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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

HAMAMATSU PHOTONICS K.K.,
Petitioner,

v.

SEMICAPS PTE LTD.,
Patent Owner.

Case IPR2017-02110
Patent 7,623,982 B2

Before KEN B. BARRETT, CHARLES J. BOUDREAU, and MONICA S. ULLAGADDI, *Administrative Patent Judges*.

BARRETT, *Administrative Patent Judge.*

FINAL WRITTEN DECISION

Finding All Challenged Claims Not Shown to Be Unpatentable
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73
and
Dismissing Patent Owner's Contingent Motion to Amend
35 U.S.C. § 316(d) and 37 C.F.R. § 42.121

I. INTRODUCTION

A. Background and Summary

Hamamatsu Photonics K.K. ("Petitioner")[1] filed a Petition requesting *inter partes* review of U.S. Patent No. 7,623,982 B2 ("the '982 patent," Ex. 1001). Paper 1 ("Pet."). The Petition challenges the patentability of claims 1, 4–7, and 21–25 of the '982 patent ("the challenged claims") on the grounds of anticipation under 35 U.S.C. § 102 and obviousness under 35 U.S.C. § 103. Petitioner asserted a total of seven grounds. *Id.* at 3–4. SEMICAPS Pte Ltd. ("Patent Owner")[2] filed a Preliminary Response to the Petition. Paper 7 ("Prelim. Resp.").

On March 19, 2018, an *inter partes* review was instituted on Petitioner's challenge of all the challenged claims 1, 4–7, and 21–25, but not as to all of the asserted grounds. Paper 8 ("Inst. Dec."), 34–35.

On April 24, 2018, the Supreme Court issued its decision in *SAS Institute Inc. v. Iancu*, 138 S. Ct. 1348 (2018). On May 3, 2018, we issued an order modifying our institution decision to institute on all of the challenged claims and all of the grounds presented in the Petition. Paper 12.

Subsequently, Patent Owner filed a Response (Paper 21, "PO Resp.") to the Petition, Petitioner filed a Corrected Reply to Patent Owner Response (Paper 25, "Pet. Reply"), and Patent Owner filed a Sur-Reply (Paper 30, "PO Sur-Reply"), with our authorization (Paper 27).

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[1] Petitioner identifies Hamamatsu Photonics K.K. as the real-party-in-interest. Pet. 1; Paper 14.
[2] Patent Owner identifies SEMICAPS Pte Ltd. as the real-party-in-interest. Paper 5, 1.

Patent Owner filed, concurrently with its Response to the Petition, a Motion to Amend. Paper 22 ("MTA"). The Motion to Amend is contingent upon the patentability determination of challenged claims 1, 4–7, and 21–25, and requests the issuance of the corresponding one of proposed substitute claims 26–35 for each claim determined to be unpatentable. *Id.* at 1. Petitioner filed a Corrected Opposition to Patent Owner's Motion to Amend (Paper 26, "MTA Opp."), and Patent Owner filed a Reply in Support of Its Motion to Amend (Paper 28, "MTA Reply").

An oral hearing was held on December 3, 2018, and a transcript of the hearing is included in the record. Paper 34 ("Tr.").

We have jurisdiction under 35 U.S.C. § 6. This Final Written Decision is entered pursuant to 35 U.S.C. § 318(a). After consideration of the parties' arguments and evidence, and for the reasons discussed below, we determine that Petitioner has *not* shown by a preponderance of the evidence that claims 1, 4–7, and 21–25 of the '982 patent are unpatentable. Accordingly, we dismiss as moot Patent Owner's contingent Motion to Amend.

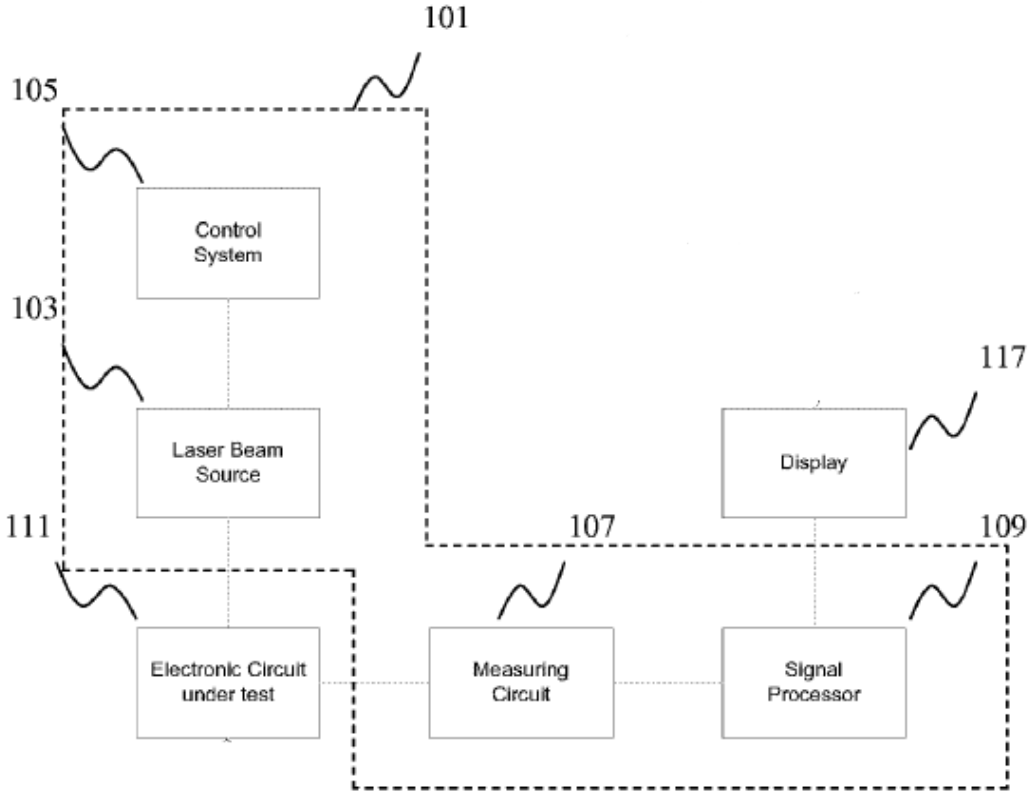
B. Related Proceedings

One or both parties identify, as matters involving or related to the '982 patent, *SEMICAPS Pte Ltd. v. Hamamatsu Photonics K.K., Hamamatsu Corp., and Photonics Management Corp.*, Case No. 3:17-cv-03340 (N.D. Cal. 2017), and Patent Trial and Appeal Board case IPR2017-02112, which was filed by Petitioner and involves a challenge to claims 2, 3, and 8–20 of the '982 patent. Pet. 2; Paper 5.

C. The '982 Patent

The '982 patent is titled "Method of Testing an Electronic Circuit and Apparatus Thereof." The testing of the circuit is performed by radiating a laser beam onto the circuit, determining a plurality of samples of a response signal output by the circuit, accumulating those samples to generate a value, and generating a test result based on the value. Ex. 1001, Abstract. Based on the generated value, a fault in the circuit may be represented on a display as a bright spot at a pixel location corresponding to the location of the fault in the circuit. *Id.* at 4:16–24, 4:34–38. According to the '982 patent, the disclosed method and apparatus provide an improvement to conventional, laser-based fault detection systems by increasing the detection sensitivity, which has particular application with advanced integrated circuits ("IC"). *See id.* at 1:28–37.

A redacted version of Figure 1 of the '982 patent shown below.



The redacted version of Figure 1 depicts an exemplary embodiment of the apparatus of the '982 patent with the omission of the digital image of the electronic circuit under test and the digital image generated as the result of the processing. *See id.* at 2:29–30, 4:8–9, 4:16–18. As indicated by Figure 1, the depicted system includes laser beam source 103, control system 105, measuring circuit 107, signal processor 109, and display unit 117. *Id.* at 2:65–3:3, 4:16–19. "Any suitable laser beam source 103 may be used," and the specification identifies, as an exemplary laser beam source, that which is described in U.S. Patent No. 6,897,664 B1 to Bruce (Ex. 1010). *Id.* at 3:4–13. "The laser beam can be a continuous laser beam or a pulsed laser beam." *Id.* at 3:29–30. Signal processor 109 accumulates the plurality of samples to generate a value and generates a test result based on that value. *Id.* at 3:65–67.

D. Illustrative Claims

Of the challenged claims of the '982 patent, claims 1 and 21 are independent claims. The remaining challenged claims depend directly or indirectly from claim 1 or claim 21. Claims 1 and 21, reproduced below, are illustrative:

1. A method of testing an electronic circuit, comprising:

radiating a laser beam onto the electronic circuit,

determining a plurality of samples of a response signal output by the electronic circuit during the period when the laser beam is radiated,

accumulating the plurality of samples to generate a value, and

generating a test result based on the value.

