest ’055 (Ground 1)

Petitioner argues that Adest ’055 anticipates claims 12–15. Pet. 15–32. Patent Owner disagrees. PO Resp. 12–39.

1. Adest ’055 (Ex. 1007)

Adest ’055 is titled “Safety Mechanisms, Wake Up and Shutdown Methods in Distributed Power Installations,” and relates to “wake-up and shutdown algorithms for . . . photovoltaic distributed power systems.” Ex. 1007, code (54), 1:26–27.

Figures 2 and 2A, reproduced below, are block diagrams respectively illustrating a distributed power harvesting circuit and a direct-current (“DC”)-to-DC converter. *Id.* at 4:39–44.

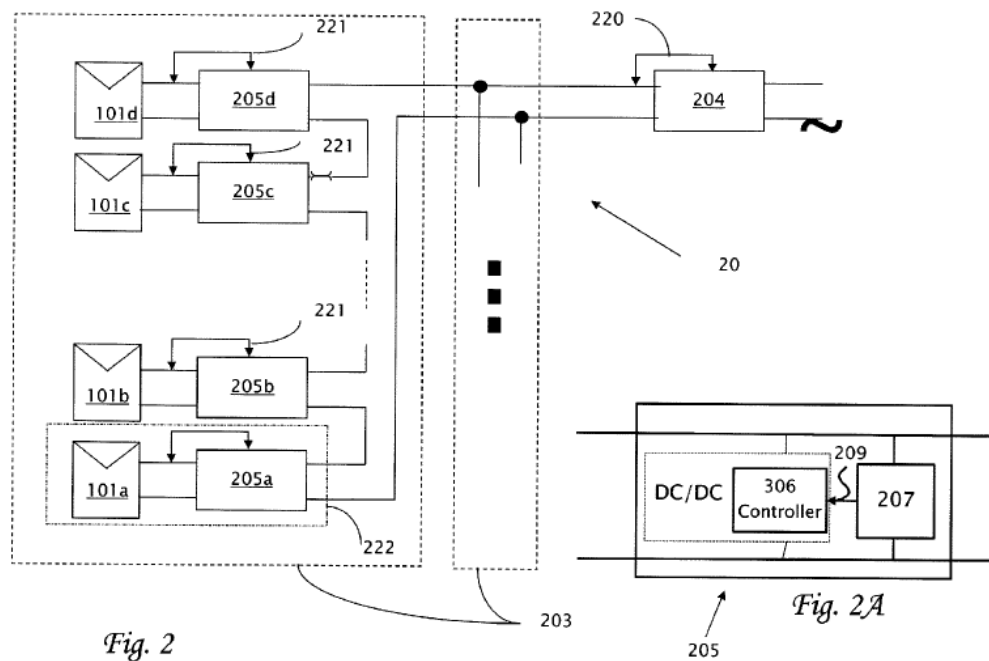


Figure 2 illustrates distributed power harvesting circuit 20 including power converter circuits or modules 205a–205d, and Figure 2A illustrates converter 205 in more detail. *Id.* at 5:39–48, 6:53–55. Circuit 20 enables connection of multiple distributed power sources (*e.g.*, solar panels 101a–101d) to a single power supply. *Id.* at 5:41–43. Series strings 203 of solar panels 101 are coupled to inverter 204. *Id.* at 5:44–45. In configuration 20, each solar panel 101a–101d is connected individually to a separate power converter circuit or a module 205a–205d. *Id.* at 5:46–48. Each solar panel 101 together with its associated power converter circuit 205 forms a power generating element 222. *Id.* at 5:49–50. Each converter 205a–205d adapts optimally to the power characteristics of the connected solar panel 101a–101d and transfers the power efficiently from input to output of converter 205. *Id.* at 5:52–55. Further, information regarding wakeup or shut-down is conveyed from inverter 204 to converters 205. *Id.* at 6:32–34.

In Figure 2A, power converter 205 is integrated with detector/receiver 207, which is configured to receive a signal originated in inverter 204. *Id.* at 6:55–59. Controller 306 either polls signal input 209 from receiver/detector 207 or uses signal input 209 as an interrupt so that only when detector/receiver 207 detects the signal, is module 205 in a normal operating mode converting power from its input to its output. *Id.* at 6:60–64.

2. *Petitioner's Arguments*

Petitioner argues that Adest '055 discloses every element of claim 12, as set forth in more detail below:

- (a) A photovoltaic panel, comprising: (Pet. 15–16 (citing Ex. 1007, 5:39–6:8, 1:25–27; Ex. 1002 ¶¶ 42–44));
- (b) at least one photovoltaic cell; (Pet. 16 (citing Ex. 1007, 7:29–31; Ex. 1002 ¶ 45));
- (c) a local unit configured on the photovoltaic panel, the local unit having: (Pet. 16–19 (citing Ex. 1007, 5:46–48, Figs. 2, 2A, 3; Ex. 1002 ¶¶ 46–50));
- (d) a voltage regulator coupled to the at least one photovoltaic cell to receive electric power generated by the at least one photovoltaic cell; and (Pet. 19–22 (citing Ex. 1007, 7:1–16, 7:29–39, 8:1–3, Fig. 3; Ex. 1002 ¶¶ 51–56));
- (e) a controller coupled to the voltage regulator; (Pet. 22–24 (citing Ex. 1007, 7:18–22, Figs. 3, 10; Ex. 1002 ¶¶ 57–59));
- (f) wherein the voltage regulator provides a power output of the photovoltaic panel using the electric power generated by the at least one photovoltaic cell; (Pet. 24–25 (citing Ex. 1007, 7:31–47; Ex. 1002 ¶ 59));

(g) wherein the controller communicates with a remote unit, disposed at a location remote from the local unit, to control operations of the voltage regulator; (Pet. 25–27 (citing Ex. 1007, 10:40–51, Figs. 2, 2A; Ex. 1002 ¶¶ 60–61));

(h) wherein the controller detects an anomaly in heartbeat signals from the remote unit; and (Pet. 27–28 (citing Ex. 1007, 10:56–62, 6:42–43; Ex. 1002 ¶¶ 62–66));

(i) wherein in response to the anomaly, the controller causes the voltage regulator to reduce the power output of the photovoltaic panel (Pet. 28–30 (citing Ex. 1007, 10:40–11:9, 10:25–30, Fig. 5A; Ex. 1002 ¶¶ 67–70)).

We agree that Petitioner has shown that the undisputed limitations are shown in Adest '055. Below, we discuss in more detail the disputed limitations.

3. *Analysis*

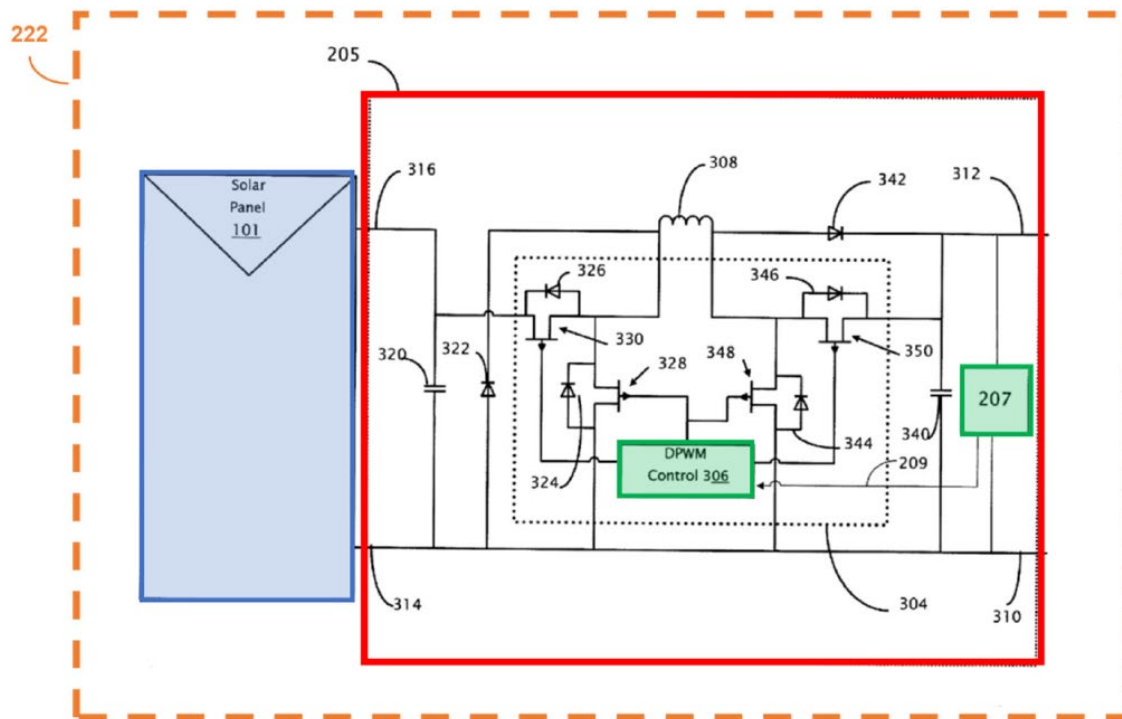
i. *Photovoltaic Panel*

Petitioner argues that limitation 12(a), the preamble, (“A photovoltaic panel, comprising”) is met by “solar panels 101.” Pet. 15–16 (citing Ex. 1007, 5:39–6:8; Ex. 1002 ¶¶ 42–44)). Petitioner also argues that limitation 12(c) (“a local unit configured on the photovoltaic panel, the local unit having”) is met by “power module 205 (also referred to as converter 205)” which “is configured on and local to the solar panel 101.” *Id.* at 16–17 (citing Ex. 1007, 5:46–48, Fig. 3; Ex. 1002 ¶¶ 46–50)). Petitioner further argues that, to the extent that “the preamble limits claim 1[2] to require that each element of claim 1[2] be included in a single ‘photovoltaic panel,’ a POSITA would have understood that power generating element 222 could

be configured as a single photovoltaic panel that includes both solar cells and a power module.” *Id.* at 17 (citing Ex. 1002 ¶¶ 47–48).

