

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE, INC.,
Petitioner,

v.

UUSI, LLC d/b/a NARTRON,
Patent Owner.

Case IPR2019-00358
Patent 5,796,183

Before BRYAN F. MOORE, MINN CHUNG, and
NORMAN H. BEAMER, *Administrative Patent Judges*.

CHUNG, *Administrative Patent Judge*.

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

I. INTRODUCTION

In this *inter partes* review, instituted pursuant to 35 U.S.C. § 314, Apple Inc. (“Petitioner” or “Apple”) challenges the patentability of claims 37–39, 94, 96–99, 101–109, 115, and 116 (the “challenged claims”) of U.S. Patent No. 5,796,183 (Ex. 1001, “the ’183 patent”), owned by UUSI, LLC d/b/a Nartron (“Patent Owner”). This Final Written Decision is entered pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons discussed below, we determine Petitioner has shown by a preponderance of the evidence that claims 94, 96, 101–106, 115, and 116 of the ’183 patent are unpatentable, but has not proven by a preponderance of the evidence that claims 37–39, 97–99, and 107–109 of the ’183 patent are unpatentable.

II. BACKGROUND

A. Procedural History

On November 29, 2018, Petitioner filed a Petition (Paper 2, “Pet.”) requesting an *inter partes* review of claims 37–39, 94, 96–99, 101–109, and 115–117 the ’183 patent.¹ Patent Owner filed a Preliminary Response (Paper 8, “Prelim. Resp.”) on May 6, 2019.

On August 5, 2019, applying the standard set forth in 35 U.S.C. § 314(a), which requires demonstration of a reasonable likelihood that Petitioner would prevail with respect to at least one challenged claim, we instituted an *inter partes* review of the challenged claims. Paper 12 (“Inst. Dec.”). In the Institution Decision, we determined Petitioner demonstrated a reasonable likelihood that it would prevail as to at least one

¹ As discussed below, we agree with Patent Owner that claim 117 is not challenged in this proceeding.

challenged claim, and we instituted trial on all claims and all grounds in the Petition. Inst. Dec. 67–68.

After institution, Patent Owner filed a Patent Owner Response (Paper 16, “PO Resp.”), Petitioner filed a Reply to Patent Owner Response (Paper 19, “Reply”), and Patent Owner filed a Sur-reply (Paper 23, “Sur-reply”). An oral hearing was held on May 7, 2020, and a copy of the hearing transcript has been entered into the record. Paper 25 (“Hearing Tr.”).

B. Related Matters

According to Petitioner, the ’183 patent is the subject of the following district court litigation: *UUSI, LLC v. Apple Inc.*, No. 3-18-cv-04637 (N.D. Cal.); and *UUSI, LLC v. Apple Inc.*, No. 2:17-cv-13798 (E.D. Mich.), which has been transferred to the Northern District of California. Pet. 81. Patent Owner indicates that the ’183 patent is also the subject of *UUSI, LLC v. Samsung Electronics Co.*, No. 1:15-cv-00146 (W.D. Mich.). Paper 3, 2.

The ’183 patent has been subject to two reexaminations: Ex Parte Reexamination Control No. 90/012,439 (“the ’439 Reexamination Proceeding” or “the ’439 Reexamination”), certificate (“Reexam. Cert. C1”) issued April 29, 2013 (Ex. 1006, 1); and Ex Parte Reexamination Control No. 90/013,106 (“the ’106 Reexamination Proceeding” or “the ’106 Reexamination”), certificate (“Reexam. Cert. C2”) issued June 27, 2014 (Ex. 1007, 24). The challenged claims were amended or added during the reexaminations. Ex. 1006, 2–3; Ex. 1007, 27–28.

The ’183 patent is the subject of an earlier-filed *inter partes* review proceeding, *Samsung Electronics Co. v. UUSI, LLC*, IPR2016-00908

(“Samsung IPR”). Pet. 81; Paper 3, 1. On June 18, 2019, the Federal Circuit vacated the final written decision in the Samsung IPR, in which the Board determined that Samsung had not demonstrated unpatentability of any claims, and remanded to the Board for further proceedings. *Samsung Elecs. Co. v. UUSI, LLC*, 775 F. App’x 692, 697 (Fed. Cir. 2019) (“Samsung Appeal Opinion”).

Petitioner has also filed five other petitions challenging claims of the ’183 patent under various grounds in IPR2019-00355, IPR2019-00356, IPR2019-00357, IPR2019-00359, and IPR2019-00360. Paper 3, 1. We denied institution of review in IPR2019-00355, IPR2019-00356, IPR2019-00357, and IPR2019-00360. IPR2019-00355, Paper 14; IPR2019-00356, Paper 14; IPR2019-00357, Paper 12; IPR2019-00360, Paper 12. We instituted trial in IPR2019-00359 on August 5, 2019. IPR2019-00359, Paper 12.

C. The ’183 Patent

The ’183 patent, titled “Capacitive Responsive Electronic Switching Circuit,” was filed January 31, 1996, and issued August 18, 1998. Ex. 1001, codes (22), (45), (54). The ’183 patent has expired. Prelim. Resp. 18.

The ’183 patent relates to a “capacitive responsive electronic switching circuit used to make possible a ‘zero force’ manual electronic switch.” Ex. 1001, 1:6–9. According to the ’183 patent, zero force touch switches have no moving parts and no contact surfaces that directly switch loads. *Id.* at 2:39–41. Instead, such switches detect an operator’s touch and use solid state electronics to switch loads or activate mechanical relays. *Id.* at 2:42–44. “A common solution used to achieve a zero force touch switch

has been to make use of the capacitance of the human operator.” *Id.* at 3:12–14. As background, the ’183 patent describes three methods used by capacitive touch switches to detect an operator’s touch, one of which relies on the change in capacitive coupling between a touch terminal and ground. *Id.* at 3:13–15, 3:44–46. In this method, “[t]he touch of an operator then provides a capacitive short to ground via the operator’s own body capacitance.” *Id.* at 3:52–55. Figure 8, reproduced below, is an example that makes use of this method.

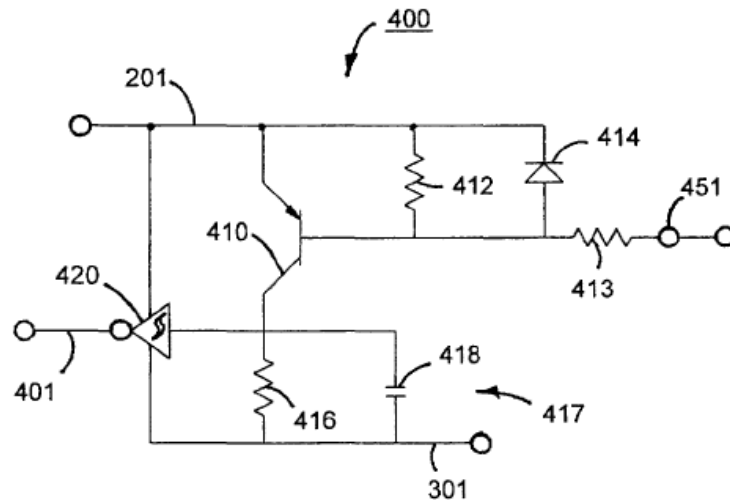


Fig. 8

Figure 8 depicts a “touch circuit” in which, when a pad (not shown) is touched to create a short to ground via terminal 451, transistor 410 turns on and connects a high frequency input at 201 to resistor/capacitor circuit 416/418, thus triggering Schmitt Trigger 420 to provide control output 401. *Id.* at 14:47–52, 15:17–47. Significantly, the operator of a capacitive touch switch using this method need not come in conductive contact with the touch terminal. *Id.* at 3:57–59. Rather, the operator needs only to come into close proximity of the switch. *Id.*

Figure 4 of the '183 patent is reproduced below.

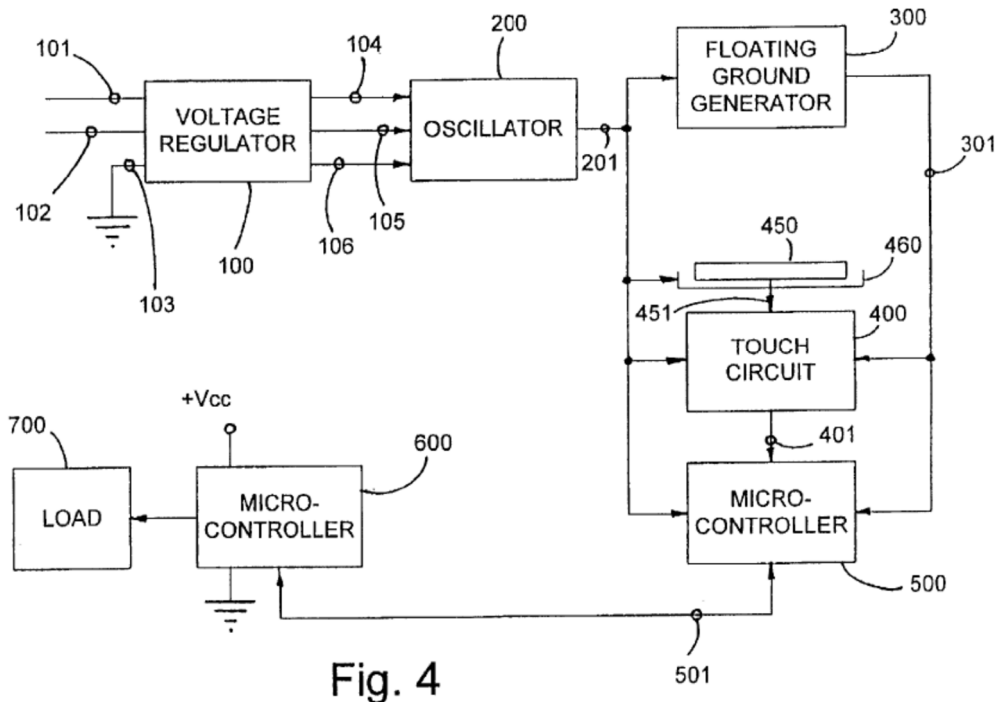


Fig. 4

Figure 4 is a block diagram of a capacitive responsive electronic switching circuit according to a first embodiment of the '183 patent. *Id.* at 7:23–25. As depicted in Figure 4, the electronic switching circuit of the first embodiment comprises voltage regulator 100, oscillator 200, floating ground generator 300, touch circuit 400, touch pad 450, and microcontroller 500. *Id.* at 11:64–12:33.

Voltage regulator 100 converts a received 24 volts (V) AC voltage to a DC voltage and supplies a regulated 5 V DC power to oscillator 200 via lines 104 and 105. *Id.* at 11:67–12:2. The 24 volt AC input may in turn be generated from 110 V AC 60 Hz commercial power line via a transformer (not shown), or a DC battery may be used in place of the 24 v AC input. *Id.* at 13:23–31. Voltage regulator 100 also supplies oscillator 200 with 26 V DC power via line 106. *Id.* at 12:2–3.

Upon being powered by voltage regulator 100, oscillator 200 generates a square wave with a frequency of 50 kHz, or preferably greater than 800 kHz, and having an amplitude of 26 V peak. *Id.* at 12:6–9. Floating common generator 300 receives the 26 V peak square wave from oscillator 200, and outputs a regulated floating common that is 5 volts below the square wave output from oscillator 200 and has the same phase and frequency as the received square wave. *Id.* at 12:14–18. This floating common output is supplied to touch circuit 400 and microcontroller 500 via line 301 such that the output square wave from oscillator 200 and floating common output from floating common generator 300 provide power to touch circuit 400 and microcontroller 500. *Id.* at 12:18–23.

Touch circuit 400 senses capacitance from touch pad 450 via line 451 and outputs a signal to microcontroller 500 via line 401 upon detecting a capacitance to ground at touch pad 450 that exceeds a threshold value. *Id.* at 12:24–27. Figure 8 reproduced above describes touch circuit 400 in detail. *Id.* at 12:27–28.

Upon receiving an indication from touch circuit 400 that a sufficient capacitance to ground is present at touch pad 450, microcontroller 500 outputs a signal to load-controlling microcontroller 600 via line 501, which is preferably a two way optical coupling bus. *Id.* at 12:29–34. Microcontroller 600 then responds in a predetermined manner to control load 700. *Id.* at 12:33–35.

Figure 11 of the '183 patent is reproduced below.

