

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

XILINX, INC. AND XILINX ASIA PACIFIC PTE. LTD.,
Petitioner,

v.

ANALOG DEVICES, INC.,
Patent Owner.

IPR2020-01483
Patent 6,900,750 B1

Before JEFFREY S. SMITH, SCOTT A. DANIELS, and
GEORGIANNA W. BRADEN, *Administrative Patent Judges*.

SMITH, *Administrative Patent Judge*.

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

On August 17, 2020, Xilinx, Inc. and Xilinx Asia Pacific Pte. Ltd. (collectively “Petitioner”) filed a Petition requesting an *inter partes* review of claims 10, 11, 13–32, and 35–43 of U.S. Patent No. 6,900,750 B1, issued on May 31, 2005 (Ex. 1001, “the ’750 patent”). Paper 1. Petitioner filed a corrected Petition on November 3, 2020, to correct typographical errors. Paper 8 (“Pet.”). Analog Devices, Inc. (“Patent Owner”) filed a Response. Paper 21 (“PO Resp.”). Petitioner filed a Reply. Paper 27 (“Reply”). Patent Owner filed a Sur-Reply. Paper 29 (“PO Sur-Reply”). A hearing was held on December 10, 2021. Paper 33.

We have jurisdiction under 35 U.S.C. § 6. This Final Written Decision is entered pursuant to 35 U.S.C. § 318(a). We determine that claims 10, 11, 13–32, and 35–43 are unpatentable.

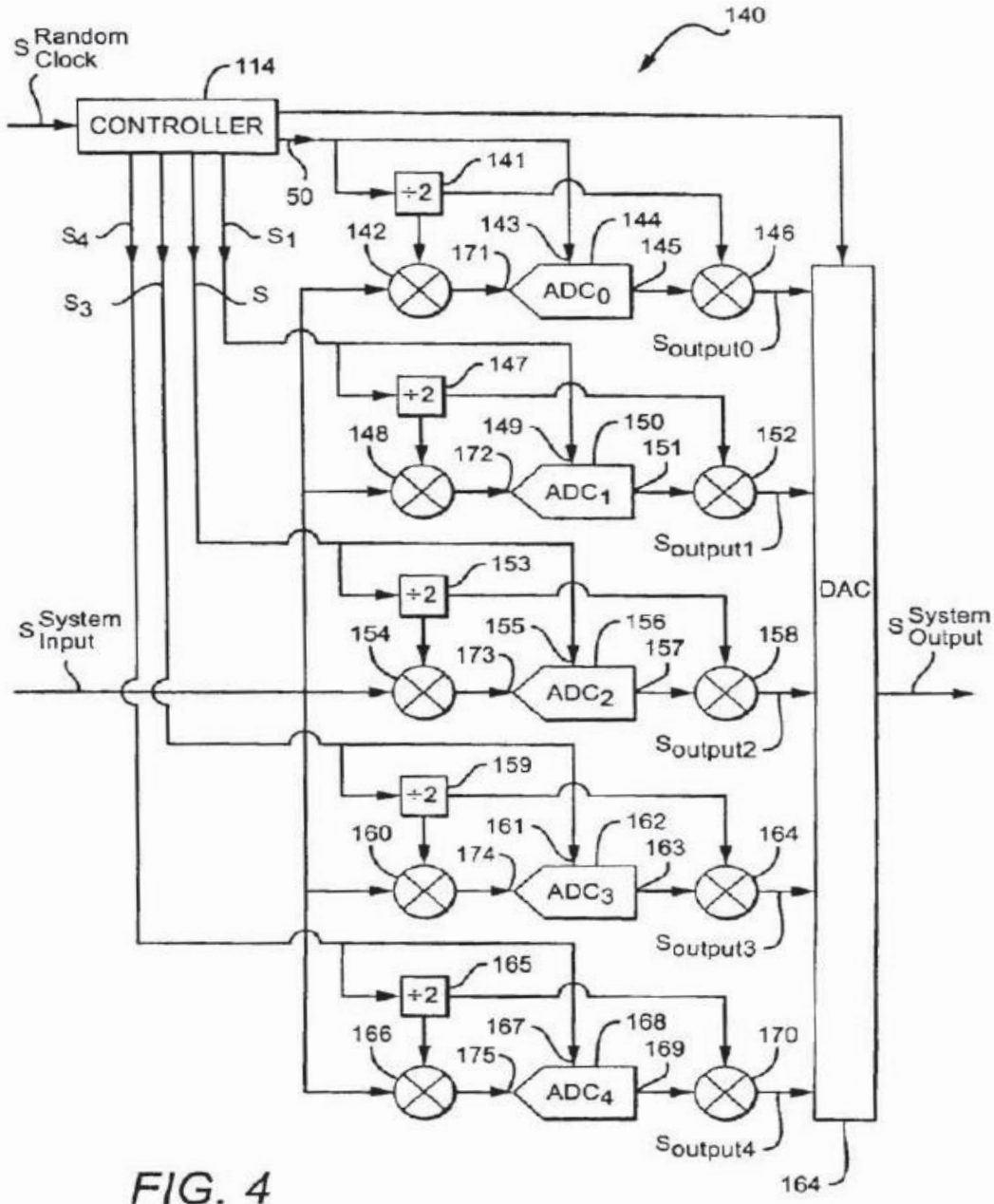
I. BACKGROUND

A. *The ’750 Patent (Ex. 1001)*

The ’750 patent relates to adjusting gain and offset mismatches in a signal conditioning system having interleaved analog-to-digital converters (ADCs). Ex. 1001, 1:9–14, 5:28–29, 6:63–66. Interleaving multiple ADCs provides the advantage of increasing the sampling rate proportionally to the number of ADCs. *Id.* at 6:63–7:4. For example, if the clock frequency of each ADC is f_c and the number of interleaved ADCs is M , then the sampling rate of the system is $f_s = M \cdot f_c$. *Id.* The interleaved ADCs often have mismatches in offset and gain, however, which affect the Signal-to-Noise and Distortion ratio. *Id.* at 1:26–37. To correct the offset mismatches of the interleaved ADCs, the system includes an offset sensor coupled with the ADCs to sense and adjust an offset signal difference. *Id.* at codes (54), (57), 3:41–47, 7:5–21, Figs. 1–4. To correct the gain mismatches, the system includes a gain sensor coupled with the ADCs to sense a gain difference, and

a gain corrector coupled with the gain sensor to adjust the gain difference.
Id. at codes (54), (57), 3:41–47, 10:12–21, 10:40–65, 11:26–52, Figs. 6–8.

Figure 4 below shows a block diagram illustrating a signal conditioning system 140 including interleaved ADCs. Ex. 1001, 3:44–46, 8:16–23.



As shown in Figure 4 above, signal conditioning system 140 includes interleaved ADCs 144, 150, 156, 162, and 168. Ex. 1001, 8:24–25. Each of the ADCs is a zero offset ADC, in which the offset signal is subtracted from an analog input signal to condition a digital output signal. *Id.* at 9:7–13; see *id.* at 5:17–45, Fig. 1. Controller 114 provides a random select or clock signal to each ADC through respective ADC select terminals. *Id.* at 8:51–54. For example, controller 114 provides random clock signal S_0 to ADC 144 through ADC select terminal 143. *Id.*

Each ADC has a modulator coupled to its input and a demodulator coupled to its output. Ex. 1001, 8:25–48. For example, modulator 142 is coupled to input 171 of ADC 144, and demodulator 146 is coupled to output 145 of ADC 144. *Id.* at 8:25–27. The modulators and demodulators are coupled to the controller through a respective divider. *Id.* at 8:25–48. For example, controller 114 is connected to modulator 142 and demodulator 146 through divider 141. *Id.* at 8:27–29.

Inputs of the modulators are configured to randomly receive the system input signal. Ex. 1001, 8:58–60. Each modulator multiplies the system input signal by the divided random clock prior to being converted by the corresponding ADC, and each demodulator multiplies the output of the corresponding ADC by the divided random clock to form each output signal $S_{\text{output}0}$ to $S_{\text{output}4}$. *Id.* at 8:41–67. The outputs of the demodulators are coupled to digital-to-analog converter (DAC) 164, which converts the digitized output into an analog signal. *Id.* at 9:1–6.

B. Illustrative Claim

As noted above, Petitioner challenges claims 10, 11, 13–32, and 35–43, of which claims 10, 19, 25, 32, and 41 are independent. Claim 10 is reproduced below.

10. An integrated circuit that converts between an analog signal and a corresponding digital code with a system sampling rate f_s , said circuit comprising:

a plurality of converter circuits clocked by a random clock, at least one converter circuit in said plurality of converter circuits sampling the analog signal at least every $1/f_s$ seconds; and

an offset sensing circuit configured to sense signal offsets and/or signal offset differentials between the outputs of said plurality of converter circuits.

Ex. 1001, 14:38–48.

C. Related Proceedings

Petitioner and Patent Owner identify the following related litigation asserting the '750 patent: *Analog Devices, Inc. v. Xilinx, Inc. and Xilinx Asia Pacific Pte. Ltd.*, C.A. No. 19-cv-02225-RGA (D. Del.). Pet. 92; Paper 4, 2. Patent Owner also states that “Petitioner[] filed petitions for *Inter Partes* Review of U.S. Patent No. 10,250,250 (Case No. IPR2020-01210), U.S. Patent No. 8,487,659 (Case No. IPR2020-01219), U.S. Patent No. 7,012,463 (Case No. IPR2020-01336), U.S. Patent No. 7,286,075 (Case No. IPR2020-01559), U.S. Patent No. 7,719,452 (Case No. IPR2020-01561), and U.S. Patent No. 6,900,750 (Case Nos. IPR2020-01484, IPR2020-01564, and the present case), which are also at issue in the above litigation.” Paper 4, 2.

D. References

Petitioner relies on the following references:

1. “Elbornsson” (Analysis of Mismatch Effects in Randomly Interleaved A/D Converter Systems, Report no.: LiTH-ISY-R-2496, Linkoping University Electronic Press, March 3, 2003) (Ex. 1004);

2. “Jamal” (A 10-b 120-Msample/s time-interleaved analog-to-digital converter with digital background calibration, IEEE Journal of Solid-State Circuits, vol. 37, no. 12, pp. 1618-27, Dec. 2002) (Ex. 1005);
3. “Ferragina” (Gain and offset mismatch calibration in multi-path sigma-delta modulators, Proceedings of the 2003 International Symposium on Circuits and Systems, 2003) (Ex. 1007).

E. Asserted Challenges to Patentability

Petitioner asserts that claims 10, 11, 13–32, and 35–43 are unpatentable on the following challenges:

Ground	Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1	10, 11, 13–17, 19, 20, 23–32, 35–43	103	Elbornsson, Jamal
2	18, 21, 22	103	Elbornsson, Jamal, Ferragina

Petitioner also relies on testimony from Dr. Douglas Holberg (Ex. 1002, “Holberg Decl.”). Patent Owner relies on the testimony of Dr. Arigit Raychowdhury (Ex. 2006), “Raychowdhury Decl.”).

II. ANALYSIS

A. Legal Principles

“In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.” *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify “with particularity . . . the evidence that supports the grounds for the challenge to each claim”)); *see also* 37 C.F.R. § 42.104(b) (requiring a petition for *inter partes* review to identify how the challenged

claim is to be construed and where each element of the claim is found in the prior art patents or printed publications relied upon).

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 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) when in evidence, objective evidence of obviousness or nonobviousness, i.e., secondary considerations. See *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). An obviousness analysis “need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ.” *KSR*, 550 U.S. at 418.

Additionally, the obviousness inquiry typically requires an analysis of “whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue.” *KSR*, 550 U.S. at 418 (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2016) (requiring “articulated reasoning with some rational underpinning to support the legal conclusion of obviousness”)). Furthermore, Petitioner does not satisfy its burden of proving obviousness by employing “mere conclusory statements,” but “must instead articulate specific reasoning, based on evidence of record, to support the legal conclusion of obviousness.” *In re Magnum Oil Tools Int’l, Ltd.*, 829 F.3d 1364, 1380 (Fed. Cir. 2016).

B. Level of Ordinary Skill in the Art

In determining whether an invention would have been obvious at the time it was made, we consider the level of ordinary skill in the pertinent art at the time of the invention. *Graham*, 383 U.S. at 17. Petitioner asserts a person of ordinary skill in the art (“POSITA”) at the time of the invention “would have at least a Master’s Degree in Electrical Engineering or equivalent field, including studies in designing data converters, and two to five years of relevant experience; or a Ph.D. degree in Electrical Engineering or equivalent field.” Pet. 25 (citing Ex. 1002 ¶¶ 17–18). Patent Owner does not address the level of ordinary skill in the art in its Response. *See generally* PO Resp.

For purposes of this decision, we adopt Petitioner’s formulation because it is consistent with the ’750 patent and the asserted prior art.

C. Claim Construction

We interpret claims in the same manner used in a civil action under 35 U.S.C. § 282(b) “including construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.” *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, 51,358 (Oct. 11, 2018) (amending 37 C.F.R. §42.100(b) effective November 13, 2018) (now codified at 37 C.F.R. § 42.100(b) (2019)). Only terms that are in controversy need to be construed, and then only to the extent necessary to resolve the controversy. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017).