Patent Owner argues that “Adest ’055 does not disclose the claimed ‘photovoltaic panel.’” PO Resp. 12. More particularly, Patent Owner argues that Petitioner “concedes that Adest ’055 does not expressly disclose ‘a photovoltaic panel comprising . . . a local unit configured on the photovoltaic panel’” and merely argues that Adest ’055 “could be configured” to meet the requirements of the claims, but that what “‘could be’ done is irrelevant to anticipation.” *Id.* at 13–14. Patent Owner relies on language in Adest ’055 discussing the solar panels and power converter circuits (“each solar panel 101a–101d is connected individually to a separate power converter circuit or a module 205a–205d,” Ex. 1007, 5:46–52) to argue that solar panels 101 and power modules 205 are separate. *Id.* at 15.

Petitioner replies that Adest ’055 does disclose the photovoltaic panel limitations, pointing to the language in the ’770 patent equating “photovoltaic panel” with “solar panel” and Dr. Balog’s testimony equating “solar panel” with “solar module.” Reply 7 (citing Ex. 1001, 4:6–9; Ex. 1030, 145:18–24). Petitioner relies on annotated versions of Figures 10 and 11 of the ’770 patent to argue that both the ’770 patent and Adest ’055 similarly depict a solar panel (photovoltaic panel) with a converter circuit (local unit) configured on the photovoltaic panel. *Id.* at 8. Petitioner provides the following annotated Figure 3, which it asserts Patent Owner’s expert agreed was correct, to argue that Adest ’055 “is clear that the converter circuit 205 / local unit is on the solar panel 101 / photovoltaic panel, together in a single, integrated power generating element 222.”



Id. at 12 (citing Ex. 1030, 245:11–22). Petitioner criticizes Patent Owner’s misinterpretation of Adest ’055 to suggest that “the solar panel must be *separate* from the converter circuit, rather than *separate* from every other power converter circuit while being individually associated with its corresponding solar panel.” *Id.*

Patent Owner responds that limitation 12(c) requires a “local unit configured on the photovoltaic panel,” but “Petitioner can only point to disclosures in Adest-055 indicating that the panel and power converter circuitry are ‘associated’ and form a power generating element,” which is “insufficient” for anticipation. Sur-Reply 7–8.

We are persuaded that Adest ’055 discloses a photovoltaic panel and a “local unit configured on the photovoltaic panel.” Claim 12 requires, in pertinent part, “12(a). A photovoltaic panel, comprising: (b) at least one photovoltaic cell; (c) a local unit configured on the photovoltaic panel”

Thus, the claim requires that the photovoltaic panel include the photovoltaic cell(s), as well as a local unit configured on the photovoltaic panel. As Petitioner argues, to the extent the claim language requires “that each element of claim 1[2] be included in a single ‘photovoltaic panel,’ a POSITA would have understood that power generating element 222 could be configured as a single photovoltaic panel that includes both solar cells and a power module.” Pet. 17 (citing Ex. 1002 ¶¶ 47–48 (a person of ordinary skill in the art “would have understood that the disclosure of power generating element 222 is a disclosure of a single photovoltaic panel that includes both solar cells and a power module”)). Petitioner points to Figures 2 and 3 of Adest ’055, which label solar panels 101 and power modules 205 with different reference numbers, but together label them as “power generating element 222” in Figure 2, and would be understood to be “a single integrated power generating element 222” in annotated Figure 3. *Id.* at 17–18; Reply 12. Petitioner’s expert provided testimony supporting Petitioner’s assertion that it “would be typical at the time of the alleged invention to integrate electronics that were provided on a per-panel basis with the panel itself.” *Id.* (citing Ex. 1002 ¶¶ 48–49 (opining that one of ordinary skill in the art would have understood that the circuitry in Figure 3 of Adest ’055 could be implemented in one of three ways: “a junction box integrated into the panel, in a box attached to the frame of the panel, or attached to the rail on which the panel is mounted” and it was “normal and expected that components that are provided on a per-panel basis” that could be “integrated into the junction box of a panel.”)). Petitioner argued at the oral hearing that Adest ’055 “is very clear that each solar panel together with its associated power converter circuit, which is what we’re saying is the

local unit of Claim 12, together forms a power generating element 222,” and “patent owner’s expert agreed with us” that “that’s an integrated power generating element 222.” Tr. 27:16–28:5.

We do not agree with Patent Owner that the language of Adest ’055 requires that solar panels 101a–101d and power converter circuits 205a–205d be “separate things.” PO Resp. 15. Rather, Adest ’055 (Ex. 1007, 5:45–52) provides that each solar panel 101a–101d has its own respective power converter circuit 205a–205d, e.g., solar panel 101a has its own power converter circuit 205a, and solar panel 101b has its own power converter circuit 205b, as shown in Figure 2 of Adest ’055. *See also* Ex. 1007, 5:49–55 (“Each solar panel 101 together with its *associated* power converter circuit 205 forms a power generating element 222. (Only one such power generating element 222 is marked in FIG. 2.) Each converter 205a–205d adapts optimally to the power characteristics of the *connected* solar panel 101a–101d”) (emphasis added).

We do not perceive Petitioner’s use of the “could be configured” language to be fatal to Petitioner’s argument, because it is part of an argument about what one of ordinary skill in the art “would have understood” about power generating element 222, which depicts a “single photovoltaic panel that includes both solar cells and a power module.” Pet. 17. Petitioner buttresses and rephrases this same argument about what one of ordinary skill in the art would have understood, avoiding use of the “could be configured” language, when it argues that one of ordinary skill in the art, viewing Figures 2 and 3 of Adest ’055, “would have understood that they disclose typical configurations that would [be] a configuration in which all of the circuitry in power generating element 222 would be included in a

single solar panel.” Pet. 18 (citing Ex. 1002 ¶¶ 47–49). Accordingly, we are persuaded that Adest ’055 discloses limitations 12(a) and 12(c).

ii. Heartbeat Signals

Petitioner argues that limitation 12(h) (“wherein the controller detects an anomaly in heartbeat signals from the remote unit; and”) is met by Adest ’055’s disclosure that the “normal operation of transferring power is maintained as long as the communications signal, e.g. 100 Hz is received from inverter 204 or signal mechanism 420, and no other warning condition is present” but if “the communications signal is not detected, or another warning condition is present, the normal mode (step 57) is typically ended and power conversion of modules 405 is typically turned off.” Pet. 27 (citing Ex. 1007, 10:56–62, 10:2–8). Petitioner argues that one of ordinary skill in the art “would understand the 100 Hz communications signal to be ‘heartbeat signals’” and that “not receiving the communications signal would constitute an anomaly because the signal is intended to show that the inverter is operating normally.” *Id.* (citing Ex. 1002 ¶¶ 63–65).

Patent Owner argues that Adest ’055 does not disclose the “heartbeat signals” limitations. PO Resp. 18–26. More particularly, Patent Owner argues that Petitioner relies on a 100 Hz ripple from Adest ’055’s inverter, which is “an undesirable noise byproduct rather than a heartbeat signal.” *Id.* at 18. The embodiment that generates the 100 Hz signal, according to Patent Owner, is an alternative embodiment of Adest ’055 “in which 100 Hz inverter noise is used instead of a separate signaling mechanism.” *Id.* at 18–19 (quoting Ex. 1007, 6:42–48). “In other words, Adest-055 discloses permitting normal operation when the inverter noise (i.e. the 100 Hz ripple) is detected, and shuts down when the noise cannot be detected.” *Id.* at 19.

However, argues Patent Owner, an inverter's 100 Hz ripple is not a heartbeat signal. *Id.* at 20. Patent Owner differentiates the '770 patent's "heartbeat signals" that "are communicated as intentional 'pings' from the remote unit, or as part of request/response 'challenges' or other two-way verifications," from the "noise" generated by Adest '055. *Id.* at 21–22.