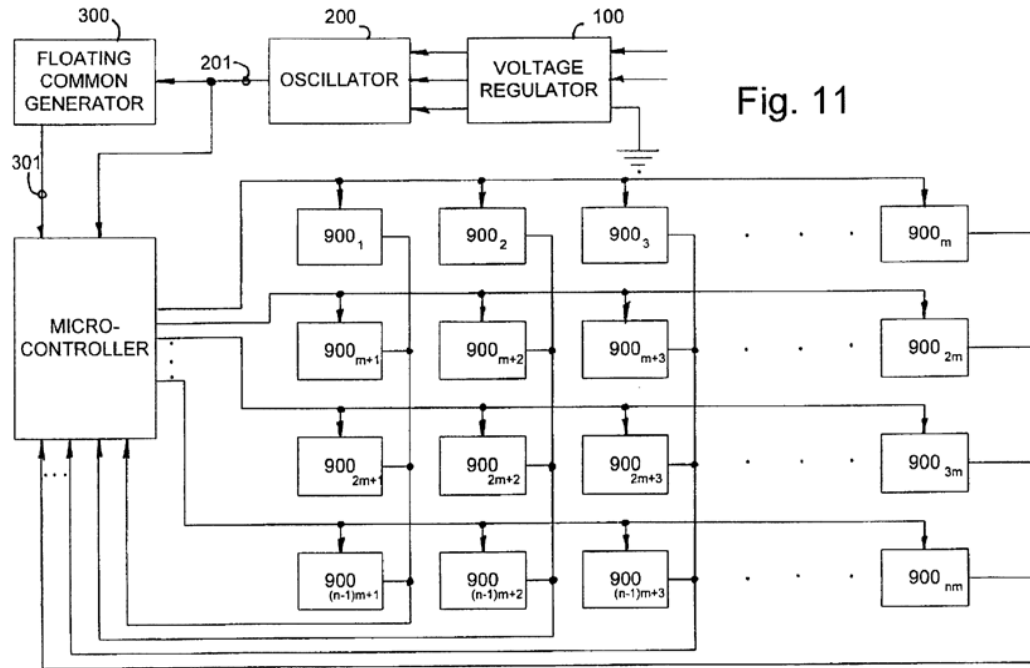


Fig. 11

Figure 11 is a block diagram of a capacitive responsive electronic switching circuit according to a second embodiment of the '183 patent. *Id.* at 7:43–45. As depicted in Figure 11, the second embodiment discloses a “multiple touch pad circuit,” which is a variation of the electronic switching circuit of the first embodiment discussed above in that the multiple touch pad circuit includes “an array of touch circuits” 900₁ through 900_{nm}, where each element of the array includes touch circuit 400 described in Figures 4 and 8 above, as well as touch pad 450 depicted in Figure 4. *Id.* at 18:34–43.

In this “multiple touch pad circuit” embodiment, microcontroller 500 selects each row of touch circuits 900₁ to 900_{nm} by providing the signal from oscillator 200 to selected rows of touch circuits. *Id.* at 18:43–46. The '183 patent describes that “[i]n this manner, microcontroller 500 can sequentially

activate the touch circuit rows and associate the received inputs from the columns of the array with the activated touch circuit(s).” *Id.* at 18:46–49. In other words, the microcontroller selects successive rows of the touch circuit array by providing the signal from oscillator 200 sequentially to each row, such that a particular activated touch circuit is detected by the microcontroller via association of an activated row with received input from a column line of the array (thereby detecting the position or the location of a touch by the row and column of the array). *Id.* at 18:43–49.

The ’183 patent recognizes that placing capacitive touch switches in dense arrays, as in Figure 11, can result in unintended actuations. *Id.* at 3:65–4:3. One method of addressing this problem known in the art involves placing guard rings around each touch pad. *Id.* at 4:4–7. Another known method of addressing this problem is to adjust the sensitivity of the touch pad such that the operator’s finger must entirely overlap a touch terminal. *Id.* at 4:8–14. “Although these methods (guard rings and sensitivity adjustment) have gone a considerable way in allowing touch switches to be spaced in comparatively close proximity, a susceptibility to surface contamination remains as a problem.” *Id.* at 4:14–18.

The ’183 patent uses the technique of Figure 11 to overcome the problem of unintended actuation of small capacitive touch switches “by using the method of sensing body capacitance to ground in conjunction with redundant detection circuits.” *Id.* at 5:33–35. Specifically, the ’183 patent’s touch detection circuit operates at frequencies at or above 50 kHz, and preferably at or above 800 kHz, in order to minimize the effects of surface contamination on the touch pads. *Id.* at 11:19–29. Operating at these

frequencies also improves sensitivity, allowing close control of the proximity required for actuation of small-sized touch terminals in a close array, such as a keyboard. *Id.* at 5:48–57.

Figure 6 of the '183 patent is reproduced below.

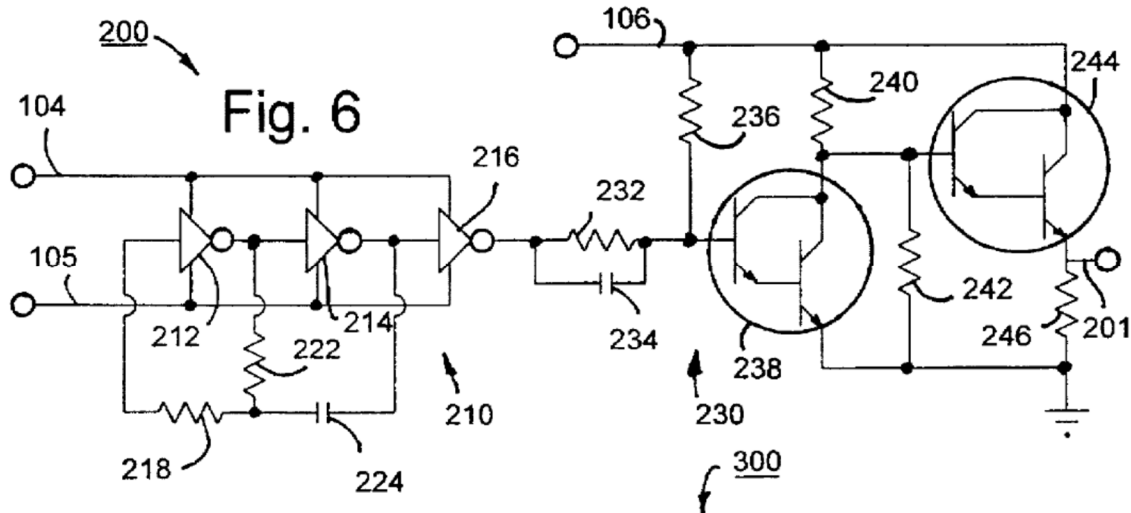


Figure 6 shows an example of an 800 kHz oscillator. *Id.* at 13:32–33.

The '183 patent describes that oscillator 200 shown in Figure 6 preferably includes a square wave generator 210 for generating a 5 Volts peak square wave having the desired frequency. *Id.* at 13:33–36. “To provide an 800 kHz output, resistor 218 preferably has a 10.0 k Ω value, resistor 222 preferably has a 1.78 k Ω value, and capacitor 224 is preferably a 220 pF capacitor.” *Id.* at 13:52–55.

According to the '183 patent,

As will be apparent to those skilled in the art, the values of the resistors and capacitors utilized in oscillator 200 may be varied from those disclosed above to provide for different oscillator output frequencies. As discussed above, however, oscillator 200 is preferably constructed so as to output a square wave having a frequency of 50 kHz or greater, and more preferably, of 800 kHz or greater.

Id. at 14:22–28. “The present combination was chosen to keep the oscillator voltage down and allow operation at 800 kHz to minimize cross talk.” *Id.* at 15:2–5.

The ’183 patent further describes that the oscillator of Figure 6 may be included in the “multiple touch pad circuit” shown in Figure 11. In describing various aspects of the second embodiment (i.e., the “multiple touch pad circuit” embodiment) depicted in Figure 11, the ’183 patent explains that the oscillator “may be slightly modified from that shown in FIG. 6 to include a transistor (not shown) coupled between the oscillator output and ground with [its] base connected to microcontroller 600 such that microcontroller 600 may selectively disable the output of oscillator 200.”

Id. at 18:60–65. The ’183 patent also explains that the Figure 6 embodiment’s choice of a combination of resistors and capacitors to reduce crosstalk is applicable to the multiple touch pad circuit embodiment of Figure 11.

The use of a high frequency in accordance with the present invention provides distinct advantages for circuits such as the multiple touch pad circuit of the present invention due to the manner in which crosstalk is substantially reduced without requiring any physical structure to isolate the touch terminals. Further, the reduction in crosstalk afforded by the present invention, allows the touch terminals in the array to be more closely spaced together.

Id. at 18:66–19:6.

D. Illustrative Claim

Of the challenged claims, claims 37, 94, and 105 are independent. Claim 105 is illustrative of the challenged claims and is reproduced below.

105. A capacitive responsive electronic switching circuit for a controlled keypad device comprising:
- an oscillator providing a periodic output signal having a predefined frequency;
 - a microcontroller using the periodic output signal from the oscillator, the microcontroller selectively providing signal output frequencies to a closely spaced array of input touch terminals of a keypad, the input touch terminals comprising first and second input touch terminals, wherein the selectively providing comprises the microcontroller selectively providing a signal output frequency to each row of the closely spaced array of input touch terminals of the keypad;
 - the first and second input touch terminals defining areas for an operator to provide an input by proximity and touch; and
 - a detector circuit coupled to said oscillator for receiving said periodic output signal from said oscillator, and coupled to said first and second touch terminals, said detector circuit being responsive to signals from said oscillator via said microcontroller and a presence of an operator's body capacitance to ground coupled to said first and second touch terminals when proximal or touched by the operator to provide a control output signal for actuation of the controlled keypad device, said detector circuit being configured to generate said control output signal when the operator is proximal or touches said second touch terminal after the operator is proximal or touches said first touch terminal.

Ex. 1001, Reexam. Cert. C2, 7:42–8:10.

E. Applied References and Declarations

Petitioner relies upon the following references in its challenges to patentability.

Reference	Issue Date	Designation	Exhibit No.
U.S. Patent No. 4,561,002	Dec. 24, 1985	Chiu	Ex. 1005
U.S. Patent No. 4,922,061	May 1, 1990	Meadows ²	Ex. 1013
U.S. Patent No. 4,418,333	Nov. 29, 1983	Schwarzbach	Ex. 1014
U.S. Patent No. 4,731,548	Mar. 15, 1988	Ingraham '548	Ex. 1016
U.S. Patent No. 4,308,443	Dec. 29, 1981	Tucker	Ex. 1019
U.S. Patent No. 4,328,408	May 4, 1982	Lawson	Ex. 1032

Petitioner also relies on two declarations from Dr. Phillip D. Wright in support of its Petition and Reply. Ex. 1003 (“Wright Declaration”); Ex. 1034 (“Second Wright Declaration”). Patent Owner relies on the Declaration of Dr. Darran Cairns (Ex. 2004, “Cairns Declaration”) in support of its Patent Owner Response.

² For clarity and ease of reference, we only list the first named inventor.

F. Instituted Grounds of Unpatentability

Petitioner asserts the following grounds of unpatentability (Pet. 3):

Claim(s) Challenged	35 U.S.C. §	References
37, 94, 96, 101, 105, 106	§ 103(a) ³	Chiu, Schwarzbach
38, 39, 104, 115, 116	§ 103(a)	Chiu, Schwarzbach, Lawson
97–99, 107–109	§ 103(a)	Chiu, Schwarzbach, Meadows
102	§ 103(a)	Chiu, Schwarzbach, Ingraham '548
103	§ 103(a)	Chiu, Schwarzbach, Tucker

Although Petitioner identified claim 117 as being one of the challenged claims in the first page of the Petition (Pet. 1), claim 117 is never mentioned again in the Petition (*see generally id.*). Petitioner did not assert any ground of unpatentability against claim 117 (*id.* at 3), nor did Petitioner present any argument in the Petition why claim 117 is unpatentable (*see id.* at 15–81). In the Patent Owner Response, Patent Owner asserts that “Apple presented no argument as to why claim 117 is obvious over the cited references” and “[t]hus, Apple has not actually challenged claim 117.” PO Resp. 1–2 n.1. Petitioner does not dispute Patent Owner’s position on claim 117. *See* Reply 1–27. We agree with Patent Owner that claim 117 is not challenged in this proceeding.

³ The Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) (“AIA”), amended 35 U.S.C. § 103. Because the ’183 patent has an effective filing date prior to the effective date of the applicable AIA amendment, we refer to the pre-AIA version of § 103.

III. ANALYSIS

A. Level of Ordinary Skill in the Art

We begin our analysis by addressing the level of ordinary skill in the art. Petitioner’s declarant, Dr. Wright, opines that a person of ordinary skill in the art as of the critical date of the ’183 patent would have had at least a Bachelor of Science degree in electrical engineering or a related technical field, and two or more years of experience in electrical circuits and sensor systems. Ex. 1003 ¶ 22. Patent Owner’s declarant, Dr. Cairns, opines that “one of ordinary skill in the art of capacitive touch sensors would have had at least a bachelor’s degree in physics or electrical engineering, or equivalent industry experience in the field.” Ex. 2004 ¶ 14.