Random clock

Patent Owner proposes construing “random clock” as a “clock that provides random clock signals (signals where a previous portion of the clock signal is not used to determine a future portion of the clock signal). The random clock signals can be provided by a random clock generator, a pseudorandom clock generator, or an aperiodic clock generator.” PO Resp. 15. Petitioner does not dispute Patent Owner’s proposed construction. *See* Reply 2–5. We do not provide an explicit construction for “random clock” because doing so is not necessary for our analysis, nor does our final determination turn on the meaning of this term in this *inter partes* review.

Offset sensing circuit

Patent Owner proposes construing “offset sensing circuit” as recited in claim 10 as “a circuit that continuously monitors the outputs of the converter circuits and senses, or detects, signal offsets and/or signal offset differentials between those outputs (thus enabling ongoing, real-time adjustment of the signal offsets and/or signal offset differentials so that the converters may be adjusted accordingly).” PO Resp. 15–16. Patent Owner contends that its proposed construction is consistent with an example of an offset sensing circuit illustrated in Figure 3 of the ’750 patent, which “senses and adjusts an offset signal mismatch between ADCs.” *Id.* at 16 (citing Ex. 1001, 7:49–53, Fig. 3; Ex. 2008, 656 (defining “sense” as “to detect (as radiation) automatically”); Ex. 2006 ¶ 41). Patent Owner, relying on testimony of its expert, Dr. Raychowdhury, contends that the offset circuit shown in Figure 3 includes filter 110 and feedback loop 128, which work together to form a signal that is used to continuously adjust the system to calibrate for offset mismatch. *Id.* at 17 (citing Ex. 2006 ¶ 44). According to Patent Owner, the specification contrasts the circuit of Figure 3 with prior art

techniques that required running separate calibration cycles with a known calibration signal. *Id.* (citing Ex. 1001, 2:9–26, 3:1–20).

Petitioner contends that construction of the claimed “offset sensing circuit” is not needed for this proceeding. Reply 2. Petitioner, also relying on the testimony of Dr. Raychowdhury, contends that the scope of the claimed “offset sensing circuit” encompasses analog as well as digital techniques. Reply 2–3 (citing Ex. 1024, 127–130, 139–143). Petitioner contends that Figure 2 of the ’750 patent shows a digital technique to correct an offset signal with feedforward loop 121, including filter 110, behaving as an offset signal sensor. Reply 3 (citing Ex. 1001, 4:36–38, 6:41–55, Fig. 2). Petitioner contends that the ’750 patent does not describe whether filter 110 samples continuously or intermittently. *Id.* at 3–4 (citing Ex. 1001, 5:40–45, 6:16–24, 7:29–31). Petitioner contends that Dr. Raychowdhury admits that it is possible to perform the functions of feedforward loop 121 and demodulator 108 of Figure 2 in a delayed or non-continuous manner. Reply 4 (citing Ex. 1024, 200–201). Petitioner concludes that Figure 2 and Dr. Raychowdhury’s testimony show that the digital techniques disclosed in some embodiments of the ’750 patent are not limited to continuous monitoring or operation, and that the scope of “offset sensing circuit,” read in light of such disclosed embodiments, is not limited to continuous monitoring or operation. *Id.* at 4.

Patent Owner contends that Petitioner is incorrect in contending that the digital techniques of the ’750 patent do not require continuous operation. PO Sur-Reply 2. According to Patent Owner, Petitioner’s contention is inconsistent with Dr. Holberg’s testimony, and that both Dr. Holberg and Dr. Raychowdhury agree that an “offset sensing circuit” as claimed is a circuit that continuously monitors the outputs of the converter circuits and senses,

or detects, signal offsets and/or signal offset differentials between those outputs. *Id.* at 2–4 (citing Ex. 2007, 88:23–89:14; Ex. 2006 ¶¶ 39–45; Ex. 1024, 198:3–7, 199:4–8, 199:19–25, 200–201; Ex. 1001, 7:50–53). Patent Owner further contends that its proposed construction is based on a dictionary definition of “sense” as “to detect (as radiation) automatically. *Id.* at 4 (citing Ex. 2008, 656). According to Patent Owner, Petitioner’s proposed construction encompasses prior art techniques described in the background section of the ’750 patent. *Id.* at 5–6. Patent Owner contends that because the background section of the ’750 patent discloses that “there is a need for a signal conditioning system where the offset and gain mismatches can be corrected continuously without interrupting the processing of any incoming signals” (Ex. 1001, 3:44–48), the scope of the claims excludes the prior art techniques described in the background section. *Id.* at 6.

We agree with Petitioner, that construction of the claimed “offset sensing circuit” is not needed for this proceeding. Reply 2. We are persuaded by Dr. Holberg’s testimony that

I am unaware of the term “sense,” “sensor,” or “sensing” being used as a term of art to imply continuous, ongoing, or automatic process of sensing to the exclusion of non-automatic sensing; and there is nothing in the plain and ordinary meaning of the term “sensing” that would inform a POSITA that the sensing has to be an automatic, ongoing process of monitoring the signal. Real-world sensing can embody manually triggered sampling as well as automatic sampling.

Ex. 1022 ¶ 4. We are also persuaded by Petitioner’s contention that the functions of feedforward loop 121 and demodulator 108 of Figure 2 can be performed in a delayed or non-continuous manner, which shows that the “offset sensing circuit” is not limited to continuous monitoring or operation

as proposed by Patent Owner. Reply 2–4 (citing Ex. 1001, Fig. 2, 4:36–38, 5:40–45, 6:16–24, 6:41–55, 7:29–31; Ex. 1024, 127–130, 139–143, 186–187, 200–201).

Petitioner’s contention that the embodiment shown in Figure 2 can be performed in a delayed or non-continuous manner is consistent with Dr. Raychowdhury’s testimony. Dr. Raychowdhury, when asked if “it is possible to store . . . the output of the ADC, store the random clock and perform these . . . functions at a later time,” answered “[i]t may be theoretically possible.” Ex. 1024, 200:18–19. Although Patent Owner contends that Dr. Raychowdhury was speaking about an example outside of the ’750 patent (PO Sur-Reply 3–4), we disagree. Dr. Raychowdhury testified that “it is impossible for you to store the random clock So in this particular context, Figure 2, Figure 1, the way . . . ’750 describes it, I would not think about any way that we can post-process that . . . in an external memory.” Ex. 1024, 199:12–200:3. Dr. Raychowdhury was then asked “why is it impossible to store a random clock,” and answered “[i]t is not impossible. It is impractical. It depends on how much data you are thinking of storing. So . . . it’s just going to cost memory.” *Id.* at 200:5–10.

We determine that Dr. Raychowdhury, in testifying that it is possible to store the output of the ADC and the random clock and perform the functions of the offset sensor at a later time, was speaking about embodiments disclosed in the ’750 patent, including Figure 2. We agree with Petitioner, that Dr. Raychowdhury testified that it is possible to perform the functions of feedforward loop 121 and demodulator 108 shown in Figure 2 of the ’750 patent in a delayed or non-continuous manner, “it’s just going to cost memory.” *Id.* We agree with Petitioner that Patent Owner’s construction excludes the disclosed embodiment shown in Figure 2, which

“is rarely, if ever, correct and would require highly persuasive evidentiary support.” *Adams Respiratory Therapeutics, Inc. v. Perrigo Co.*, 616 F.3d 1283, 1290 (Fed. Cir. 2010). We now address Patent Owner’s arguments to the contrary.

We disagree with Patent Owner’s contention with respect to the embodiment shown in Figure 3 of the ’750 patent. PO Resp. 16–17. The Federal Circuit has held that “it is improper to read limitations from a preferred embodiment described in the specification – even if it is the only embodiment – into the claims absent a clear indication in the intrinsic record that the patentee intended the claims to be so limited.” *Dealertrack, Inc. v. Huber*, 674 F.3d 1315, 1327 (Fed. Cir. 2012); *Phillips v. AWH Corp.*, 415 F.3d 1303, 1323 (Fed. Cir. 2005) (en banc) (“[C]laims may embrace different subject matter than is illustrated in the specific embodiments in the specification.”). Neither the claims nor the detailed description of the ’750 patent uses the term “continuous.” Therefore, we find no clear indication in the intrinsic record that the patentee intended the claims to be so limited to the embodiment of Figure 3.

The background of the ’750 patent does use the term “continuously” in disclosing “there is a need for a signal conditioning system where the offset and gain mismatches can be corrected continuously without interrupting the processing of any incoming signals.” Ex. 1001 3:44–48. However, we disagree with Patent Owner’s contention that, because of this disclosure, the background indicates that the scope of the claims excludes the non-continuous prior art techniques. PO Sur-Reply 5–6; PO Resp. 18. The background of the ’750 patent discloses examples of prior art techniques that include both continuous as well as non-continuous techniques. For example, the background discloses a digital calibration of offset and gain

without running a separate calibration cycle, which is a continuous technique. Ex. 1001, 1:50–65, 3:21–30. Patent Owner contends that continuous techniques are within the scope of the claims. PO Sur-Reply 5–6. As another example, the background discloses that “[i]nterleaving is a well-known technique for achieving high sample rates in analog-to-digital (ADC) systems.” Ex. 1001, 1:13–25. Interleaved ADC systems are also within the scope of the claims. *Id.* at 14:64–65, 16:22–23. Thus, Patent Owner’s contention that the prior art techniques described in the background of the ’750 patent are outside the scope of the claims is inconsistent with Patent Owner’s contention that continuous techniques, which are described in the background and known in the prior art, are within the scope of the claims. Patent Owner’s contention is also inconsistent with the background’s description that interleaved ADC systems, which are within the scope of the claims, are well-known.

In contrast to the background, the summary of the invention of the ’750 patent discloses that “[t]he present invention provides a signal conditioning system with a first converter and a random clock.” Ex. 1001, 3:51–52. Similarly, every independent claim of the ’750 patent recites a converter and a random clock. Thus, a person of ordinary skill would understand that the claims are distinguished over the prior art disclosed in the background by a converter and a random clock as claimed, not by continuously calibrating the offset, which was known in the prior art.

We disagree with Patent Owner’s contention that Dr. Holberg confirmed that offset is corrected in a continuous or ongoing fashion, and that one could think of that as continuous calibration. PO Sur-Reply 2. Dr. Holberg, when asked “[i]s the offset-sensing circuit part of a calibration process,” testified that

Well, I think the problem with a question or the difficulty in answering that question is, you know, how do you construe calibration?

I mean, you can see it as a process that's ongoing or you can see it as something that you do once or intermittently. And so what's going on in the '750 is gain -- well, we're talking about offset here. Offset is being corrected in an ongoing or a continuous fashion.

So you, perhaps, could think of that as a continuous calibration, maybe. But certainly that's not the term that's used in this --in this particular phrase or throughout. I don't believe they use -- they use "corrector" rather than "calibrator."

But it's kind of a loaded term, like I say. I mean, you might -- you can see it a couple of ways, I suppose, continuous versus intermittent.

Ex. 2007, 88:23–89:22. The first sentence that Patent Owner relies on, that “[o]ffset is being corrected in an ongoing or continuous fashion,” does not indicate that Dr. Holberg was construing the claimed “offset sensing circuit” as requiring continuous calibration. Rather, this sentence, consistent with Dr. Raychowdhury’s testimony, indicates that “ongoing” and “continuous” are distinct terms. As Dr. Raychowdhury testifies, a process that is ongoing may not be continuous, such as a process of performing foreground calibration every couple of hours or every day. Ex. 1024, 160:11–161:7. The fragment of the other sentence that Patent Owner relies on, that “one could think of that as continuous calibration,” also does not indicate that Dr. Holberg was construing the claimed “offset sensing circuit” as requiring continuous calibration. Rather, in this sentence, Dr. Holberg testifies that “you, *perhaps*, could think of that as continuous calibration, *maybe*,” then further explains that “you can see it a couple of ways . . . continuous versus intermittent.” Dr. Holberg’s deposition testimony is consistent with his declaration testimony, where he testifies that “I am unaware of the term

‘sense,’ ‘sensor,’ or ‘sensing’ being used as a term of art to imply continuous, ongoing, or automatic process of sensing to the exclusion of non-automatic sensing.” Ex. 1022 ¶ 4.

We disagree with Patent Owner’s reliance on the dictionary definition of “sense” as “to detect (as radiation) automatically.” PO Sur-Reply 4 (citing Ex. 2008, 656). The Federal Circuit has held that “a general-usage dictionary cannot overcome art-specific evidence of the meaning of a claim term.” *Phillips*, 415 F.3d at 1322. Dr. Holberg provides art-specific evidence in testifying that “there is nothing in the plain and ordinary meaning of the term ‘sensing’ that would inform a POSITA that the sensing has to be an automatic, ongoing process of monitoring the signal. Real-world sensing can embody manually triggered sampling as well as automatic sampling.” Ex. 1022 ¶ 4.

Considering the complete record now before us, we agree with Petitioner that no explicit construction for “offset sensing circuit” is needed.

“Sensing” a gain or offset signal

Claim 19 recites “sensing” an offset signal, and claim 41 recites “sensing” a gain. Patent Owner proposes that the term “sensing” as recited in claims 19 and 41 should be construed as “an automatic, ongoing process of monitoring the signal to discover or respond to some characteristic in that monitored signal.” PO Resp. 17. Patent Owner contends that its proposed construction is consistent with the specification, which discloses filter 110 to sense offset signals, and rectifiers and filters to sense gain signals. *Id.* at 18.