Petitioner replies that Patent Owner "gets this wrong by relying on the incorrect meaning of 'heartbeat signals.'" Reply 13. Under Petitioner's interpretation, "the 100 Hz signal from the inverter meets the plan [sic] language for a 'heartbeat signal.'" *Id.* Petitioner also argues that "Patent Owner ignores that *Adest-055* also discloses an alternative 'signaling mechanism 420' shown in Figs. 4 and 4B" which "signal is superimposed by action of relay 428 onto serial string 423 over wires 410 and 412" and "the relay 428 *intentionally* generates this signal—it is not merely 'undesirable noise.'" *Id.* at 13–15. According to Petitioner, Adest '055 "describes generating the 100 Hz signal from *either* the inverter 204 *or* the signaling mechanism 420, interchangeably." *Id.* at 15.

Patent Owner responds that although Adest '055 "discloses an inverter noise option and a signaling mechanism option, the Petition only relied on the former." Sur-Reply 8 (citing Pet. 27–28; Ex. 1002 ¶ 65 ("both relying on Ex-1007 at 6:42-44 regarding inverter noise")). Patent Owner faults Petitioner's three citations to signaling mechanism 420 in Ground 1 of the Petition as "never tied to any limitation" and failing to "argue unit 420 sent heartbeat signals." *Id.* at 9. Patent Owner also argues that Petitioner relies on the incorrect construction of "heartbeat signals." *Id.* at 9–10.

On this record, Petitioner's reliance on the 100 Hz signal from Adest '055 sufficiently establishes that Adest '055 discloses heartbeat

signals. We refer to our construction of “heartbeat signals” as “periodic signals.” *See supra*. The Petition asserts that Adest ’055 “discloses that ‘controller 306 maintains safety mode operation (step 53) until a communications signal, e.g. 100 Hz, is received by receiver/detector 207 from inverter 204 or signaling block 420.’” Pet. 25 (quoting Ex. 1007, 10:40–46) (discussing limitation 12(g), “wherein the controller communicates with a remote unit, disposed at a location remote from the local unit, to control operations of the voltage regulator”). The Petition also asserts that Adest ’055 “discloses that ‘[t]he normal operation of transferring power is maintained as long as the communications signal, e.g. 100 Hz is received from inverter 204 or signal mechanism 420, and no other warning condition is present.’” Pet. 27 (quoting Ex. 1007, 10:56–62) (discussing limitation 12(h), “wherein the controller detects an anomaly in heartbeat signals from the remote unit”); *see also* Pet. 32 (quoting Ex. 1007, 10:56–69, including signal mechanism 420, when discussing claim 15). Although we acknowledge Patent Owner’s concerns regarding Petitioner’s citations to signal mechanism 420, it appears to us that the Petition fairly relies on both inverter 204 and signaling block 420 as the source of the 100 Hz signal, and identifies the 100 Hz signal of Adest ’055 as the “heartbeat signals” of limitation 12(h) (and claims 13, 14, and 15). Pet. 25, 27, 30–32. Referring to our claim construction of “heartbeat signals” as “periodic signals” above, we are persuaded that the 100 Hz signal of Adest ’055 qualifies as a “periodic signal” from a remote unit, as in limitation 12(h). Pet. 27–28 (citing Ex. 1002 ¶¶ 62–66); *see also* Reply 13–15 (discussing how the 100 Hz signal of Adest ’055 functions as a heartbeat signal). We are, thus, persuaded by Petitioner’s position that the 100 Hz signal of Adest ’055,

“whether generated by the inverter [204] or by the signaling mechanism [420] discloses the claimed ‘heartbeat signal.’” Reply 15; *see also id.* at 14–15 (citing Ex. 1007, 11:28–31 (the “communication signal, e.g., 100 Hz, is superimposed on serial string 203, 423 either from signaling mechanism 420 or from inverter 204”)).

iii. Skips

Petitioner argues that “skips” of a heartbeat signal are disclosed by Adest ’055 in that its receiver/detector 207 detects that the 100 Hz communication is not being received, and one of ordinary skill in the art would understand that “to detect that a periodic signal 100 Hz is not being received, the detector would need to detect that at least one ‘heartbeat’ is not received (*i.e.* is skipped).” Pet. 30 (citing Ex. 1002 ¶¶ 71–73). Petitioner argues that one of ordinary skill in the art “would understand that detection of the 100 Hz signal would likely require a threshold of more than one skip and thus, a POSITA would understand that Adest ’055 discloses that the anomaly includes more than one skip.” *Id.* (citing Ex. 1002 ¶¶ 72–73). Regarding claim 14, which requires a “predetermined number of skips,” Petitioner argues that a “threshold of at least one ‘skip’ would necessarily need to be set in order for the detector/receiver to even be able to detect that the 100 Hz communication signal was not being received.” Pet. 31 (citing Ex. 1002 ¶ 75). Regarding claim 15, which requires that “skips of the heartbeat signal are less than the predetermined number,” Petitioner argues that the “normal mode” of Adest ’055 “is the maximum power point (MPP) tracking mode of converting DC power from its input to its output by maintain[ing] maximum power at its input” and that “when the number of skips of the heartbeat is zero (*i.e.* less than 1), then the controller would not

cause the voltage regulator to reduce the power output of the photovoltaic panel.” Pet. 32 (citing Ex. 1007, 10:53–56; Ex. 1002 ¶¶ 77–78).

Patent Owner argues that Adest ’055 does not disclose “skips” of a 100 Hz ripple. PO Resp. 24. Patent Owner alleges that “Petitioner cannot point to any disclosure in Adest-055 where ‘skips’ are used to determine whether to cease normal operations—the Petition merely says doing so was ‘likely’” which “is not enough for anticipation.” *Id.* at 25 (quoting Pet. 30).

Petitioner replies that “Patent Owner relies on the incorrect construction of ‘skips.’” Reply 15. Petitioner argues that, under Petitioner’s definition, the “*Adest-055* system operates normally as long as the 100 Hz communications signal is received from either the inverter or the signaling mechanism 420, but normal operation ceases if the signal is not received.” *Id.*

Patent Owner responds that the “Reply incorrectly suggests that ‘skips’ occur any time that any communications is missed,” and that “Adest-055 does not disclose this limitation because it does not detect ‘skips’ of heartbeat signals (claim 13) or ‘a predetermined number of skips’ (claims 14–15).” Sur-Reply 10. Rather, “Petitioner can only suggest that a missing signal means there was at least one skip,” but the claims require more. *Id.*

As discussed above, we arrived at the following construction: “Skips refers to the event of missing a communication or pulse.” Ex. 2005, 9:36–37. In the case of claim 13, which only requires that “the anomaly includes skips of heartbeat signals,” we find sufficient Petitioner’s argument that “to detect that a periodic signal 100 Hz is not being received, the detector would need to detect that at least one “heartbeat” is not received (*i.e.*, is skipped),” because that event is “the event of missing a communication or pulse.”

Pet. 30 (citing Ex. 1002 ¶ 71). Adest '055's detection of a missing 100 Hz signal by receiver/detector 207 fairly constitutes that “the controller detects an anomaly” (claim 12) and “the anomaly includes skips” (claim 13), i.e., the anomaly includes the event of missing a communication or pulse.

Patent Owner's argument that Adest '055 fails to disclose a “predetermined number” of skips as set forth in claims 14 and 15, however, has merit. We determine that the “predetermined number” of skips is different than an anomaly in heartbeat signals (claim 12), or an anomaly that includes skips of heartbeat signals (claim 13). Figure 21 of the '770 patent illustrates an embodiment of a method of controlling the output of a solar module (Ex. 1001, 3:27–28) and is described in the specification:

If, in operation **2405**, the software does not receive a ping or other expected response within an allotted time, it moves to operation **2406**, where it checks the number of allowed skips. Depending on the circumstances, a certain number of skips may be allowed, particularly if the “heartbeats” of the ping are set at a high rate, such as 100 or even 1000 per second. In such cases, the software may allow two, five, or even 100 skips (this limit is drawn from data store **2401**) before it moves to operation **2410**, where the process again branches.

Id. at 18:4–13. Accordingly, the '770 patent describes that the software checks “the number of allowed skips” and “a certain number of skips may be allowed.”

Having considered the record as a whole, we find that Adest '055 does not disclose the “predetermined number” of skips limitation. As Patent Owner notes, Adest '055 “discloses shutting the system down when the inverter noise is absent.” PO Resp. 24. Accordingly, although Adest '055 discloses that “the anomaly includes skips of heartbeat signals” (claim 13) as we discuss above, Petitioner does not point to sufficient disclosure in

Adest '055 disclosing a “predetermined number” of skips of heartbeat signals as in the '770 patent. Petitioner does not, for example, point to any disclosure in Adest '055 that discusses “predetermined number” in the way the '770 patent does, i.e., “the software may allow two, five, or even 100 skips.” To the extent that Petitioner tries to identify a predetermined number of skips in Adest '055, we do not find that Petitioner’s assertion that a “threshold of at least one ‘skip’ would *necessarily* need to be set” supports a finding of a “predetermined number” of skips. Pet. 31 (citing Ex. 1002 ¶ 75 (making same assertion without supporting evidence)) (emphasis added). The open-ended nature of this possible number of skips (“at least one ‘skip’”) does not meet the “predetermined number” value requirement of the '770 patent. Similarly, Petitioner’s argument that one of ordinary skill in the art “would understand that detection of the 100 Hz signal would likely require a threshold of more than one skip” also fails to identify a “predetermined number” limitation in Adest '055. *Id.*; *see also Arendi S.A.R.L v. Apple Inc.*, 832 F.3d 1355, 1361–63 (Fed. Cir. 2016) (noting that common sense “cannot be used as a wholesale substitute for reasoned analysis and evidentiary support, especially when dealing with a limitation missing from the prior art references specified”). Finally, even if Petitioner were making an inherency argument, we do not discern adequate reasoning or evidence to support such argument. *See Kennametal, Inc. v. Ingersoll Cutting Tool Co.*, 780 F.3d 1376, 1381 (Fed. Cir. 2015) (a reference can anticipate even if it does not expressly spell out all the limitations “if a person of skill in the art, reading the reference, would ‘at once envisage’ the claimed arrangement or combination”). Accordingly, Adest '055 does not disclose a “predetermined number” of skips of heartbeat signals.