21. An apparatus, comprising:

a laser beam source, wherein the laser beam source radiates a laser beam onto the electronic circuit,

a control system operable to direct the laser beam source to dwell on a location on the electronic circuit,

a measuring circuit, wherein the measuring circuit determines a plurality of samples of a response signal output by the electronic circuit during the period when the laser beam is radiated, and

a signal processor, wherein the signal processor accumulates the plurality of samples to generate a value, and

generates a test result based on the value.

Ex. 1001, 10:60–67, 12:19–31.

E. Applied References and Evidence

Reference	**Exhibit No.**
JP2003-179108A, published June 27, 2003 ("Hamada"[3])	Ex. 1003/1004
ACT Quah et al., *DC-Coupled Laser Induced Detection System for Fault Localization in Microelectronic Failure Analysis*[4] ("Quah")	Ex. 1005
F. Beaudoin et al., *From Static Thermal and Photoelectric Laser Stimulation (TLS/PLS) to Dynamic Laser Testing*, 43 MICROELECTRONICS RELIABILITY 1681–86 (2003) ("Beaudoin")	Ex. 1009
U.S. Patent No. 6,897,664 B1, issued May 24, 2005 ("Bruce")	Ex. 1010

[3] Exhibit 1003 is a Japanese-language publication. All references to Hamada in this decision are to the English translation (Ex. 1004) of the publication.
[4] As discussed below, the parties disagree as to when Quah was published.

Petitioner also relies on the Declaration of Melvin Ray Mercer, Ph.D. dated September 8, 2017 (Ex. 1014), the Declaration of Kiyoshi Nikawa, Ph.D. dated Sept. 11, 2018 (Ex. 1025), and the Second Declaration of Melvin Ray Mercer, Ph.D. dated Sept. 18, 2018 (Ex. 1026) in support of its arguments. Patent Owner relies on the Declaration of Michael Bruce, Ph.D. dated December 18, 2017 (Ex. 2004), the Declaration of Alfred Quah dated Oct. 24, 2017 (Ex. 2011), and the Declaration of Dr. Gary Woods dated June 15, 2018 (Ex. 2029) in support of its arguments. The parties rely on other exhibits as discussed below.

F. Asserted Grounds of Unpatentability

Petitioner asserts the following grounds of unpatentability:

Reference(s)	**Basis**	**Claims**
Hamada	§ 102(b)	1, 21, and 22
Quah	§ 102(b)	1, 4–7, 21, and 23–25
Hamada	§ 103(a)	1, 21, and 22
Hamada and Beaudoin	§ 103(a)	4, 5, 7, 23, and 24
Hamada and Bruce	§ 103(a)	4–7 and 22–25
Hamada and Quah	§ 103(a)	4–7 and 23–25
Quah	§ 103(a)	1, 4–7, 21, and 23–25

II. ANALYSIS

A. Principles of Law

Petitioner bears the burden of proving unpatentability of the claims challenged in the Petition, and that burden never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015). To prevail, Petitioner must establish by a preponderance of

the evidence that the challenged claims are unpatentable. 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d).

"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 patent claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) any objective evidence of non-obviousness.[5] *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

B. The Level of Ordinary Skill in the Art

Petitioner, relying on the testimony of its declarant, Dr. Mercer, asserts, in the Petition, that the person of ordinary skill in the art would be

> one who has experience with testing electronic circuits and who has a working knowledge of apparatus for testing integrated circuits, semiconductor devices, and other electronic circuits. [Ex.] **1014** ¶ 33. This person would have (1) at least an undergraduate degree in Electrical Engineering or Physics, or comparable training, and (2) at least two years of industrial or other professional experience in designing, developing,

[5] The parties have not directed our attention to any objective evidence of non-obviousness.

> analyzing, and/or utilizing electronic circuit testing equipment. *Id.* A higher level of training/experience in one area could compensate for a deficit in the other. *Id.*

Pet. 11–12. Patent Owner initially agreed with Petitioner's definition of the level of ordinary skill in the art. Prelim. Resp. 27. After Institution and after deposing Dr. Mercer, Patent Owner began advocating for an elevated and very specific level of experience. PO Resp. 17. According to Patent Owner:

> a POSITA would have at least two years of experience in this type of laser-based testing of semiconductor circuits [involved in the '982 patent] and would be familiar with the use of laser stimulation to localize defects in semiconductor devices, including static laser stimulation (e.g. TIVA, OBIRCH), dynamic laser stimulation (e.g. LADA, SDL) and their fundamental differences.

Id. (citing Ex. 2029 ¶¶ 30–32). Patent Owner characterizes "[t]his type of laser-based testing [as] the area of focus of the '982 patent, as well as that of the references relied upon in the petition." *Id.* Notwithstanding the purported "area of focus," Patent Owner's new definition is much more specific than the subject matter of the independent claims of the '982 patent—which do not specify, for example, the type of laser stimulation or require a pulsed laser—and is directed to, at most, certain specific embodiments disclosed in the Specification. *See, e.g.*, Ex. 1001, 10:60–67 (independent claim 1), 11:8–9 (dependent claim 4: "The method of claim 1, wherein the laser beam is a pulsed laser beam."); *cf.* PO Resp. 19 (Patent Owner characterizing "the use and operation of lock-in amplifiers [as] a common and critical component of pulsed laser-based systems").

Patent Owner attempts to use its elevated definition as a vehicle to make the argument that Petitioner's expert, Dr. Mercer, is not a person of

ordinary skill and to attack his credibility.[6] *See* PO Resp. 18–20 (segueing, still under the heading of "The Level of Ordinary Skill in the Art," into an argument that Patent Owner's two experts have more experience and expertise "in the relevant field" as compared to Petitioner's expert); *id.* at 20 (concluding this same section with the argument that Dr. Mercer's opinions should be afforded little weight). However, in directing its arguments almost exclusively at attacking Dr. Mercer, Patent Owner fails to adequately address the pertinent issue—whether Petitioner's proposed *hypothetical person of ordinary skill in the art* would lack the requisite experience and understanding of the art. Patent Owner does not identify adequately a substantive difference between Petitioner's hypothetical person of ordinary skill in the art and Patent Owner's. *See* PO Resp. 17–20. For example, Patent Owner does not argue that an electrical engineer or physicist with two years of experience utilizing electronic circuit testing equipment would lack adequate knowledge of the use of lasers in circuit testing. To the contrary, Patent Owner's expert, Dr. Woods, "generally agree[s] with petitioner's definition of a [person of ordinary skill in the art]"—including the type of education and level of experience—and testified that "[t]hese techniques [of OBIRCH and TIVA] were known and widely used around the time of the invention of the '982 patent to determine the location of defects in a semiconductor device and would have been known to those of ordinary skill in the art." Ex. 2029 ¶¶ 30–31.

[6] Patent Owner did not file a motion to exclude the testimony of Dr. Mercer on the basis that he is unqualified to offer opinion testimony regarding the knowledge of a person of ordinary skill in the art.

To the extent that Patent Owner's proposed definition of the level of *ordinary* skill is more than merely an elaboration upon Petitioner's, we find it to be directed to a super-expert in a very narrowly defined field and calculated to undermine Dr. Mercer's credibility while simultaneously promoting the credentials of its own experts. We do not find this litigation-induced argument persuasive.

We determine that the definition offered by Dr. Mercer comports with the qualifications a person would have needed to understand and implement the teachings of the '982 patent and the prior art of record. *Cf. Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (the prior art itself may reflect an appropriate level of skill in the art). Accordingly, we apply Dr. Mercer's definition of the level of ordinary skill in the art.

C. Claim Construction

In an *inter partes* review, claim terms in an unexpired patent are given their broadest reasonable construction in light of the specification of the patent in which they appear. 37 C.F.R. § 42.100(b) (2017)[7]; *see also Cuozzo Speed Techs. LLC v. Lee*, 136 S. Ct. 2131, 2144–46 (2016). Under the broadest reasonable construction standard, claim terms are given their ordinary and customary meaning, as would be understood by one of ordinary skill in the art in the context of the entire patent disclosure. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007).

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[7] A recent amendment to this rule does not apply here because the Petition was filed before November 13, 2018. *See* Changes to the Claim Construction Standard for Interpreting Claims in Trial Proceedings Before the Patent Trial and Appeal Board, 83 Fed. Reg. 51,340, 51,340 (Oct. 11, 2018).

"accumulating" and "accumulates"

Independent claims 1 and 21 recite, respectively, "accumulating" and "accumulates."

Petitioner maintains that these terms "relate to the plurality of samples being accumulated to generate a value" and "[t]he accumulation process described in the '982 patent involves adding together the plurality of samples." Pet. 4–5 (citing Ex. 1001, 4:63–65, 8:20–9:19, Fig. 6). Petitioner's proposed construction for "accumulating" is, in part, "adding or performing any act that includes adding as a step." *Id.* at 5; *see* Pet. Reply 6–7 ("accumulating" would encompass "adding").