Petitioner, relying on testimony of Dr. Raychowdhury, contends that the ’750 patent does not provide implementation details of filters 110 and 138, and does not provide implementation details of rectifiers 182 and 184. Reply 4 (citing Ex. 1024, 186–187, 202). Petitioner contends that low pass

filters 110 and 138 could be implemented using any low pass filter configuration, and that rectifiers 183 and 184 could be implemented using any rectifier configuration. *Id.* at 4–5. Petitioner contends that Patent Owner relies on a dictionary definition of “sense” to support Patent Owner’s proposed construction, but that there is nothing in the plain and ordinary meaning of the term “sensing” that would inform a POSITA that the sensing must be an automatic, ongoing process. *Id.* at 5. Petitioner contends “there is no disclosure in the ’750 patent that expressly limits the functionality of its disclosed embodiments to a continuous or automatic, ongoing process.” *Id.* Petitioner contends that Dr. Raychowdhury understands that for a POSITA, automatic and ongoing monitoring is not the same as continuously monitoring, and that performing foreground calibration every couple of hours or every day would be an ongoing, but not continuous, process. *Id.* Petitioner contends that Dr. Raychowdhury’s testimony supports Petitioner’s contention that the scope of “sensing” does not require continuous monitoring. *Id.*

Patent Owner contends that Dr. Raychowdhury was discussing a hypothetical foreground correction technique that was ongoing but not continuous, to make plain that a foreground technique is distinct from the claims because it would not be sensing continuously in time. PO Sur-Reply 7–8.

We disagree with Patent Owner. Dr. Raychowdhury testified that the term ongoing “would mean – to someone skilled in the art . . . that it’s happening, and it may or may not be continuous.” Ex. 1024, 160:11–14. Dr. Raychowdhury testified that “you can, for example, perform foreground calibration every couple of hours or every day But it is not a continuous technique So definitely in a context like that, the process

would be ongoing, but not necessarily . . . continuous.” *Id.* at 160:17–161:5. As discussed above in our analysis of “offset sensing circuit,” we do not agree with Patent Owner’s contention that a foreground technique is distinct from the claims. Rather, we agree with Petitioner’s contention, which is supported by Dr. Holberg’s testimony and Dr. Raychowdhury’s testimony, that non-continuous sensing, such as that used in a foreground technique, is within the scope of the claims.

The other arguments presented by the parties for construing the term “sensing” were also presented by the parties for construing “offset sensing circuit,” which we have addressed above. We agree with Petitioner that no explicit construction for “sensing” is needed.

D. Asserted Obviousness Over Elbornsson and Jamal

1. Overview of Elbornsson (Ex. 1004)

Elbornsson discloses a time interleaved ADC system to increase the sampling rate of the system. Ex. 1004, 3.¹ Elbornsson discloses that a drawback of such a system is that the ADCs are not identical, due to errors in the manufacturing process, which means that time, gain, and offset mismatch errors are introduced into the system. *Id.* Elbornsson discloses decreasing the impact of mismatch errors by randomizing the order in which the ADCs are used. *Id.* Figure 3 of Elbornsson is reproduced below.

¹ We cite to the page numbers inserted by Petitioner at the bottom of each page of Exhibit 1004.

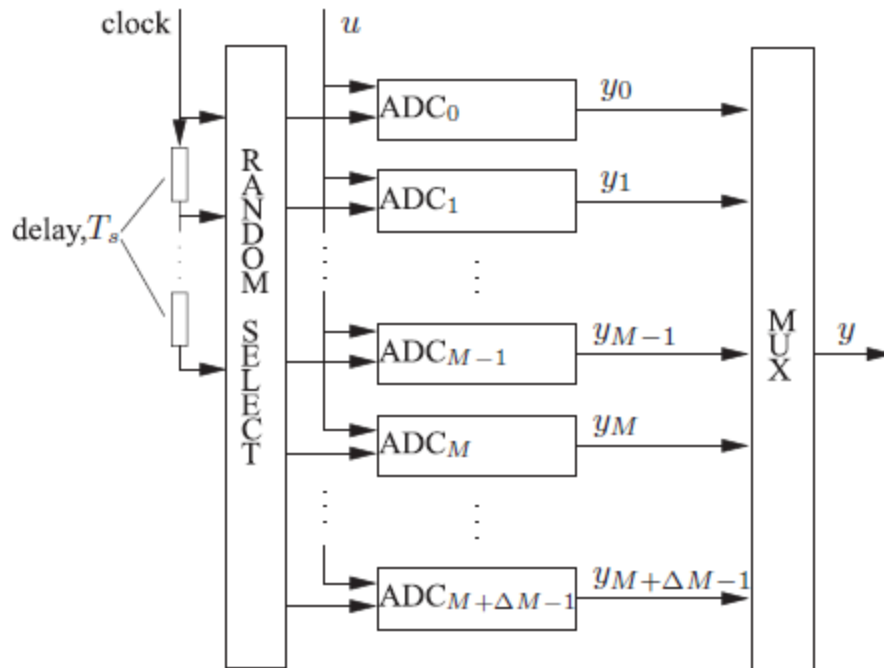


Figure 3 above shows a randomly interleaved ADC system including $M + \Delta M$ parallel ADC units having outputs coupled to a multiplexer.

Ex. 1004, 3–4. As shown in Figure 3, input signal u is connected to all ADCs. *Id.* at 3. Each ADC works with a sampling interval of MT_s , where M is the number of ADCs in the array and T_s is the sampling interval. *Id.* The i th ADC gives an output signal y_i . The output signals are multiplexed to form one output signal y . *Id.* The clock signal is delayed by delay blocks, each having a delay of T_s such that the clock signal to the i th ADC is delayed with iT_s , to give an overall sampling interval of T_s . *Id.* The impact of distortion is decreased by randomizing the selection of which ADC is used at each time instance. *Id.*

Elbornsson further discloses correcting the output signal from offset errors by subtracting an offset value of a given ADC from the output, or subsequence, of the ADC to yield an offset corrected output. *Id.* at 12. In order to correct the gain of each subsequence, Elbornsson discloses dividing

the offset corrected subsequence by the ratio of the average amplitude of the i th ADC to the average amplitude of all ADCs. *Id.*

2. Overview of Jamal (Ex. 1005)

Jamal discloses a time-interleaved ADC that uses digital-background calibration to overcome offset, gain, and sample-time errors between channels. Ex. 1005, 7.² Figure 1 of Jamal is reproduced below.

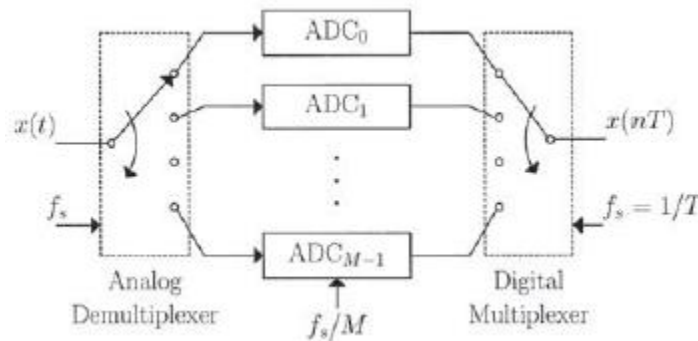
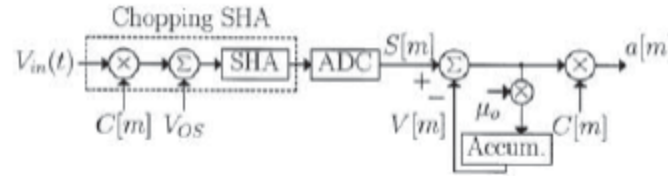


Figure 1 above shows a block diagram of a time-interleaved ADC including M ADCs in parallel, an analog demultiplexer at the input, and a digital multiplexer at the output. Ex. 1005, 7–8. During operation, the analog demultiplexer selects each channel in turn to process the analog input signal. *Id.* at 7. The digital multiplexer selects the digital output of the selected channel to form a high-speed ADC, where the overall sampling rate increases by a factor of M . *Id.* The performance of the interleaved ADCs, however, is sensitive to mismatches among the channels. *Id.*

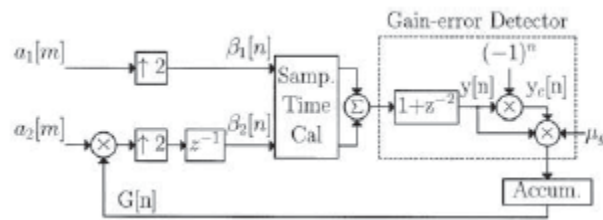
Figure 3 of Jamal shows a block diagram of a signal channel that uses chopper-based offset calibration to correct the offset at the output of each ADC and is reproduced below. Ex. 1005, 8.

² We cite to the page numbers inserted by Petitioner at the bottom of each page of Exhibit 1005.



As shown in Figure 3 above, a chopping SHA (sample and hold amplifier) multiplies the analog input signal $V_{in}(t)$ by a pseudorandom binary signal $C[m]$, where m is a discrete time index. Ex. 1005, 8. $C[m]$ is white, has zero mean, and is uncorrelated with the input signal. *Id.* Together with V_{OS} , the chopped analog signal is sampled and digitized by the ADC, producing signal $S[m]$. *Id.* The accumulator produces a variable offset $V[m]$ that is subtracted from the output $S[m]$ of the ADC, and the result is multiplied again by $C[m]$ to produce the channel output $a[m]$. *Id.* The combination of the accumulator and the summer forms a feedback loop that forces the average of the accumulator input to be zero, which results in canceling the offset of the channel. *Id.*

Jamal also discloses correcting gain mismatch between ADC channels using a gain calibration method shown in Figure 5, which is reproduced below. Ex. 1005, 8–9.



As shown in Figure 5 above, a gain-error detector and an accumulator produce a gain correction signal $G[n]$ based on signals $a_1[m]$ and $a_2[m]$ that represent the outputs of two ADC channels after offset calibration. *Id.* Gain correction signal $G[n]$ adjusts to be the ratio of G_1 to G_2 , which are the gains of two interleaved ADC channels, respectively. *Id.* The gain mismatch is

corrected by multiplying the offset calibrated output signal $a_2[m]$ by gain correction signal $G[n]$, which makes the gain of each channel equal to G_1 .
Id.

3. *Analysis*

Petitioner contends claims 10, 11, 13–17, 19, 20, 23–32, and 35–43 are unpatentable over Elbornsson and Jamal. Pet. 25–87.

Claim 10

The preamble of claim 10 recites “[a]n integrated circuit that converts between an analog signal and a corresponding digital code with a system sampling rate f_s .” Petitioner contends, to the extent the preamble is limiting, the combination of Elbornsson and Jamal teaches this limitation because “Elbornsson suggests implementing the ADC, random selection, and mismatch correction algorithms using an integrated circuit by mentioning non-idealities caused by a ‘manufacturing process,’” and Jamal discloses implementing time interleaved ADCs and an offset calibration system on an integrated circuit. Pet. 26–27 (citing Ex. 1004, 4, Fig. 3; Ex. 1005, 7–8, 13, Fig. 12).

Petitioner contends that implementing Elbornsson’s ADC system on an integrated circuit as disclosed by Jamal is the combination of familiar elements according to known methods that does no more than yield predictable results, uses a known technique to improve similar devices in the same way, and applies a known technique to a known device ready for improvement to yield predictable results. Pet. 28 (citing Ex. 1002 ¶¶ 149–158). Petitioner further contends that a person of ordinary skill in the art would have implemented Elbornsson’s offset and gain correction calibration algorithms on an integrated circuit for the benefit of making the overhead

small enough to use the calibration algorithms in products as taught by Jamal. Pet. 28–29 (citing Ex. 1005, 13; Ex. 1002 ¶¶ 161–162).

Claim 10 recites “a plurality of converter circuits clocked by a random clock.” Petitioner contends that Elbornsson discloses this limitation because Elbornsson discloses a plurality of converter circuits, each of which is randomly clocked by a random select block. Pet. 29–30 (citing Ex. 1004, 3–4, Fig. 3; Ex. 1002 ¶¶ 243–250).

Claim 10 recites “at least one converter circuit in said plurality of converter circuits sampling the analog signal at least every $1/f_s$ seconds.” Petitioner contends that Elbornsson discloses this limitation because Elbornsson discloses an overall sampling interval of T_s . Pet. 30 (citing Ex. 1004, 3; Ex. 1002 ¶ 251). Dr. Holberg testifies that the sampling interval T_s is the reciprocal of the sampling rate f_s . Ex. 1002 ¶ 251. Dr. Holberg also testifies that in order to support an overall sampling interval of $T_s = 1/f_s$ seconds, at least one ADC would need to sample the analog signal every $T_s = 1/f_s$ seconds. *Id.*

Claim 10 recites “an offset sensing circuit configured to sense signal offsets and/or signal offset differentials between the outputs of said plurality of converter circuits.” Petitioner contends that Elbornsson discloses estimating offset errors present at the output of each ADC. Pet. 31 (citing Ex. 1004, 4, 12; Ex. 1002 ¶¶ 252–257). Petitioner further contends Jamal discloses an offset sensing circuit configured to sense signal offsets at the output of each ADC. Pet. 31–32 (citing Ex. 1005, 8, Fig. 3).