These proposals are similar for all purposes relevant to this Final Written Decision, and both are consistent with the level of ordinary skill in the art reflected in the disclosure of the ’183 patent and the prior art of record. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001); *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995). Our Decision takes both articulations into account. To the extent there exist any material differences between the parties’ articulations, we note that the parties do not identify any disputed issue that turns on such differences in the level of ordinary skill in the art. Our analysis and conclusions in this Final Written Decision would be the same regardless of whether Petitioner’s or Patent Owner’s definition of level of ordinary skill in the art is adopted.

B. Claim Construction

In an *inter partes* review, we apply the same claim construction standard that would be used in a civil action under 35 U.S.C. § 282(b),

following the standard articulated in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). 37 C.F.R. § 42.100(b) (2019). In applying such standard, claim terms are generally given their ordinary and customary meaning, as would be understood by a person of ordinary skill in the art, at the time of the invention and in the context of the entire patent disclosure. *Phillips*, 415 F.3d at 1312–13. “In determining the meaning of the disputed claim limitation, we look principally to the intrinsic evidence of record, examining the claim language itself, the written description, and the prosecution history, if in evidence.” *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 469 F.3d 1005, 1014 (Fed. Cir. 2006) (citing *Phillips*, 415 F.3d at 1312–17).

Petitioner proposes constructions for three claim terms: “providing signal output frequencies” recited in independent claims 37, 94, and 105; “supply voltage” recited in claim 94; and “coupled” recited in claims 37, 94, and 105. Pet. 9–15; Reply 1–10.

Patent Owner disputes Petitioner’s proposed construction for the claim term “providing signal output frequencies.” PO Resp. 13–30; Sur-reply 1–9. Patent Owner also raises additional claim construction issues in the context of its patentability analysis of the challenged claims. Specifically, Patent Owner discusses constructions for the claim terms “closely spaced array” recited in independent claims 37, 94, and 105 (PO Resp. 38–40), “oscillator voltage” recited in claim 37 (*id.* at 44–45), and “a peak voltage of the signal output frequencies” recited in claim 94 (*id.* at 47–48).

We discuss each of these terms in turn below. No other claim terms need to be construed expressly for purposes of this Final Written Decision. *See Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (holding that only terms that are in controversy need to be construed, and “only to the extent necessary to resolve the controversy”); *see also Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (applying *Vivid Techs.* in the context of an *inter partes* review).

1. “selectively providing signal output frequencies”

The challenged independent claims 37, 94, and 105 each recite “the microcontroller selectively providing signal output frequencies to a closely spaced array of input touch terminals of a keypad.”⁴ Ex. 1001, Reexam. Cert. C1, 2:49–51 (claim 37); *id.*, Reexam. Cert. C2, 6:44–46 (claim 94), 7:46–49 (claim 105). Prior to institution, the main claim construction dispute between the parties over the claim term “the microcontroller selectively providing signal output frequencies” centered on whether the term requires the recited “microcontroller” select a frequency from multiple frequencies. Patent Owner asserted that the challenged claims are so limited (Prelim. Resp. 25–30), whereas Petitioner contended, and continues to contend, that they are not (Pet. 9–10; Reply 5–10).

In the Institution Decision, we agreed with Petitioner that claims 37, 94, and 105 do “*not* require the microcontroller to select signal output

⁴ We refer to the claim term “the microcontroller selectively providing signal output frequencies to a closely spaced array of input touch terminals of a keypad” commonly recited in independent claims 37, 94, and 105 as the “selectively providing limitation” in this Final Written Decision.

frequencies from multiple available frequencies.” Inst. Dec. 31–32. We also recognized that the claim language “selectively providing” is on its face ambiguous as to what the microprocessor is required to select—frequencies or rows of the touch terminals array, or both. *Id.* at 26. After careful consideration of the claim language as a whole and the illustrative embodiments described in the Specification of the ’183 patent, we resolved the ambiguity according to the ’183 patent’s description of the invention in the Specification, and preliminarily construed the term “selectively providing signal output frequencies” to encompass the microcontroller selecting a row or a portion of the array of touch pads to provide signal output frequencies to the array. *Id.* at 32. We emphasized, however, the preliminarily nature of our construction (*see id.* at 29, 32, 67) and invited the parties to address the term “selectively providing signal output frequencies” further in their papers during trial, including how a person of ordinary skill in the art would understand the meaning of the term in the context of the ’183 patent, including the Specification. *Id.* at 30.

We also noted in the Institution Decision that, after the Preliminary Response was filed, the Federal Circuit issued an opinion (Samsung Appeal Opinion) in an appeal from the Samsung IPR that also involved the ’183 patent (both referenced in Section II.B. above). *Id.* at 3. Because the Samsung Appeal Opinion discussed claim construction of the claim term “the microcontroller selectively providing signal output frequencies to a plurality of small sized input touch terminals of a keypad” recited in claim 40 (not challenged in this proceeding), we invited the parties to address in their papers during trial the import of the Samsung Appeal

Opinion on the construction of the term “selectively providing signal output frequencies” recited in the challenged independent claims in this proceeding. *Id.* at 30–31.

During the trial, Patent Owner has continued to argue that the “selectively providing limitation” requires the microcontroller select a frequency from multiple available frequencies. PO Resp. 28–30; Sur-reply 4, 6–7. In addressing the import of the Federal Circuit’s claim construction in the Samsung Appeal Opinion, however, Patent Owner makes an alternative (and possibly inconsistent) argument that “the claims do not require that the *selection of frequency* be performed by the microcontroller” and that “the ‘183 specification and claims clearly contemplate that the ‘selection’ of frequencies can be performed by the circuit’s designer” during the design of the claimed switching circuit. Sur-reply 5.

In what follows, we first address the issue of whether the “selectively providing limitation” requires the microcontroller select a frequency from multiple frequencies during operation of the circuit. We then address Patent Owner’s alternative argument in the context of addressing the Federal Circuit’s findings in the Samsung Appeal Opinion as they relate to the specific claim construction issue raised in this case.

For the reasons discussed below, we determine that independent claims 37, 94, and 105 do *not* require the microcontroller to select signal output frequencies from multiple available frequencies. We also construe the term “the microcontroller selectively providing signal output frequencies” to encompass the microcontroller selecting a row or a portion of the array of touch pads to provide signal output frequencies to the array.

Finally, we determine that our claim construction in this proceeding is consistent with the Federal Circuit’s findings on claim construction in the Samsung Appeal Opinion.

a. Whether the Microcontroller Is Required to Select a Frequency from Multiple Frequencies

(1) Claim Language

We begin our claim construction analysis by considering the language of the claims themselves. *Phillips*, 415 F.3d at 1314. The full claim language of the disputed limitation of claim 94 is reproduced below with emphases added:

the microcontroller *selectively providing* signal output frequencies to a closely spaced array of input touch terminals of a keypad, *wherein the selectively providing comprises* the microcontroller *selectively providing* a signal output frequency to each row of the closely spaced array of input touch terminals of the keypad.

Ex. 1001, Reexam. Cert. C2, 6:44–50. Claim 105 recites essentially the same claim language. *Id.* at 7:47–54. Claim 37 similarly recites “the microcontroller selectively providing signal output frequencies to a closely spaced array of input touch terminals of a keypad,” but does not recite the “wherein” clauses of claims 94 and 105. Ex. 1001, Reexam. Cert. C1, 2:49–51.

Considering the claim language, we note that the challenged independent claims do not recite that the microcontroller provides signal output frequencies “selected from multiple frequencies.” The claims recite “*selectively providing*,” not “providing *selected* frequencies.” Thus, at least based on their plain language, the challenged independent claims are not

limited to require the signal output frequencies be “selected from multiple frequencies” as Patent Owner contends.

Patent Owner argues that the use of the plural “frequencies” in “selectively providing signal output frequencies” means that the recited “selection” is made from among multiple “frequencies.” PO Resp. 28–29. We are not persuaded by this argument because the plurality in “signal output frequencies” may be accounted for by the fact that a plurality of signals (at least two) are provided to the claimed “first and second input touch terminals”—that is, one “signal output frequency” is provided to the first input touch terminal, and another “signal output frequency” is provided to the second input touch terminal. *See* Ex. 1001, Reexam. Cert. C2, 6:44–51 (claim 94), 7:47–50 (claim 105); Reexam. Cert. C1, 2:49–52 (claim 37).

Further confirming this, as discussed further below, for claims 94 and 105, the claims recite that a signal output frequency is provided to each row of the input touch terminals (Ex. 1001, Reexam. Cert. C2, 6:46–50 (claim 94), 7:51–54 (claim 105))—i.e., a plurality of signals for the number of rows are provided to the array of the touch terminals, one “signal output frequency” for each row. In other words, the use of the plural noun “frequencies” in the recitation “the microcontroller selectively providing signal output frequencies” does not necessarily require the “microcontroller” to “select” signal output frequencies from multiple frequencies. Thus, we are not persuaded the plural noun “signal output frequencies” resolves the ambiguity in the claim language discussed above—whether the recited “selectively providing” by the microcontroller requires selectivity of

frequency values or selectivity as to when and where to provide signal output frequencies to the touch terminal array.

Additional claim language in claims 94 and 105 helps resolve this ambiguity in favor of the latter interpretation. As discussed above, in claims 94 and 105, the disputed claim term (i.e., the “selectively providing limitation”) is modified by the identical “wherein” clause that recites “wherein *the selectively providing comprises* the microcontroller *selectively providing* a signal output frequency *to each row* of the closely spaced array of input touch terminals of the keypad.” Ex. 1001, Reexam. Cert. C2, 6:46–50 (claim 94) (emphases added), 7:51–54 (claim 105) (emphases added). Patent Owner admits that the claim language “selectively providing . . . to each row” recited in the wherein clause requires the microcontroller to “select . . . *which rows* of the array will receive the signal.” PO Resp. 29. Thus, the plain language of claims 94 and 105 indicates that the “selectively providing” recited in the “selectively providing limitation” “comprises” or encompasses selection of rows by the microcontroller to provide the signal output frequencies.

Patent Owner asserts that this interpretation is improper because it renders the wherein clause superfluous. PO Resp. 28–29; Sur-reply 6. According to Patent Owner, if the “selectively providing limitation” is interpreted to “cover the selection of ‘which row’ receives the signal,” “selectively providing . . . to each row” recited in the wherein clause “would be rendered wholly superfluous.” PO Resp. 29.

We disagree with Patent Owner’s argument. Contrary to Patent Owner’s assertion, we do not interpret the “selectively providing limitation”

to only “cover the selection of ‘which row’ receives the signal.” *See, e.g.*, Inst. Dec. 32 (preliminarily construing the “selectively providing limitation” to “encompass the microcontroller selecting a row or *a portion of the array of touch pads* to provide signal output frequencies to the array” (emphasis added)). Rather, the claim term more broadly covers the selection of which “input touch terminals” receive the signal. Ex. 1001, Reexam. Cert C2, 6:44–51. As pointed out by Petitioner, the “wherein” clause further narrows the scope of the “selectively providing limitation” to require selection of rows, rather than some other group of touch terminals. Reply 7–8. In other words, contrary to Patent Owner’s argument, rather than amounting to a superfluous recitation of the subject matter recited elsewhere in the claims, the wherein clauses of claims 94 and 105 further specify the nature of the selection by the microcontroller recited in the “selectively providing limitation.” At a minimum, the wherein clause indicates that the “selectively providing” recited in claims 94 and 105 encompasses selection of rows by the microcontroller.

Patent Owner asserts that the only way to avoid a superfluous construction of the “selectively providing limitation,” as modified by the wherein clause in claim 94, would be to construe the “selectively providing limitation” (identified as element (a) by Patent Owner) as requiring the microcontroller to select the frequency of the signal, and the “wherein” clause (identified as element (b) by Patent Owner) as requiring that the microcontroller to select “*which rows* of the array will receive the signal (at that frequency).” PO Resp. 29. Put another way, Patent Owner argues that “element (a) requires selection of a frequency, and element (b) requires that

this frequency is provided ‘to each row.’” Sur-reply 7. We disagree with Patent Owner’s argument for the reasons similar to those discussed above.

The plain language of claim 94 indicates that “*the* selectively providing” recited in the wherein clause (element (b)) refers (as its antecedent basis) to “selectively providing” recited in the immediately preceding limitation, i.e., the “selectively providing limitation” (element (a)). As discussed above, element (b) recites that “the selectively providing,” i.e., “selectively providing” recited in element (a), “comprises” “the microcontroller selectively providing a signal output frequency to each row of the closely spaced array of input touch terminals of the keypad,” which Patent Owner admits requires the microcontroller to “select . . . *which rows* of the array will receive the signal” (PO Resp. 29). Thus, contrary to Patent Owner’s contention, claim 94 does not require the dual function of the microcontroller argued by Patent Owner, where the microcontroller selects a frequency in element (a) and selects which row will receive the selected frequency in element (b). Instead, the plain language of claim 94 shows that element (b) specifies the nature of the selection made by the microcontroller in element (a) to be selection of rows to provide output signal frequencies.