Patent Owner similarly contends that "accumulating" "refer[s] to collecting a number of individual samples to be mathematically processed, for example to generate a single value from the multiple samples." PO Resp. 20–21. Patent Owner asserts that "[t]he specification illustrates the accumulation of these values using an equation showing summation, or adding, of the values" and that "the ordinary meaning of 'accumulate' is to gather together, increase, or add." *Id.* at 20 (citing Ex. 1001, 8:55–62; Ex. 2007, 12 (American Heritage Dictionary)).

Thus, the parties agree that accumulating encompasses, at least, adding values together. This understanding is consistent with the specification's discussion of accumulated samples. *See, e.g.*, Ex. 1001, 8:20–29.

Petitioner initially asserted in the Petition that "accumulating" should be construed to include the act of averaging. Pet. 5. In the Institution Decision, we declined to construe "accumulating" as necessarily including the act of averaging. Inst. Dec. 7–8. In its Reply, Petitioner no longer

advocates this as a matter of claim construction. *See* Pet. Reply 6–7. As discussed below, the parties address the issue as a factual matter, and specifically as to whether a prior art reference's use of the term "average" discloses "accumulating" within the meaning of the claims of the '982 patent.

We again, as we did in the Institution Decision, Inst. Dec. 9, construe the term "accumulating" merely as encompassing the process of addition.

We determine that, for purposes of resolving the dispositive issues in this decision, no other claim terms require express construction.

D. The Alleged Anticipation of Claims 1, 21, and 22 by Hamada

Petitioner, relying on the testimony of Dr. Mercer (Ex. 1014), alleges that independent method claim 1, independent apparatus claim 21, and dependent apparatus claim 22 (which depends directly from claim 21) are anticipated by Hamada. *See* Pet. 12–21 (addressing together claims 1 and 21). Patent Owner argues that Hamada does not disclose "determining a plurality of samples of a response signal . . . during the period when the laser beam is radiated" or "accumulating the plurality of samples to generate a value." PO Resp. 2.

1. Hamada (Ex. 1004)

Hamada discloses a method and device for inspection of a semiconductor device by irradiating it with an optical beam and measuring the resistance change in the circuit to determine a defective portion of the circuit. Ex. 1004 ¶ 9. Figure 1 of Hamada is reproduced below.

FIG. 1

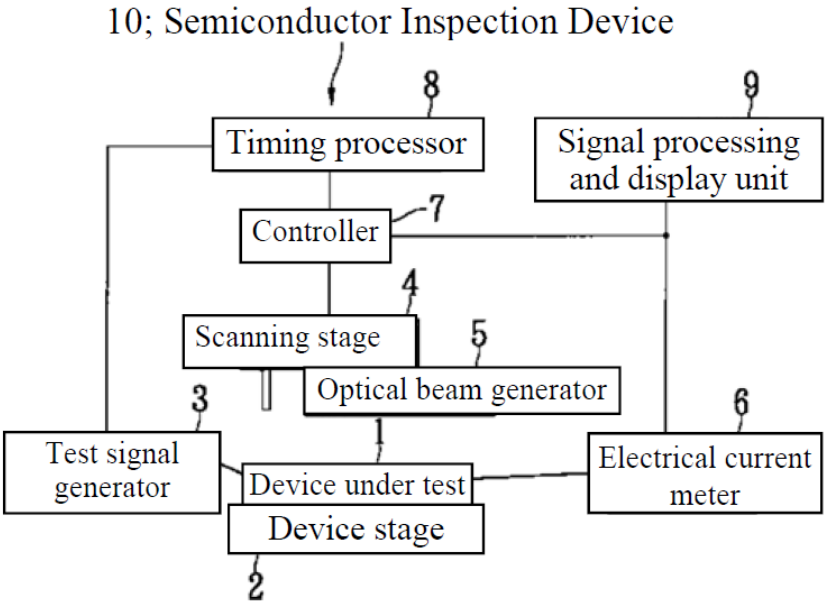

Figure 1 "is a block diagram showing a configuration of an inspection device for inspecting a semiconductor device." *Id.* ¶ 21. Figure 1 depicts, as the "device under test" ("DUT"), an integrated circuit (a semiconductor device). Also depicted are: "test signal generator 3 for generating a test signal of the same pattern repeating multiple times periodically and applying the same to the device under test 1 [the integrated circuit]"; optical beam generator 5 for scanning a desired location on the integrated circuit with an optical beam and irradiating the desired location for a fixed time; electrical current meter 6 for measuring an operation current at various locations on the integrated circuit for a fixed time; timing processor 8 for controlling the operation timing for the test signal generator 3, the operation timing for the optical beam generator 5, and the electrical current meter 6 through a controller 7; and signal processing and display device 9 for calculating an average current at a respective scanning site based on an operational current measured when the respective site of the integrated circuit is measured, converting the same to a contrast image, and displaying the same. *Id.*

Figure 2, including Figures 2(a), 2(b), and 2(c), of Hamada is reproduced below:

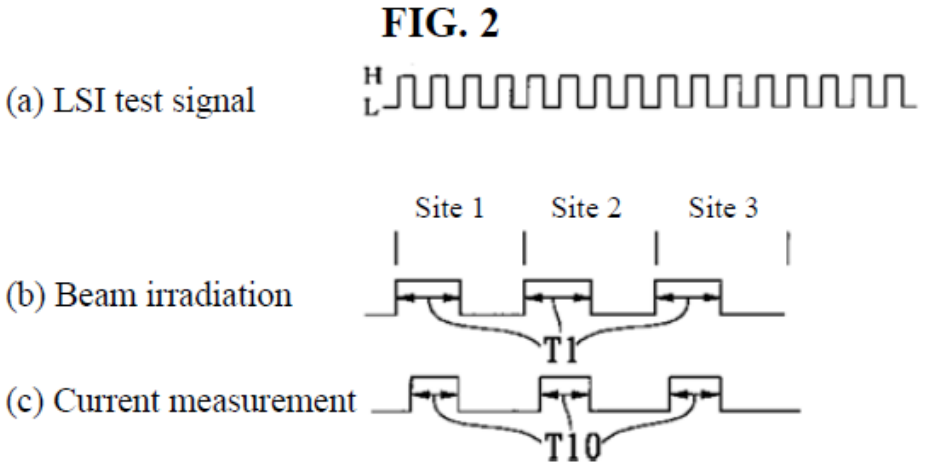

Figure 2(a) is a timing chart showing an LSI (large scale integrated circuit) test signal applied to the integrated circuit. *Id.* ¶ 23. As shown in Figure 2(b), "the optical beam generator 5 scans each of the sites 1, 2, 3 on the device under test 1 stepwise with the optical beam, irradiating the sites 1, 2, and 3 for a fixed time T1." *Id.* "[A]s shown in FIG. 2(c), the electrical current meter 6 measures the operation current at the site 1, site 2, and site 3 on the device under test 1 for a fixed time T10." *Id.* ¶ 24. "In this embodiment, the operation current is measured only for the fixed time T10 in synchronization with the H-level interval; the operation current is not measured during the L-level interval." *Id.*

Hamada explains:

> [B]ased on the operation current measured at the sites 1, 2, and 3 of the device under test 1 at the measurement time T10 by the electrical current meter 6, the signal processing and display device 9 calculates the average current at each of the sites scanned by the optical beam generator 5, converts the calculation into a contrast image and displays the same.

Id.

2. "determining a plurality of samples" and "accumulating the plurality of samples"

The dispositive issue regarding Hamada is whether it discloses determining and accumulating a plurality of samples.

Independent method claim 1 recites:

> determining a plurality of samples of a response signal output by the electronic circuit during the period when the laser beam is radiated, [and]
>
> accumulating the plurality of samples to generate a value.

Ex. 1001, 10:62–66. Independent apparatus claim 21 recites a measuring circuit and a signal processor that, respectively, determines and accumulates the plurality of samples. *Id.* at 12:24–30. The parties do not draw any substantive distinction between the claims for purposes of resolving the dispositive issues. *See* Pet. 15–19 (addressing the determining/determines limitation with a single discussion); PO Resp. 31 (arguing that the purported "novel approach" "is captured in the [determining and accumulating] limitations substantively required by every claim of the '982 patent"). We focus our discussion on claim 1, and our analysis applies equally to independent claim 21.