Petitioner contends that using Jamal’s offset correction in Elbornsson’s ADC system is the substitution of Jamal’s known plurality of offset correction circuits for Elbornsson’s known single correction circuit that yields the predictable benefits of correcting the offset for each channel

and reducing the calculation needed to detect and correct the offset. Pet. 32–37 (citing Ex. 1002 ¶¶ 164–204, 254–255).

Whether Elbornsson is prior art

Patent Owner contends that Petitioner has not shown that Elbornsson was published prior to the critical date of the '750 patent, which is April 16, 2003. PO Resp. 18. Petitioner, relying on the testimony of Dr. Jan-Ake Larsson, who is the Head of the Department of Electrical Engineering at Linkoping University in Sweden, and the testimony of Dr. Ingrid Hsieh-Yee, who is a professor in the Department of Library and Information Science at the Catholic University of America, contends that Elbornsson was published on March 3, 2003. Pet. 9 (citing Ex. 1013; Ex. 1021).

Dr. Larsson testifies that Elbornsson “was published on the website for the Department of Electrical Engineering in March 2003,” and that this publication date “is based on information from our publication database.” Ex. 1021 ¶¶ 8–9. Patent Owner contends that Dr. Larsson does not have personal knowledge about the publication practices of Linkoping University’s Department of Electrical Engineering in 2003, because he joined the electrical engineering department in 2008. PO Resp 21. Patent Owner contends that Dr. Larsson “confirms that Elbornsson was available from Linkoping’s Publications Data Base (the ‘Control Database’) in March 2003,” by “relying on the ‘date of publication displayed on the cover page of the report’ and the publication database he cited was a ‘separate system’ from the ‘Control Database’ upon which Petitioner relies.” PO Sur-Reply 9.

We disagree with Patent Owner’s contention. We are persuaded that Dr. Larsson, as the Head of the Department of Electrical Engineering at Linkoping University, understands the accuracy of the department’s business records, including the publication database, and credibly relies on the

publication database to provide accurate information about the date that Elbornsson was published on the website of the Department of Electrical Engineering (what Patent Owner calls the “Control Database”). Ex. 1021 ¶¶ 1, 8–9; Ex. 2017, 20:18–24:6. We are persuaded that it is reasonable for Dr. Larsson to rely on known business and publication practices including evidence indicating that Elbornsson was published on the website of the Department of Electrical Engineering, or “Control Database,” in March 2003.

Dr. Hsieh-Yee, relying on an email from the editor of the Library/LiU Electronic Press of Linkoping University, Hakan Andersson; the March 3, 2003, date on the title page of Elbornsson; her knowledge and experience with metadata and design of digital repositories; and Internet Archive records, testifies that Elbornsson was published on March 3, 2003, and became discoverable and available for public access at least by March 15, 2003. Ex. 1013 ¶¶ 11, 14, 15, 31, 43, 60, 61. Patent Owner contends that Dr. Hsieh-Yee’s testimony does not show that Elbornsson was accessible via the Control Database prior to April 16, 2003, because the earliest date of Elbornsson captured by the Internet Archive records is May 11, 2003. PO Resp. 18–19, 25. Patent Owner contends that Dr. Hsieh-Yee testifies that it was possible that Elbornsson could have been added to the Control Database as late as May 10, 2003. *Id.* at 26 (citing Ex. 2016, 71:13–72:3); PO Sur-Reply 8. Patent Owner contends that Dr. Hsieh-Yee’s testimony, that Elbornsson was added to the Control Database at least by March 15, 2003, is based on eight other technical reports that were added to the Control Database within 12 to 25 days of the dates listed on those reports, and that this sample of eight reports is too small to establish a pattern or practice of the Control Database in 2003. PO Resp. 25–26. Patent Owner contends that

Dr. Hsieh-Yee has no personal knowledge of the Control Database's business practices in the early 2000s, and is not aware of any policies concerning how quickly technical reports were added to the system. PO Sur-Reply 8–9.

We disagree with Patent Owner's contentions. Dr. Hsieh-Yee testifies "that Internet Archive does not – does not archive everything, every moment, every second." Ex. 2016, 62:10–12. Dr. Hsieh-Yee testifies that "they ran the query twice and they capture it. And so one time was . . . May 11, 2003 And it's likely to be available before that So I would caution us, when we look at the May 11, [2003] date, keep in mind that that is the date of the Internet Archive activity. It does not indicate a first public availability." Ex. 2016, 64:1–16. Dr. Hsieh-Yee testifies that her opinion that Elbornsson was publicly accessible through the control database in March 2003 is based further on an analysis of eight documents found in appendices D1 to D8 of her declaration, which were selected from the same series as Elbornsson, were added to the Control Database around the same time as Elbornsson, and were archived by the Internet Archive. Ex. 2016, 72:4–76:3. She testifies that "based on the pattern that I established from the analysis of D1 to D8, 12 to 25 days is the most – most likely window for the technical reports to get into the database." Ex. 2016, 92:21–25.

We find Dr. Hsieh-Yee's opinion, that 12 to 25 days is the most likely window for Elbornsson to be publicly accessible in the Control Database, persuasive, because it is based on the publication dates of eight documents from the same series as Elbornsson, which were added to the Control Database around the same time as Elbornsson, and were archived by the Internet Archive. Her opinion is consistent with the date of March 3, 2003, found on the cover page of Elbornsson, is consistent with Dr. Larsson's

testimony that Elbornsson was published in March 2003, and is consistent with an email from the editor of the LiU Electronic Press, who wrote that Elbornsson was published on March 3, 2003. Ex. 1013 ¶¶ 32–43, App’x A; Ex. 1021 ¶ 8; Ex. 1004, 1. We find that documents D1 to D8, Dr. Larsson’s testimony, and the date of March 3, 2003 found on the cover page, support Dr. Hsieh-Yee’s opinion that Elbornsson would have been discoverable and publicly accessible from 12 to 25 days after March 3, 2003.

Patent Owner contends that a person of ordinary skill in the art would not have known about the Control Database, and would not have been able to find it by exercising reasonable diligence. PO Resp. 26. We disagree with Patent Owner. We are persuaded by the testimony of Dr. Hsieh-Yee and Dr. Larsson that a skilled artisan, exercising reasonable diligence, would have been aware of the research conducted by the Department of Electrical Engineering at Linkoping University, and would have been able to access the reports published in the Control Database found on the department’s website. Dr. Hsieh-Yee testifies that the Control Database is part of the LiU E-Press, and that on the cover of the technical reports, there is a link telling readers that they can go to that database to search. Ex. 2016, 133:3–10. Dr. Hsieh-Yee testifies that because it is on the open web, “we can claim . . . that everybody in the world know[s] about it [T]he fact that it’s already on the open web, that means that you can claim that you’re the first author.” Ex. 2016, 142:12–20. She testifies that “[i]f you have a group of people working in a particular area, often you know . . . who are the top researchers, you know where the teams are located.” Ex. 2016, 143:2–6. She testifies that “within the researchers in that particular area, they will be able to . . . know that in Linkoping University . . . this control group has a database.” Ex. 2016, 152:22–153:5. She testifies that “on the cover page of every

report . . . they alert people that this article can be found in [the Control] database.” Ex. 2016, 85:9–11, 133:7–10; *see* Ex. 1004, 1.

Similarly, Dr. Larsson testifies that “you try to make your research as visible as possible. This is . . . what we do.” Ex. 2017, 13:14–16. When asked whether the Department of Electrical Engineering at Linköping University took any action to publicize Elbornsson, Dr. Larsson testifies that “I would expect so, yes. The Ph.D. defense is public And in the course of that, when you prepare, you present your research at conferences within the field, and this is standard. So this is what I would expect.” Ex. 2017, 14:8–15. We credit the testimony of Dr. Hsieh-Yee and Dr. Larsson in determining that a person of ordinary skill in the art, exercising reasonable diligence, would have been aware that Linköping University researchers, including Jonas Elbornsson, were working in this field and publishing their reports on the Control Database.

Patent Owner contends that the Control Database was not meaningfully indexed, because Dr. Hsieh-Yee only included results of searches performed using the author’s name in her declaration, which shows that the Control Database was only indexed by author’s name. PO Resp. 27; PO Sur-Reply 9–10. We do not agree with Patent Owner. Dr. Hsieh-Yee testifies that she did not search the control database using any parameter other than the author’s name, because the “publication database of this group is itself no longer searchable because they had migrated to DiVA. And so, currently, in 2021, we are not able to search that system because the entire database is not archived by the Internet Archive.” Ex. 2016, 95:25–96:6; *see id.* at 98:24–99:25. She also testifies that the “way the [Control] Database is set up is that it has a lot of metadata, and those metadata are searchable. So if you go to any of those appendixes that represent publication database, you

will see that there are fields that are searchable, and that means that they can be indexed.” Ex. 2016, 94:20–95:9; Ex. 1013 ¶¶ 31, 43, 60–61, App’x D1b, D1c, D6b. We credit Dr. Hsieh-Yee’s testimony in finding that the documents in the Control Database were indexed and searchable in March 2003.

We disagree with Patent Owner’s reliance on *Acceleration Bay, LLC v. Activision Blizzard Inc.*, 908 F.3d 765 (Fed. Cir. 2018). PO Resp. 20. In *Acceleration Bay*, “the record supports the Board’s finding that the CSE Library website’s advanced search function did not successfully permit keyword searching of titles.” 908 F.3d at 774. In contrast to *Acceleration Bay*, the record in this case does not include evidence that any of the title, year, type, research area, number, and keyword search fields in the Publications Database as shown in Appendix D1b and Appendix D6b of Dr. Hsieh-Yee’s declaration, did not function properly in March 2003. Rather, the record here supports Dr. Hsieh-Yee’s testimony that the Control Database had searchable metadata, and that the Publications Database had fields that were searchable by author name, title, year, type, research area, number, and keyword. Ex. 2016, 94:20–95:9; Ex. 1013 ¶¶ 31, 43, 60–61, App’x D1b, D1c, D6b; see *In re Lister*, 583 F.3d 1307, 1316 (Fed. Cir. 2016) (A reference “was publicly accessible as of the date that it was included in . . . databases that permitted keyword searching of titles.”).

Patent Owner contends that Dr. Hsieh-Yee has not shown that Elbornsson was published by the LiU E-Press in March 2003. PO Resp. 27–28. Patent Owner contends that the LiU E-Press was not meaningfully indexed, and that a person of ordinary skill exercising reasonable diligence would not have found the LiU E-Press website, nor the Elbornsson reference. PO Resp. 28. Dr. Hsieh-Yee testifies that the “Control Database

is part of . . . the LiU E-Press, and [the Control Database] can be searched by itself as we saw And [the Control Database] also is searchable through LiU E-Press.” Ex. 2016, 133:3–14. Patent Owner’s contentions regarding the LiU E-Press are similar to Patent Owner’s contentions regarding the Control Database, which we find unpersuasive as discussed above. See PO Resp. 27–30. We credit Dr. Hsieh-Yee’s testimony in determining that Elbornsson was published by the LiU E-Press in March 2003. Ex. 1013 ¶¶ 44–61.

Patent Owner presents an additional contention, that the LiU E-Press website states that “E-Press publication is suitable for articles where the author has his or her own ways of reaching the intended community,” and that Dr. Hsieh-Yee and Dr. Larsson have no knowledge of the authors of Elbornsson promoting or publicizing Elbornsson. PO Resp. 31 (citing Ex. 1013, App’x E, 569). We are not persuaded.

The E-Press website says that it “is suitable for articles where the author has his or her own ways of reaching the intended reader community, and less suitable,” not unsuitable, “if that is not the case.” Ex. 1013, App’x E at 569. The E-Press website states that, with E-Press publication, “[t]he article is instantly available world-wide.” *Id.* at 568. The E-Press website states that “the purpose of the E-Press is to do unrefereed electronic publication. When something comes out of the E-Press, it has been published, but it has not been subject to the confidential peer review This does not mean that we think that peer review is unnecessary, only that we think it can be done after the first publication of the article.” *Id.* at 567 (emphasis omitted). The E-Press website states that “some journals are relatively easy to get into fast, but are not so widely available; others are widely available but have long publication delays. With the E-Press

publication you do not have to choose between those two problems.” *Id.* at 568. The E-Press website also states that publishing an article on E-Press “make[s] it more easily accessible to the world.” *Id.* at 567.

Dr. Hsieh-Yee’s testimony is consistent with the E-Press website. Dr. Hsieh-Yee testifies that “the whole idea of the E-Press, you submit it to a platform, we make it available on open web.” Ex. 2016, 143:19–21. Dr. Hsieh-Yee testifies that “the LiU E-Press, they can say, our University stand behind this because we are this enterprise, we are this entity and we are saying that our researchers, when their material showed up on E-Press, that means that they are published.” *Id.* at 144:4–9. Thus, contrary to Patent Owner’s contention, the E-Press publication, which makes the article “instantly available world-wide,” is suitable where the author wants to publish quickly so that the “research result becomes official” and “you can claim your results from the date of first publication, and you are not dependent on reviewers from the point of view of priority.” Ex. 1013, App’x E, 567–69. We do not agree with Patent Owner’s contention that the authors of Elbornsson were required to promote or publicize the article in order for the article to be published and publicly accessible. We credit Dr. Hsieh-Yee’s testimony in determining that when Elbornsson was published by the LiU E-Press, it was published and instantly available world-wide.