As noted above, the “selectively providing limitation” recited in independent claim 37 is not modified by a similar wherein clause (Ex. 1001, Reexam. Cert. C1, 2:49–51), and thus may be broader than selecting “each row” recited in claim 94’s or claim 105’s “wherein” clause (such as selecting rows, columns, or other portions of the array of touch pads). Nonetheless, because independent claims 37, 94, and 105 all recite the

microcontroller “selectively providing” signal output frequencies “to a closely spaced *array* of input touch terminals of a keypad,” this identical claim language should be construed to have the same meaning, i.e., to encompass the microcontroller “selecting a row or a portion of the array of touch terminals,” absent compelling evidence to the contrary. *See Paice LLC v. Ford Motor Co.*, 881 F.3d 894, 904 (Fed. Cir. 2018) (“unless otherwise compelled . . . the same claim term in the same patent or related patents carries the same construed meaning” (quoting *Omega Eng’g, Inc. v. Raytek Corp.*, 334 F.3d 1314, 1334 (Fed. Cir. 2003))).

In addition, the separate “oscillator” and “detector circuit” claim requirements present in all the independent claims support resolving the ambiguity of “selectively providing signal output frequencies” in a similar fashion. For instance, claim 94 recites:

an oscillator providing *a periodic output signal having a predefined frequency*;

a microcontroller using the periodic output signal from the oscillator, the microcontroller selectively *providing signal output frequencies* to a closely spaced array of input touch terminals of a keypad, wherein the selectively providing comprises the microcontroller selectively providing a signal output frequency to each row of the closely spaced array of input touch terminals of the keypad . . . ;

. . . .

a detector circuit coupled to said oscillator for *receiving said periodic output signal from said oscillator*, and coupled to said first and second touch terminals, said detector circuit being responsive to signals *from said oscillator via said microcontroller*

Ex. 1001, Reexam. Cert. C2, 6:41–61 (emphases added).

“[T]he context of the surrounding words of the claim also must be considered in determining the ordinary and customary meaning of those terms.” *Phillips*, 415 F.3d at 1314 (*quoting ACTV, Inc. v. Walt Disney Co.*, 346 F.3d 1082, 1088 (Fed. Cir. 2003)). In context, these additional requirements confirm that “the microcontroller selectively providing signal output frequencies to [an] . . . array of input touch terminals” requirement encompasses signals having a pre-defined frequency provided to the microcontroller by the oscillator and then routed via multiple outputs of the microcontroller to the touch terminals—the microcontroller selecting *where* the frequency signals go, not necessarily *what* the frequency values are.

These additional recitations also help clarify that the term “signal output frequencies” recited in the “selectively providing limitation” encompasses “signals having a pre-defined frequency” and does not necessarily require different “frequencies of the signal output.” *See, e.g.*, Ex. 1001, Reexam. Cert. C2, 6:41–44 (“an oscillator providing *a periodic output signal having a predefined frequency*; a microcontroller using *the periodic output signal from the oscillator*, the microcontroller selectively providing *signal output frequencies* to [an] . . . array of input touch terminals” (emphases added)). In addition, claim 94 recites that “a peak voltage of the signal output frequencies is greater than a supply voltage.” *Id.* at 6:44–53. This recitation indicates that the term “signal output frequencies” is used to denote “output signals having a frequency” because signals can have a voltage (or a peak voltage), but frequencies (which are a temporal measure) cannot. Again, these additional requirements help clarify

that the microcontroller selects *where* the frequency signals go, not *what* the frequency values are.

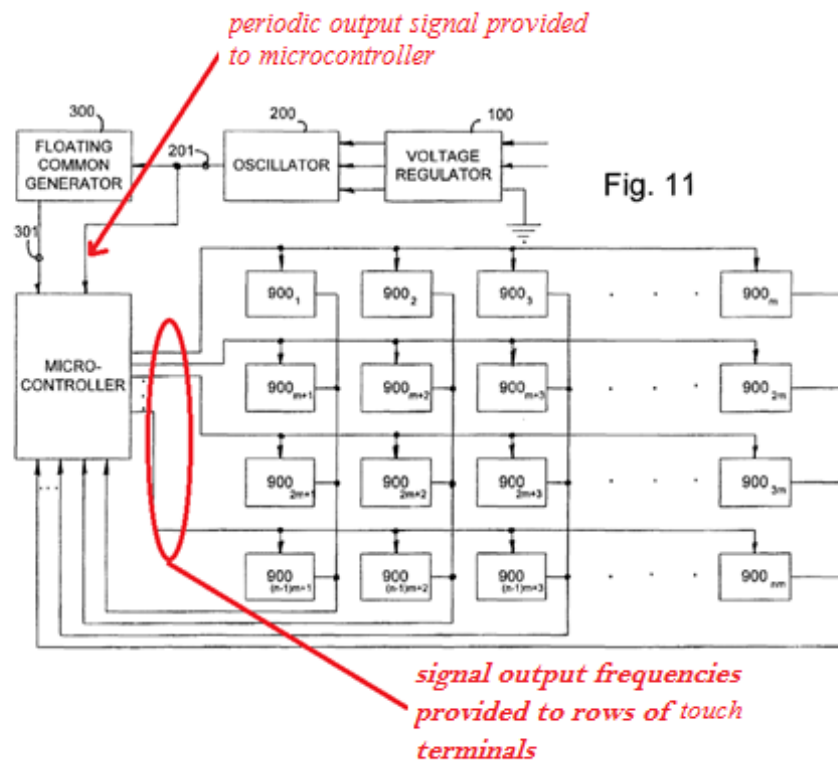
When interpreting a claim limitation, “the claim must be viewed as a whole.” *Apple Computer, Inc. v. Articulate Sys., Inc.*, 234 F.3d 14, 25 (Fed. Cir. 2000) (citing *Gen. Foods Corp. v. Studiengesellschaft Kohle mbH*, 972 F.2d 1272, 1274 (Fed. Cir. 1992) (“each claim is an entity that must be considered as a whole”)). When viewing each of the challenged independent claims as a whole, the claim language, absent compelling evidence to the contrary, tends to resolve the ambiguity in the claim term “selectively providing signal output frequencies to [an] . . . array of input touch terminals” to encompass the microcontroller “selecting a row or a portion of the array of touch terminals” to provide signals having a predefined frequency to the selected portion of the array of touch terminals.

(2) Written Description

“[I]n case of doubt or ambiguity it is proper in all cases to refer back to the descriptive portions of the specification to aid in solving the doubt or in ascertaining the true intent and meaning of the language employed in the claims.” *Phillips*, 415 F.3d at 1315 (quoting *Bates v. Coe*, 98 U.S. 31, 38 (1878)); *see also Howmedica Osteonics Corp. v. Zimmer, Inc.*, 822 F.3d 1312, 1321–22 (Fed. Cir. 2016) (when the meaning of a claim term is “not facially clear,” “[t]his problem is only resolved by examining the written description” as “a skilled artisan would naturally look to the written description for a full understanding of the claims”). Here, because the meaning of the disputed term “the microcontroller selectively providing signal output frequencies to [an] . . . array of input touch terminals” is not

clear on its face, it is particularly important in this case to consult the Specification in order to ascertain the term's correct meaning. *See Howmedica*, 822 F.3d at 1321 (when the meaning of a claim term is “not facially clear,” construing the claims by examining the written description is “not only consistent with our precedent, but also necessary in light of the claim language at issue”).

Turning to the Specification, the only embodiment disclosed in the '183 patent that describes an “array of input touch terminals of a keypad” to which the microcontroller “selectively provid[es] signal output frequencies,” as recited in the claims, is depicted in Figure 11, reproduced with annotations below.



Annotated Figure 11 above identifies the periodic output signal provided from oscillator 200 to the microcontroller, and the signal output frequencies provided from the microcontroller to the rows of touch terminals.

Referencing Figure 11, the '183 patent describes

A multiple touch pad circuit constructed in accordance with the second embodiment is shown in FIG. 11. . . . The multiple touch pad circuit is a variation of the first embodiment in that it includes an array of touch circuits designated as 900₁ through 900_{nm}, which, as shown, include both the touch circuit 400 shown in FIGS. 4 and 8 and the input touch terminal pad 451 (FIG. 4). Microcontroller 500 selects each row of the touch circuits 900₁ to 900_{nm} by providing the signal from oscillator 200 to selected rows of touch circuits. In this manner, microcontroller 500 can sequentially activate the touch circuit rows and associate the received inputs from the columns of the array with the activated touch circuit(s). . . .

The use of a high frequency in accordance with the present invention provides distinct advantages for circuits such as the multiple touch pad circuit of the present invention due to the manner in which crosstalk is substantially reduced without requiring any physical structure to isolate the touch terminals.

Ex. 1001, 18:34–19:4 (emphases added).

As described in the quoted passage above, the microcontroller only selects rows of the array of touch pads, and merely provides a signal of a fixed frequency from the oscillator to the selected row. In other words, as described in the '183 patent, the only selection made by the microcontroller is *selection of rows* to “*sequentially activate the touch circuit rows*” to “*associate the received inputs from the columns of the array with the activated touch circuit(s),*” i.e., to detect the position or location of a touch by the row and column of the array. *Id.* at 18:43–49 (emphases added).

There is no disclosure of the microcontroller determining or selecting the *frequency* of the signal provided to a row.

Indeed, the '183 patent Specification does not disclose an embodiment in which the microcontroller selects or provides different frequencies to the input touch terminals during operation of the system. Although the '183 patent describes using various high frequencies to improve “immunity to surface contaminants,” in all cases the selection of different frequencies is accomplished by selecting different circuit components, such as resistors and capacitors having different values, or modifying the design of the touch circuit. *See id.* at 14:22–25, 18:1–33. For example, the '183 patent describes that

As will be apparent to those skilled in the art, *the values of the resistors and capacitors utilized in oscillator 200 may be varied from those disclosed above to provide for different oscillator output frequencies.* As discussed above, however, *oscillator 200* is preferably constructed so as to *output a square wave having a frequency* of 50 kHz or greater, and more preferably, of 800 kHz or greater.

. . . .

The combination of oscillator voltage, frequency and transistor gain bandwidth product that is used will necessarily vary with the cost.

Id. at 14:22–28 (emphases added), 14:65–67. The Specification further describes that “[t]he present *combination* of [the values of the resistors and capacitors] was chosen to keep the oscillator voltage down and allow operation *at 800 kHz* to minimize cross talk.” *Id.* at 15:2–5 (emphases added). Regarding the capacitive switching circuit shown in Figure 11, the '183 patent describes that

The use of *a high frequency* in accordance with the present invention provides distinct advantages for circuits such as the multiple touch pad circuit of the present invention due to the manner in which crosstalk is substantially reduced without requiring any physical structure to isolate the touch terminals.

Id. at 18:66–19:4 (emphases added). Thus, the '183 patent describes choosing different values of the resistors and capacitors in the capacitive switching circuit at the design phase for the human designer to *select* an optimal, *fixed frequency* for the oscillator.

Patent Owner acknowledges that these disclosures in the '183 patent describe “choosing appropriate components during the design phase,” i.e., when the capacitive switching circuit is designed or constructed by a human circuit designer. PO Resp. 20; Sur-reply 5–6 (“The specification teaches that a circuit designer, constructing an embodiment of the invention, can select different ‘values of the resistors and capacitors utilized in oscillator 200 . . . to provide for different oscillator output frequencies.’” (citing Ex. 1001, 14:22–33)); Hearing Tr. 61:1–62:7. Petitioner’s declarant, Dr. Wright agrees. *See* Ex. 2003 (Wright Dep. Tr.), 254:1–255:8; Reply 5–6 (citing Ex. 2003, 254:1–255:8).

Thus, the only disclosures found in the Specification regarding selection of different frequencies are about design and component choices made *by a human circuit designer* during the design or construction of the capacitive switching circuit, *not* selection of frequencies *by a microcontroller* during the operation of the switching circuit. But the challenged claims expressly require *the microcontroller*, not a human individual, “selectively provid[e] signal output frequencies.”

Thus, if the claim language, “the microcontroller selectively providing signal output frequencies to a closely spaced array of input touch terminals of a keypad,” were to require the microcontroller select frequencies from multiple available frequencies, as Patent Owner contends, then none of the claims would encompass the illustrative embodiments disclosed in the ’183 patent. Such an interpretation, which “excludes a [disclosed] embodiment from the scope of the claim is rarely, if ever, correct.” *Broadcom Corp. v. Emulex Corp.*, 732 F.3d 1325, 1333 (Fed. Cir. 2013) (quoting *Accent Pkg., Inc. v. Leggett & Platt, Inc.*, 707 F.3d 1318, 1326 (Fed. Cir. 2013)) (citing *Phillips*, 415 F.3d at 1312–13).