As an initial matter, we note that Petitioner does not point to any explicit disclosure in Hamada of determining a plurality of samples when the laser beam is radiated or of accumulating, or even adding, the plurality of samples. Petitioner's theory, at least in part, is rooted in inherency[8],

[8] "Inherency . . . may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient. . . . If, however, the disclosure is sufficient to show that the natural result flowing from the operation as taught would

notwithstanding Petitioner's denial of that assertion. *See* PO Resp. 37 (Patent Owner asserting that "[Petitioner's] argument constitutes an anticipation by inherent disclosure argument, i.e., 'average' inherently discloses multiple samples"); Pet. Reply 14 ("Petitioner has never made an inherency argument. . . . Petitioner's argument is and has always been that Hamada discloses the accumulating and determining steps because '[b]y definition, 'averaging' requires the addition of the values of a number of samples.'"); *see also* Ex. 1014 ¶¶ 87, 90–93 (Petitioner's expert repeatedly using the term "necessarily" in the opinions related to Hamada's purported disclosure of a plurality of samples). Additionally, much of Petitioner's argument hinges on the proper meaning of Hamada's Japanese terms translated here as "average" and "calculate." *See, e.g.*, Pet. 16 (arguments referring to the "calculation of an average current"), Pet. Reply 10 (arguing that the Japanese-language term translated as "calculate" should be understood to refer to digital, rather than analog, processing).

Regardless as to the proper characterization of Petitioner's theory, we, for the reasons discussed below, determine that Petition has failed to establish by a preponderance of the evidence that Hamada discloses the "determining a plurality of samples" and "accumulating the plurality of samples," as required by independent claim 1 and the corresponding limitations of independent claim 21.

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result in the performance of the questioned function, it seems to be well settled that the disclosure should be regarded as sufficient." *In re Oelrich*, 666 F.2d 578, 581 (CCPA 1981) (quoting *Hansgirg v. Kemmer*, 102 F.2d 212, 214 (CCPA 1939)).

Determining a Plurality of Samples

For the recited step of "determining a plurality of samples of a response signal output by the electronic circuit during the period when the laser beam is radiated," Petitioner points to Hamada's paragraphs 21–25 as disclosing the electrical current meter determining a plurality of samples of the response signal output of the DUT (the integrated circuit). Pet. 16. Specifically, Petitioner contends:

> Hamada's indication that the calculation of an average current at each of sites 1, 2, and 3 is performed based on the operation current measured by electrical current meter 6 at each respective site, **1003/1004** ¶¶ [0021], [0022], [0024], means that Hamada determines or measures a plurality of samples of the response signal at each of the sites. **1014** ¶ 93. *By definition, "averaging" requires the addition of the values of a number of samples resulting in a sum, and a division of that sum by the number of samples that were added.* **1015; 1014** ¶ 93. Thus, Hamada's disclosure that the average current is determined at each of sites 1, 2, and 3 teaches that electrical current meter 6 determines multiple samples of the response signal output by DUT 1 for each of the sites. **1003/1004** ¶¶ [0021], [0022], [0024], **1014** ¶ 94.

Id. at 16–17 (emphasis added).[9] Petitioner further contends that Hamada additionally discloses the "determining a plurality of samples" step in describing the measurements relative to the repeating LSI test signal. *Id.* at 17–19 (citing, *inter alia*, Ex. 1004, Fig. 2; Ex. 1014 ¶¶ 89–97).

[9] Petitioner places great weight on the purported applicable definition of the English word "average." We note that Petitioner's "[b]y definition" argument technically is not applied to the term utilized by the author of the article—which would have been a Japanese term—but rather involves a proposed definition for the English word selected by Petitioner's translator when translating the article from Japanese.

Petitioner, in support of its "[b]y definition" argument, relies on a definition of "average" from a general dictionary,[10] and specifically one identified by Petitioner as "Oxford Living Dictionaries, https://en.oxforddictionaries.com/definition/average, Oxford University Press, 2017." Pet. vi (Exhibit List), 16 (citing Ex. 1015); *see* Ex. 1015 (an online dictionary lacking facial identification via, e.g., a footer). Petitioner also relies on the testimony of Dr. Mercer, which offers little more than Petitioner's argument phrased as an opinion and also is based on the general dictionary. *See* Ex. 1014 ¶¶ 93, 94. Dr. Mercer opines that "the reference to calculating an average current at each of the sites in Hamada necessarily means that Hamada determines or measures a plurality of samples." *Id.* ¶ 93 (citing Ex. 1015).

Patent Owner argues that "[a person of ordinary skill in the art] would not interpret 'average current' in Hamada to mean that multiple samples of the response signal were obtained." PO Resp. 34. Unlike Petitioner's argument and Dr. Mercer's opinion based on a general dictionary, Patent Owner's argument, relying on the testimony of Dr. Woods, presents a technology-based case. *Id.* at 32–40 (citing, *inter alia*, Ex. 2029 ¶¶ 42–43, 75). Patent Owner contends that Hamada's system was like similar systems of the time, which utilized analog averaging by, for example, a low-pass filter, and thereafter used an analog-to-digital (A/D) converter to create a

[10] Assuming Petitioner is referring to the first definition set forth in the dictionary, it appears that Petitioner actually is relying on the definition of "mean," which is identified as one of several forms of an "average." *See* Ex. 1015, 1.

digital signal for display purposes. *Id.* at 32–34[11] (citing Ex. 2029 ¶¶ 42–43, 75; Ex. 2025 (Kiyoshi); Ex. 1012 (Nishida)); *see also id.* at 38–39. Patent Owner asserts that such an analog averaging process produces a single analog measurement and does not, as Petitioner argues, involve determining a plurality of samples. *Id.* at 32. Dr. Woods testifies credibly that:

> In terms of determining an average current, a low-pass filter or an integrator circuit can be used to obtain an average current, which does not involve sampling. This was the primary technique used in the scanning microscopes used for laser-based testing of semiconductor circuits at the time of the Nikawa, Nishida, Kiyoshi, Cole, and Hamada references.

Ex. 2029 ¶ 43. Dr. Woods notes that Hamada cites to the Kiyoshi reference and further testifies credibly that:

> [f]rom inspecting the figures and the translation of this [Kiyoshi] publication (Ex. 2025), it is clear that the Hamada system, based on NEC's Kiyoshi application, also operates like the system described in NEC's Nikawa patent; all these systems measure the output current variation caused by the laser irradiation using a single analog average current measurement per location.

Ex. 2029 ¶ 42 (citing Ex. 2025 ¶ 35, Fig. 6).

In Reply, Petitioner pivots from its original "[b]y definition" position and argues that Hamada must utilize digital processing utilizing multiple samples because "Hamada does not disclose any A/D converter located downstream from current meter 6 of Figure 1." Pet. Reply 9 (citing Ex. 1026 ¶ 23). Even if Petitioner is correct, we do not find the lack of

[11] We do not view, as Petitioner argues, Pet. Reply 10–11, Patent Owner's arguments as incorporation by reference of the other references, but as an assertion that those references reflect the typical practice at the time of Hamada and that Hamada followed that typical practice.

disclosure to satisfy Petitioner's burden to establish a particular disclosure (i.e. a determination of a plurality of samples). *See* PO Sur-Reply 7 ("[T]he absence of an express mention of an A/D converter does not provide a disclosure of 'digital sampling.'"). Also, Petitioner pits one of its technical witnesses against its own translator in impliedly arguing that the translator failed to provide an allegedly full and correct meaning for the word translated as "calculate." Pet. Reply 10. Petitioner's technical witness, Dr. Nikawa, testifies that the corresponding Japanese-language term in Hamada is "most commonly used" to refer to digital-based calculation. *See* Ex. 1025 ¶ 33. The stated basis for this opinion is only "my expertise and experience." *Id.* Rather than supporting Petitioner's position, this apparent inconsistency between Petitioner's witnesses calls into question the credibility of Petitioner's own translation of the reference. Petitioner further presents the speculative argument that Hamada must be utilizing digital processing, asserting that a person of ordinary skill would have viewed Hamada as departing from the analog averaging approach because Hamada, as a patent application, meant the applicant considered the subject matter to be an advancement over the state of the art such as Kiyoshi. Pet. Reply 11.

Conspicuously absent from Petitioner's Reply is any persuasive argument to support its original position that the mere use of the word "average" in the context of electrical circuits involves the determination of a plurality of samples or of Dr. Mercer's dictionary-based opinion that "the reference to calculating an average current at each of the sites in Hamada necessarily means that Hamada determines or measures a plurality of samples," Ex. 1014 ¶ 93 (citing Ex. 1015). *But see* Pet. Reply 14 (Petitioner arguing not that Dr. Mercer's opinion is correct but only that the

cross-examination testimony elicited by Patent Owner is too ambiguous to show that Dr. Mercer's opinion is wrong).

We do not find Petitioner's dictionary-based "[b]y definition" argument to be persuasive as it is disconnected from the technology at issue. We cannot find that a person of ordinary skill in the art would apply, in this context, a lay dictionary's general definition and thereby understand Hamada to disclose determining a plurality of samples. We credit the opinion of Dr. Woods, containing persuasive reasoning, and find that Hamada's use of the word "average" does not disclose "determining a plurality of samples," as Petitioner contends. We now turn to Petitioner's arguments that are more closely related to the technology.