The E-Press website also states that the E-Press publication is suitable “for articles in specialized fields with a well defined research community where ‘everyone knows everyone else,’ and for papers which are primarily written for other members of the same community.” Ex. 1013, App’x E, 566. Dr. Hsieh-Yee, Dr. Larsson, and Elbornsson itself provide evidence of a specialized field with a well defined research community suitable for publishing an article on E-Press. For example, Dr. Hsieh-Yee testifies that

“the intent and commitment of the LiU E-Press [is] to help their researchers document and publicize research findings quickly and to ensure free and long-term access to their publications by any interested parties.” Ex. 1013 ¶ 60. She testifies that “[i]f you have a group of people working in a particular area, often you know . . . who are the top researchers, you know where the teams are located.” Ex. 2016, 143:2–6. She testifies that “within the researchers in that particular area, they will be able to . . . know that in Linköping University, . . . this control group has a database.” Ex. 2016, 152:22–153:5.

Dr. Larsson testifies that publicizing the Elbornsson reference “is our usual course of action. You try to make your research as visible as possible. This is what we – what we do.” Ex. 2017, 13:9–16. Dr. Larsson testifies that the “Ph.D defense is public. This is required in law, Swedish law. And in the course of that, when you prepare, you present your research at conferences within the field, and this is standard. So this is what I would expect.” *Id.* at 14:4–15. Finally, the cover page of Elbornsson has a date of March 3, 2003, and a link to the Control Database, which was searchable on the website of the Department of Electrical Engineering and through the LiU E-Press. Ex. 1004, 1; Ex. 1013 ¶¶ 43, 60; Ex. 2016, 133:3–14. We are persuaded by the testimony of Dr. Larsson and Dr. Hsieh-Yee, and find that publishing an article by the LiU E-Press of Linköping University in March 2003 would have made the article accessible to a person of ordinary skill exercising reasonable diligence.

We find, by a preponderance of evidence, that Elbornsson was publicly accessible through at least the Control Database and the LiU E-Press more than one year before the April 16, 2004, filing date of the ’750

patent. Therefore, Elbornsson is prior art to the '750 patent under 35 U.S.C. § 102(b).

Whether Elbornsson alone teaches an “offset sensing circuit”

Petitioner contends that Elbornsson discloses estimating offset errors present at the output of each ADC according to an equation describing a digital moving average filter. Pet. 31 (citing Ex. 1004, 2, 10; Ex. 1002 ¶ 252). Petitioner contends that it would have been obvious to a person of ordinary skill to implement the equation on an integrated circuit. Pet. 31 (citing Ex. 1002 ¶ 253). Patent Owner contends that Elbornsson does not teach an offset sensing circuit that continuously monitors the outputs of the converter circuits to sense and correct offset errors. PO Resp. 32; PO Sur-Reply 2. In particular, Patent Owner contends that the estimation algorithm of Elbornsson requires tens of thousands of samples for eight bits, and over a billion samples for sixteen bits. PO Resp. 44 (citing Ex. 1004, 13–14, Fig. 10; Ex. 2006 ¶ 69). Petitioner contends that Patent Owner never alleges that implementing Elbornsson's equation of the moving average filter would be impossible to construct or would fail to provide a continuous flow of data. Reply 6–7. Patent Owner contends that Petitioner has not demonstrated that a person of ordinary skill would be motivated to implement an impractically large circuit to provide continuous monitoring and correction. PO Sur-Reply 12–13. Patent Owner contends that the more rational interpretation is that Elbornsson suggests a separate, rather than continuous, calibration cycle for estimating offset errors. *Id.* at 13; PO Resp. 48.

We agree with Patent Owner, that Petitioner has not persuasively explained why a person of ordinary skill would want to implement the moving average filter of Elbornsson using an impractically large circuit in order to provide continuous offset monitoring and correction. We agree

with Patent Owner, that the more rational explanation is that Elbornsson suggests an offset sensing circuit that operates during a separate, rather than continuous, calibration cycle. However, claim 10 does not require an offset sensing circuit that performs continuous monitoring and correction, as discussed in our claim construction of this term. Claim 10 encompasses the separate calibration cycle suggested by Elbornsson. PO Resp. 39–49; PO Sur-Reply 12–18. We find that Elbornsson alone teaches an “offset sensing circuit” within the scope of claim 10.

Whether Petitioner has shown a reason to combine Elbornsson and Jamal

Patent Owner contends that a person of ordinary skill in the art would not have been motivated to combine the teachings of Elbornsson and Jamal because (a) Elbornsson teaches that gain and offset mismatch can be effectively addressed using random interleaving alone, (b) incorporating Jamal’s teachings would result in a larger, more complex circuit without providing any additional benefit, (c) the proposed combination would render the prior art unsatisfactory for its intended purpose and changes its principles of operation, and (d) Jamal expressly criticizes configurations which use extra ADCs, like Elbornsson’s configuration. PO Resp. 49. We address each contention below.

(a) whether Elbornsson teaches that gain and offset mismatch can be effectively addressed using random interleaving alone

Patent Owner contends that Figure 2 of Elbornsson shows gain and offset mismatches as deleterious tones, or distortion spikes, in the frequency spectrum of the system’s output. PO Resp. 54–55. Patent Owner contends that Figure 5 of Elbornsson shows that such spikes reduce the system’s spurious free dynamic range (SFDR). *Id.* at 55. Patent Owner contends

that Figure 7 of Elbornsson shows that Elbornsson's interleaving technique obliterates the spikes by spreading the spikes into the noise floor, and there is no need for Jamal's correction circuitry. *Id.* at 55–57. According to Patent Owner, the “Petition and declaration identify no shortcoming or deficiency in Elbornsson alone, nor any extra benefit that Jamal would provide if combined with Elbornsson.” *Id.* at 57; *see* PO Sur-Reply 18. Patent Owner contends that Petitioner's reasons to combine are speculative and rely on unsupported assertions from Dr. Holberg. PO Sur-Reply 18–19.

Petitioner contends that Elbornsson explicitly discloses correcting gain and offset mismatches in order to get the noise produced by the spikes below the quantization level of the converter. Reply 12 (citing Ex. 1004, 10–12). Petitioner contends that the Petition advances a number of technical reasons to combine Elbornsson and Jamal, including (a) reducing the calculation needed to detect and correct for offset, (b) eliminating notches in the ADC output spectrum, thereby enabling the ADC to convert analog signals having useful information at dc and low frequencies to the digital domain, and (c) a reduction of hardware needed to implement the required gain correction. Reply 13 (citing Pet. 33–36, 67–70).

Patent Owner's contention that Elbornsson's interleaving technique obliterates spikes caused by offset and gain mismatches by spreading the spikes throughout the frequency spectrum and expresses no desire for any further improvement to noise performance is inconsistent with Patent Owner's contention that Elbornsson teaches estimation formulas to correct offset and gain mismatches. *See* PO Resp. 48. As discussed above in our analysis of Elbornsson alone, we find that Elbornsson teaches an offset sensing circuit within the scope of claim 10. Thus, contrary to Patent Owner's contention, we find that Elbornsson explicitly discloses correcting

offset and gain mismatches, not only from the interleaving technique, but also from offset and gain error estimates. Ex. 1004, 10–12, Figs. 10–11.

(b) whether incorporating Jamal’s teachings would result in a larger, more complex circuit without providing any additional benefit

Petitioner contends that modifying Elbornsson’s feedforward-based offset correction to incorporate Jamal’s feedback-based structure would have resulted in a system improvement in terms of reducing the calculation needed to detect and correct for offset. Pet. 33–34; see Ex. 1002 ¶¶ 176, 178, 181–182. Patent Owner contends that the combination of Elbornsson and Jamal would result in a larger, more complex circuit with increased power consumption without providing any additional benefit. PO Resp. 58–59; PO Sur-Reply 19–20. Petitioner contends that Patent Owner’s contention, that the combination would result in a larger, more complex circuit, is inconsistent with Patent Owner’s contention that a physical implementation of Elbornsson’s mismatch equations would be so large that it would dwarf the ADC itself. Reply 13–14 (citing PO Resp. 44). Petitioner, relying on the testimony of Dr. Raychowdhury, contends that implementing Jamal’s offset correction algorithms in place of Elbornsson’s offset mismatch equations would be more efficient. Reply 14 (citing Ex. 1025, 300).

Dr. Holberg testifies that “the required amount of estimation data required to get the offset mismatch noise below the quantization noise for a 10-bit ADC and 4 parallel converters is about 10^6 , which would require a large number of registers to implement Elbornsson’s offset sensing equation.” Ex. 1002 ¶ 181. Dr. Holberg testifies that “Jamal’s offset sensing algorithm, on the other hand, only requires a single accumulator, a summing block and a scaling circuit (to scale by μ_m).” *Id.* at ¶ 182. Dr.

Holberg testifies that a “POSITA would have also understood that modifying Elbornsson’s feedforward-based offset correction to incorporate Jamal’s feedback-based structure would have also resulted in a system improvement in terms of reducing the calculation needed to detect and correct for offset.” *Id.* at ¶ 181. Dr. Holberg provides similar testimony for replacing Elbornsson’s gain mismatch correction with Jamal’s gain mismatch correction system. *Id.* at ¶¶ 210–232. For example, Dr. Holberg testifies that “each digital moving average filter (of Elbornsson) requires at least $N_i - 1$ registers to store delayed samples in order to calculate the average amplitude. Jamal, on the other hand, only requires a[n] accumulator in order to perform the calculations necessary to measure and correct a gain difference,” and that “replacing Elbornsson’s gain mismatch correction system with Jamal’s gain mismatch correction circuit would advantageously result in a reduction of hardware needed to implement required gain correction.” *Id.* at ¶ 227.

We credit Dr. Holberg’s testimony and Dr. Raychowdhury’s testimony in determining that implementing Jamal’s feedback-based structure would be more efficient than implementing Elbornsson’s offset equation as circuitry, which shows sufficient motivation to combine the teachings of Elbornsson and Jamal. *See DyStar Textilfarben GmbH & Co. Deutschland KG v. C.H. Patrick Co.*, 464 F.3d 1356, 1368–69 (Fed. Cir. 2006) (collecting cases holding that there was a motivation to combine because the prior art combination was “more efficient”); Pet. 32–37, 61–67; Reply 13; Ex. 1002 ¶¶ 164–209; Ex. 1025, 300. We agree with Petitioner and Dr. Holberg in determining that a person of ordinary skill in the art would have replaced Elbornsson’s feedforward-based offset correction algorithm with Jamal’s feedback-based offset correction and detection

circuit to yield the predictable efficiency of reducing the calculation needed to detect and correct for offset. Ex. 1002 ¶¶ 164–187. We agree with Petitioner and Dr. Holberg, that a person of ordinary skill would have replaced Elbornsson’s gain mismatch correction system with Jamal’s gain mismatch correction circuit to yield the predictable efficiency of reducing the hardware needed to implement required gain correction. Ex. 1002 ¶¶ 210–232.

We also agree with Petitioner, that Jamal provides motivation to combine its teachings with those of Elbornsson. Evidence of a motivation to combine prior art references “may flow from the prior art references themselves.” *See Brown & Williamson Tobacco Corp. v. Philip Morris Inc.*, 229 F.3d 1120, 1125 (Fed. Cir. 2000). Jamal teaches that “[t]o eliminate the notches in the ADC output spectrum, a random-chopper-based offset calibration scheme removes offset mismatches.” Ex. 1005, 8. We agree with Petitioner and Dr. Holberg, that a person of ordinary skill would have combined the teachings of Elbornsson and Jamal for the benefit of eliminating notches in the ADC output spectrum, thereby enabling the ADC to convert analog signals having useful information at dc and low frequencies to be in the digital domain as taught by Jamal. Ex. 1002 ¶¶ 188–209.

(c) whether the proposed combination would render the prior art unsatisfactory for its intended purpose and changes its principles of operation

Patent Owner contends that the intended purpose of Elbornsson is random interleaving to spread spikes over a frequency system, and that Jamal relies on random chopping of a fixed, sequentially interleaved system, which would not work in a randomly interleaved system. PO Resp. 60.

According to Patent Owner, Jamal's calibration scheme would not sense or correct gain mismatch if the ADCs were randomly interleaved, but rather, would induce errors. *Id.* at 61. Patent Owner contends that Jamal does not teach how to sense or correct offset or gain mismatch in a randomly interleaved system, and that the Petition provides no explanation of modifying Jamal to work in such a system. PO Resp. 62. Patent Owner contends that all of Elbornsson's estimation techniques, apart from random interleaving, are time-domain techniques, and Jamal's techniques are continuous and frequency-based. PO Resp. 63. Patent Owner contends that the Petition does not explain why a person of ordinary skill would change Jamal's principles of operation to work with Elbornsson. *Id.*

Petitioner contends that Patent Owner has not provided a reason why combining Jamal's offset control circuit would change the principle of operation of Jamal's offset control circuit, or would render Jamal's offset control circuit unsuitable for its intended purpose. Reply 15. Petitioner, relying on the testimony of Dr. Raychowdhury, contends that Patent Owner's contrast of time and frequency-based techniques is a distinction without a difference, and that Jamal's offset correction circuit would work when included in Elbornsson's randomly interleaved system, and would not change the function of Jamal's choppers, summing block, or accumulator. *Id.*, see also Ex. 1025, 287 (Dr. Raychowdhury admitting that "time and frequency are duals of each other.").