Instead, the written description in the Specification supports a construction that encompasses selection of frequencies *by the human designer* during the design phase *and* selection of rows or a portion of the array of touch terminals *by the microcontroller* during operation of the circuit so-designed. As discussed above in our consideration of the claim language, viewing the claim as a whole, “the microcontroller selectively providing signal output frequencies to [an] . . . array of input touch terminals” requirement encompasses signals having a *pre-defined* frequency (i.e., a frequency selected or pre-selected during the design phase) provided to the microcontroller by the oscillator and then routed via multiple outputs of the microcontroller to the touch terminals—the microcontroller selecting *where* the frequency signals go, not necessarily *what* the frequency values are. Patent Owner does not cite, nor do we discern, anything in the Specification that requires the recited “microcontroller” to select a frequency

from multiple possible frequencies during the operation of the microcontroller or the claimed switching circuit.

(3) Prosecution History

As noted above, all of the challenged claims were amended or added during the reexaminations. Ex. 1006, 2–3; Ex. 1007, 27–28. The claim requirement at issue here—“the microcontroller selectively providing signal output frequencies to a closely spaced array of input touch terminals of a keypad”—did not appear in the original issued claims, but rather was added during reexamination. Ex. 1001, Reexam. Cert. C1, 2:49–51 (claim 37); *id.*, Reexam. Cert. C2, 6:44–46 (claim 94), 7:46–49 (claim 105). During reexamination, the support cited for this added language was the above-quoted portions of the Specification describing the human designer’s choice of the values of resistors and capacitors to *select* the *single frequency* of the oscillator *at the design stage* or describing the microcontroller’s *selection of rows* of the array of touch pads during the operation of the switching circuit to “sequentially activate the touch circuit rows” and detect the position or location of a touch by the row and column of the array. Ex. 1006, 43–45 (claim 37); Ex. 1007, 158–162 (claim 94), 183–186 (claim 105).⁵ In other words, when the “selectively providing limitation” was added to the challenged claims during the reexamination proceedings, no supporting disclosure was cited describing the microcontroller selecting a frequency from multiple frequencies.

⁵ The portions of Exhibit 1007 cited above show the support for application claim 95, which issued as claim 94, and application claim 111, which issued as claim 105. Ex. 1007, 45.

Thus, during the prosecution of the reexamination proceeding, Patent Owner (or the applicant) did not describe the “selectively providing limitation” as claiming or covering the subject matter of the microcontroller selecting a frequency from multiple frequencies during operation.

(4) Patent Owner’s “Variable Resistors and Capacitors” Argument

Citing the testimony of its declarant, Dr. Cairns, Patent Owner argues that the ’183 patent discloses the microcontroller selecting frequencies “on the fly,” i.e., during the operation of the capacitive switching circuit, because a person of ordinary skill in the art would have known that “the inventors possessed an embodiment that uses variable resistors and capacitors in the oscillator 200” that can be controlled by the microcontroller to change the values of the resistors and capacitors during operation. PO Resp. 21–24. The only supporting citations to the Specification Patent Owner provides, however, are the portions of the Specification discussed above (*id.* (citing Ex. 1001, 14:22–33)), which Patent Owner concedes describe a human circuit designer selecting different values of the resistors and capacitors for oscillator 200 to provide for different oscillator output frequencies, *not* the microcontroller selecting the values of the resistors and capacitors (*id.* at 20; Sur-reply 5–6 (“The specification teaches that a circuit designer, constructing an embodiment of the invention, can select different ‘values of the resistors and capacitors utilized in oscillator 200 . . . to provide for different oscillator output frequencies.’” (citing Ex. 1001, 14:22–33)); Hearing Tr. 61:1–62:7). The rest of Patent Owner’s citations to evidence consist entirely of citations to the Cairns Declaration. *See* PO Resp. 21–24 (citing Ex. 2004 ¶¶ 65–74).

Thus, in making the “variable resistors and capacitors” argument, Patent Owner entirely relies on the declaration testimony of Dr. Cairns. We are not persuaded by Dr. Cairn’s testimony because Dr. Cairns cannot rewrite the Specification (or the prosecution history) of the ’183 patent to narrow the scope of the challenged claims (and the “selectively providing limitation”) to require a feature not found in the claims, i.e., the microcontroller selecting a frequency from multiple frequencies. *See Prolitec, Inc. v. Scentair Techs., Inc.*, 807 F.3d 1353, 1358–59 (Fed. Cir. 2015) (Prolitec’s expert cannot rewrite the intrinsic record of the patent to narrow the scope of the patent and the disputed claim element.), *overruled on other grounds by Aqua Prods., Inc. v. Matal*, 872 F.3d 1290 (Fed. Cir. 2017); *Phillips*, 415 F.3d at 1318 (explaining that “a court should discount any expert testimony that is clearly at odds . . . with the written record of the patent”) (internal quotation marks omitted) (citation omitted).

Moreover, Dr. Cairns only focuses on providing variable resistors and capacitors for the oscillator circuit, and ignores that fact that the sensing circuitry of the disclosed embodiment is specifically designed to handle a set frequency, and so any hypothetical embodiment that would select frequencies “on the fly” would have to change the values of multiple components throughout the circuitry if the frequency is changed. *See, e.g.*, Ex. 1001, 14:58–60 (“the higher the frequency, the higher the gain bandwidth product that is required in transistor 410”).

Patent Owner’s alternative arguments based on the purported use of a microprocessor-controlled frequency divider or a voltage-controlled oscillator are similarly unpersuasive. *See* PO Resp. 24–28.

(5) Patent Owner's "Key Element of the Invention" Argument

Finally, Patent Owner asserts that the microcontroller selecting a frequency from multiple frequency is required because “a key element of the invention is selecting an appropriate frequency, to optimize the relative impedance of surface-contaminant paths.” Sur-reply 9 (citing Ex. 1001, Fig. 3, 5:43–55, 6:60–7:6). According to Patent Owner,

The ‘183 patent grew out of a “study” which the inventor performed to determine the optimal scan frequencies for close-proximity touch arrays. The ‘183 patent describes this study, and then reports its conclusion: “higher frequencies” are optimal. The ‘183 patent’s “switching circuit” incorporates the “use of higher frequencies,” as suggested by the study.

Id. (citing Ex. 1001, 8:19–11:65). Patent Owner asserts that our preliminary construction “reads selection of frequencies *entirely* out of the claims” and is directly “at odds with the purposes of the invention.” *Id.*

We disagree with Patent Owner’s argument. As discussed above, our construction *encompasses selection of frequencies* by the human designer during the design phase (as well as selection of rows or a portion of the array of touch terminals by the microcontroller during operation of the circuit so-designed). Indeed, all of the portions of the Specification cited by Patent Owner are about general design considerations for frequencies used in capacitive touch pad circuits or choosing different values of the resistors and capacitors in the circuit during the design or construction of the circuit to select a desired operation frequency. *See, e.g.*, Ex. 1001, 11:60–63 (“Having provided a basis for the use of higher frequencies, the basic *construction* of the electronic switching circuit *constructed* in accordance with a first embodiment of the present invention is now described with reference to

FIG. 4.” (emphases added)). As discussed above in our consideration of the written description in the Specification, Patent Owner does not cite, nor do we discern, anything in the Specification that requires the recited “microcontroller” to select a frequency from multiple possible frequencies during the operation of the microcontroller or the claimed switching circuit.

Furthermore, Patent Owner does *not* argue that the purported “key element of the invention” is *the microcontroller* “selecting an appropriate frequency” during the operation of the circuit. *See* Sur-reply 9. Our construction that encompasses selection of frequencies by the human designer during the design phase (as well as selection of rows or a portion of the array of touch terminals by the microcontroller during operation of the circuit so-designed) does not “read[] selection of frequencies *entirely* out of the claims,” as Patent Owner contends. *See id.* Nor is it “directly ‘at odds with the purposes of the invention.’” *See id.*

(6) Conclusion

Based on the complete record and after examining the claims as a whole, the Specification, and the prosecution history, we determine that the term “the microcontroller selectively providing signal output frequencies to a closely spaced array of input touch terminals of a keypad” recited in the challenged independent claims 37, 94, and 105 does *not* require the microcontroller to select signal output frequencies from multiple available frequencies. In addition, we resolve the question of what the microcontroller is selecting—frequencies or a portion of the touch pad array—according to the ’183 patent’s description of the invention in the Specification and the applicant’s description of the invention during the prosecution history, and

construe the term “the microcontroller selectively providing signal output frequencies to a[n] . . . array of input touch terminals of a keypad” to encompass “the microcontroller selecting a row or a portion of an array of touch terminals to provide signal output frequencies to the array.” We also determine that the challenged claims encompass selection of frequencies by the human designer during the design or construction of the claimed switching circuit. *See Phillips*, 415 F.3d at 1316 (“The construction that stays true to the claim language and most naturally aligns with the patent’s description of the invention will be, in the end, the correct construction.” (quoting *Renishaw PLC v. Marposs Societa’ per Azioni*, 158 F.3d 1243, 1250 (Fed. Cir. 1998))).

b. Whether the Samsung Appeal Opinion Compels a Different Claim Construction

(1) Samsung Appeal Opinion

As discussed above, in our Institution Decision, we noted issuance of the Samsung Appeal Opinion, entered in the appeal from the Samsung IPR, and invited the parties to address in their papers the import of that opinion on the construction of the term “selectively providing signal output frequencies” recited in the challenged independent claims in this proceeding. Inst. Dec. 30–31.

In that opinion, the Federal Circuit, considering claims and prior art not at issue here, vacated and remanded for further consideration the Board’s decision that petitioner failed to establish a reasonable expectation of success in combining the prior art at issue. 775 F. App’x at 697. The Federal Circuit focused on the requirement in claim 40 of the ’183 patent:

the microcontroller selectively providing signal output frequencies to a plurality of small sized input touch terminals of a keypad, wherein the selectively providing comprises the microcontroller selectively providing a signal output frequency to each row of the plurality of small sized input touch terminals of the keypad.

Ex. 1001, Reexam. Cert. C2, 1:28–34. In the Samsung IPR proceeding, unlike here, the petitioner had assumed that this claim language *did* require the microcontroller to provide a plurality of different frequencies during operation of the circuit.⁶ Samsung IPR, Paper 2, 26. Patent Owner agreed, and amplified this purported requirement to further require that the microcontroller provide different frequencies to different rows of touch pads. 775 F. App’x at 696. The Federal Circuit rejected Patent Owner’s embellished construction, based on the fact that dependent claim 45 added to claim 40 the requirement, “wherein each signal output frequency selectively provided to each row of the plurality of small sized input touch terminals of the keypad has a same [frequency] value.” *Id.* at 697. The Court therefore held:

Given that the dependent claim recites sending the same frequency to all of the rows of the device, we interpret the necessarily broader independent claim 40 as also covering such a situation (even though it may also cover a situation where different frequencies are provided to different rows). In other words, the claims are not limited to situations in which different frequencies are provided to different rows. A reasonable

⁶ Petitioner in the Samsung IPR correctly noted that this construction was “not disclosed or supported by the specification of the ’183 patent,” but only “reserve[d] the right to challenge and address [it] in other proceedings.” Samsung IPR, Paper 2, 26 n.6.

expectation of success thus only requires that different frequencies be provided to the entire pad.

Id. The Federal Circuit further directed:

Based on the proper claim construction, we *vacate* and *remand* The question is whether there would have been a reasonable expectation of success . . . (i.e., whether there was a reasonable expectation that the combination could have been modified to “provide” a frequency, selected from multiple possible frequencies, to the entire touch pad).

Id. (underlined emphasis added).

Patent Owner argues that the Federal Circuit “repeatedly, and explicitly, characterized its ruling as one of claim construction” and that the Federal Circuit’s construction is binding on the Board, or at least should be followed as a matter of policy. PO Resp. 15–19; Sur-Reply 1–3.

In response, Petitioner argues the Samsung Appeal Opinion is not binding here because it is non-precedential, and in any event it did not set forth a “full claim construction analysis,” but rather is limited to the narrow issue of whether a there was a reasonable expectation of success in combining prior art that is not at issue in this proceeding. Reply 2–5. In support of that latter argument, we note that our above-discussed analysis leading to our conclusion that the microcontroller is not required to select frequencies during operation does not appear to have been brought to the attention of, or considered by, the Federal Circuit.

(2) Our Claim Construction Is Consistent with the Samsung Appeal Opinion

We need not resolve the extent to which the statements in the Samsung Appeal Opinion are binding here, and if so whether they conflict

with our construction, because Patent Owner has ultimately conceded that the Federal Circuit’s construction does *not* require that “the microcontroller ‘select’ from multiple possible frequencies ‘on the fly,’ during operation of the claimed device.” PO Resp. 19–20; Sur-reply 5; Hearing Tr. 61:1–62:7.

Although, as discussed above, Patent Owner in addressing the claim language has argued that the claim term “selectively providing signal output frequencies to [an] . . . array of input touch terminals” requires the microcontroller selecting a frequency from multiple frequencies (Prelim. Resp. 30; PO Resp. 28–30; Sur-reply 7) and that the Samsung Appeal Opinion mandates the same construction (PO Resp. 29–30), when addressing the written description support for the Federal Circuit’s construction, Patent Owner pivots to a position that appears to be at odds with that stance— asserting that “[n]othing in the Federal Circuit’s construction requires that the microcontroller ‘select’ from multiple possible frequencies ‘on the fly,’ during operation of the claimed device” (PO Resp. 19).