Petitioner also relies on Hamada's discussion in the context of Figure 2. Pet. 17–19 (citing, *inter alia*, Ex. 1004 ¶¶ 23–25). We again reproduce Figure 2:

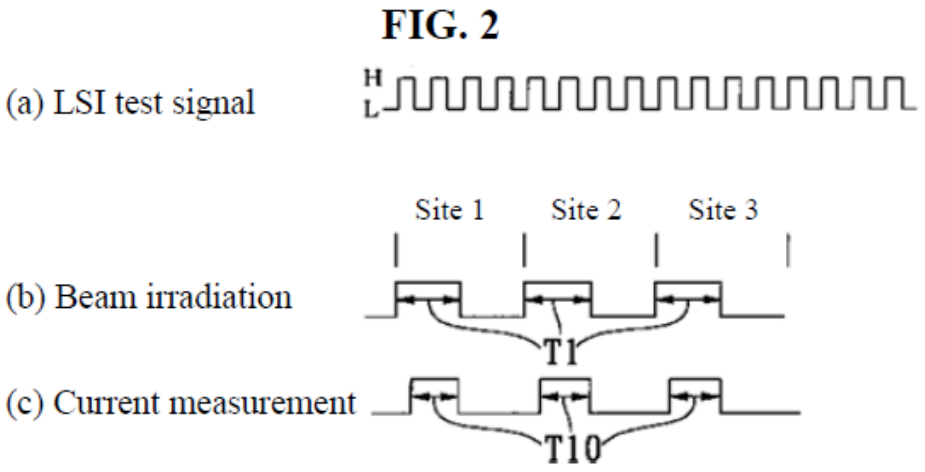

Figure 2 is a timing chart showing the repeating pattern of an LSI test signal, the stepwise irradiation of three sites, and a graph of current measurement. Ex. 1004 ¶¶ 23–24. Petitioner contends that Hamada discloses that the length of measurement time T10 corresponds to multiple LSI test signal cycles. Pet. 17. We find this contention to be consistent with Figure 2

(assuming but not finding that the three graphs of Figure 2 are the same scale and aligned to each other)—depicting the length of time T10 as approximately the duration of two LSI test signals cycles—and the text of Hamada, which Petitioner quotes and relies upon. Ex. 1004 ¶ 25 (Hamada: "[I]n FIG. 2, the measurement time T10 at site 1 may be a length corresponding to two to three cycles of the LSI test signal."); Pet. 17 (quoting the same). Thus, at this point in the chain of logic, Petitioner has asserted that there is an *input* of multiple test signals per current measurement time T10; but Petitioner has not addressed yet the critical issue—whether there is a disclosure of determining a plurality of samples of an *output*. For this, Petitioner offers a conclusory argument: "Moreover, a POSITA at the time of the invention would have understood that a current measurement (and its resulting sampled value) will occur for each applied cycle of the LSI test signal." Pet. 17 (citing Ex. 1014 ¶ 91).

The cited and relied-upon paragraph of Dr. Mercer's declaration is similarly conclusory with the phrase "in my opinion" attached thereto and the use of the absolute phrase "must necessarily." Specifically, Dr. Mercer testified:

> Moreover, because there must necessarily be a measurement and associated sample value for every test pattern applied (as stated above), it is my opinion that a POSITA at the time of the invention would have understood that a current measurement (and its resulting sampled value) will occur for each applied cycle of the LSI test signal.

Ex. 1014 ¶ 91. Although Dr. Mercer fails to indicate in this paragraph where we might find the basis, purportedly "stated above," underlying the assertion that "there must necessarily be" multiple samples, we did find in paragraph 90 that which may be the referenced basis. However, that

testimony is equally conclusory and, again, uses the absolute term "necessarily":

> [I]t is my opinion that a POSITA would understand that . . . at least one current measurement (and its resulting sampled value) occurs for each applied test pattern. Thus, multiple occurrences of the same test pattern (*repeating multiple times*) necessarily teaches a plurality of current value samples (for each site).

Ex. 1014 ¶ 90 (emphasis in original). Dr. Mercer's opinion is a series of conclusory assertions stacked upon each other and relies on absolute terms "must be" and "necessarily" as a substitute for providing an adequate underlying basis. Further, Patent Owner points out that Dr. Mercer, on cross-examination, backed away from the opinion that a measurement necessarily would be taken at every applied test pattern. PO Resp. 41 (citing Ex. 2019, 99:10–103:4). *But see* Pet. Reply 16 (Petitioner maintaining that its position is not based solely on Dr. Mercer's testimony, but also is supported by the language in Hamada, and that "Patent Owner never explains where or how the cited portion of Dr. Mercer's deposition testimony allegedly constitutes any retraction of the position that, in Hamada, a current measurement occurs for each applied cycle of the LSI test signal"). During Dr. Mercer's cross-examination, the following exchange occurred:

> Q So there's not necessarily a measurement that has to be taken for every high on the LSI test signal of Hamada figure 2(a), right?
>
> A No. I mean, that will be -- that will be determined by things like whenever you define the test pattern set and you determine how you control the tester -- okay? And it may come out, but it may not necessarily be used. By saying that, there probably will be a voltage at the output of the pins, but that

> voltage output will be ignored by the tester that's collecting the data, maybe.

Ex. 2019, 102:19–103:4. Dr. Mercer's declaration testimony, lacking adequate and persuasive reasoning or evidence, is too conclusory to establish by a preponderance of the evidence that the determination of a plurality of samples must necessarily have occurred and is undercut by his testimony under cross-examination. Accordingly, we find that Petitioner has failed to establish that Hamada discloses, under this theory, determining a plurality of samples of a response signal output.

Petitioner next argues that Hamada teaches that "the operation current is measured multiple times within each measurement period T10 of Figure 2(c) in synchronization with the H-level interval of the LSI test signal depicted in Figure 2(a)." Pet 19 (citing Ex. 1014 ¶¶ 96–97). We understand Petitioner to argue that a graph of current measurement would mimic the test signal pattern of Figure 2(a). Petitioner's theory is based on a quote from Hamada's text and the above-discussed general dictionary definition of "average." *See id.* at 18–19. Specifically, Petitioner relies on the last sentence of the following statement from Hamada:

> Next, as shown in FIG. 2(c), the electrical current meter 6 measures the operation current at the site 1, site 2, and site 3 on the device under test 1 for a fixed time T10. In this embodiment, the operation current is measured only for the fixed time T10 in synchronization with the H-level interval; the operation current is not measured during the L-level interval.

Ex. 1004 ¶ 24; *see* Pet 18. We note that Figure 2(c) depicts, for each site, a single line of duration T10 and labeled "Current measurement." Ex. 1004, 13. Petitioner contends that the H-level and L-level must be references to the graph of Figure 2(a), not 2(c), because otherwise there would be only

one sample measured during each measuring time T10, which would be inconsistent with Petitioner's theory that the word "average" means that a plurality of samples are taken. Pet. 18–19. We find this reasoning circular, and unpersuasive, in that it is little more than an assertion that Petitioner's argument is correct because its earlier "[b]y definition" argument is correct. *See id.* (Petitioner arguing that there could not be a single sample "because Hamada calculates the average current at each of the sites, and an average current calculation requires multiple samples"); Ex. 1014 ¶ 96 (Dr. Mercer testifying similarly, basing opinion on the assertion that "an average current calculation, by definition, requires multiple samples"). Additionally, and although not dispositive, we find that Petitioner has not reconciled adequately the seeming singularity of Hamada's statement that the "current is measured only for the fixed time T10," Ex. 1004 ¶ 24, with the theory that a current is measured a plurality of times.

Further, Patent Owner, relying on the testimony of Dr. Woods, reasonably argues that Petitioner's position is "nonsensical as the response signal of interest is current variation as a result of beam irradiation; not variation as result of the test signal." PO Resp. 43–44 (citing Ex. 2029 ¶¶ 69–70). Patent Owner, citing several examples, contends that Hamada consistently refers to current measure with reference to the optical beam. *Id.* (citing Ex. 1004 ¶¶ 4, 27, 30, 33, 39). At least one of those cited examples associates the H-level label with the beam, stating: "[A]s shown in FIG. 11(c), the current change detecting unit 117 measures an electrical current during the high (H) level interval of the pulse shown in FIG. 11(b)." Ex. 1004 ¶ 4; *see id.*at Fig 11 (identifying Fig. 11(b) as "Beam irradiation"). Whether or not Patent Owner is correct, this technology-based argument

further indicates the weakness of Petitioner's arguments based on little more than an assumption.

Petitioner replies with the argument that Patent Owner has taken inconsistent positions as to which graph of Figure 2 the H-level synchronization statement in Hamada applies. Pet. Reply 17–18. In other words, it appears that Petitioner is attempting to prevail by arguing that Patent Owner's argument lacks credibility.[12] Although it is not clear to us that there was an inconsistent position, as alleged by Petitioner, any inconsistent attorney argument from Patent Owner does not help Petitioner in this case. Attorney argument is not evidence, and the purportedly inconsistent attorney argument does not translate into evidence that is necessary for Petitioner to meet its burden of proving its own case by a preponderance of that evidence.