Petitioner contends that Jamal's sequential interleaving is not a "principle of operation," but rather, is a specific example of an ADC system that uses Jamal's gain correction scheme. *Id.* Petitioner contends that Jamal's principle of operation is using the relationship between the input at f_0 and the image at f_i to correct for gain mismatch. *Id.* at 15–16 (citing Ex.

1005, 8–9). Petitioner contends that random interleaving does not change Jamal’s expressly stated gain correction principle of operation. *Id.* at 17 (citing Ex. 1022 ¶¶ 21–27 (Holberg reply declaration)). Petitioner contends that the data sequencing function of Jamal does not perform gain error detection or gain correction. *Id.* at 19. Petitioner contends that the gain correction system shown in Figure 5 of Jamal includes an interface configured to accept an alternating sequential data format. *Id.* at 20. Dr. Holberg testifies that adapting Jamal’s interface to accommodate a randomly sequenced data format would have been within the level of ordinary skill. Ex. 1022 ¶¶ 33–34.

Patent Owner contends that the adaptation discussed by Dr. Holberg was not mentioned in the Petition, and that the adaptation is beyond what *KSR* permits. PO Sur-Reply 22. Patent Owner contends that even if the combined teachings of Elbornsson and Jamal were made operable, a person of ordinary skill would have appreciated that Elbornsson obliterates the spikes, so that there would have been no need to add Jamal. *Id.*

We disagree with Patent Owner’s contention, that because Elbornsson obliterates spikes caused by offset and gain mismatches, there would have been no need or motivation to add Jamal. When the spikes are “obliterated,” as alleged by Patent Owner, the distortion is spread over a wider frequency range. Ex. 1004, 3, 9, 10, 12, Figs. 6, 7, 12, 13. Thus, random interleaving decreases distortion, but does not eliminate distortion. *Id.* As we discussed above, contrary to Patent Owner’s contention, Elbornsson itself still relies on additional offset and gain error estimation for correcting error and gain mismatches, and Jamal provides the benefit of more efficient offset and gain correction circuitry. See Ex. 1002 ¶¶ 181–182, 227.

We disagree with Patent Owner's contention that Elbornsson's estimation techniques are time-domain techniques, and Jamal's techniques are continuous and frequency based. We are persuaded by the testimony of Dr. Holberg and Dr. Raychowdhury, that Patent Owner's contrast of time and frequency-based techniques is a distinction without a difference, and that time and frequency are duals of each other. Ex. 1022 ¶ 17 (quoting Ex. 1025, 287:3–4).

We disagree with Patent Owner's contention that adapting Jamal's interface to accommodate a randomly sequenced data format is beyond what *KSR* permits. The mere fact that Jamal's gain correction system that includes an interface configured to accept an alternating sequential data format may not be physically combinable with Elbornsson's randomly sequenced data format does not undermine a showing of obviousness. See *Facebook, Inc. v. Windy City Innovations*, 973 F.3d 1321, 1343 (Fed. Cir. 2020) (“[T]he test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference.”) (quoting *In re Keller*, 642 F.2d 413, 425 (CCPA 1981)); *In re Keller*, 642 F.2d at 425 (“Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art.”). The Supreme Court has held that “[a] person of ordinary skill is also a person of ordinary creativity, not an automaton,” and that the obviousness analysis “need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill would employ.” *KSR*, 550 U.S. at 421, 418.

Dr. Holberg provides persuasive testimony that “the operation of data sequencers that sequence incoming parallel data and to provide a serial

stream are well known in the art,” and that it “would be well within one of ordinary skill in the art to adapt a data interface to accommodate the different timing of a randomly sequenced ADC.” Ex. 1022 ¶ 33. Dr. Holberg testifies that “all it requires is following Jamal’s expressly disclosed two-step gain-error detection principle of operation (chopping at a sample frequency followed by a multiplication), accumulating the detected error, multiplying the gain of one channel by the accumulated error, and serializing the data provided by the interleaved ADC to a data stream compatible with the particular implementation of the gain correction algorithm.” *Id.* at ¶ 34 (citing Ex 1005, 9); see Ex. 1002 ¶¶ 57–73, 113–119 (describing operation of Jamal’s gain error corrector as chopping at a sample frequency followed by a multiplication, accumulating the detected error, and multiplying the gain of one channel by the accumulated error), 124–127, 141–147, 149–232, 254–257). We credit Dr. Holberg’s testimony in determining that modifying the data interface of Jamal’s offset and gain correction circuitry to accommodate Elbornsson’s timing was not “uniquely challenging or difficult for one of ordinary skill in the art.” *Leapfrog Enters., Inc. v. Fisher-Price, Inc.*, 485 F.3d 1157, 1162 (Fed. Cir. 2007) (citing *KSR*, 550 U.S. at 419). We agree with Dr. Holberg, that modifying the data interface of Jamal’s offset and gain correction circuitry to accommodate the timing of Elbornsson’s randomly sequenced ADCs would have been within the level of ordinary skill. *Facebook, Inc.*, 973 F.3d at 1343.

We are persuaded by Dr. Holberg’s testimony that “[s]imilar to Jamal’s example system adapted to operate with a fixed, sequential interleaving, adapting Jamal’s system to operate with a randomly interleaved ADC would still perform the functions of sequencing incoming data, measuring a gain difference between channels, and adjusting the gain of one

channel based on the measured gain difference in a closed loop manner.” Ex. 1022 ¶ 34. We agree with Petitioner and Dr. Holberg that Jamal’s gain correction circuit would maintain its principle of operation and would be suitable for its intended purpose of sensing and correcting gain mismatch when combined with Elbornsson’s randomly interleaved ADC system. Ex. 1002 ¶ 118; Ex. 1022 ¶¶ 20–35. We also agree with Petitioner and Dr. Holberg that combining Jamal’s offset control circuit with Elbornsson’s randomly interleaved ADCs would not change the principle of operation of Jamal’s offset control circuit, nor would it render Jamal’s offset control circuit unsuitable for its intended purpose. Ex. 1022 ¶¶ 17–18.

We find that Dr. Holberg’s Reply testimony “follow[s] from contentions raised in the Petition” and “properly responds to arguments raised in Patent Owner’s Response.” See *Ericsson Inc. v Intellectual Ventures I LLC*, 901 F.3d 1374, 1379-1381 (Fed. Cir. 2018). Here, unlike in *Ariosa*, Dr. Holberg “does not identify a previously unidentified piece of prior art to make a meaningfully distinct contention, but instead expands the same argument made in the Petition,” that combining Jamal’s offset circuit with Elbornsson’s randomly interleaved ADCs would have been obvious. *Id.* at 1381 (citing *Ariosa Diagnostics v. Verinata Health, Inc.*, 805 F.3d 1359 (Fed. Cir. 2015). “Nor does [Dr. Holberg’s testimony] constitute an entirely new rationale worthy of being excluded.” *Id.* (citing *Intelligent Bio-Systems, Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1370 (Fed. Cir. 2016)). Here, unlike in *Intelligent Bio-Systems*, Dr. Holberg “cites no new evidence and merely expands on a previously argued rationale as to why” the combination of the prior art disclosures was within the level of ordinary skill. *Id.*

(d) whether Jamal expressly criticizes configurations which use extra ADCs, like Elbornsson's configuration

Patent Owner contends that Jamal expressly criticizes systems which use extra sub-ADCs, such as Elbornsson's system. PO Resp. 63. In particular, Patent Owner contends that Jamal identifies a paper by Dyer as an example of analog calibration circuits that are not easily portable to evolving scaled technologies, where the Dyer paper describes a time-interleaved ADC system that uses adaptive calibration to overcome gain and offset mismatches by interleaving a number of high speed ADCs with an additional reference ADC. *Id.* at 63–64 (citing Ex. 1005, 7; Ex 2009, 1913). Patent Owner contends that Elbornsson includes an extra ADC in order to achieve randomization. *Id.* at 64 (citing Ex. 1004, 3–4; Ex. 2007, 52:8–16). Patent Owner contends that Jamal's statement and reference to Dyer's additional reference ADC is a criticism of all $M + 1$ architectures as not easily portable, and teaches away from combination with any $M + 1$ architecture, such as Elbornsson's. *Id.* at 64–65; PO Sur-Reply 23.

Petitioner, relying on the testimony of Dr. Raychowdhury, contends that Jamal is not criticizing all $M + 1$ architectures, but only those that use extra calibration ADCs. Reply 21–22 (citing Ex. 1014, 266–267). Petitioner contends that Elbornsson does not include a calibration ADC. *Id.* at 22 (citing Ex. 1024, 268). Petitioner also contends that Jamal's criticism of circuits that are not easily portable to evolving scaled technologies refers to analog calibration circuits, not to digital calibration circuits used by Elbornsson and Jamal. *Id.* (citing Ex. 1024, 269).

We agree with Petitioner. Dr. Raychowdhury, when asked “it's your understanding that Jamal criticizes adding additional calibration ADCs; is that correct,” answered “Yes, that's right.” Ex. 1024, 267:7–10. Dr.

Raychowdhury testified that “Elbornsson’s paper [does] not talk about any calibration [T]he whole principle here is . . . to avoid calibration by randomly interleaving the different channels of the ADC So this method is – is not connected to the calibration – of any kind of calibration.” *Id.* at 268:9–20. Dr. Raychowdhury testified that “as we go to smaller and smaller technology nodes, it becomes harder and harder to design analog circuits. It’s easier to design digital circuits because they are more scaling friendly. That’s what I suspect Jamal is saying when he mentions that the required analog calibration circuits are not easily portable to evolving scaled technologies.” *Id.* at 269:14–22. We rely on Dr. Raychowdhury’s testimony in determining that Jamal is criticizing analog circuits that use extra calibration ADCs, not all $M + 1$ architectures, and that Elbornsson does not describe an analog circuit that uses extra calibration ADCs. Therefore, Jamal does not teach away from the invention.

We disagree with Patent Owner’s contention that even if Jamal does not expressly teach away, Jamal’s alleged preference against combining its teachings with any $M + 1$ architecture show that a skilled artisan would not be motivated to combine Elbornsson and Jamal. PO Resp. 64–65 (citing *Polaris Indus., Inc. v. Arctic Cat, Inc.*, 882 F.3d 1056, 1069 (Fed. Cir. 2018)). Even were we to accept Patent Owner’s contention that Jamal criticizes all $M + 1$ architectures, including “digital circuits [that] are more scaling friendly” (Ex. 1024, 269:14–22) such as Elbornsson’s (Ex. 1024, 259:15–19), Patent Owner does not consider the advantages of Elbornsson’s $M + 1$ architecture, namely, random interleaving, which “decrease[s] the impact of mismatch errors [by] spread[ing] the distortion over a wider frequency range.” Ex. 1004, 1. The Federal Circuit has stated that “a given course of action often has simultaneous advantages and disadvantages, and

this does not necessarily obviate motivation to combine.” *Medichem, S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1165 (Fed. Cir. 2006). “Instead, the benefits, both lost and gained, should be weighed against one another.” *Id.* We are not persuaded that Jamal’s alleged preference against all $M + 1$ architectures outweighs the advantages of decreasing the impact of mismatch errors provided by Elbornsson’s $M + 1$ architecture.

Further, “[i]t’s not necessary to show that a combination is the best option, only that it is a suitable option.” *Intel Corp. v. Qualcomm Inc.*, 21 F.4th 784, 800 (Fed. Cir. 2021) (emphasis omitted); see *In re Mouttet*, 686 F.3d 1322, 1334 (Fed. Cir. 2012) (finding no teaching away where nothing in the prior art device suggested that the invention was unlikely to work). “And if a technique has been used to improve one device, and a person of ordinary skill would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill.” *Intel Corp.*, 21 F.4th at 800 (citing *KSR*, 550 U.S. at 417). We agree with Dr. Holberg that we have that here. Ex. 1002 ¶¶ 198–200.

Whether Petitioner has shown a reasonable expectation of success

Patent Owner contends that when Elbornsson’s ADC is combined with Jamal’s teaching, the input signal is Jamal’s chopped output rather than Elbornsson’s analog input signal $u(t)$. PO Resp. 66–67. Patent Owner contends that Petitioner provides no explanation to show how Elbornsson and Jamal would actually function together. *Id.* at 68. Petitioner, relying on the testimony of Dr. Raychowdhury and Dr. Holberg, contends that the output of Jamal’s chopper provides a signal that fulfills Elbornsson’s mathematical assumption of a quasi-stationary, zero mean signal, thus, the combined system would work with the output of Jamal’s choppers applied to

the inputs of Elbornsson's ADCs. Reply 23 (citing Ex. 1024, 85–89; Ex. 1022 ¶¶ 37–39). Patent Owner contends that the size, cost, power consumption, and complexity of circuitry would not motivate a person of ordinary skill to combine Elbornsson and Jamal. PO Sur-Reply 24. Patent Owner also contends that Petitioner improperly argues that connecting Jamal's chopper output to the input of the ADCs of Elbornsson would remain quasi-stationary. *Id.* Patent Owner contends that such a signal would remain quasi-stationary over a short period of time, which is insufficient to satisfy Elbornsson's requirements. *Id.*

We disagree with Patent Owner's contention that Petitioner provides no explanation to show how Elbornsson and Jamal would actually function together. Dr. Holberg persuasively testifies that modifying Elbornsson's system to incorporate Jamal's feedback-based offset correction circuit would have led to predictable results, because Jamal discloses measured results of the prototype system, which show that Jamal's feedback-based offset correction system operates in a predictable manner. Ex. 1002 ¶ 172 (citing Ex. 1005, 13–15). Dr. Holberg persuasively testifies that there is a reasonable expectation of success in modifying Elbornsson's interleaved ADC system to incorporate Jamal's random chopper-based offset calibration, because Jamal demonstrates that random chopping can be applied to an interleaved ADC system to “eliminate notches in the ADC output system,” and discloses measured results that demonstrate Jamal's random chopper based offset correction system operates in a predictable manner. *Id.* at ¶ 193 (citing Ex. 1005, 8, 13–15).