4. Conclusion as to Ground 1

For the reasons given above, Petitioner has demonstrated by a preponderance of the evidence that Adest '055 anticipates claims 12 and 13; however, we do not find that Petitioner has demonstrated by a preponderance of the evidence that Adest '055 anticipates claims 14 and 15.

E. Asserted Obviousness based on Adest '055 and Kronberg (Ground 2)

Petitioner argues that the combination of Adest '055 and Kronberg would have rendered obvious claims 12–15. Pet. 32–43. Patent Owner disagrees. PO Resp. 26–39.

1. Kronberg (Ex. 1006)

Kronberg is titled “‘Smart’ Watchdog Safety Switch,” and relates to “a method and apparatus for monitoring the output signal of process control equipment and for shutting down process equipment in the event of control equipment failure” through the usage of a “‘smart’ watchdog safety switch.” Ex. 1006, code (54), 2:5–9, 30.

Figure 1 of Kronberg, reproduced below, shows the invention in block diagram form. *Id.* at 2:50–51.

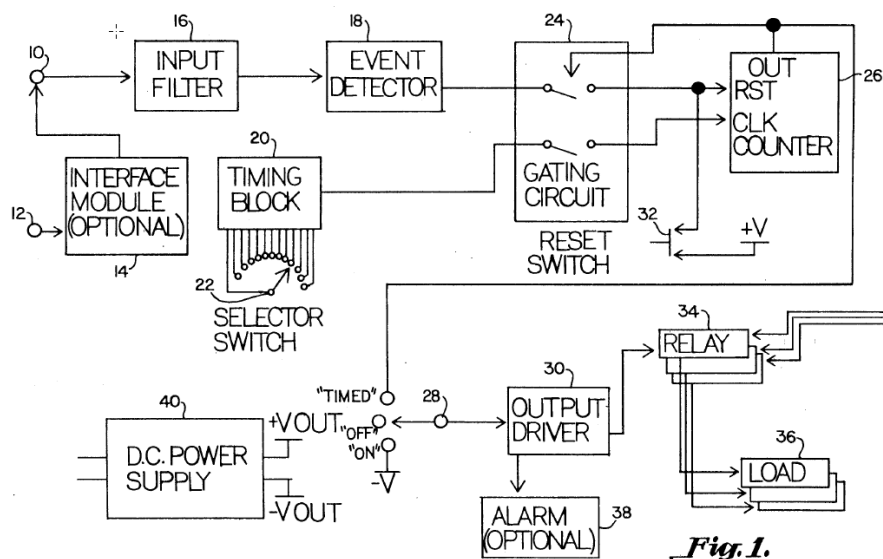


Figure 1 illustrates the components that make up the circuit corresponding to the process equipment. *Id.* at 3:4–12. The signal to be monitored is introduced at input 10. *Id.* at 3:13. A filtered output of input filter 16 enters event detector 18 where valid transitions in the signal are identified and marked by a series of short “event” pulses. *Id.* at 3:23–26. In timing block 20, a train of timing pulses is continuously generated having a frequency determined by the position of selector switch 22. *Id.* at 3:27–29. The timing pulses pass to gating circuit 24, which normally allows free passage to multistage binary counter 26 incremented by each timing pulse. *Id.* at 3:29–32. If no further event pulses arrive before a specified number of timing pulses, counter 26 is incremented and the output of counter 26 changes state from a logic “0” to a logic “1.” *Id.* at 3:38–43. When logic “1” appears, gating circuit 24 blocks timing and event pulses from reaching counter 26, so that the count is frozen and the output of counter 26 remains at logic “1” until manually reset by reset switch 32. *Id.* at 3:47–51. Through the described interactions, prompt shutdown of critical load elements 36 is implemented whenever valid transitions fail to arrive at input 10 within the period set by timing block 20 and counter 26. *Id.* at 4:5–9.

2. *Petitioner’s Arguments*

Petitioner argues that Adest ’055 discloses the features of claim 12, and to the extent Adest ’055 alone does not disclose limitation 1(h) (“wherein the controller detects an anomaly in heartbeat signals from the remote unit;”), Kronberg “discloses a watchdog apparatus that receives an input from a periodically varying output.” Pet. 34–38. More particularly, Petitioner argues that Kronberg’s “watchdog apparatus has an internal timing block 20 that produces a train of timing pulses having a frequency

determined by a selector switch and multistage binary counter 26 that receives and counts the train of timing pulses.” *Id.* at 35 (citing Ex. 1006, 3:27–32). “When an event pulse is received the binary counter is reset to zero.” *Id.* (citing Ex. 1006, 3:33–37). “Thus, so long as watchdog continues to receive the input signal, the counter will continuously be reset,” but “if the watchdog receives no event pulse before a specified number of timing pulses, then the counter outputs a ‘1,’ which indicates the “attainment of a specified binary count;” the binary count can be, for example, “2048 . . . or another power of 2.” *Id.* at 35–36 (citing Ex. 1006, 3:38–43). Accordingly, argues Petitioner, one of ordinary skill in the art “would understand that attainment of the specified count (i.e. that the periodic signal has not been detected for a certain amount of time) is the detection of an anomaly.” *Id.* at 36 (citing Ex. 1002 ¶ 90).

One of ordinary skill in the art would have been motivated to combine the watchdog apparatus of Kronberg with the solar power system of Adest ’055, Petitioner argues, because watchdog timers, “such as the watchdog apparatus taught by *Kronberg*, were a well-known technique for detecting malfunctions at the time of the invention” and merely “one of a number of solutions for detecting the absence of a periodic signal.” *Id.* at 36–37 (citing Ex. 1002 ¶¶ 92–98). Petitioner further argues that Kronberg “suggests that its watchdog apparatus is to be used to provide ‘automatic shutdown of critical devices in case of failure,’” consistent with the objective of Adest ’055. *Id.* at 37 (citing Ex. 1006, 1:12–15). Furthermore, Petitioner argues, one of ordinary skill in the art would have had a reasonable expectation of success in making this combination, because

Kronberg is specifically capable of detecting 100 Hz signals, like those of Adest '055. *Id.* (citing Ex. 1006, 11:34–61).

Petitioner argues that Adest '055 and Kronberg disclose the additional limitations of challenged dependent claims 13–15. *Id.* at 39–43. Regarding claim 13 (“wherein the anomaly includes skips of heartbeat signals”), Petitioner relies on its claim 12 arguments and argues that the “watchdog apparatus [of Kronberg] detects whether the input signal has not been received for a ‘specified number of timing pulses.’” *Id.* at 39 (citing Ex. 1002 ¶ 100; Ex. 1006, 3:38–43).

Regarding claim 14 (“wherein the controller causes the voltage regulator to reduce the power output of the photovoltaic panel when the anomaly includes a predetermined number of skips of the heartbeat signals”), Petitioner relies on its claim 12 arguments and argues that receiver/detector 207 of Adest '055 detects that the 100 Hz communication is not being received and controller 306 subsequently causes module 205 to reduce power output. *Id.* at 40. Also relying on its claim 12 arguments that Kronberg detects whether the input signal has not been received for a “specified number of timing pulses,” Petitioner further argues that Kronberg’s “timing pulses can be, for example, ‘2048 . . . or another power of 2’” and its resistor values “can provide timing pulses at frequencies ranging from 34 to 18,800 Hz,” with 370 Hz being one exemplary frequency. *Id.* (citing Ex. 1006, 3:38–43, 11:34–61). Petitioner reasons:

The counter would provide a “1” value, if it reached 2048, and this would occur within approximately 5.535 seconds when the timing block is providing pulses at a rate of 370 Hz. Ex-1002, ¶104. If, as taught by Adest '055, the input signal was expected to be 100 Hz, then 553 skips of the input signal would trigger the output of “1” from the counter, indicating an anomaly. Ex-

1002, ¶104. A larger or smaller “predetermined number of skips” could be selected by choosing an appropriate resistor size. It would have been obvious to a POSITA to predetermine a number of skips to trigger the controller to reduce power output so as not to avoid a false trigger Ex-1002, ¶105.