Petitioner also contends that the H-level and L-level must be references to the graph of Figure 2(a) because Figure 2(a), not 2(c), contains the H and L labels. Pet. 18. Petitioner further argues "a POSITA at the time of the invention would have found that interpreting 'H-level interval' as if it referred to Figure 2(c) renders the aforementioned citation redundant because the citation already says that 'the current is measured only for the fixed time T10.'" *Id.* (citing Ex. 1004 ¶ 24; Ex. 1014 ¶ 96). Petitioner does not elaborate on these two single-sentence arguments. *See id.* As Patent Owner notes, Hamada discusses the H- and L-levels of Figure 11(b) even

[12] Petitioner argues that the alleged inconsistent positions by Patent Owner are *based on* Dr. Bruce's testimony and Dr. Woods' testimony, but does not explicitly allege that the testimony of the two witnesses is inconsistent with each other. *See* Pet. Reply 18.

though that figure does not contain those labels. *See* PO Resp. 43–46 (citing Ex. 1004 ¶ 4 (Hamada referring to the H-level interval of the pulse shown in Figure 11(b) notwithstanding that Figure 11(b) does not bear the H and L labels)). As Patent Owner persuasively argues, this indicates the incorrectness of Petitioner's assertion that the presence of labeling of H and L in Figure 2(a) is evidence that Hamada must be referring to a synchronization of measurement with the pattern shown in Figure 2(a). *Id.* We also do not find persuasive Petitioner's argument regarding the alleged redundancy if the current measurement graph, Figure 2(c), was deemed to have H- and L-level intervals. *See* Pet. 18; PO Resp. 45 (arguing that, because the H-level interval in paragraph 24 of Hamada is referring to Figure 2(b), there is no redundancy with Figure 2(c), and that, in addition, redundancy is not unheard of in patent specifications).

Having considered both parties' arguments and evidence, we find that Petitioner has failed to establish by a preponderance of evidence that Hamada discloses "determining a plurality of samples of a response signal output by the electronic circuit during the period when the laser beam is radiated," as recited in independent claim 1, or "a measuring circuit, wherein the measuring circuit determines a plurality of samples of a response signal output by the electronic circuit during the period when the laser beam is radiated," as recited in independent claim 21.

Accumulating the Plurality of Samples

As mentioned, independent claim 1 recites the step of "accumulating the plurality of samples to generate a value." Ex. 1001, 10:65. For the "accumulating" step, Petitioner again directs us to Hamada's statement that signal processing and display unit 9 calculates the average current at each of

the sites scanned by optical beam generator 5 and converts the calculation into a contrast image. *Id.* at 19–20 (citing Ex. 1004 ¶ 24). Petitioner, again relying on the general dictionary, maintains that, "[b]y definition, this generation of an average current value from a plurality of current value samples requires that the sampled values must be added as a part of the averaging calculation," and thereby satisfies the claimed "accumulating" step. *Id.* at 20 (citing Ex. 1014 ¶¶ 101–102; Ex. 1015).

Patent Owner applies to this "accumulating" limitation its arguments discussed above regarding Petitioner's "[b]y definition" argument in the context of the "determining a plurality" limitation. *See, e.g.*, PO Resp. 31–32 (arguing that Hamada's average current is a single analog measurement), 37–38 (specifically addressing the "[b]y definition" argument).

We, for the same reasons discussed above, do not find Petitioner's dictionary-based "[b]y definition" argument to be persuasive. We cannot find that a person of ordinary skill in the art would apply, in this context, a lay dictionary's general definition of "average" and thereby understand Hamada to disclose adding (or accumulating) a plurality of samples. We find that Hamada's use of the word "average" does not disclose "accumulating the plurality of samples," as Petitioner contends.

Accordingly, we find that Petitioner has failed to establish by a preponderance of evidence that Hamada discloses "accumulating the plurality of samples to generate a value," as recited in independent claim 1, or "a signal processor, wherein the signal processor accumulates the plurality of samples to generate a value," as recited in independent claim 21.

In light of the above, we determine that Petitioner has failed to demonstrate that independent claim 1, independent claim 21, or dependent claim 22, which depends from independent claim 21, is anticipated by Hamada.

E. The Alleged Obviousness of Claims 1, 21, and 22 over Hamada

Petitioner argues that, if the determining and accumulating steps are not disclosed in Hamada so as to be anticipatory, "such limitations and the overall combinations recited in claims 1 and 21, would still have been obvious over Hamada." Pet. 34–35 (citing Ex. 1014 ¶ 204). Petitioner contends that it would have been obvious to configure Hamada's process to add up a plurality of samples. *Id.* at 35.

Patent Owner asserts that Petitioner's arguments are conclusory, lack adequate reasoning why a person of ordinary skill would have made the proposed modification to Hamada's process, and are based on improper hindsight. PO Resp. 49–50. Patent Owner, relying on the testimony of Dr. Woods, contends that, "consistent with the prevalent approach at the time (as for example evidenced in Kiyoshi, Nishida, and Nikawa)[,] Hamada was using a single analog measurement per site." *Id.* at 50 (citing Ex. 2029 ¶¶ 77, 137–138). Patent Owner further asserts that the person of ordinary skill in the art at the time would have had no motivation to depart from that approach. *Id.*

In support of its case, Petitioner reasons that "[a] POSITA would have considered it obvious to have configured Hamada's electrical current meter 6 to determine a plurality of samples of the response signal, and to have configured signal processing and display 9 to add up this plurality of samples, *in order to optimize Hamada's averaging process*." Pet. at 35

(emphasis added) (citing Ex. 1004 ¶ 24; Ex. 1014 ¶ 205). Neither Petitioner nor its expert elaborates on the conclusory assertion that performing the claimed determining and accumulating steps would have "optimize[d]" Hamada's averaging process.

Petitioner further reasons that:

> it would have been obvious for a POSITA at the time of the invention to have configured electrical current meter 6 and signal processing and display unit 9 to respectively measure and add multiple samples of the response signal to allow Hamada's averaging process, in turn, to be performed on multiple samples.

Id. at 35–36 (citing Ex. 1014 ¶ 206). This reasoning is circular in that it is, effectively, an assertion that it would have been obvious to perform operations on multiple samples in order to perform the process on multiple samples.

We also have considered Petitioner's arguments in the Petition that the "motivation" comes from the "teaching or suggestion" provided by the disclosure of "averaging," along with Petitioner's string of reasons from *KSR International Co. v. Teleflex Inc.*, 550 U.S. 398 (2007). *See* Pet. 35, 52–53 (citing Ex. 1014 ¶¶ 206, 306). Petitioner does not develop adequately any of these reasons. An obviousness analysis requires more than "mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006).

In its Reply, Petitioner repackages its "[b]y definition" argument as purportedly an obviousness argument. Pet. Reply 20–21. Petitioner argues that, "to the extent that Hamada does not explicitly disclose this limitation, a POSITA would have considered the act of configuring Hamada to measure

and add multiple samples to have been obvious because that is what the definition of 'averaging' requires." *Id.* (citing Pet. 34–36; Ex. 1014 ¶¶ 204–208). Although possibly an obviousness theory, this argument reads more like an assertion that the claimed determining and accumulating of a plurality of samples either is inherently or implicitly disclosed in Hamada (offered as an alternative if it is deemed not explicitly disclosed). Thus, Petitioner appears to take the position that the disputed limitation is *not* absent from Hamada, and Petitioner fails to explain why a person of ordinary skill would have seen a reason to modify Hamada. For the reasons discussed above, we do not find Petitioner's "[b]y definition" argument persuasive in the anticipation context and, for those same reasons, do not find it persuasive when couched as an obviousness ground.

We determine that Petitioner has failed to demonstrate that independent claim 1, independent claim 21, or dependent claim 22 would have been obvious over Hamada.

F. The Remaining Obviousness Grounds Based on Hamada in Combination with Additional References

Petitioner argues that dependent claims 4, 5, 7, 23, and 24 would have been obvious over Hamada and Beaudoin. Pet. 36–43, 53–54. Petitioner also argues that dependent claims 4–7 and 22–25 would have been obvious over Hamada and Bruce. *Id.* at 44–47, 53–54. Petitioner further argues that dependent claims 4–7 and 23–25 would have been obvious over Hamada and Quah. *Id.* at 48–50. These challenged claims pertain to the use of a pulsed laser, the frequencies of the sampling of the laser beam pulses, and a control system operable to move the laser according to a pattern (claim 22).