Dr. Holberg persuasively testifies that Patent Owner has not made any technical argument alleging that combining Jamal's random chopping with Elbornsson's random sequencing would not function, nor has Patent Owner

provided any technical discussion explaining how the proposed combination would not work. Ex. 1022 ¶ 38. Dr. Holberg persuasively testifies that the output of Jamal's chopper would provide a signal that fulfills Elbornsson's assumption of a quasi-stationary, zero mean signal. *Id.* (citing Ex. 1024, 85:2–88:2). Dr. Holberg persuasively testifies that Elbornsson's analysis would still be valid if the output of Jamal's random choppers were applied to its inputs. *Id.* at ¶ 39.

We disagree with Patent Owner's contention that the signal would remain quasi-stationary for an insufficiently short period of time. Dr. Holberg, relying on testimony of Dr. Raychowdhury, testifies that Elbornsson's definition of quasi-stationary is the same as the community definition, which does not require that a signal be locally stationary for the entire duration of the offset analysis. Ex. 1022 ¶ 11 (citing Ex. 1024, 74; Ex. 2012; Ex. 1023, 2173, Fig. 1). Dr. Holberg persuasively testifies that an audio signal is a quasi-stationary signal and may have local stationary intervals of 20-40 milliseconds, but the entire signal is considered quasi-stationary, not just the local stationary interval. *Id.* ¶ 12 (citing Ex. 1023, 2168). Dr. Holberg testifies that Jamal's interleaved ADC operates at 120 Ms/s and has a resolution of 10 bits. *Id.* ¶ 15 (citing Ex. 1005, 1626). Dr. Holberg persuasively testifies that collecting one million samples would only take 8.3 milliseconds, which is a timeframe in which many signals are locally stationary. *Id.*

Patent Owner, in the Sur-Reply, contends that Jamal has an absurdly high sampling rate of 120 Ms/s, and that a person of ordinary skill would not consider sampling audio at such a high rate. PO Sur-Reply 16–17. However, Patent Owner has not provided persuasive evidence showing that a person of ordinary skill would have considered Jamal's sampling rate to be

absurdly high. We are persuaded by Dr. Holberg's testimony, that a person of ordinary skill in the art would have had a reasonable expectation of success in combining the teachings of Elbornsson and Jamal.

We are not persuaded by Patent Owner's contention that the size, cost, power consumption, and complexity of circuitry would not motivate a person of ordinary skill to combine Elbornsson and Jamal. As discussed above, we are persuaded that Jamal's benefits of reducing the calculation needed to correct for offset, and reducing hardware needed to implement gain correction, would reduce the size of the circuitry to implement the teachings of Elbornsson and Jamal. *See* Ex. 1002 ¶¶ 181, 182, 227. Further, as discussed above, we are persuaded that the combined benefits, including Elbornsson's benefit of randomly interleaving the ADCs in order to decrease the impact of mismatch errors, and Jamal's additional benefit of eliminating notches in the ADC output spectrum, outweigh the disadvantages alleged by Patent Owner. *See id.* ¶¶ 164–232.

Conclusion

For the reasons set forth by Petitioner and explained above, we are persuaded that Elbornsson and Jamal teach all of the limitations of claim 10, and that a person of ordinary skill would have combined the teachings of the references to achieve the integrated circuit recited in the claim and would have had a reasonable expectation of success in doing so. Dr. Holberg's testimony provides sufficient evidence of reasons that a person of ordinary skill would have used the teachings of Jamal within the interleaved ADC system of Elbornsson, and would have had a reasonable expectation of success in doing so. Petitioner has proven by a preponderance of the evidence that claim 10 would have been obvious over Elbornsson and Jamal.

Claims 11, 13–17, 19, 20, 23–32, and 35–43

Claim 11 depends from claim 10, and recites “said offset sensing circuit includes a plurality of offset sensing sub-circuits, each offset sensing sub-circuit in said plurality of sub-circuits being configured to adjust the signal offset differential and/or signal offsets between respective pairs of converter circuits.” Petitioner contends that the combination of Elbornsson and Jamal teaches this limitation in disclosing offset estimation and correction equations implemented on a per channel basis, and that a person of ordinary skill would have implemented Elbornsson’s offset correction circuits using a plurality of sub-circuits. Pet. 37–39.

Claim 13 depends from claim 10, and recites “a controller circuit configured to detect instances when available converter circuits in said plurality of converter circuits are available to process an upcoming one of said random samples.” Petitioner contends that Elbornsson teaches this limitation in disclosing a random select block that randomizes the selection of which ADC is used at each time instance. Pet. 40–42.

Claim 14 depends from claim 10, and recites “said plurality of converter circuits are interleaved.” Petitioner contends that Elbornsson teaches this limitation in disclosing a plurality of interleaved ADCs. Pet. 42–43.

Claim 15 depends from claim 10, and recites “said offset signal is subtracted from one of said input signal through a feedback loop circuit and said corresponding output signal through a feedforward loop circuit.” Petitioner contends that Elbornsson teaches this limitation in disclosing an offset correction equation that describes a feedforward circuit. Pet. 43–45.

Claim 16 depends from claim 10, and recites “each offset sensing circuit includes at least one of a filter and an amplifier.” Petitioner contends

that the combination of Elbornsson and Jamal teaches this limitation. Pet. 45. Petitioner contends that Elbornsson discloses a digital moving average filter and an amplifier with respect to a gain scaling factor, and that Jamal teaches a digital filter formed by an accumulator and a summer. Pet. 45–46.

Claim 17 depends from claim 10, and recites “each converter circuit in said plurality of converter circuits is corrected to one of a zero offset and another desired offset value.” Petitioner contends that Elbornsson teaches this limitation in disclosing subtracting the offset from the respective subsequences in order to correct to a zero offset. Pet. 47. Petitioner contends Jamal teaches this limitation in disclosing introducing a notch at dc, as well as setting the accumulator input to be zero, which results in a zero offset. *Id.*

The preamble of independent claim 19 recites a “method of adjusting an offset signal in a signal conditioning system.” Petitioner contends that Elbornsson teaches the preamble in disclosing conditioning an output signal of a converter with an offset signal. Pet. 48.

Claim 19 recites “clocking a first converter with a random clock.” Petitioner contends that Elbornsson teaches this limitation in disclosing a plurality of converter circuits clocked by a random clock. Pet. 48–49.

Claim 19 recites “sensing a first offset signal of said first converter.” Petitioner contends that the combination of Elbornsson and Jamal teaches this limitation. Pet. 49. Petitioner contends that Elbornsson suggests implementing its mismatch measurement and correction algorithms on an integrated circuit. *Id.* Petitioner contends that Jamal teaches an offset correction circuit and an offset chopping circuit. *Id.* at 49–50. Petitioner contends that combining Elbornsson’s interleaved ADC system with Jamal’s

chopper-based offset calibration, or both chopping and offset correction circuits would have been obvious. *Id.* at 50.

Claim 19 recites “conditioning one of an input signal and an output signal of said first converter with said first offset signal.” Petitioner contends that the combination of Elbornsson and Jamal teaches this limitation in disclosing conditioning an output signal of a first converter with an offset signal. Pet. 51.

Claim 20 depends from claim 19, and recites “a step of sensing a second offset signal of a second converter, said second converter being clocked with said random clock.” Petitioner contends that the combination of Elbornsson and Jamal teaches this limitation for the reasons given in Petitioner’s analysis of claim 19. Pet. 52.

Claim 23 depends from claim 20, and recites “a step of sampling an input signal to said first and second converters with said random clock.” Petitioner contends that the combination of Elbornsson and Jamal teaches this limitation. Pet. 52. Petitioner contends that Elbornsson teaches that each ADC samples an analog signal, and that the sampling time instances for each ADC are picked at random. *Id.* at 53. Petitioner contends that Jamal teaches sampling an input signal. *Id.* Petitioner contends that incorporating Jamal’s sampling circuit with Elbornsson’s ADC is the combination of prior art elements according to known methods that does nothing more than yield predictable results. *Id.* at 54.

Claim 24 depends from claim 23, and recites “a step of selecting said first and second converters in a random sequence correlated to said random clock.” Petitioner contends that Elbornsson teaches this limitation in disclosing a random select block that randomizes the selection of which ADC is used at each time instance. Pet. 55–56.

The preamble of independent claim 25 recites a “signal conditioning system.” Petitioner contends that Elbornsson teaches the preamble for the reasons given in Petitioner’s analysis of claim 19. Pet. 56.

Claim 25 recites “a first converter with a first gain and a second converter with a second gain, said first and second converters being clocked in a random sequence.” Petitioner contends that Elbornsson teaches this limitation in disclosing that each ADC has a gain error, and is clocked in a random sequence by the random select block. Pet. 56–58.

Claim 25 recites “a gain corrector configured to adjust a difference between said first and second gains.” Petitioner contends that Elbornsson teaches this limitation in disclosing a gain corrector configured to adjust a difference between gains of the various ADCs. Pet. 58–59.

Claim 26 depends from claim 25, and recites “at least one of a random clock generator, a pseudorandom clock generator, and an aperiodic clock generator to provide said random sequence.” Petitioner contends that Elbornsson teaches this limitation in disclosing a random select block. Pet. 59–60

Claim 27 depends from claim 25, and recites “said gain corrector provides a difference between said first and second gains.” Petitioner contends that the combination of Elbornsson and Jamal teaches this limitation. Pet. 61. Petitioner contends that Elbornsson teaches determining a difference between a first and second gain. *Id.* Petitioner contends that Jamal teaches a gain-error detector that provides a difference between first and second gains. *Id.* at 62–63. Petitioner contends a person of ordinary skill in the art would have applied the teachings of Jamal’s gain correction circuit to the interleaved ADC system of Elbornsson for the benefits of equalizing gains using only a single path multiplication as taught by Jamal,

setting a gain of a second channel to have the same gain as a first channel, and reducing hardware needed to implement gain correction. *Id.* at 63–70. Petitioner contends that combining Jamal’s gain correction circuit to Elbornsson’s ADC system is the combination of prior art elements according to known methods that does no more than yield predictable results. *Id.* at 70.

Claim 28 depends from claim 27, and recites “said difference provides a gain correction signal to adjust said gain difference between said first and second converters.” Petitioner contends that Elbornsson in combination with Jamal teaches this limitation. Petitioner asserts that Jamal discloses a gain-error detector that adjusts a gain of one ADC channel to have the same gain as another ADC channel. Pet. 70–71.

Claim 29 depends from claim 25, and recites “said gain corrector provides a gain correction signal proportional to a ratio between said first and second gains.” Petitioner contends that Elbornsson in combination with Jamal teaches this limitation. Petitioner asserts that Jamal discloses a gain correction signal that adjusts the ratio of the gains of two interleaved ADC channels. Pet. 71.

Claim 30 depends from claim 25, and recites “said gain sensor forms one of a feedback loop and a feedforward loop.” Petitioner contends that the combination of Elbornsson and Jamal teaches this limitation. Pet. 72. Petitioner contends that Elbornsson’s gain correction equation teaches a feedforward loop. *Id.* Petitioner contends that Jamal teaches a feedback loop that controls the gain. *Id.* at 73.

Claim 31 depends from claim 25, and recites “said gain sensor includes at least one of a filter and a rectifier.” Petitioner contends that Elbornsson’s equation 63 teaches a rectifier with respect to taking the absolute value of offset corrected ADC output value, and teaches a filter in

disclosing taking a moving average of the absolute value of offset adjusted ADC output value. Pet. 73–74.

The preamble of independent claim 32 recites an “integrated circuit that converts between an analog signal and a corresponding digital code at a clock rate f_s .” Petitioner contends that the combination of Elbornsson and Jamal teaches the preamble for the reasons given in Petitioner’s analysis of claim 10. Pet. 75.

Claim 32 recites “a plurality of converter circuits clocked by a random clock.” Petitioner contends that Elbornsson teaches this limitation for the reasons given in Petitioner’s analysis of claim 10. Pet. 75.

Claim 32 recites “a gain sensor coupled to each converter circuit in said plurality of converter circuits, said gain sensor circuit sensing a gain from said corresponding converter circuit, each gain sensor circuit being coupled to one of said plurality of converter circuits.” Petitioner contends that the combination of Elbornsson and Jamal teaches this limitation. Pet. 76. Petitioner contends that Elbornsson teaches a gain sensor circuit in equation 63. *Id.* at 76–78. Petitioner contends that Jamal teaches a gain sensor circuit for the reasons given in Petitioner’s analysis of claim 27. *Id.* at 78.