Patent Owner asserts that the Federal Circuit’s construction “merely” requires “provid[ing] a frequency, selected from multiple possible frequencies, to the entire touch pad.” PO Resp. 19–20 (citing 775 F. App’x at 697). Apparently recognizing that this language does not specify who or what “select[s]” a frequency “from multiple possible frequencies,” Patent Owner now argues that the “selected from multiple possible frequencies” language in the Federal Circuit’s opinion does not require selecting frequencies by the microcontroller during operation of the system. *Id.* at 19. Rather, Patent Owner asserts the Federal Circuit’s construction “broadly

encompasses a ‘selection’ that occurs during the design of a touch circuit.”⁷ *Id.* at 20. And Patent Owner states, “[a]lthough the claimed component that ‘provides’ signals to the keypad is the ‘microcontroller,’ the claims do not require that the *selection of frequency* be performed by the microcontroller.” Sur-reply 5. We agree with Patent Owner on these points.

Indeed, the Federal Circuit opinion does not state that frequencies are selected by the microprocessor. The Samsung Appeal Opinion states that

A reasonable expectation of success thus only requires that different frequencies be provided to the entire pad.

. . . .

The question is . . . whether there was a reasonable expectation that the combination could have been modified to “provide” a frequency, selected from multiple possible frequencies, to the entire touch pad.

775 F. App’x at 697. This does not require the microcontroller to select frequencies during operation. Nor do any challenged claims. Among the challenged claims only claims 97 and 107 refer to selecting frequencies, as an entirely separate requirement from the “selectively providing limitation,” reciting “each signal output frequency selectively provided . . . is selected from a plurality of Hertz values.” Ex. 1001, Reexam. Cert. C2, 7:13–16 (claim 97), 8:15–19 (claim 107). Even in those claims there is no requirement that the microcontroller select the frequencies during operation.

⁷ Patent Owner argues that because the Federal Circuit’s construction does *not* require the microcontroller selecting frequencies during operation of the system and instead encompasses a selection by a human designer that occurs during the design of a touch circuit, the Federal Circuit’s construction would not cause the challenged claims to lack written description support. PO Resp. 19–21.

As discussed above, we determine that the claim term “the microcontroller selectively providing signal output frequencies to a closely spaced array of input touch terminals of a keypad” recited in the challenged independent claims 37, 94, and 105 does *not* require the microcontroller to select signal output frequencies from multiple available frequencies. This construction is entirely consistent with Patent Owner’s alternative, written-description-focused articulation of the Federal Circuit’s construction in the Samsung Appeal Opinion.

We also construe the same claim term at issue to encompass the microcontroller “selecting a row or a portion of the array of touch pads to provide signal output frequencies to the array.” In addition, we determine that independent claims 37, 94, and 105 encompass a human designer choosing different values of the resistors and capacitors in the capacitive switching circuit to *select a fixed frequency* for the oscillator. As discussed above, the claims encompass a human designer selecting (or pre-selecting or predefining) a fixed frequency for the oscillator, the oscillator providing a signal having a predefined frequency to the microcontroller, and the microcontroller selecting rows of the array of touch terminals to provide a signal having the predefined frequency from the oscillator to the selected row. Thus, under our construction, the claim term “the microcontroller selectively providing signal output frequencies to a closely spaced array of input touch terminals of a keypad” encompasses the microcontroller selecting a row or a portion of the array of touch pads to provide a signal having the human designer selected frequency from the oscillator. Our construction is consistent with the Federal Circuit’s construction, as

explained by Patent Owner, in the Samsung Appeal Opinion. At a minimum, there is nothing inconsistent between our construction in this proceeding and the Federal Circuit’s construction in the Samsung Appeal Opinion.

Based on foregoing and upon considering the complete record, we conclude that our claim construction of the “selectively providing limitation” in this Final Written Decision is consistent with the Samsung Appeal Opinion.

2. “*closely spaced array*”

Independent claims 37, 94 and 105 require “selectively providing signal output frequencies” to a “closely spaced array of input touch terminals of a keypad.” Ex. 1001, Reexam. Cert. C1, 2:49–51 (claim 37); *id.*, Reexam. Cert. C2, 6:44–46 (claim 94), 7:46–49 (claim 105). As discussed above, we construe the term “selectively providing signal output frequencies” to encompass the microcontroller providing a signal having a human designer selected frequency from the oscillator. As discussed further in Section III.C.3.b(4) below, Patent Owner, in arguing nonobviousness, seeks to narrow the meaning of “selectively providing” and “closely spaced array” to incorporate the design considerations in the ’183 patent regarding selection of frequencies and the arrangement of the touch terminal array.

In particular, Patent Owner would require the “selection” of frequencies to be “for the specific purpose it is done in the ’183 Patent — *i.e.*, minimizing contamination-based crosstalk between adjacent touch terminals.” PO Resp. 34. Similarly, Patent Owner argues the cited art does not disclose a “closely spaced array” as required by the claims because “the

array must be sufficiently closely-spaced that, if high frequencies were not used, surface contamination would cause significant crosstalk between adjacent terminals.” *Id.* at 38 (emphasis omitted); Sur-reply 12.

In substance, Patent Owner would incorporate into the claims the details of the disclosure in the Specification explaining how the inventors “conducted extensive empirical research to develop the theoretical and practical framework for rejection of contamination-induced crosstalk in closely-spaced capacitive touch terminals.” PO Resp. 1 (citing Ex. 1001, 8:9–11:60).

This attempt to narrow the claims is without merit. The claims at issue here make no mention of these considerations. In contrast, claims such as claim 40 provide:

wherein said predefined frequency of said oscillator and said signal output frequencies are selected to decrease a first impedance of said dielectric substrate relative to a second impedance of any contaminate that may create an electrical path on said dielectric substrate between said adjacent areas defined by the plurality of small sized input touch terminals, and wherein said detector circuit compares a sensed body capacitance change to ground proximate an input touch terminal to a threshold level to prevent inadvertent generation of the control output signal.

Ex. 1001, Reexam. Cert. C2, 1:46–56. To ask us to incorporate such a limitation into claims which do not recite it, when other claims do, is to tempt us to commit “one of the cardinal sins of patent law—reading a limitation from the written description into the claims.” *Phillips*, 415 F.3d at 1319–20 (quoting *SciMed Life Sys., Inc. v. Advanced Cardiovascular Sys., Inc.*, 242 F.3d 1337, 1340 (Fed. Cir. 2001)).

Therefore, based on the complete record, we determine that providing signal output frequencies to a “closely spaced array of input touch terminals of a keypad” does not require an array “sufficiently closely-spaced [such] that, if high frequencies were not used, surface contamination would cause significant crosstalk between adjacent terminals.”

3. *“supply voltage” and “peak voltage of the signal output frequencies”*

Claim 94 recites “a peak voltage of the signal output frequencies is greater than a supply voltage.” Ex. 1001, Reexam. Cert. C2, 6:51–53. Petitioner submits that “‘supply voltage’ in this claim is properly construed to be a supply voltage of the microcontroller, as opposed to a supply voltage for another component in the touch circuit.” Pet. 13. Patent Owner agrees with Petitioner’s construction of “supply voltage,” “[f]or the purposes of this proceeding.” PO Resp. 44–45. Although claim 94 does not expressly recite that the “supply voltage” is for the microcontroller, given the parties’ agreement, we adopt this construction.⁸

In addition to construction of “supply voltage” recited in claim 94 discussed above, a separate issue concerns the portion highlighted in the following: “the microcontroller selectively providing signal output

⁸ We note that the requirement that the peak voltage be greater than a supply voltage was added during reexamination. Ex. 1001, Reexam. Cert. C2, 6:51–53. During reexamination, the support cited for this added language mentioned the supply voltage for the oscillator, not the microcontroller. Ex. 1007, 159–160. However, for purposes of our Decision, we need not resolve the issue of whether the recited “supply voltage” is for the “oscillator” or the “microcontroller,” because, as discussed in Section III.C.3 below, in this particular case the reference asserted to teach this limitation (Chiu) includes the oscillator in the microcontroller.

frequencies to a closely spaced array of input touch terminals of a keypad . . . wherein *a peak voltage of the signal output frequencies* is greater than a supply voltage.” Ex. 1001, Reexam. Cert. C2, 6:44–53 (emphasis added).

As discussed further in Section III.C.3.c. below, Patent Owner, in arguing nonobviousness, construes the term “peak voltage of the signal output frequencies” to refer to the peak voltage of the signals output from the microcontroller. PO Resp. 47; Sur-reply 17–18. Based on this construction, Patent Owner argues that this limitation is not met because the asserted prior art combination does not teach that the peak voltage of the microcontroller output is greater than the supply voltage. PO Resp. 47; Sur-reply 17–18.

In response, Petitioner argues that claim 94 recites “a peak voltage of *the signal output frequencies* is greater than a supply voltage,” not the peak voltage of the “signal output by the microprocessor” is greater than a supply voltage. Reply 21. Petitioner further asserts that the claim recites providing signal output frequencies to the array of touch terminals, and, therefore, the term “peak voltage of the signal output frequencies” should be interpreted as the peak voltage of the signal provided to the array of touch terminals. *Id.* at 21–23.

We agree with Petitioner’s argument and disagree with Patent Owner’s argument. In the pertinent illustrative embodiment disclosed in the ’183 patent, the microcontroller merely routes the supply voltage from the oscillator to the array, and a separate buffer circuit raises the signal output frequency voltages from 5 volts to 26 volts. Ex. 1001, 12:6–8, 13:32–39, 18:43–46, Figs. 6, 11. Patent Owner does not cite, nor do we discern,

anything in the intrinsic record that compels limiting the term “a peak voltage of the signal output frequencies” provided to the touch terminals to a peak voltage of the microprocessor output. The Specification evidences no basis for requiring the microcontroller to play any part in determining the voltage of the signal output frequencies. Nor is there anything in the Specification that requires the voltage of the signal to remain unchanged (e.g., no amplification or buffering) between the microcontroller output and the input signal provided to the touch terminals. Therefore, based on the complete record, we conclude that the “peak voltage” recited in claim 94 refers to the voltage provided to the touch terminals.

4. “coupled”

The term “coupled” is recited in independent claims 37, 94, and 105. Ex. 1001, Reexam. Cert. C1, 2:55–67 (claim 37); *id.*, Reexam. Cert. C2, 6:57–65 (claim 94), 7:58–8:6 (claim 105). Petitioner argues “‘coupled’ in claims 37, 94, and 105 should be construed to include indirect coupling via intervening components.” Pet. 15. Patent Owner does not address Petitioner’s construction of “coupled.” Petitioner’s proposed construction is consistent with the record and we adopt it for this Final Written Decision. *See* Ex. 1001, 12:60–62, 13:46–48, 20:6–8.

5. “oscillator voltage”

Claim 37 recites “an oscillator voltage is greater than a supply voltage.” Ex. 1001, Reexam. Cert. C1, 2:46–47. Petitioner does not propose an express construction for the term “an oscillator voltage.” Rather, in arguing obviousness of claim 37, Petitioner relies on an implicit construction

of “oscillator voltage” to mean the output voltage of an oscillator. Pet. 29. Patent Owner agrees with this construction. PO Resp. 44.

For the reasons discussed below in Section III.C.3.e., we need not construe this term for purposes of this Final Written Decision. *See Vivid Techs.*, 200 F.3d at 803.

C. Obviousness over Chiu and Schwarzbach

In this asserted ground of obviousness, Petitioner contends that claims 37, 94, 96, 101, 105, and 106 are unpatentable under 35 U.S.C. § 103(a) as obvious over the combination of Chiu and Schwarzbach. Pet. 16–58.

1. Relevant Principles of Law

To prevail in challenging Patent Owner’s claims, Petitioner must demonstrate by a preponderance of the evidence that the claims are unpatentable. 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d). “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”)). This burden never shifts to Patent Owner. *See Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) (citing *Tech. Licensing Corp. v. Videotek, Inc.*, 545 F.3d 1316, 1326–27 (Fed. Cir. 2008)) (discussing the burden of proof in *inter partes* review).

A claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject

matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the 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) where in evidence, so-called secondary considerations.⁹ *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). We analyze these asserted grounds based on obviousness with the principles identified above in mind.

2. Scope and Content of the Prior Art

a. Overview of Chiu (Ex. 1005)

Chiu describes a capacitive type touch switch cell arrangement using capacitive coupling between a touch pad and an electrode, which is alterable by a human touching or being proximate to the touch pad. Ex. 1005, Abstract.

⁹ The parties do not address secondary considerations, which therefore do not constitute part of our analysis.

Figure 6A of Chiu is reproduced below.