Id. at 41. Thus, argues Petitioner, it would have been obvious to use the watchdog apparatus of Kronberg to implement receiver/detector 207 of Adest ’055 with a reasonable expectation of success. *Id.*

Regarding claim 15 (“wherein when skips of the heartbeat signals are less than the predetermined number, the controller does not cause the voltage regulator to reduce the power output of the photovoltaic panel”), Petitioner argues that the “counter of the watchdog timer of *Kronberg* only outputs a ‘1’ when the number of timing pulses reaches the specified number, indicating the absence of the signal;” before the predetermined number is reached, “the counter outputs a ‘0’” and the voltage regulator continues to operate in “normal mode.” *Id.* at 42 (citing Ex. 1006, 3:33–46).

3. Patent Owner’s Arguments and Petitioner’s Replies

i. Rationale to Combine

Patent Owner argues that Petitioner’s rationale for combining Adest ’055 and Kronberg is faulty. PO Resp. 26–35. More particularly, Patent Owner argues that Petitioner’s statement that the “watchdog of Kronberg *could be* used as part of the receiver/detector 207 of Adest ’055 to detect the absence of the 100 Hz communications signal” is “not a cognizable basis for combining prior art.” *Id.* at 26. Patent Owner further argues that Petitioner failed to “perform a *Graham* analysis” and instead “focused on generalities.” *Id.* at 28–31. All in all, Patent Owner argues that “it appears that Petitioner intended to evoke one or more of the rationales set forth in *KSR*,” but that Petitioner failed to “identify a reason that would have

prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does.” *Id.* at 32–33.

Regarding Petitioner’s articulation of a reasonable expectation of success, Patent Owner argues that Petitioner “mischaracterizes Adest-055’s signal. The 100 Hz signal that Petitioner relies on *is the noise generated by the inverter.*” *Id.* at 34. According to Patent Owner, these “disclosures destroy Petitioner’s motivation to combine argument,” because “it would result in Kronberg filtering out the signal it was supposed to detect.” *Id.* at 35. Additionally, Patent Owner argues that Adest ’055 and Kronberg would not render any claims obvious, because Kronberg “would filter rather than detect the alleged ‘heartbeat signal.’” *Id.* at 36.

Petitioner replies that Patent Owner’s expert provided no expert testimony or opinions in his declaration concerning obviousness or to rebut Petitioner’s expert’s opinions of obviousness. Reply 16. What remains, Petitioner asserts, is attorney argument. *Id.* Petitioner maintains that it analyzed the *Graham* factors, including the level of ordinary skill in the art, the scope and content of the prior art, any differences between the prior art and the ’770 patent’s claims, and that there are no secondary considerations. *Id.* at 17–18 (citing Pet. 3–4, 9–10, 13–14, 32–43). Regarding motivation to combine, Petitioner reiterates that “the watchdog timer of *Kronberg* could be combined with the teachings of *Adest-055* for the reasons Petitioner and its expert have already explained in detail,” and “the combination would have been obvious, the teachings are compatible, and a POSITA would have reasonably expected success.” *Id.* at 18–19 (citing Pet. 36; Ex. 1002 ¶¶ 88–98, 100, 103–107, 109–111). Petitioner restates that the 100 Hz signal in Adest ’055 is not merely “undesirable noise,” and that Kronberg’s “input

filter” could remove unwanted noise from the 100 Hz signal of Adest ’055.
Id. at 19.

Patent Owner responds that Petitioner’s arguments and testimony are conclusory, factually unsupported, and directed to what “could” be combined, and criticizes Petitioner’s arguments as “hindsight driven justifications.” Sur-Reply 11–12. Patent Owner reiterates that “Petitioner cannot now rely on the signal mechanism embodiment” 420 because Petitioner relied on the inverter noise embodiment in the Petition, but even if Petitioner could, “a POSITA would not have combined that embodiment with Kronberg because it would have made Adest-055 unsuitable or inoperable for its intended purpose” and “Petitioner’s proposed combination filters Adest-055’s inverter signal.” Sur-Reply 12–14.

We have reviewed Petitioner’s rationale to combine and arguments regarding reasonable expectations of success, and are persuaded that Petitioner has met its burden by a preponderance of the evidence. Petitioner articulates clearly its motivations to combine (Pet. 36–37) and reasonable expectation of success (Pet. 36–38), and addresses the Graham factors (Pet. 4, 9–10, 13–14, 32–43), supporting these arguments with testimony from its expert (Ex. 1002 ¶¶ 17–18, 79–111). As discussed herein, we do not agree that the 100 Hz signal of Adest ’055 is merely noise, nor that Petitioner improperly relied on signaling block 420. *See supra*. We find that Petitioner has established by a preponderance of the evidence that one of ordinary skill in the art would have had a motivation to combine Adest ’055 with Kronberg, with a reasonable expectation of success.

ii. Skips

Patent Owner argues that Adest '055 in view of Kronberg fails to disclose the “skips” limitation of claims 13–15. PO Resp. 36–39. Patent Owner argues that, instead, “Kronberg discloses a counter that ‘fills up’ at a set frequency” and “is reset when a separate, unrelated event pulse is received.” *Id.* at 37. According to Patent Owner, Kronberg “does not disclose choosing its variables to detect anomalous skips or a predetermined number of skips before the system will shut down—it does not disclose, teach, or suggest this concept of allowed skips at all.” *Id.* at 38.

Petitioner replies that Patent Owner’s argument relies on “Patent Owner’s incorrect and overly narrow interpretation of the meaning of the term ‘skips.’” Reply 20. Petitioner also replies that Kronberg’s counter with a set number of increments that would fill up at a rate set by the counter “could be the predetermined way in which the predetermined number of skips is reached.” *Id.*

Patent Owner reiterates that “Kronberg does not disclose choosing variables to detect anomalies or a predetermined number of skips—it does not consider ‘skips’ at all.” *Id.* at 15.

Regarding Patent Owner’s argument that Kronberg would necessarily filter out the 100 Hz signal of Adest '055, we credit Petitioner’s argument that the watchdog apparatus of Kronberg would have been configured to sense the 100 Hz signal of Adest '055 rather than filtering it out. Pet. 38 (citing Ex. 1002 ¶¶ 96–97); Reply 19 (explaining that Kronberg “has an ‘input filter’” that can “remove unwanted noise from the 100 Hz signal of Adest '055 so that it ‘could successfully be detected’—not completely filter out *Adest-055*’s 100 Hz signal, which contrary to Patent Owner’s arguments

is not merely unwanted noise.”) (citing Ex. 1002 ¶¶ 96–97). We also credit Petitioner’s argument that one of ordinary skill in the art would have configured Kronberg to detect the 100 Hz signal and operate its counter accordingly. Pet. 34–38 (citing Ex. 1002 ¶¶ 86–98).

As discussed above, we arrived at the following construction of “skips” taken from the specification of the ’770 patent: “Skips refers to the event of missing a communication or pulse.” Ex. 2005, 9:36–37. In the case of claim 13, which requires that “the anomaly includes skips of heartbeat signals,” we agree with Petitioner’s argument that “the watchdog apparatus” of the combination “detects whether the input signal has not been received for a ‘specified number of timing pulses.’” Pet. 39 (citing Ex. 1002 ¶ 100; Ex. 1006, 3:38–43). The combination’s detection of a missing 100 Hz signal by receiver/detector 207 of Adest ’055 together with the watchdog of Kronberg meets the limitations that “the controller detects an anomaly” (claim 12) and “the anomaly includes skips” (claim 13), i.e., the anomaly includes the event of missing a communication or pulse. Petitioner’s proposed combination would detect “skips of heartbeat signals” when Kronberg’s watchdog would output a “1,” indicating that the periodic signal has not been detected for a certain amount of time; this would meet the limitation of “skips of heartbeat signals,” i.e., the event of missing a communication of the periodic signal. The addition of Kronberg’s watchdog to receiver/detector 207 of Adest ’055 in the manner proposed by Petitioner would allow the controller to detect such an anomaly, i.e., skips of heartbeat signals, as set forth in claim 13. Pet. 39.

Patent Owner’s argument that the Adest ’055-Kronberg combination fails to disclose a “predetermined number” of skips as set forth in claims 14

and 15, however, has merit. Having considered the record as a whole, we find that the Adest '055-Kronberg combination does not disclose the “predetermined number” of skips limitation. As discussed above, we find that Adest '055 alone does not disclose the “predetermined number” of skips limitation. We understand Patent Owner’s argument that the counter of Kronberg is not “allowing a predetermined number of skips before a shutdown,” because “it is simply filling up to its limit at a given frequency,” and Kronberg does not disclose choosing its variables to detect “so as to permit a predetermined number of allowed skips.” PO Resp. 37–38. Accordingly, although the Adest '055-Kronberg combination discloses that “the anomaly includes skips of heartbeat signals” (claim 13) as we discuss above, Petitioner does not point to sufficient disclosure in the Adest '055-Kronberg combination showing a “predetermined number” of skips of heartbeat signals, as required by claims 14 and 15. Petitioner does not, for example, point to any disclosure in Kronberg of a “predetermined number” such as the examples in the '770 patent, i.e., “the software may allow two, five, or even 100 skips.” Ex. 1001, 18:7–13. To the extent that Petitioner tries to identify a “predetermined number” of skips in Kronberg, we do not find adequate support or reasoning for Petitioner’s assertion that a larger or smaller “predetermined number of skips” could be selected by choosing an appropriate resistor size.” Pet. 41 (citing Ex. 1002 ¶ 105 (making same assertion without supporting evidence)); *see also* Ex. 1002 ¶ 104 (providing hypothetical calculations but without supporting evidence). Accordingly, the Adest '055-Kronberg combination does not disclose a “predetermined number” of skips of heartbeat signals.