Claim 32 recites “a controller circuit configured to select said plurality of converter circuits in a random sequence.” Petitioner contends that Elbornsson teaches this limitation for the reasons given in Petitioner’s analysis of claim 13. Pet. 79.

Claim 35 depends from claim 32, and recites “said plurality of converter circuits are interleaved.” Petitioner contends that Elbornsson teaches this limitation for the reasons given in Petitioner’s analysis of claim 14. Pet. 79.

Claim 36 depends from claim 32, and recites “an input signal provided to said plurality of converter circuits includes a zero-offset signal.” Petitioner contends that the combination of Elbornsson and Jamal teaches this limitation. Pet. 79. Petitioner contends that Elbornsson teaches that the input signal is quasi-stationary and zero mean. *Id.* Petitioner contends that Jamal teaches the technique of random chopping in conjunction with offset mismatch correction to equalize the offset between parallel channels of an interleaved ADC. *Id.* at 80.

Claim 37 depends from claim 32, and recites “said gain sensor circuit provides a gain correction signal proportional to a difference between said gain of said corresponding converter circuit and a reference gain of one other correction circuit.” Petitioner contends Jamal teaches this limitation in disclosing a gain-error detector that outputs a signal having a dc component proportional to the gain mismatch of two interleaved channels. Pet. 80–81.

Claim 38 depends from claim 32, and recites “said gain sensor circuit provides a gain correction signal proportional to a ratio between a gain of said corresponding converter circuit and a reference gain of one other corrector circuit.” Petitioner contends that Jamal teaches this limitation for the reasons given in Petitioner’s analysis of claim 29. Pet. 81.

Claim 39 depends from claim 32, and recites “said gain sensor circuit forms one of a feedback loop and a feedforward loop.” Petitioner contends that Jamal teaches this limitation for the reasons given in Petitioner’s analysis of claim 30. Pet. 82.

Claim 40 depends from claim 32, and recites “said gain sensor circuit includes at least one of a filter circuit and a rectifier circuit.” Petitioner contends that Elbornsson teaches this limitation for the reasons given in Petitioner’s analysis of claim 31. Pet. 82.

The preamble of independent claim 41 recites a “method of adjusting a gain mismatch in a signal conditioning system.” Petitioner contends that Elbornsson teaches the preamble in disclosing a randomly time interleaved ADC that converts an analog input signal to a digital output signal. Pet. 82–83.

Claim 41 recites “sensing a first gain of a first converter.” Petitioner contends that the combination of Elbornsson and Jamal teaches this limitation for the reasons given in Petitioner’s analysis of claim 32. Pet. 83–84.

Claim 41 recites “sensing a second gain of a second converter, said first and second converters being clocked with a random clock.” Petitioner contends that Elbornsson teaches this limitation for the reasons given in Petitioner’s analysis of claim 25. Pet. 84–85.

Claim 41 recites “adjusting at least one of said first and second gains to adjust said gain mismatch between said first and second converters.” Petitioner contends that the combination of Elbornsson and Jamal teaches this limitation for the reasons given in Petitioner’s analysis of claim 10. Pet. 85–86.

Claim 42 depends from claim 41, and recites “the step of adjusting at least one of said first and second gains includes a step of sensing a difference between said first and second gains.” Petitioner contends that the combination of Elbornsson and Jamal teaches this limitation for the reasons given in Petitioner’s analysis of claim 27. Pet. 86.

Claim 43 depends from claim 41, and recites “the step of adjusting at least one of said first and second gains includes a step of sensing a ratio between said first and second gains.” Petitioner contends that the

combination of Elbornsson and Jamal teaches this limitation for the reasons given in Petitioner’s analysis of claim 29. Pet. 86–87.

Patent Owner does not argue separately claims 11, 13–17, 19, 20, 23–32, and 35–43, but instead relies on arguments presented for claim 10, with which we disagree as discussed in our analysis of claim 10. *See generally* PO Resp. 18–68. Petitioner’s analysis for claims 11, 13–17, 19, 20, 23–32, and 35–43, supported by the testimony of Dr. Holberg (Ex. 1002 ¶¶ 258–424), which we credit, is persuasive that claims 11, 13–17, 19, 20, 23–32, and 35–43 would have been obvious over Elbornsson and Jamal.

E. Asserted Obviousness Over Elbornsson, Jamal, and Ferragina

1. Overview of Ferragina (Ex. 1007)

Ferragina discloses correcting offset mismatch in time interleaved ADCs. Ex. 1007, 6.³ Ferragina discloses that “[t]he difference between the digital outputs of the path under calibration and the reference path is integrated over the calibration time slot NT_{CK} .” *Id.* at 7. “The result is a digital word proportional to the difference between the offsets of the two paths.” *Id.* Thus, when the offset “is added to the output of the path under calibration, its overall offset becomes equal to the offset of the reference path.” *Id.* at 8. According to Ferragina, “[t]his procedure is repeated for the M paths” so that “all the M paths have the same overall offset of the reference path, thus avoiding spurious tones.” *Id.*

2. Analysis

Petitioner contends claims 18, 21, and 22 are unpatentable as obvious over Elbornsson, Jamal, and Ferragina. Pet. 87–92.

³ We cite to the page numbers inserted by Petitioner at the bottom of each page of Exhibit 1007.

Claim 18 depends from independent claim 10 and further recites “wherein each converter circuit in said plurality of converter circuits is corrected to said offset signal of one converter circuit in said plurality of converter circuits.” Petitioner contends that Ferragina teaches this limitation in disclosing calibrating all ADCs so that all the M paths have the same overall offset of the reference path. Pet. 88–89 (citing Ex. 1007, 6–8; see Ex. 1002 ¶ 428). Petitioner contends that a person of ordinary skill in the art would have reduced offset mismatch in the ADCs of Elbornsson and Jamal by setting the offset of each channel to a reference ADC as taught by Ferragina for the predictable benefit of avoiding spurious tones caused by offset mismatches between parallel channels as taught by Ferragina. Pet. 88–90 (citing Ex. 1002 ¶¶ 429–435).

Patent Owner contends that the sigma-delta converter implementation of Ferragina is incompatible with the Nyquist-rate converter implementation of Elbornsson. PO Resp. 69–72. In its Reply, Petitioner contends that the Petition does not propose bodily incorporating the specific implementation of Ferragina’s offset and gain control system in the system of Elbornsson and Jamal. Reply 29. Petitioner contends that the Petition suggests incorporating Ferragina’s teaching of setting the offset of a first channel to match the offset of another channel. Id. at 29–30. In particular, Petitioner contends that it would have been obvious to “set the offset of each ADC channel to a selected or reference ADC channel instead of setting the offset of each ADC channel to zero individually.” Id. at 30 (citing Pet. 89). In its Sur-Reply, Patent Owner contends that Petitioner’s Reply makes a new argument, which ignores the sigma-delta implementation of Ferragina’s system. PO Sur-Reply 25.

We agree with Petitioner. Ferragina discloses that when the offset “is added to the output of the path under calibration, its overall offset becomes equal to the offset of the reference path.” Ex. 1007, 8. Ferragina discloses that this procedure is repeated for each channel, so that all paths “have the same offset of the reference path, thus avoiding spurious tones.” *Id.* Dr. Holberg testifies that setting the offset of each ADC channel to a selected or reference ADC channel instead of setting the offset of each ADC channel to zero individually is the simple substitution of one known element for another that yields the predictable benefit of reducing or eliminating offset mismatch between channels. Ex. 1002 ¶ 434. Dr. Holberg testifies that Ferragina’s technique of setting the offset of each ADC channel to the offset of a selected ADC channel is readily and easily substitutable with the technique of setting the offset of each ADC channel to zero individually. *Id.* ¶ 435.

We agree with Petitioner and Dr. Holberg, that the Petition does not propose bodily incorporating the specific implementation of Ferragina into the combined system of Elbornsson and Jamal, but rather, suggests setting the offset of each ADC channel to a selected ADC channel as taught by Ferragina, instead of to zero as taught by Elbornsson and Jamal, for the benefit of reducing or eliminating offset mismatch between channels as taught by Jamal. *See* Pet. 88–90 (citing Ex. 1002 ¶¶ 429–440). We credit Dr. Holberg’s testimony in determining that setting the offset of each ADC channel to a selected ADC channel as taught by Ferragina, instead of to zero as taught by Elbornsson and Jamal, was not “uniquely challenging or difficult for one of ordinary skill in the art.” *Leapfrog Enters.*, 485 F.3d at 1162.

Patent Owner contends that Jamal explicitly criticizes using the $M + 1$ ADC architecture utilized in Ferragina. PO Resp. 72–73. Petitioner

contends that Jamal's criticism of analog calibration circuits does not apply to Ferragina's digital calibration. Reply 30. We agree with Petitioner, that Jamal does not criticize digital calibration circuits, for the reasons given in our analysis of claim 10.

Patent Owner contends that if Jamal's random chopping technique is applied to Ferragina, then Ferragina's gain calibration can no longer work. PO Resp. 73–74. Petitioner responds that the Petition incorporates Ferragina's teaching of setting the offset of a first channel to match the offset of another channel, but does not suggest combining Ferragina's gain control system with Elbornsson and Jamal, and that claims 18, 21, and 22 do not require gain correction. Reply 30 (citing Ex. 1025, 281–284). We agree with Petitioner, that claims 18, 21, and 22 do not require gain correction. We determine that Patent Owner's arguments regarding combining the gain correction of Ferragina with Elbornsson and Jamal do not address the proposed combination in the Petition and are not commensurate with the scope of claims 18, 21, and 22.

Patent Owner contends that combining the teachings of Ferragina with those of Elbornsson and Jamal would add additional cost and complexity with no identified benefit. PO Resp. 74–75. Patent Owner has not shown how setting the offset of a first channel to match the offset of another channel instead of setting the offset to zero would increase cost or complexity. Further, according to Dr. Holberg, Ferragina itself teaches that the benefit of setting the offset to a first channel is that all paths “have the same offset of the reference path, thus avoiding spurious tones.” Ex. 1007, 8; Ex. 1002 ¶¶ 428, 433–435.

For the reasons set forth by Petitioner and explained above, we are persuaded that Elbornsson, Jamal, and Ferragina teach all of the limitations

of claim 18, and that a person of ordinary skill would have combined the teachings of the references to achieve the integrated circuit recited in the claim and would have had a reasonable expectation of success in doing so. Dr. Holberg’s testimony provides sufficient evidence of reasons that a person of ordinary skill would have used the teachings of Ferragina within the interleaved ADC system taught by Elbornsson and Jamal, and would have had a reasonable expectation of success in doing so. Petitioner has proven by a preponderance of the evidence that claim 18 would have been obvious over Elbornsson, Jamal, and Ferragina.

Claim 21 depends from claim 20 and recites “a step of sensing a difference between said first and second offset signals.” Petitioner contends that Ferragina teaches this limitation in disclosing integrating the difference between the digital outputs of the path under calibration and the reference path. Pet. 90.

Claim 22 depends from claim 21 and recites “a step of adjusting said difference between said first and second offset signals.” Petitioner contends that Ferragina teaches this limitation in disclosing that as the offset is added to the output of the path under calibration, the difference between the offset of the reference path and the offset of the path under calibration is also adjusted. Pet. 91–92.

Patent Owner does not argue separately claims 21 and 22, but instead relies on arguments presented for claim 18, with which we disagree as discussed in our analysis of claim 18. *See generally* PO Resp. 68–75. Petitioner’s analysis for claims 21 and 22, supported by the testimony of Dr. Holberg (Ex. 1002 ¶¶ 425–435, 441–448), which we credit, is persuasive that claims 21 and 22 would have been obvious over Elbornsson, Jamal, and Ferragina.

III. CONCLUSION

As summarized in the table below, the Petition and supporting evidence has shown by a preponderance of the evidence that claims 10, 11, 13–32, and 35–43 of the '750 patent are unpatentable.⁴

Claims	35 U.S.C. §	Reference(s)/Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
10, 11, 13–17, 19, 20, 23–32, 35–43	103	Elbornsson, Jamal	10, 11, 13–17, 19, 20, 23–32, 35–43	
18, 21, 22	103	Elbornsson, Jamal, Ferragina	18, 21, 22	
Overall Outcome			10, 11, 13–32, 35–43	

IV. ORDER

Accordingly, it is:

ORDERED that claims 10, 11, 13–32, and 35–43 of the '750 patent are unpatentable; and

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

⁴ 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).

IPR2020-01483
Patent 6,900,750 B1

FOR PETITIONER:

Steven H. Slater
John D. Koetter
Benjamin E. Nise
SLATER MATSIL, LLP
sslater@slatermatsil.com
jkoetter@slatermatsil.com
bnise@slatermatsil.com

Hector G. Gallegos
Mehran Arjomand
Alex S. Yap
MORRISON & FORESTER LLP
hgallegos@mofo.com
marjomand@mofo.com
ayap@mofo.com

FOR PATENT OWNER:

Peter Dichiara
Scott Bertulli
WILMER CUTLER PICKERING HALE AND DORR, LLP
peter.dichiara@wilmerhale.com
scott.bertulli@wilmerhale.com