FIG. 6A

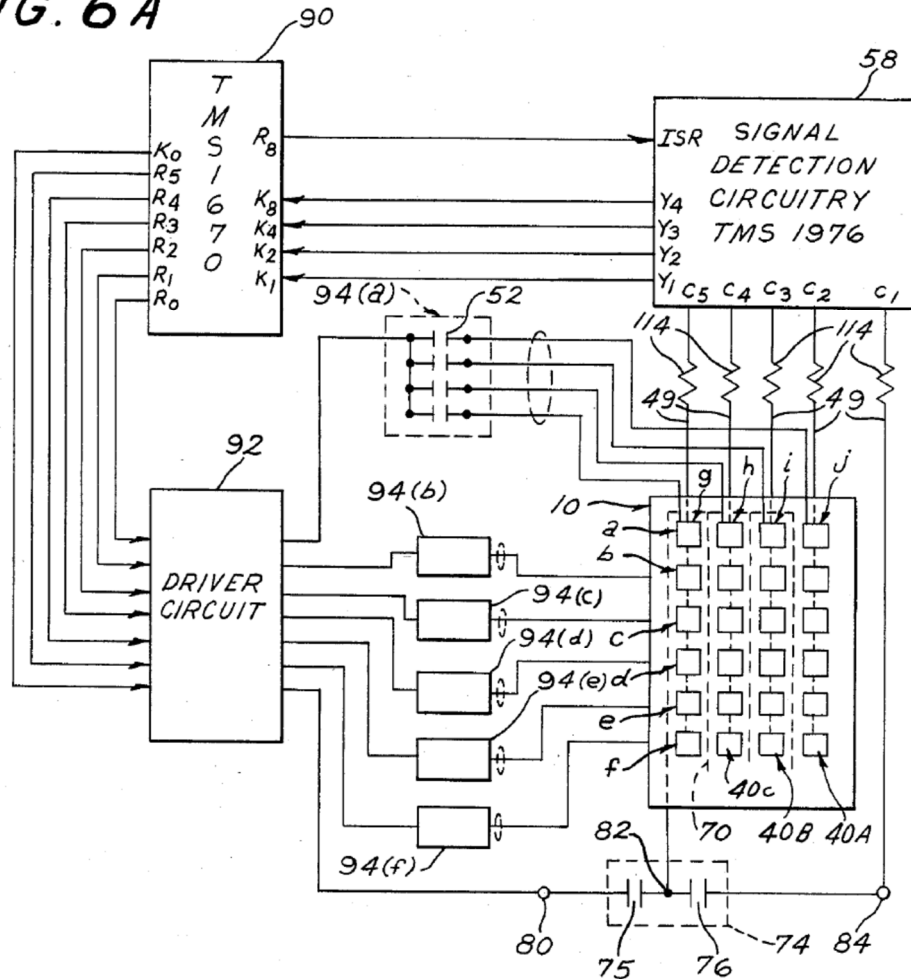


Figure 6A is a simplified schematic circuit diagram of an exemplary touch switch arrangement of Chiu. *Id.* at 3:38–41.

Chiu describes that, in the control circuit depicted in Figure 6A, microprocessor 90 sequentially generates a scan pulse at each of outputs R₀–R₅, which are coupled to rows a–f of the capacitive touch cell array 10 via driver circuitry 92. *Id.* at 8:45–49. According to Chiu, in this embodiment, microprocessor 90 is a commercially available TMS 1670 microprocessor, which can be customized by configuring its read only memory (ROM) to

implement the desired control scheme. *Id.* at 9:7–12. Chiu describes that a portion of the ROM of microprocessor 90 is configured to generate the capacitive touch keyboard drive signals, which are scan pulses provided sequentially at outputs R_0 – R_5 of microprocessor 90. *Id.* at 9:12–18.

Figure 7 of Chiu is reproduced below.

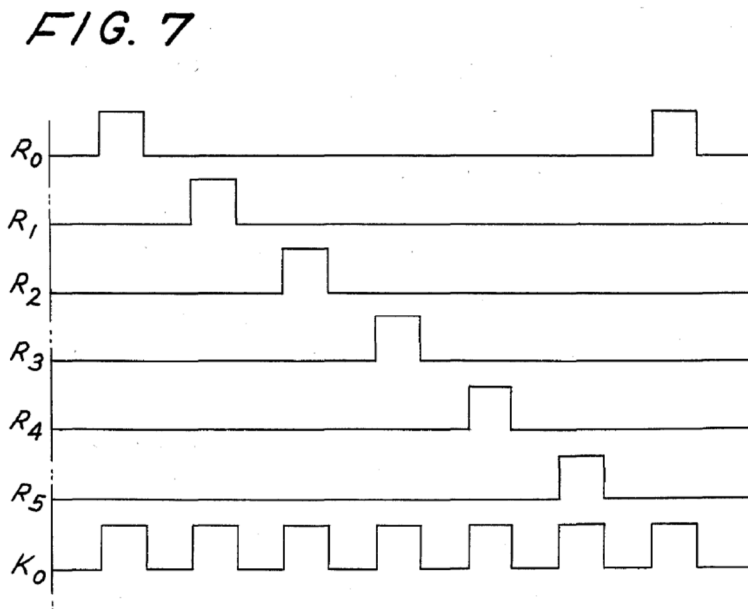


Figure 7 is a timing diagram illustrating the scan signals used in the control circuit depicted in Figure 6A. *Id.* at 3:45–46. According to Chiu, the timing diagram shown in Figure 7 represents one complete scan cycle. *Id.* at 10:30–31. Chiu describes that, during each scan cycle, a scan pulse appears sequentially at each of outputs R_0 – R_5 .

According to Chiu, as shown in Figure 6A, columns g–j of the touch cell array are coupled to inputs C_5 – C_2 , respectively, of detection circuitry 58 via limiting resistors 114. *Id.* at 8:56–58. Detection circuitry 58 senses the scan signal at each of the touch cells in the row being scanned by checking their respective column output lines 49 to detect an attenuation of the

column output line signal, signifying that a touch pad in a particular column has been touched. *Id.* at 8:63–67. If a touch pad in the row being scanned is touched, the signal detector circuit will detect the attenuation of the scanned signal for that column containing the touched pad. *Id.* at 8:67–9:3. Chiu describes that, in this fashion, the signal detection circuitry provides the column information to microprocessor 90, which can thereby identify by row and column which pad in the touch cell array that has been touched, which in turn “initiate[s] the appropriate programmed response to the touching of [the] pad.” *Id.* at 9:3–6, 10:15–19, 10:46–51.

b. Overview of Schwarzbach (Ex. 1014)

Schwarzbach describes an appliance control system including a central control unit. Ex. 1014, Abstract. Figure 1 of Schwarzbach is reproduced below.

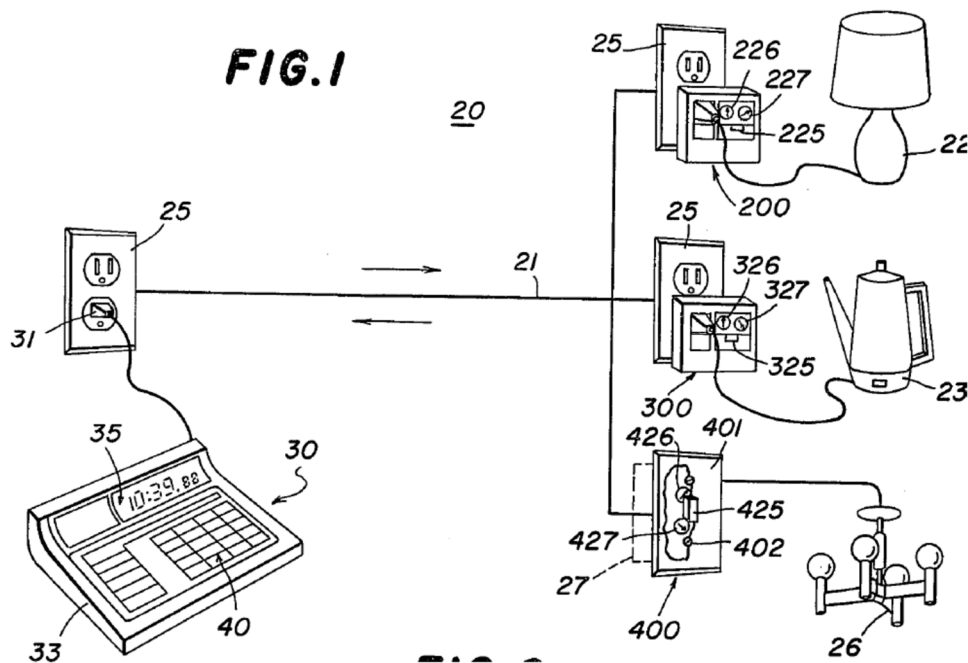


Figure 1 describes an exemplary appliance control system according to Schwarzbach. *Id.* at 3:8–10. As shown in Figure 1, system 20 includes central control unit 30, one or more lamp slave units 200, one or more appliance slave units 300, and one or more wall switch slave units 400.

Figure 4B of Schwarzbach is reproduced below.

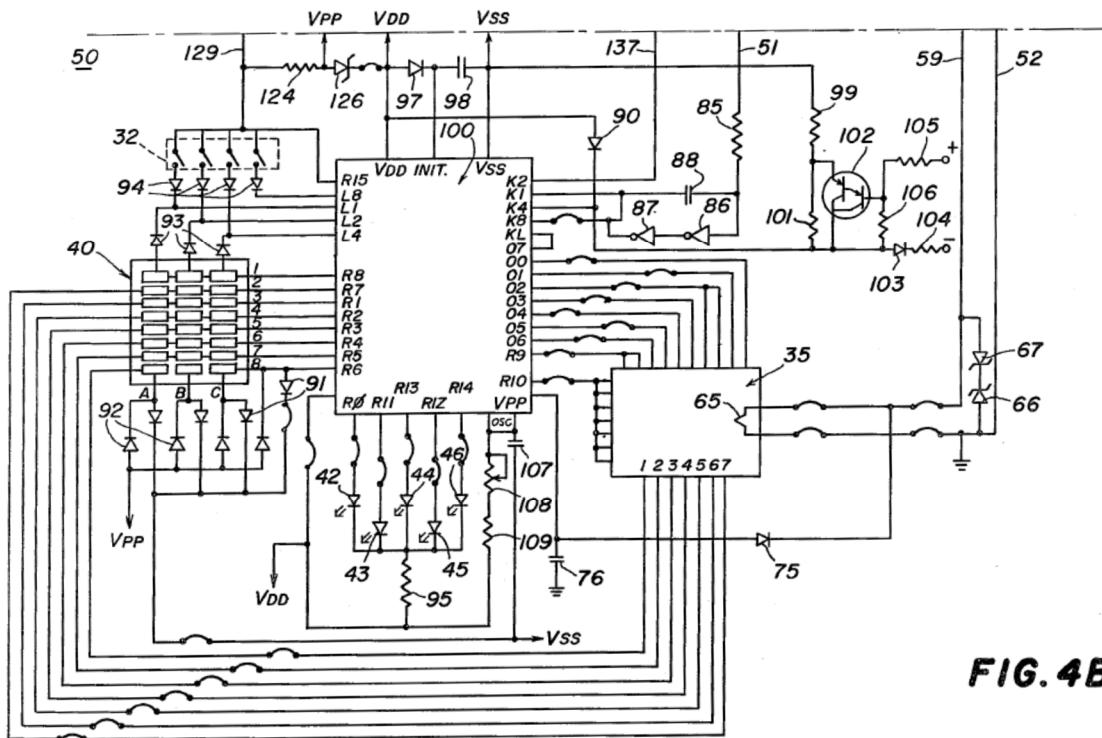


Figure 4B is a schematic circuit diagram of a portion of the electrical circuit in central control unit 30 depicted in Figure 1. *Id.* at 3:18–20.

As shown in Figure 4B, electrical circuit 50 of central control unit 30 includes microprocessor 100. *Id.* at 4:9–11. Schwarzbach describes that microprocessor 100 is preferably a TMS 1670 microprocessor. *Id.* at 15:62. Central control unit 30 also includes keyboard 40 which is coupled to display panel 35 and to microprocessor 100. *Id.* at 4:50–52. Keyboard 40 is connected as a 3x8 matrix, with its row pins connected to corresponding

microprocessor output terminals. *Id.* at 4:55–58. Key presses are detected by driving output terminals and scanning for closed keys. *Id.* at 4:58–67. When a key closure is detected, microprocessor 100 takes the appropriate action after the end of the keyboard scan. *Id.* at 4:67–5:1.

3. *Discussion —*
Differences Between the Claimed Subject Matter and the Prior Art

a. Proposed Combination of Chiu and Schwarzbach; Reason to Combine

In its proposed combination of Chiu and Schwarzbach, Petitioner relies on Chiu to teach most of the limitations recited in the challenged claims. *See* Pet. 21–58. Petitioner’s reliance on Schwarzbach is limited to a few, relatively narrow limitations relating to a “supply voltage.” For claim 37, Petitioner relies on Schwarzbach to teach the limitation reciting “wherein an oscillator voltage is greater than a supply voltage.” *Id.* at 28–30. For claim 94, Petitioner relies on Schwarzbach to teach a “supply voltage” recited in the limitation “wherein a peak voltage of the signal output frequencies is greater than a supply voltage.” *Id.* at 51–53. Petitioner also relies on Schwarzbach for the limitation of dependent claim 101 reciting “the supply voltage is a battery supply voltage.” *Id.* at 56.