4. Conclusion as to Ground 2

For the reasons given above, Petitioner has demonstrated by a preponderance of the evidence that Adest '055 and Kronberg would have rendered obvious claims 12 and 13; however, we do not find that Petitioner has demonstrated by a preponderance of the evidence that Adest '055 and Kronberg would have rendered obvious claims 14 and 15.

F. Asserted Obviousness based on Adest '178 and Moine (Ground 3)

Petitioner argues that claims 12–16 would have been obvious in view of the combination of Adest '178 and Moine. Pet. 43–62. Patent Owner disagrees. PO Resp. 39–47.

1. Adest '178 (Ex. 1008)

Adest '178 is titled “Distributed Power Harvesting Systems Using DC Power Sources,” and is directed “generally to power production from distributed DC power sources, and more particularly to management of distributed DC power sources in series installations.” Ex. 1008, code (54), 1:34–37. Figure 3 of Adest '178 is reproduced below:

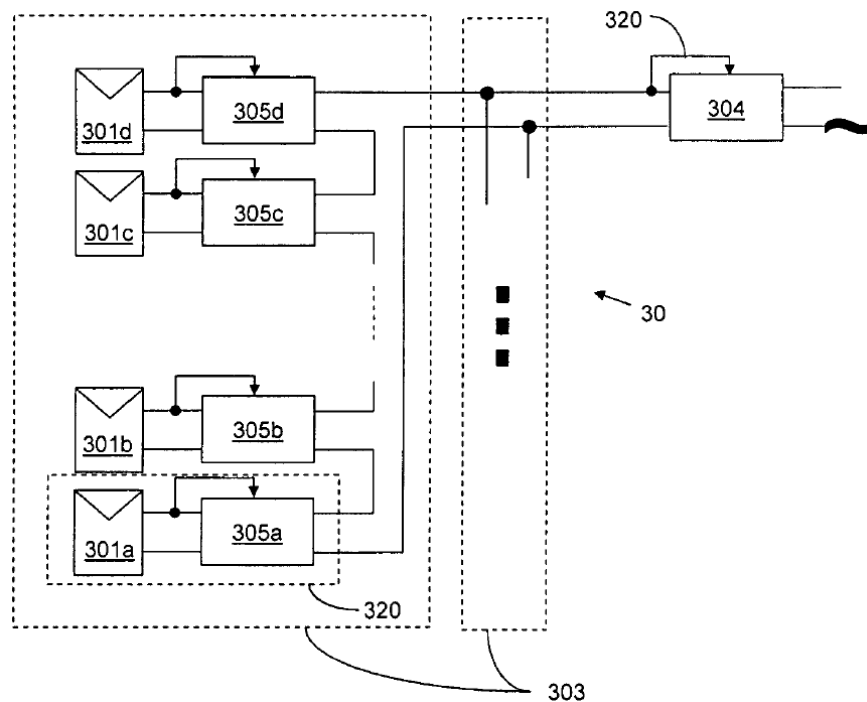


Figure 3 of Adest '178 shows “a distributed power harvesting system, according to aspects of the invention, using DC power sources.” *Id.* at 9:25–27. More particularly, Figure 3 shows solar panels 301a–301d, each having corresponding power converter circuits 305a–305d, wherein each solar panel together with its associated power converter circuit forms a module, e.g., module 320. *Id.* at 10:66–11:2. Each converter 305a–305d “adapts optimally to the power characteristics of the connected solar panel 301a–301d and transfers the power efficiently from converter input to converter output.” *Id.* at 11:2–5.

2. *Moine (Ex. 1005)*

Moine is titled “System for Controlling an Electric Power Generation Facility and Electric Power Generation Facility Implementing Such a System,” and relates to “a system for controlling an electrical power production facility” including “photovoltaic modules mounted in series and/or in parallel in order to constitute an electrical circuit,” where the

electrical circuit incorporates “an electric switch capable of neutralizing the electric power provided by the output of the power terminals of [the photovoltaic] modules.” Ex. 1005, code (54), 3:11–16.

Figure 1 of Moine, reproduced below, is an illustration of a circuit in which the electrical power production facility is connected either to a domestic power supply or to an electrical load using the electricity produced. *Id.* at 4:24–26.

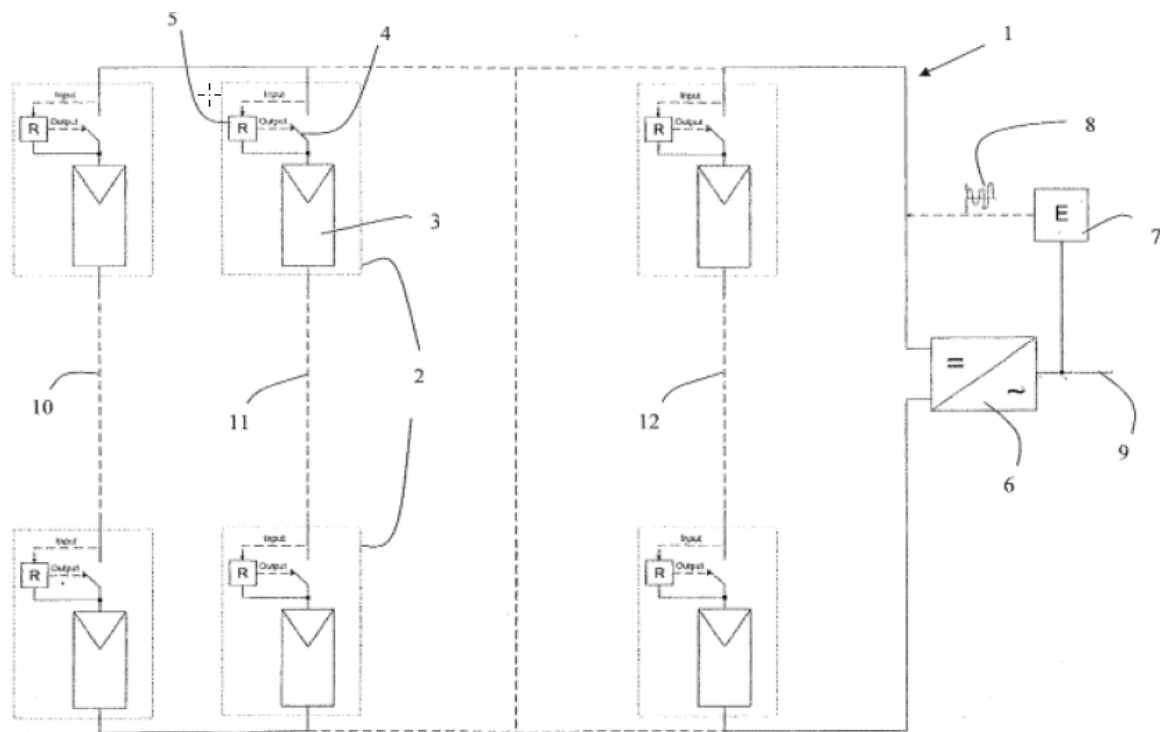


Figure 1

Figure 1 shows the electrical diagram of a photovoltaic electric power production facility. *Id.* at 4:32–33. The facility includes three series of electric generators 2 mounted in parallel. *Id.* at 5:1–3. Each of the generators 2 is composed of photovoltaic power module 3 that converts solar radiation into direct electric current. *Id.* at 5:5–7. Each of the modules further includes electronic switch 4, specifically a field-effect transistor [“FET”]. *Id.* at 5:9–10. The operation of the transistor is controlled by

receiver 5 that causes switch 4 to open or close according to a coded signal sent as an alternating signal through power circuit 1, where the alternating signal is generated by electrically-powered transmitter 7 upstream or downstream from inverter or converter 6. *Id.* at 5:19–27. Thus, if transmitter 7 detects a lack of current in domestic power supply network 9 or failure thereof, it stops the periodic transmission of the coded alternating signal through circuit 1, whose absence, identified by receivers 5, causes the latter to open corresponding switches 4 such that the circuit powers down. *Id.* at 6:1–5.