For these grounds, Petitioner builds upon the foundational argument that independent claims 1 and 21 are anticipated or rendered obvious by Hamada. *See, e.g.*, *id.* at 37 (beginning the analysis of claims 4 and 23 with the assertion "Hamada anticipates claims 1 and 21"), 47 (beginning the analysis of claim 22 with "[c]laim 21 is anticipated by or would have been obvious in view of Hamada"); *see also, e.g.*, *id.* at 39–41 (reiterating the unpersuasive argument that Hamada, in the context of Figure 2, discloses determining multiple samples); *id.* at 21, 23 (reiterating Petitioner's reliance on Hamada for the determining and accumulating limitations). Petitioner contends that Beaudoin, Bruce, and Quah disclose the use of a pulsed laser of a particular frequency range. *Id*. at 38–39, 41–42, 44–45, 44–47, 48–50. Petitioner also contends, for claim 22, that Bruce teaches moving the laser from location to location on the DUT in a controlled manner. *Id.* at 47–48.

Patent Owner argues that Hamada does not disclose determining and accumulating a plurality of samples as required by the underlying independent claims and that Petitioner's Beaudoin and Bruce obviousness grounds are based on the reliance on Hamada for those teachings. PO Resp. 51, 55. Patent Owner further argues that Petitioner's obviousness ground involving the combination of Hamada and Quah fails because neither of those references discloses a pulsed laser and also because Quah is not prior art. PO Resp. 57.

Petitioner does not contend that Beaudoin, Bruce, and Quah cure the deficiencies noted above with respect to independent claims 1 and 21. Therefore, for the same reasons discussed above, we determine that Petitioner has failed to demonstrate that dependent claims 4, 5, 7, 23, and 24 would have been obvious over Hamada and Beaudoin, that dependent

claims 4–7 and 22–25 would have been obvious over Hamada and Bruce, or that dependent claims 4–7 and 23–25 would have been obvious over Hamada and Quah. Additionally, for the reasons discussed below, we determine that Petitioner has failed to establish that Quah is prior art to the '982 patent, and therefore Petitioner's obviousness challenge based on Hamada and Quah fails for that reason too.

G. Status of Quah as Prior Art

Petitioner contends that Quah (Ex. 1005) qualifies as a prior art printed publication under 35 U.S.C. § 102(b). Pet. 22–23; *see* Pet. Reply 1, 20–21. Patent Owner argues that the specific Quah reference before us is not a § 102(b) reference because it was not published until after the critical date. PO Resp. 47. We determine, for the reasons that follow, that Petitioner has not met its burden of establishing that the Quah reference is a prior art printed publication under § 102(b).

Petitioner must prove that Quah is a prior art printed publication by a preponderance of the evidence. 35 U.S.C. § 316(e); *Dynamic Drinkware, LLC*, 800 F.3d at 1378–80; *see also Blue Calypso, LLC v. Groupon, Inc.*, 815 F.3d 1331, 1350–51 (Fed. Cir. 2016) ("[W]e agree with the Board that [petitioner] Groupon failed to carry its burden of proving public accessibility of the Ratsimor Reference."). We look to the underlying facts to make a legal determination as to whether a reference is a printed publication. *Suffolk Techs., LLC v. AOL Inc.*, 752 F.3d 1358, 1364 (Fed. Cir. 2014). The determination of whether a given reference qualifies as a prior art "printed publication" involves a case-by-case inquiry into the facts and circumstances surrounding its disclosure to members of the public. *In re Klopfenstein*, 380 F.3d 1345, 1350 (Fed. Cir. 2004). The key inquiry is whether the reference

was made "sufficiently accessible to the public interested in the art" before the critical date. *In re Cronyn*, 890 F.2d 1158, 1160 (Fed. Cir. 1989); *In re Wyer*, 655 F.2d 221, 226 (CCPA 1981). "A given reference is 'publicly accessible' upon a satisfactory showing that such document has been disseminated or otherwise made available to the extent that persons interested and ordinarily skilled in the subject matter or art exercising reasonable diligence, can locate it." *Bruckelmyer v. Ground Heaters, Inc.*, 445 F.3d 1374, 1378 (Fed. Cir. 2006) (citation omitted).

The '982 patent was filed on November 5, 2007, thus the critical date under § 102(b) is November 5, 2006. *See* Ex. 1001, 1 (22). Petitioner asserts that "Quah was published by four of the five inventors listed on the '982 patent on July 3-7, 2006." Pet. 22. Specifically, Petitioner contends that Quah was published in conference proceedings and that a copy of the proceedings was distributed to attendees on a CD-ROM on the last day of the conference, July 7, 2006. *Id.* at 22–23.

Patent Owner argues in its Preliminary Response that the Quah reference used in Petitioner's challenges is not a § 102(b) reference because Petitioners failed to sufficiently show that the reference was publicly accessible more than one year prior to the filing date of the '982 patent. Prelim. Resp. 20–21. Patent Owner argues that Petitioner's evidence shows that the Quah paper was first published on November 30, 2006—after the critical date—when the article was added to the IEEE *Xplore* database. *Id.* at 21 (citing Ex. 1016 ¶¶ 9–11, Exhibit A (the article abstract attached to Exhibit 1016)). Patent Owner also argues that the evidence fails to show that the Quah reference before us now was the paper on the CD distributed at the conference. *Id.* at 22 (citing Ex. 1017 ¶ 8). Patent Owner notes that

the Quah reference has a footer containing the IEEE index number and price. *Id*. at 23.

In the Institution Decision, we determined, based on the initial papers and for purposes of that decision only, that Petitioner had provided adequate evidence to make a threshold showing that Quah is a prior art printed publication under § 102(b). Inst. Dec. 25. We, therefore, initiated an *inter partes* review on the grounds based on Quah, but noted that we were not making a final determination on the publication date issue at that time. Inst. Dec. 5 n.3 ("The listing of the conference dates here [in the identification of the applied references] does not indicate that we have reached a final determination as to the publication date issue."), 25 ("We determine, *for the purposes of this decision only*, that Petitioner has provided adequate evidence to make a threshold showing that Quah is a prior art printed publication under § 102(b)." (emphasis added)); Tr. 9:1–6 (Petitioner stating: "that, for *purposes of institution*, the Board did not agree with Patent Owner's arguments, and instead found that Quah was a printed publication constituting prior art under 102B *for purposes of the institution*. . . . Thus *for purposes of the institution*, it was shown that Quah was the 102B publication." (emphasis added)); Tr. 65:19–66:3 (Petitioner's counsel acknowledging his understanding that "that was a preliminary finding at best" and stating "I know there are different standards for institution").

Patent Owner, in its Response to the Petition, reiterated its position that Quah is not a § 102(b) reference and that Petitioner's own evidence indicates that Quah was published November 30, 2006—after the critical

date. PO Resp. 2 ("one of Petitioner's other key references, Quah, is not prior art"), 47 (citing Ex. 1016; Prelim. Resp. 20–23).

Petitioner replied with the assertion that "the Board has already dismissed [the argument] that Quah is not prior art." Pet. Reply 19. Based on this assumption, Petitioner attempted to shift the burden to Patent Owner. *Id.* at 19–20. Specifically, Petitioner argued "Patent Owner has failed to submit *any* additional evidence or new arguments to the Board to rebut Petitioner's threshold showing." *Id.* at 20; *see also* Tr. 9:7–13 (arguing that Patent Owner could have taken certain actions "in support of the non-publication argument"). We note that that "threshold showing" was Petitioner bringing forth enough evidence to demonstrate a likelihood of prevailing on the publication date issue during the ensuing trial, and did not involve a determination, during that preliminary stage, that Petitioner had satisfied the ultimate burden of proving the matter by a preponderance of the evidence. After institution, we do not shift the burden onto Patent Owner to prove patentability. *In re Magnum Oil Tools Int'l, Ltd.*, 829 F.3d 1364, 1376 (Fed. Cir. 2016). Rather, we review the totality of the record to determine whether Petitioner has proven by a preponderance of the evidence that the Quah article used in the challenges is a printed publication and a § 102(b) reference.[13] *See id.* at 1377 ("[T]he Board has an obligation to assess the question anew after trial based on the totality of the record.").

[13] Petitioner contends only that Quah is a § 102(b) reference, *see* Pet. 22–23, Pet. Reply 1, 20–21, and, therefore, we do not reach Patent Owner's assertions of an earlier conception and reduction to practice, PO Resp. 47. *Cf. Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1379 (Fed. Cir. 2015) ("[Petitioner] Dynamic also had the initial burden of

Before we turn to Petitioner's evidence, we first note what is *not* in evidence. The referenced CD-ROM is not in the record and it is undisputed that the CD-ROM has not been produced to Patent Owner notwithstanding that Patent Owner raised this printed publication issue early and prior to institution. *See* Prelim. Resp. 22 ("Notably, the [Tan] declaration does not state that the Quah paper attached as Exhibit B to the declaration was the actual copy on the CD, and the CD has not been provided as evidence."); Tr. 52:17–26, 53:10–12 (Patent Owner representing that it has never seen the CD-ROM); *id.* at 65:20–21 (Petitioner: "it's true that the CD wasn't produced"); *id.* at 67:6–10 (Petitioner acknowledging that Patent Owner, earlier, made the argument that there was a failure of proof that the reference was the paper on the CD-ROM).

