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EXAMINER

FOTAKIS, ARISTOCRATIS

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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*Ex parte* TORU DAN

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Appeal 2018-006136  
Application 14/864,060  
Technology Center 2600

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Before MAHSHID D. SAADAT, JOHNNY A. KUMAR, and  
STEVEN M. AMUNDSON, *Administrative Patent Judges*.

AMUNDSON, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellant<sup>1</sup> seeks our review under 35 U.S.C. § 134(a) from a final rejection of claims 1–4, 7, 8, 11, 12, and 14–20, i.e., all pending claims. We have jurisdiction under 35 U.S.C. § 6(b).

We affirm.

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<sup>1</sup> Appellant identifies the real party in interest as Semiconductor Components Industries, LLC. App. Br. 3.

## STATEMENT OF THE CASE

### *The Invention*

According to the Specification, the invention “relates generally to clock generator circuits, and more particularly to spread spectrum clock generator circuits.” Spec. ¶ 1.<sup>2</sup> The Specification explains that (1) “a spread spectrum clock generator includes a clock generator and a modulator”; (2) “[t]he clock generator modulates a frequency of a reference clock signal using a modulation signal to provide a spread spectrum clock signal”; and (3) “[t]he modulator generates the modulation signal according to a desired profile conditioned by an inverse of” the clock generator’s “characteristic transfer function.” *Id.* Abstract; *see id.* ¶¶ 34–38.

### *Exemplary Claim*

Independent claim 1 exemplifies the claims at issue and reads as follows (with formatting added for clarity):

1. A spread spectrum clock signal generator comprising:
  - a clock generator for modulating a frequency of a reference clock signal using a modulation signal to provide a spread spectrum clock signal, said clock generator having a characteristic transfer function at a predetermined nominal frequency; and
  - a modulator for generating said modulation signal according to a desired profile at said predetermined nominal frequency conditioned by an inverse of said characteristic transfer function of said clock generator,

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<sup>2</sup> This decision uses the following abbreviations: “Spec.” for the Specification, filed September 24, 2015; “Final Act.” for the Final Office Action, mailed September 5, 2017; “App. Br.” for the Appeal Brief, filed February 5, 2018; “Ans.” for the Examiner’s Answer, mailed March 28, 2018; and “Reply Br.” for the Reply Brief, filed May 25, 2018.

wherein said modulator comprises a profile memory that stores a waveform table of values of said modulation signal that provides a uniform frequency change over a predetermined period of time, and having an output for providing said modulation signal according to said desired profile,

wherein said modulation signal is said desired profile pre-distorted by said inverse of said characteristic transfer function of said clock generator and stored in said profile memory in pre-distorted form.

App. Br. 15 (Claims App.).

*The Prior Art Supporting the Rejections on Appeal*

As evidence of unpatentability under 35 U.S.C. § 103, the Examiner relies on the following prior art:

Perrott et al. (“Perrott”)	US 6,008,703	Dec. 28, 1999
Zhang et al. (“Zhang”)	US 6,442,188 B1	Aug. 27, 2002
Castiglione et al. (“Castiglione”)	US 2003/0039330 A1	Feb. 27, 2003
Kokubo et al. (“Kokubo”)	US 2005/0008113 A1	Jan. 13, 2005
Puma	US 2006/0088126 A1	Apr. 27, 2006
Chen	US 2008/0063130 A1	Mar. 13, 2008
Zhu et al. (“Zhu”)	US 2012/0112809 A1	May 10, 2012
D.B.Y. Nguyen et al., <i>A High-Precision Spread Spectrum Clock Generator Based on a Fractional-N Phase Locked Loop</i> , 74 ANALOG INTEGRATED CIRCUITS & SIGNAL PROCESSING 661–65 (Mar. 2013) (“Nguyen”)		

*The Rejections on Appeal*

Claims 1–4, 7, 8, and 11 stand rejected under 35 U.S.C. § 103 as unpatentable over Kokubo, Puma, Perrott, and Nguyen. Final Act. 3–10.

Claim 12 stands rejected under 35 U.S.C. § 103 as unpatentable over Kokubo, Puma, Perrott, Nguyen, and Castiglione. Final Act. 10–11.

Claim 14 stands rejected under 35 U.S.C. § 103 as unpatentable over Kokubo, Puma, Perrott, Nguyen, and Zhang. Final Act. 11–12.