3. *Petitioner's Arguments*

Petitioner argues that the combination of Adest '178 and Moine discloses every element of claim 12, as set forth in more detail below:

(a) A photovoltaic panel, comprising: (Pet. 43 (citing Ex. 1008, 5:39–6:8; Ex. 1002 ¶¶ 112–115));

(b) at least one photovoltaic cell; (Pet. 44–45 (citing Ex. 1008, 7:21–24, 21:46–67, Fig. 11; Ex. 1002 ¶¶ 116–119));

(c) a local unit configured on the photovoltaic panel, the local unit having: (Pet. 45–47 (citing Ex. 1008, 10:66–11:2, 21:46–67, Figs. 3, 11; Ex. 1002 ¶¶ 120–125));

(d) a voltage regulator coupled to the at least one photovoltaic cell to receive electric power generated by the at least one photovoltaic cell; and (Pet. 47–50 (citing Ex. 1008, 11:5–43, 7:36–39, 8:1–3, Fig. 3; Ex. 1002 ¶¶ 126–129));

(e) a controller coupled to the voltage regulator; (Pet. 50 (citing Ex. 1008, 16:11–29, 17:8–10, 21:46–50, Fig. 6; Ex. 1002 ¶¶ 130–131));

(f) wherein the voltage regulator provides a power output of the photovoltaic panel using the electric power generated by the at least one photovoltaic cell; (Pet. 51 (citing Ex. 1008, 16:39–52; Ex. 1002 ¶ 132));

(g) wherein the controller communicates with a remote unit, disposed at a location remote from the local unit, to control operations of the voltage regulator; (Pet. 51–54 (citing Ex. 1005, 4:33–5:27, 6:1–10, 2:27–33, Fig. 1; Ex. 1008, Fig. 6; Ex. 1002 ¶¶ 133–142));

(h) wherein the controller detects an anomaly in heartbeat signals from the remote unit; and (Pet. 55–56 (citing Ex. 1005, 6:1–5, 7:1–4; Ex. 1002 ¶¶ 143–147));

(i) wherein in response to the anomaly, the controller causes the voltage regulator to reduce the power output of the photovoltaic panel (Pet. 56–57 (citing Ex. 1005, 6:6–10; Ex. 1008, Fig. 6; Ex. 1002 ¶¶ 148–151)).

Petitioner argues that one of ordinary skill in the art would have been motivated to combine Moine’s receiver 5 and transmitter 7 with the solar power system of Adest ’178, because Moine “was a known technique for improving the safety of photovoltaic power systems” and the safety issues recognized in Moine are equally present in the system of Adest ’178. *Id.* at 53 (citing Ex. 1002 ¶¶ 137–141). Petitioner further argues that one of ordinary skill in the art “would have recognized that FET 630 [of Adest ’178] could perform the same function (and more) as the switch (4) of *Moine*” and, thus, “application of *Moine*’s technique to the system of Adest ’178 would have yielded a predictable result of improving the safety of the system.” *Id.* at 54 (citing Ex. 1002 ¶ 141).

Regarding claim 13, Petitioner argues that transmitter 7 of Moine transmits the alternating signal “according to a set timing” such as five

minutes, and if it stops transmitting, receiver 5 is configured to identify the absence of the alternating signal. Pet. 58 (citing Ex. 1005, 7:1–4).

Receiver 5 “would necessarily only be able to detect the absence of the signal once the ‘set timing’ had elapsed, indicating that communication had been interrupted for at least one skip.” *Id.* (citing Ex. 1002 ¶ 153).

Regarding claim 14, Petitioner argues that receiver 5 “would necessarily only be able to detect the absence of the signal once the ‘set timing’ had elapsed, indicating that communication had been interrupted for at least one skip.” *Id.* at 59 (citing Ex. 1002 ¶¶ 154–155). Additionally, “when the absence of the signal is detected, switch (4) [of Moine] is opened to power down the circuit.” *Id.* (citing Ex. 1005, 7:6–12).

Regarding claim 15, Petitioner argues that “in the absence of the signal (i.e., when it is interrupted), the receiver (5) [of Moine] controls the FET 630 (of Adest ’178) to disconnect the solar module” and “the converse is also true—that when the signal is not interrupted, the switch remains in its normal operating state.” *Id.* at 60 (citing Ex. 1005, 6:1–10). Because “the absence of the signal can only be detected after one skip,” before the skip, “FET 630 would remain in normal operating mode.” *Id.* at 60–61.

Regarding claim 16, Petitioner argues that Moine’s transmitter 7 “receives signals indicating the charge level of said battery and if it detects that the battery is fully charged, it then opens the switches (4) and accordingly stops recharging said battery.” *Id.* at 61 (citing Ex. 1005, 7:23–25). One of ordinary skill in the art “would have understood that a sensor within the battery charger would be sending the “signals” to transmitter (7) indicating the charge level” and “would understand that, in response to

notifications from sensors in the battery charger, the transmitter (7) causes skips in the signal it sends to receiver (5).” *Id.* at 61–62.

4. *Analysis*

i. *Motivation to Combine*

Patent Owner argues that “Petitioner’s motivations to combine Adest-178 and Moine are not based on any rational underpinnings,” and are hindsight-driven. PO Resp. 39–43. Regarding limitation 12(g), “wherein the controller communicates with a remote unit, disposed at a location remote from the local unit, to control operations of the voltage regulator,” Patent Owner argues that Petitioner’s rationale that Moine was a known technique for improving the safety of photovoltaic power systems “does not set forth a legitimate rationale for combining Adest-178 and Moine, let alone support any such rationale with rational underpinnings.” *Id.* at 40. Patent Owner argues that a “POSITA had no reason to look to Moine given that Adest-178 describes known safety issues with solar installations” and “discloses various safety mechanisms at length,” and that Petitioner’s proposed combination “would appear to make Adest-178 less safe.” *Id.* at 41. Regarding limitation 12(h), “wherein the controller detects an anomaly in heartbeat signals from the remote unit,” Patent Owner argues that Petitioner does not provide “any additional reasons to combine its two references with respect to this limitation.” *Id.* at 42–43. Regarding limitation 12(i), “wherein in response to the anomaly, the controller causes the voltage regulator to reduce the power output of the photovoltaic panel,” Patent Owner also argues that Petitioner does not provide “any additional bases for modifying Adest-178 in view of Moine.” *Id.* at 43.

Petitioner replies that it provided an adequate rationale to combine Adest '178 and Moine. Reply 21–22 (citing Pet. 43–62; Ex. 1002 ¶¶ 112–162). More particularly, Petitioner argues that “just because one reference describes known safety issues does not mean that it would not be desirable to increase the safety of that system.” *Id.* at 21. Petitioner also argues that Patent Owner’s “speculations about the combination making a more dangerous situation” are controverted by the '321 patent, which “specifically discusses a watchdog unit (a single device) ‘disconnect[ing] the solar modules 102 from the power bus 108’ when it receives a shutdown signal from the central controller.” *Id.* at 21–22 (citing Ex. 2005, 3:36–40).

Patent Owner reiterates that Petitioner has not supported its proposed combinations with rational underpinnings. Sur-Reply 15. Patent Owner argues that Petitioner failed to explain why Adest '178’s “safety mechanisms were inadequate (or different at all),” and “noted only a generic concern (safety) and identified a safety teaching in Moine.” *Id.* at 17.

We have reviewed Petitioner’s rationale to combine and arguments regarding reasonable expectation of success, and are persuaded that Petitioner has met its burden by a preponderance of the evidence. Petitioner articulates clearly its motivations to combine and reasonable expectation of success (Pet. 53–54, 56–62), and addresses the Graham factors (Pet. 4, 11–14, 43–62), supporting these arguments with statements from its expert (Ex. 1002 ¶¶ 17–18, 112–162). Accordingly, we find that Petitioner has established by a preponderance of the evidence that one of ordinary skill in the art would have had a motivation to combine Adest '178 with Moine, with a reasonable expectation of success.

ii. Reducing

Petitioner argues that the combination of Adest '178 and Moine discloses limitation 12(i) (“wherein in response to the anomaly, the controller causes the voltage regulator to reduce the power output of the photovoltaic panel”). Pet. 56–57. More particularly, Petitioner argues, Moine discloses “that upon detecting the absence of the signal, the **receiver (5)** (*i.e.*, the recited local controller) causes **switch (4)** to open and thus “powers down” the circuit. Ex-1005, 6:6-10. When **switch (4)** is open, **photovoltaic power module (3)** is disconnected from the **circuit (1)**.” *Id.* at 56 (citing Ex. 1002 ¶¶ 148–151). Based on Petitioner’s previous arguments that Adest '178’s FET 630 could be used to implement the functionality of switch (4), Petitioner argues that if FET 630 were turned off, no current could be output from the solar panel, and consequently “no power would be output from the solar panel.” *Id.* at 56–57 (citing Ex. 1008, Fig. 6; Ex. 1002 ¶¶ 149–150)

Patent Owner argues that Moine does not disclose limitation 12(i), because Moine discloses turning off an entire circuit rather than reducing the power output of the photovoltaic panel in response to a detected anomaly. PO Resp. 44–46. Patent Owner criticizes Petitioner’s position that “a power shutdown is a type of reduction of power output.” *Id.* at 46.

Petitioner replies that (1) “reducing the voltage from an operating voltage to zero volts *reduces* the power output to zero”; (2) the '770 and '321 patents describe “reduction on a continuum from a duty cycle of 0–100%, corresponding to a power output and voltage of 0–100%”; and (3) Moine’s system does not shut down the entire circuit, but “can reduce the

power output by shutting down solar panels on select lines and need not shut down its entire circuit.” Reply 22–24.