Petitioner relies on the declaration of Gerard P. Grenier, Senior Director of Publishing Technologies of the Institute of Electrical and Electronics Engineers, Inc. ("IEEE"), who testifies:

> A. Quah, eta [sic] al. "DC-Coupled Laser Induced Detection System for Fault Localization in Microelectronic Failure Analysis" was published in the proceedings of the 13th International Symposium on the Physical and Failure Analysis of Integrated Circuits. The 13th International Symposium on the Physical and Failure Analysis of Integrated Circuits was held from July 3-7, 2006. Copies of the conference proceedings were made available no later than the last day of the conference. The article is currently available for public download from the IEEE digital library, IEEE Xplore.

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production, and it satisfied that burden by arguing that Raymond anticipated the asserted claims of the '196 patent *under § 102(e)(2).*" (emphasis added)).

Ex. 1016 ¶ 11. Thus, Mr. Grenier testifies that a Quah article was published at some point in a compilation of the proceedings of the conference and that the conference occurred in July of 2006. He also testifies that copies of the proceedings "were made available" at the conference. *Id.* Mr. Grenier, however, does not indicate the basis for any knowledge underlying that assertion, what is encompassed by his use of the phrase "made available," or whether the specific article attached as an exhibit to his declaration was on a CD-ROM at the conference. Rather, he testifies that he obtained, in 2017 (over a decade later), a copy of that exhibit from the IEEE *Xplore* digital library, not from the CD-ROM, and implies that the basis of his knowledge is the metadata used by the IEEE *Xplore* digital library to populate the abstract. *Id.* ¶¶ 9, 10. He further testifies that the article abstract, attached to his declaration, "shows the date of publication" and that that date was obtained from "the metadata associated with the publication." *Id.* ¶ 10. Mr. Grenier's declaration suggests that his use of the terms "publish" and "publication" refers to the practice of IEEE making documents available to the public via the IEEE *Xplore* digital library. *See id.* ¶¶ 6–7. The abstract states that the Quah article was "[p]ublished in . . . 2006," but does not specify the month. Ex. 1016, 4. The abstract also states: "Date of Conference: 3-7 July 2006" and "Date Added to IEEE *Xplore*: 30 November 2006." *Id.* The abstract, thus, tells us again that there was a conference in July 2006 and that a Quah article was "published" with the proceedings at some point, and indicates that the article was not added to the digital library until the end of November 2006, which is after the critical date. *Id.* This evidence supports a finding that Patent Owner is correct in its

argument that the publication date of the specific Quah article before us was November 2006.

Petitioner also relies on the declaration testimony of Kevin Tan, who attended the conference as an employee of Petitioner's agent and apparently as an exhibitor at the event. *See* Ex. 1017 ¶¶ 3, 6–7, 9 (referring to "other exhibitors"). Mr. Tan testifies:

> 8. Attached as Exhibit B is a true and correct copy of "DC-Coupled Laser Induced Detection System for Fault Localization in Microelectronic Failure Analysis" by ACT Quah, et al. ("Quah"). While attending IPFA 2006, I received a CD-ROM containing electronic copies of all papers accepted for presentation at IPFA 2006, including Quah.
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> 9. While attending IPFA 2006, I observed other exhibitors and registered conference participants also receiving copies of the CD-ROM containing all of the papers accepted for presentation.

Ex. 1017 ¶¶ 8–9. Thus, Mr. Tan testifies that he attached a true copy of a Quah article to his declaration and he testifies that he received a CD-ROM. *Id.* ¶ 8. The attachment, like the Exhibit 1005 before us, contains a footer with IEEE indexing and reprint cost information and page numbering beginning with page 327. *See* Ex. 1017, 7. He does not testify as to how the attachment came into his possession—whether, for example, he printed it from the referenced CD or whether he obtained it from another source. He testifies that the CD contained copies of *all* papers accepted for presentation "including Quah," but does not explain how he, as an exhibitor at the conference, knows that every accepted paper was placed on the CD-ROM. Ex. 1017 ¶¶ 8–9. As Patent Owner correctly asserts, "the declaration does not state that the Quah paper attached as Exhibit B to the declaration was the

actual copy on the CD, and the CD has not been provided as evidence." Prelim. Resp. 22 (citing Ex. 1017 ¶ 8); *cf.* PO Resp. 47 (referring to its earlier printed publication arguments). Mr. Tan's declaration does not draw explicitly a tie between the attachment and any document that was on the CD-ROM.

Thus, Petitioner's argument that, based on Mr. Tan's testimony, "it's pretty clear that the document that was submitted was the one on the CD," Tr. 65:22–24, is built on an inference drawn from the declaration drafter's labeling of the attachment as "('Quah')" in combination with Mr. Tan's statement that he "received a CD-ROM containing . . . all papers . . . including Quah." *See* Ex. 1017 ¶ 8; Tr. 69:10–12 (Petitioner's counsel: "[Mr. Tan] referred to the document as Quah, and he's using the same language to refer to it again."). At the initial stage of this case, we found that inference to be adequate to meet the threshold showing and justify taking the case to trial for further development. *See* Inst. Dec. 23–25. Petitioner, seemingly operating under the erroneous assumption that it prevailed on a triable issue before the trial was instituted, did not develop the record further but rather attempted to shift the burden onto Patent Owner to disprove the inference. Also, Petitioner did not attempt to remove the issue from contention, without our involvement, by producing to Patent Owner the CD-ROM allegedly containing the exact reference it argues in its grounds.

Additionally, although Mr. Tan testifies that the CD-ROM contains papers "accepted for presentation," Petitioner has not offered an explanation as to why such a paper offered for presentation at a conference, several months before it was added to the IEEE *Xplore* digital library, would have an IEEE index number, the reprint cost, and page numbering beginning at

327. Petitioner does not, for example, present testimonial evidence indicating that it was a common practice to have prepared at the time of a conference a clean, ready-for-IEEE-publication version in a compilation but then not upload that version to the IEEE library for a number of months.

Petitioner also argues that the Board's decision in *GoPro, Inc. v. Contour IP Holding LLC* (IPR2015-01078, Paper 54), initially relied upon by Patent Owner, Prelim. Resp. 23, has been reversed, thereby making Petitioner's case even stronger. *See* Pet. Reply 20. Specifically, Petitioner argues that the Board's *GoPro* decision "has been overturned and establishes a lower threshold for showing a prior art publication." *Id.* (citing *GoPro, Inc. v. Contour IP Holding LLC*, 898 F.3d 1170, 1176–77 (Fed. Cir. 2018), *modified and superseded by* 908 F.3d 690, 694 (Fed. Cir. 2018)). That case does not help Petitioner as it is not on point for the dispositive issue before us. In *GoPro*, the issue pertained to whether the reference, a product catalog distributed at a trade show, was sufficiently accessible to the public within the meaning of 35 U.S.C. § 102(b). *GoPro*, 908 F.3d at 694. Unlike in our case, there was no dispute in *GoPro* that the relied-upon reference existed as of the critical date. *See id.* Without adequate proof from Petitioner that the Quah version relied on in the grounds was in existence as of the critical date, we do not reach the issue as to whether such a document was sufficiently accessible under § 102(b).

In the end, Petitioner's evidence of printed publication is, at best, ambiguous. After carefully reviewing the evidence presented, we find that Petitioner has not established by a preponderance of that evidence that the Quah article before us and asserted in Petitioner's grounds was the same article allegedly distributed at the conference. Therefore, the evidence does

not support a finding that Exhibit 1005 was in existence, let alone accessible or otherwise available to the pertinent interested persons, prior to the critical date. Accordingly, Petitioner has not established that Quah (Ex. 1005) is a prior art printed publication under § 102(b).

In light of the above, we determine that Petitioner has failed to demonstrate that claims 1, 4–7, 21, and 23–25 are anticipated by or would have been obvious over Quah.

H. Patent Owner's Motion to Amend

Patent Owner filed a Motion to Amend. Paper 22 (proposing to substitute the corresponding claim of the proposed substitute claims 26–35 for issued claims 1, 4–7, and 21–25). The Motion is contingent on a determination by the Board that Petitioner has established that any of issued claims 1, 4–7, and 21–25 are unpatentable. *Id.* at 1. Because we determine that Petitioner has not established that any of those claims are unpatentable, the Motion to Amend is *dismissed* as moot.

III. CONCLUSION

Petitioner has *not* demonstrated by a preponderance of the evidence that the challenged claims 1, 4–7, and 21–25 of the '982 patent are unpatentable.

IV. ORDER

For the foregoing reasons, it is

ORDERED that claims 1, 4–7, and 21–25 of the '982 patent have *not* been proven to be unpatentable;

FURTHER ORDERED that Patent Owner's Motion to Amend is *dismissed as moot*; 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.

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