Claims 15–19 stand rejected under 35 U.S.C. § 103 as unpatentable over Kokubo, Puma, Perrott, and Zhu. Final Act. 12–15.

Claim 20 stands rejected under 35 U.S.C. § 103 as unpatentable over Kokubo, Puma, Perrott, Zhu, and Chen. Final Act. 16.

### ANALYSIS

We have reviewed the § 103 rejections in light of Appellant’s arguments that the Examiner erred. For the reasons explained below, we concur with the Examiner’s conclusions concerning unpatentability under § 103. We adopt the Examiner’s findings and reasoning for the § 103 rejections in the Final Office Action (Final Act. 3–18) and Answer (Ans. 3–9). We add the following to address and emphasize specific findings and arguments.

#### *The § 103 Rejection of Claims 1–4, 7, 8, and 11*

#### INDEPENDENT CLAIMS 1 AND 8

Appellant argues that the Examiner erred in rejecting independent claims 1 and 8 because the references do not disclose or suggest a modulator comprising “a profile memory that stores a waveform table of values” for a modulation signal and outputs the modulation signal according to a desired profile “pre-distorted by” an “inverse of” a clock generator’s “characteristic transfer function” where the modulation signal “provides a uniform frequency change over a predetermined period of time.” *See* App. Br. 9–11; Reply Br. 2–4. In particular, Appellant contends that “Perrott does not disclose a clock generator, but rather a modulator for modulating a data signal.” App. Br. 9; *see* Reply Br. 3–4. Appellant asserts that Perrott’s read-

only memory “store[s] a different quantity than a waveform table” according to the claims because it implements “a non-recursive [finite impulse response] FIR filter.” App. Br. 10; *see* Reply Br. 3–4. Appellant also asserts that Perrott’s read-only memory “stores a table of values” that “do not provide a uniform frequency change of a modulation signal over a predetermined period of time.” App. Br. 11; *see* Reply Br. 3–4.

Appellant’s arguments do not persuade us of Examiner error because they attack the references individually, while the Examiner relies on the combined disclosures in the references to teach or suggest the disputed limitations. *See* Final Act. 3–9, 17–18; Ans. 3–6. Where a rejection rests on the combined disclosures in the references, an appellant cannot establish nonobviousness by attacking the references individually. *See In re Merck & Co.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986).

Here, the Examiner correctly finds that Kokubo discloses a modulator comprising “a profile memory that stores a waveform table of values” for a modulation signal and outputs the modulation signal according to a desired profile where the modulation signal “provides a uniform frequency change over a predetermined period of time.” Ans. 4; *see* Final Act. 3–4, 7, 17; Kokubo ¶¶ 3, 8–10, 93–104, Figs. 1–2, 16. In particular, Kokubo describes a spread-spectrum clock generator with a clock generator (e.g., nos. 1–4 and 51 in Figure 1) and a modulator (e.g., nos. 6–9 in Figure 1). Kokubo ¶¶ 93–102, Figs. 1–2. The modulator includes a signal generator with a read-only memory (ROM). *Id.* ¶ 102, Fig. 2. The ROM stores “a sine function so that a sine wave of digital representation can be output.” *Id.* ¶ 103; *see id.* ¶¶ 58–59, Fig. 21. The sine-wave output “provides a uniform frequency change over a predetermined period of time” according to the

claims. The ROM can “generate several types of spread waveforms by storing data representing a triangle wave and any other function.” *Id.* ¶ 104; *see id.* ¶¶ 58–59, Figs. 20–21.

Appellant fails to explain how the stored waveform data in Kokubo differs from the stored waveform tables described in the Specification and recited in the claims. *See* App. Br. 9–11; Reply Br. 2–4; *see also* Spec. ¶¶ 37, 46, 49, 63, Fig. 5.

Further, the Examiner correctly finds that Puma discloses a modulator comprising “a profile memory” for a modulation signal and outputs the modulation signal according to a desired profile “pre-distorted by” an “inverse of” a “characteristic transfer function.” Ans. 4–5; *see* Final Act. 4, 8, 17; Puma ¶¶ 9, 12–14, Fig. 2. In particular, Puma describes a modulator for a phase-locked loop (PLL), and the modulator includes “a digital compensation filter.” Puma ¶ 12; *see* Reply Br. 5. The “transfer function of the compensation filter . . . corresponds to the inverse of the transfer function of the PLL.” Puma ¶ 12. Puma explains that the compensation filter may be combined with a pulse-shaping filter and implemented with values “stored in a ROM” and “adapted as appropriate for integration of” the combined filters. *Id.*