Patent Owner responds that Moine does not reduce the power output of the photovoltaic panel, noting that claim 1 of the ’770 patent “is directed to shutting the panel down, while claim 12 is directed to reducing the panel’s power output.” Sur-Reply 17–18. Patent Owner criticizes as “new argument” Petitioner’s assertions “about Moine shutting down individual lines in a circuit rather than an entire circuit.” *Id.* at 19.

On this record, we are persuaded that Petitioner has demonstrated that the combination of Moine and Adest ’178 would have rendered obvious the “reduce” limitation. We agree that “reducing the voltage from an operating voltage to zero volts *reduces* the power output to zero,” and that mathematically it would be essentially impossible to go from an operating voltage to zero volts without reducing the power output from some extant level to zero. Reply 22. This is consistent with the disclosure of the ’770 patent, which Petitioner characterizes as describing “reduction on a continuum from a duty cycle of 0–100%, corresponding to a power output and voltage of 0–100%.” *Id.* at 23; Ex. 1001, 8:10–19 (indicating that the duty cycle “can be expressed as a percentage (e.g. from 0 to 100%) of the time the solar module” is to be connected to the serial power bus). Accordingly, we are persuaded that Petitioner has demonstrated that the combination of Moine and Adest ’178 would have rendered obvious the “reduce” limitation.

iii. Skips

Patent Owner argues that Moine does not disclose the “skips” limitations. PO Resp. 46–47. Patent Owner elaborates that “detecting an

anomaly that includes ‘skips’ in the context of the claim language requires something more specific, namely detecting an anomaly that includes skipped heartbeats” and Moine’s disclosures “do not disclose or suggest any notions of ‘skips.’” *Id.*

Petitioner replies that Patent Owner relies on an incorrect interpretation of “skips.” Reply 24. Petitioner further argues that Moine’s receiver 5 detects the absence of a communication signal from transmitter 7 after “a set timing” such as 5 minutes, and can detect when the communication has been interrupted or cannot be verified and can take the necessary action to shut down. *Id.* at 25.

Patent Owner responds that Petitioner misconstrues the specification of the ’321 patent “as suggesting that any use of a threshold in ‘the number of skips allowed decision’ means a ‘skip’ anomaly is detected (claim 12) and a ‘predetermined number of skips’ (claims 13–16) is used,” but that “Moine’s timer does not read on the ‘skips’ limitation.” Sur-Reply 20.

On this record, we are persuaded that the combination of Adest ’178 and Moine would have rendered obvious the “controller detects an anomaly in heartbeat signals” limitation of claim 12 and the “wherein the anomaly includes skips of heartbeat signals” limitation of claim 13. As discussed above, we arrived at the following construction taken from the specification of the ’770 patent: “Skips refers to the event of missing a communication or pulse.” Ex. 2005, 9:36–37. Petitioner persuasively argues that, as “the Petition explains, the “*Moine receiver (5)* detects the absence of a communication signal from the **transmitter (7)** after “a set timing” (*e.g.*, 5 minutes) and can thereby detect when the communication has been interrupted or cannot be verified.” Reply 25 (citing Ex. 1005, 7:1–4; Ex.

1002 ¶ 153). We agree with Petitioner that this detected absence of a periodic alternating signal, or heartbeat signal (Pet. 55), would be claim 13's "anomaly" that includes "skips of heartbeat signals."

Patent Owner's argument that the Adest '178-Moine combination fails to disclose a "predetermined number" of skips as set forth in claims 14 and 15, however, has merit. Having considered the record as a whole, we find that the Adest '178-Moine combination does not disclose the "predetermined number" of skips limitation. Although the Adest '178-Moine combination discloses that "the anomaly includes skips of heartbeat signals" (claim 13) as we discuss above, we agree with Patent Owner that "Moine never discloses or suggests, for example, setting, or detecting skips (1, 2, 100 or any other number)." Sur-Reply 20. Petitioner does not point to sufficient disclosure in the Adest '178-Moine combination showing a "predetermined number" of skips of heartbeat signals, as required by claims 14 and 15. Petitioner does not, for example, point to any disclosure in Adest '178 or Moine that discusses "predetermined number" in the way the '770 patent does, i.e., "the software may allow two, five, or even 100 skips." To the extent that Petitioner tries to identify a "predetermined number" of skips in Moine, we do not find adequate support or reasoning for Petitioner's assertion that "communication had been interrupted for at least one skip" constitutes a "predetermined number" of skips. Pet. 59 (citing Ex. 1002 ¶¶ 154–155). The open-ended nature of this possible number of skips (one or more) does not meet the "predetermined number" value requirement of the '770 patent. Accordingly, the Adest '178-Moine combination does not disclose a "predetermined number" of skips of heartbeat signals as in claims 14 and 15.

Claim 16 (“wherein the remote unit causes the skips in response to a notification from a sensor”) depends from claim 13, which depends from claim 12. Petitioner identifies transmitter 7 of Moine as the “remote unit” of limitation 12(g) and, presumably, of claim 16. Pet. 53 (discussing limitation 12(g)). Petitioner also identifies the absence of an “alternating signal ‘according to a set timing’” from transmitter 7 as the “skips of heartbeat signals” of claim 13 and, presumably, of claim 16. *Id.* at 58 (discussing claim 13). For claim 16, Petitioner argues, transmitter 7 “receives signals indicating the charge level of [a] battery and if it detects that the battery is fully charged, it then opens the switches.” *Id.* at 61 (citing Ex. 1005, 7:23–25). Petitioner also argues that one of ordinary skill in the art “would have understood that a sensor within the battery charger would be sending the ‘signals’ to transmitter (7) indicating the charge level” and “would understand that, in response to notifications from sensors in the battery charger, the transmitter (7) causes skips in the signal it sends to receiver (5).” *Id.* at 62 (no citations). Claim 16, however, requires the remote unit (i.e. transmitter 7) to cause the skips of heartbeat signals (i.e. “alternating signal ‘according to a set timing’”) in response to a notification from a sensor (unidentified in Moine but presumed to be part of Moine (Ex. 1002 ¶ 159 (not citing to any evidence to support this assertion))). Petitioner fails to sufficiently identify a sensor or a notification from a sensor in the Adest ’178-Moine combination. Petitioner also fails to identify how transmitter 7 “causes the skips” of the heartbeat signal in response to a notification from a sensor. Ex. 1002 ¶ 160 (not citing to any evidence to support this assertion). In sum, Petitioner has not shown by a preponderance

of the evidence that the Adest '178-Moine combination would have rendered claim 16 unpatentable.

4. *Conclusion as to Ground 3*

For the reasons given above, Petitioner has demonstrated by a preponderance of the evidence that Adest '178 and Moine would have rendered obvious claims 12 and 13; however, we do not find that Petitioner has demonstrated by a preponderance of the evidence that Adest '178 and Moine would have rendered obvious claims 14–16.

G. *Asserted Obviousness based on Adest '178, Moine, and Kronberg (Ground 4)*

Petitioner argues that claims 14–16 would have been unpatentable as obvious under 35 U.S.C. § 103 in view of Adest '178, Moine, and Kronberg. Pet. 63–69. Petitioner's arguments primarily address claim 14. *See id.* at 63–68. As we determined in our analysis of the Adest '055-Kronberg combination in Ground 2, Kronberg does not provide the missing “predetermined number of skips of heartbeat signals” of claim 14. As we determined in our analysis of the Adest '178-Moine combination in Ground 3, Moine does not provide the missing “predetermined number of skips of heartbeat signals” of claim 14. None of Petitioner's arguments in Ground 4 account for or resolve the previously discussed shortcomings in the proposed combinations presented in Grounds 2 and 3. For essentially the same reasons given in our Grounds 2 and 3 analysis of claim 14, *supra*, we are unpersuaded that Petitioner has met its burden to establish that the combination of Adest '178, Moine, and Kronberg would have rendered claim 14 obvious.

For claims 15 and 16, Petitioner relies on its Ground 3 arguments. For the same reasons given in connection with claims 15 and 16 in our

Ground 3 analysis, *supra*, we are unpersuaded that Petitioner has met its burden to establish that the combination of Adest '178, Moine, and Kronberg would have rendered claims 15 and 16 obvious.

III. CONCLUSION⁹

For the reasons discussed above, we determine Petitioner meets its burden of establishing, by a preponderance of the evidence, that certain challenged claims are unpatentable, as summarized in the following table:

Claims	35 U.S.C. §	Reference(s)/ Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
12–15	§ 102(e)	Adest '055	12, 13	14, 15
12–15	§ 103(a)	Adest '055, Kronberg	12, 13	14, 15
12–16	§ 103(a)	Adest '178, Moine	12, 13	14–16
14–16	§ 103(a)	Adest '178, Moine, Kronberg		14–16
Overall Outcome			12, 13	14–16

⁹ Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner's attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. See 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. See 37 C.F.R. § 42.8(a)(3), (b)(2).

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that Petitioner establishes, by a preponderance of the evidence, that claims 12 and 13 of U.S. Patent No. 10,256,770 B2 are unpatentable, but does not establish that claims 14–16 of U.S. Patent No. 10,256,770 B2 are unpatentable; and

FURTHER ORDERED that this is a Final Written Decision; therefore, 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.

IPR2021-01287
Patent 10,256,770 B2

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