Moreover, the Examiner correctly finds that Perrott discloses a modulator comprising “a profile memory that stores a waveform table of values” for a modulation signal and outputs the modulation signal according to a desired profile “pre-distorted by” an “inverse of” a “characteristic transfer function.” Ans. 5; *see* Final Act. 5, 8–9, 17; Perrott 5:30–36, 7:12–9:29, 10:64–11:14, 11:31–38, 14:23–41, 15:8–11, Figs. 2A–2B, 4, 7. In particular, Perrott describes a modulator for a PLL, and the modulator

includes “a digital processor 46” with a digital compensation filter. Perrott 5:30–36, 7:12–44, Figs. 2A–2B, 4. The digital processor 46 receives digital modulation data 44 and provides “filtered digital modulation output 48.” *Id.* at 7:40–45, 14:23–33, Figs. 2A–2B, 7. The digital compensation filter “imposes on the modulation data a transfer function that is based on the inverse of the PLL transfer function” at certain frequencies. *Id.* at 8:49–54. Specifically, the PLL has transfer function  $G(f)$ , the digital compensation filter has transfer function  $C(f)$ , and  $C(f)$  equals the inverse of  $G(f)$ . *Id.* at 7:63–64, 9:10–29, 10:67–11:3. Thus, digital modulation output 48 “represents a convolution of the input data with the compensated” filter transfer function. *Id.* at 14:27–33, Figs. 2A, 7. Preferably, a ROM implements the digital filtering, e.g., with a look-up table. *Id.* at 11:3–14, 11:31–38, 13:10–13, 14:23–29, 15:8–11.

In addition, the Examiner correctly finds that Nguyen discloses a modulator that outputs a modulation signal according to a desired profile where the modulation signal “provides a uniform frequency change over a predetermined period of time.” Ans. 5; *see* Final Act. 5, 9; Nguyen 661–63, e.g., Figs. 1(a)–1(c), 2(a), 3(a). In particular, Nguyen describes a spread-spectrum clock generator with a fractional-N PLL, i.e., a clock generator, and a Triangular Profile Generator, i.e., a modulator. *Id.* at 661–62. The modulator includes a compensation filter “to prevent various triangular modulation profiles from being distorted.” *Id.* at 661–62. Specifically, the PLL low-pass filter has transfer function  $G(f)$ , the compensation filter has transfer function  $C(f)$ , and  $C(f)$  equals the inverse of  $G(f)$ . *Id.* at 662. The device produces “a precise triangular modulation profile.” *Id.* at 663. That

profile “provides a uniform frequency change over a predetermined period of time” according to the claims.

For the reasons discussed above, the combined disclosures in the references teach or suggest the disputed limitations in claims 1 and 8. Ans. 4–5; *see* Final Act. 3–5, 7–9, 17; Kokubo ¶¶ 3, 8–10, 58–59, 93–104, Figs. 1–2, 16, 20–21; Puma ¶¶ 9, 12–14, Fig. 2; Perrott 5:30–36, 7:12–9:29, 10:64–11:14, 11:31–38, 14:23–41, 15:8–11, Figs. 2A–2B, 4, 7; Nguyen 661–63, *e.g.*, Figs. 1(a)–1(c), 2(a), 3(a). Appellant’s arguments have not persuaded us that the Examiner erred in rejecting claims 1 and 8 under § 103. Thus, we sustain the § 103 rejection of claims 1 and 8.

#### DEPENDENT CLAIMS 2–4, 7, AND 11

Claims 2–4 and 7 depend directly or indirectly from claim 1, and claim 11 depends directly from claim 8. Appellant does not argue patentability separately for these dependent claims. App. Br. 9–11; Reply Br. 2–4. Thus, we sustain the § 103 rejection of these dependent claims for the same reasons as claims 1 and 8. *See* 37 C.F.R. § 41.37(c)(1)(iv).

#### *The § 103 Rejection of Claims 15–19*

##### INDEPENDENT CLAIM 15: WAVEFORM TABLE OF VALUES

Appellant asserts that the Examiner erred in rejecting independent claim 15 because (1) “neither Kokubo, nor Puma, nor Perrott disclose a waveform table of values of the modulation signal” and (2) Zhu’s waveform table does not store a desired profile pre-distorted according to an “inverse of” a clock generator’s “characteristic transfer function.” App. Br. 12. Appellant contends that “Zhu is not concerned with generating a spread spectrum clock signal by modulating a reference clock signal with a modulation signal.” *Id.* at 12–13.

Appellant’s arguments do not persuade us of Examiner error because they attack the references individually, while the Examiner relies on the combined disclosures in the references to teach or suggest the disputed limitations. *See* Final Act. 12–15. As discussed above for claims 1 and 8, Kokubo describes a spread-spectrum clock generator with a clock generator and a modulator, and the modulator includes a signal generator with a ROM storing waveform data. *See* Kokubo ¶¶ 3, 58–59, 93–104, Figs. 1–2, 20–21. As also discussed above, Puma and Perrott each disclose storing a desired profile pre-distorted according to an “inverse of” a “characteristic transfer function.” *See* Puma ¶¶ 9, 12–14, Fig. 2; Perrott 5:30–36, 7:12–9:29, 10:64–11:14, 11:31–38, 14:23–41, 15:8–11, Figs. 2A–2B, 4, 7; *see also* Ans. 7.

Further, the Examiner correctly finds that Zhu discloses generating a modulation signal according to a desired profile stored in a memory where “the profile consists of a sequence of signals representative of an amplitude of a modulation signal” and “the sequence of signals provide[s] a uniform frequency change over a predetermined period of time.” Final Act. 14; *see* Ans. 7–8. Specifically, Zhu discloses a waveform generator with a “memory for storing digital values” used “to construct a waveform” that “may take on a desired shape and may be changed or modified by storing new or modified digital values in the memory.” Zhu ¶ 4; *see id.* ¶¶ 21, 27, 49. Zhu’s Figure 4 shows a triangular waveform generated from stored digital values. *Id.* ¶¶ 12, 33, Fig. 4. Zhu’s Figure 5 shows a sinusoidal waveform generated from stored digital values. *Id.* ¶¶ 13, 39, Fig. 5. Each waveform “provides a uniform frequency change over a predetermined period of time” according to claim 15.

In addition, Zhu describes several devices that use the waveform generator. *See, e.g.*, Zhu ¶¶ 4–5, 10–11, 17–20, 23, 28, Figs. 1–3. Some embodiments employ the waveform generator in a modulator for a PLL in a clock-synchronization circuit, i.e., a spread-spectrum clock generator. *Id.* ¶¶ 10–11, 17, 23–32, Figs. 2–3. The modulator “generates the modulation value from digital values stored in a memory” to drive a “feedback path of the clock synchronization circuit” and spread “power density at the output clock . . . over a small frequency band instead of being concentrated at a single frequency.” *Id.* ¶ 17; *see id.* ¶¶ 5, 26, 43; Ans. 8. Hence, electromagnetic interference (EMI) “is reduced at the output clock.” Zhu ¶ 17; *see id.* ¶¶ 26, 43. Consequently, Appellant incorrectly contends that “Zhu is not concerned with generating a spread spectrum clock signal by modulating a reference clock signal with a modulation signal.” *See* App. Br. 12–13.

For the reasons discussed above, the combined disclosures in the references teach or suggest the disputed limitations in claim 15. *See* Final Act. 12–15; Ans. 7–9; Kokubo ¶¶ 3, 8–10, 58–59, 93–104, Figs. 1–2, 16, 20–21; Puma ¶¶ 9, 12–14, Fig. 2; Perrott 5:30–36, 7:12–9:29, 10:64–11:14, 11:31–38, 14:23–41, 15:8–11, Figs. 2A–2B, 4, 7; Zhu ¶¶ 4–5, 9–13, 17–33, 39, 49, Figs. 1–5.

#### INDEPENDENT CLAIM 15: MOTIVATION TO COMBINE

Appellant argues that the rejection “is legally insufficient because there is no reason in the references or known to one of ordinary skill in the art to combine them as claimed, and thus the rejection fails under the law of obviousness as affirmed by the U.S. Supreme Court in KSR v. Teleflex.” App. Br. 11; *see* Reply Br. 6–8. Specifically, Appellant asserts that the

“reasons proffered by the Office are conclusory and not supported by the references themselves or by the general knowledge of one of ordinary skill in the art.” App. Br. 13; *see* Reply Br. 6–8.

Appellant’s arguments do not persuade us of Examiner error because, as the Examiner notes, the motivation to combine comes from the references themselves. *See* Ans. 8–9. Specifically, Puma’s modulator “overcomes the conflict” between using a narrow PLL bandwidth to reduce noise and a wide PLL bandwidth to satisfy transmission needs. Puma ¶¶ 9, 17. Puma explains that the modulator “has the advantage that the PLL bandwidth which is actually set in an operating situation is just sufficiently high to ensure transmission of the modulation data signal, while the noise on the output side in this case remains as low as possible at the same time.” *Id.* ¶ 22.

Similarly, Perrott’s “digital compensation technique . . . provides a solution for achieving both PLL noise attenuation and high data rate modulation” and “enhance[s] PLL modulation bandwidth performance.” Perrott 8:29–31, 9:30–32. Perrott explains that the PLL-modulation technique may be “employed in a wide range of applications” and “elegantly incorporated in a given PLL modulation system without the need for any extra componentry or specialized reconfiguration.” *Id.* at 1:10–13, 5:1–3, 6:46–48.

Additionally, in a spread-spectrum clock generator, Zhu’s waveform generator spreads “power density at the output clock . . . over a small frequency band instead of being concentrated at a single frequency,” and thus reduces EMI. Zhu ¶ 17; *see id.* ¶¶ 5, 10–11, 17, 23–32, 43, Figs. 2–3. The waveform generator “allows the generated waveform to take on any

desired shape so that the waveform may be customized for the particular application or operating mode” and “also allows the shape of the generated waveform to be modified or changed, which may be desirable as applications or environmental factors change.” *Id.* ¶ 21; *see id.* ¶¶ 17, 20, 27.

The improvements described by Puma, Perrott, and Zhu would have prompted a person of ordinary skill in the art to combine their respective teachings with Kokubo’s spread-spectrum clock generator. *See* Ans. 8–9. “[T]he desire to enhance commercial opportunities by improving a product or process is universal . . . .” *DyStar Textilfarben GmbH v. C.H. Patrick Co.*, 464 F.3d 1356, 1368 (Fed. Cir. 2006); *see In re Peterson*, 315 F.3d 1325, 1330 (Fed. Cir. 2003). “[T]he law does not require that the references be combined for the reasons contemplated by the inventor.” *In re Beattie*, 974 F.2d 1309, 1312 (Fed. Cir. 1992); *see Outdry Techs. Corp. v. Geox S.p.A.*, 859 F.3d 1364, 1371 (Fed. Cir. 2017).

#### INDEPENDENT CLAIM 15: TEACHING AWAY

Appellant argues that “[t]he references themselves teach away from a method including generating a spread spectrum clock signal including storing a waveform table in memory that stores pre-distorted values of the modulation signal.” Reply Br. 5. We disagree.

“A reference does not teach away . . . if it merely expresses a general preference for an alternative invention but does not ‘criticize, discredit, or otherwise discourage’ investigation into” the claimed invention. *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 567 F.3d 1314, 1327 (Fed. Cir. 2009) (quoting *In re Fulton*, 391 F.3d 1195, 1201 (Fed. Cir. 2004)). Appellant does not explain how any reference criticizes, discredits,

or otherwise discourages investigation into the claimed invention. *See* Reply Br. 5–8. Hence, Appellant’s teaching-away arguments do not persuade us of Examiner error.

Because Appellant’s arguments have not persuaded us that the Examiner erred in rejecting claim 15 under § 103, we sustain the § 103 rejection of claim 15.

#### DEPENDENT CLAIMS 16–19

Claims 16–19 depend directly or indirectly from claim 15. Appellant does not argue patentability separately for these dependent claims. App. Br. 11–14; Reply Br. 5–8. Thus, we sustain the § 103 rejection of these dependent claims for the same reasons as claim 15. *See* 37 C.F.R. § 41.37(c)(1)(iv).

#### *The § 103 Rejections of Claims 12, 14, and 20*

Claims 12 and 14 depend directly or indirectly from claim 8, and claim 20 depends directly from claim 15. Appellant does not argue patentability separately for these dependent claims. App. Br. 9–14; Reply Br. 2–8. Thus, we sustain the § 103 rejection of these dependent claims for the same reasons as claims 8 and 15. *See* 37 C.F.R. § 41.37(c)(1)(iv).

#### DECISION

We affirm the Examiner’s decision to reject claims 1–4, 7, 8, 11, 12, and 14–20.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv). *See* 37 C.F.R. § 41.50(f).

AFFIRMED