Petitioner contends that a person of ordinary skill in the art would have been motivated to combine Chiu and Schwarzbach in the manner proposed by Petitioner. *Id.* at 19–21. Patent Owner disputes Petitioner’s contention and additionally argues Petitioner does not establish a reasonable expectation of success in making the proposed combination to achieve the claimed invention. PO Resp. 40–44. Because the parties’ disputes over the motivation to combine are directed to specific features of claims 37, 94, and

101, we discuss the issues of the motivation to combine and a reasonable expectation of success in the context of considering each of those claims below.

b. Common Limitations

Many of the limitations recited in independent claims 37, 94, and 105 are identical or nearly identical. As discussed below, Petitioner relies on Chiu to teach all of these identical or nearly identical limitations common to the challenged independent claims. In what follows, we discuss these common limitations first and then address the remaining limitations and the claims as a whole.

(1) Preamble

Claim 37 recites a preamble as follows: “[a] capacitive responsive electronic switching circuit for a controlled device.” Ex. 1001, Reexam. Cert. C1, 2:43–44. Claims 94 and 105 each recite a preamble with the following identical claim language: “[a] capacitive responsive electronic switching circuit for a controlled keypad device.” *Id.*, Reexam. Cert. C2, 6:39–40 (claim 94), 7:42–43 (claim 105). Petitioner contends that Figure 6A of Chiu (reproduced above) describes a “control circuitry” that integrates a “touch panel” with a “control system for an appliance.” Pet. 21–22 (citing Ex. 1005, 8:41–44, Fig. 6A). Petitioner also asserts that Chiu teaches touch detection circuits that employ “a touch responsive pad or electrode and a receiver electrode” for “capacitive coupling [that] is alterable by [a] human being touching of or proximate to the touch pad.” *Id.* at 21 (citing Ex. 1005, 2:16–23). In addition, Petitioner contends that Chiu teaches that “capacitive touch keyboard drive signals” are generated and provided to an “array of

touch switch cells ('keypad')." *Id.* at 47 (citing Ex. 1005, 9:12–16).

Petitioner argues Chiu therefore teaches "[a] capacitive responsive electronic switching circuit for a controlled device," as recited in claim 37, and "[a] capacitive responsive electronic switching circuit for a controlled keypad device," as recited in claims 94 and 105. *Id.* at 22, 47–49, 56–57.

Patent Owner does not dispute Chiu teaches the preambles of claims 37, 94, and 105. *See* PO Resp. 32–49. Based on the complete record and for the reasons explained by Petitioner, we determine that Petitioner has demonstrated sufficiently that Chiu teaches the preambles of claims 37, 94, and 105.^{10, 11}

(2) "an oscillator providing a periodic output signal having a predefined frequency"

Claims 37, 94, and 105 each recite "an oscillator providing a periodic output signal having a predefined frequency." Referencing Figure 6A of Chiu, Petitioner asserts that Chiu describes that a "portion of the ROM" of microprocessor 90 "is configured in a conventional manner to generate capacitive touch keyboard drive signals." Pet. 22–23 (citing Ex. 1005, 9:7–25, Fig. 6A). According to Petitioner, Chiu refers to this ROM portion of the microprocessor as "signal generator circuitry." *Id.* at 24 (citing

¹⁰ Because Petitioner has shown that the recitations in the preambles are satisfied by Chiu, we need not determine whether the preambles are limiting. *See Vivid Techs.*, 200 F.3d at 803.

¹¹ We also find that Patent Owner has waived any argument directed to the preambles of claims 37, 94, and 105. *See* Paper 13 (Scheduling Order), 7 ("Patent Owner is cautioned that any arguments for patentability not raised in the response may be deemed waived.").

Ex. 1005, 8:1). Citing the testimony of its declarant, Dr. Wright, Petitioner argues that a person of ordinary skill in the art would have understood that the signal generator circuitry of microprocessor 90 that generates square wave signals shown in Figure 7 of Chiu operates as an “oscillator” described in the ’183 patent. *Id.* at 24–25 (citing Ex. 1005, 8:1, 9:7–25, Figs. 6A & 7; Ex. 1001, 13:33–39; Ex. 1003 ¶¶ 93–94).

In addition, Petitioner asserts that Chiu describes the drive signal produced by the signal generator as “a pulsating waveform,” i.e., a periodic signal, as shown in Figure 7 of Chiu. *Id.* at 27 (citing Ex. 1005, 4:49–50). Relying on the testimony of Dr. Wright, Petitioner argues that, because Chiu teaches that the scan signal is a “pulsating” (i.e., periodic) “waveform,” such as the square wave shown in Figure 7, a person of ordinary skill in the art would have understood the scan signal to be a “periodic output signal” having a “predefined frequency.” *Id.* (citing Ex. 1003 ¶ 96).

Referencing an annotated version of Figure 7 (not reproduced herein), Petitioner additionally argues that the scan pulses shown in Figure 7 have a scan cycle that repeats during the operation of the circuit. *Id.* at 31–32 (citing Ex. 1005, 10:30–33, Fig. 7). Thus, Petitioner asserts that the scan pulses have a period of the duration of the scan cycle. *Id.* at 32. Citing the testimony of Dr. Wright, Petitioner argues that the period of the scan pulse signal is inversely related to the frequency of the signal. *Id.* (citing Ex. 1003 ¶ 105). Based on this, Dr. Wright testifies that a person of ordinary skill in the art would have understood the scan signals to be a “periodic output signal” having a “predefined frequency.” *Id.* at 27 (citing Ex. 1003 ¶ 93).

Patent Owner asserts that Chiu does not teach “an oscillator providing a periodic output signal having a predefined frequency” because Chiu’s statement relied upon by Petitioner, “a signal generator 28 [is] configured to drive transmitting electrode 20 with a pulsating waveform,” describes prior art systems, rather than the illustrative embodiments of the Chiu invention. PO Resp. 34–35 (emphasis omitted). Patent Owner argues that “nothing in Chiu describes the signals depicted in Figure 7 as ‘pulsating,’ ‘periodic,’ ‘regular,’ or anything else that would suggest a repeating signal of ‘predefined’ frequency.” *Id.* at 35.

In response, Petitioner points out that Patent Owner’s declarant, Dr. Cairns, admitted during his deposition that Figure 7 of Chiu shows a periodic signal of a particular frequency. Reply 15 (citing Ex. 1033 (Cairns Dep. Tr.), 39:7–9 (“Q. If that period was related to the scan rate . . . would the signal on R0 be periodic? A. It can be periodic.”), 37:22–25¹² (“if this is showing the scan rate . . . it would be periodic, and it would have a frequency.”)). Petitioner also argues that Chiu clearly describes its signals as “pulsating.” *Id.* (citing Ex. 1005, 6:39–42).

Based on the complete record and for the reasons explained by Petitioner, we are persuaded that Petitioner has demonstrated sufficiently that Chiu teaches “an oscillator providing a periodic output signal having a predefined frequency,” as recited in claims 37, 94, and 105.¹³

¹² Petitioner erroneously cites to Ex. 1033, 41:4–13.

¹³ Petitioner also separately relies on Schwarzbach’s 150 kHz oscillator as disclosing the claimed “oscillator.” Pet. 27–28 (citing Ex. 1014, 9:8–32). Patent Owner asserts that Schwarzbach’s “150 kHz” oscillator is not used to generate scan signals to the keypad in Schwarzbach, but instead is used to

(3) “*a microcontroller using the periodic output signal from the oscillator*”

Claims 37, 94, and 105 each recite “a microcontroller using the periodic output signal from the oscillator.” Petitioner maps the recited “microcontroller” to microprocessor 90 of Chiu and argues that Chiu’s microprocessor generates a scan pulse at outputs R₀–R₅ coupled to rows a–f of capacitive touch cell array 10. Pet. 30 (citing Ex. 1005, 8:45–55). Because Chiu’s scan pulse is a “periodic output signal,” as discussed above, Petitioner asserts that Chiu’s microprocessor uses the scan pulse signal (the claimed “periodic output signal”) from the signal generator circuitry of microprocessor 90 (the claimed “oscillator”) to drive rows of touch cell array 10. *Id.*

Patent Owner does not specifically dispute that Chiu teaches “a microcontroller using the periodic output signal from the oscillator” recited in the challenged independent claims beyond its unpersuasive argument discussed in the previous subsection that Chiu does not teach the recited “oscillator.”

Based on the complete record and for the reasons explained by Petitioner, we are persuaded that Petitioner has demonstrated sufficiently

“send *control signals* over the building’s power lines, to the remote “slave units” that control lamps, etc.” PO Resp. 35–36 (citing Ex. 1014, 8:21–9:50). As discussed below in Section III.C.3.e, we agree with Patent Owner that Schwarzbach’s 150 kHz oscillator does not teach the claimed “oscillator” of the challenged independent claims because Schwarzbach’s carrier wave signal does not teach the “periodic output signal” provided to “input touch terminals,” as recited in the claims. *Id.* at 36–37 (citing Ex. 1014, 8:21–26, 9:20–21, Figs. 4A, 4B).

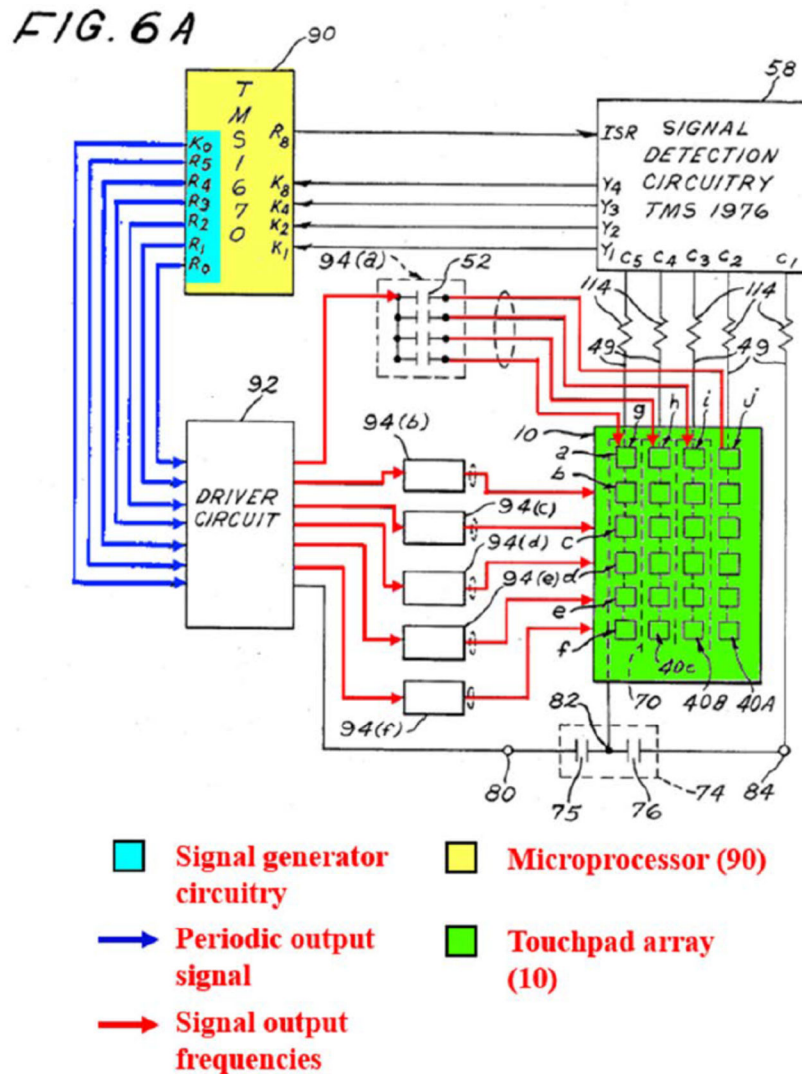
that Chiu teaches “a microcontroller using the periodic output signal from the oscillator,” as recited in claims 37, 94, and 105.¹⁴

(4) “the microcontroller selectively providing signal output frequencies to a closely spaced array of input touch terminals of a keypad”

Claims 37, 94, and 105 each recite “the microcontroller selectively providing signal output frequencies to a closely spaced array of input touch terminals of a keypad.” Referencing an annotated version of Figure 6A of Chiu, Petitioner contends that Chiu teaches this limitation (the “selectively providing limitation”).

¹⁴ We also find that Patent Owner has waived any argument directed to this claim limitation aside from contesting whether Chiu teaches the recited “oscillator.” See Paper 13, 7.

Figure 6A of Chiu, as annotated by Petitioner, is reproduced below.



Pet. 34. Annotated Figure 6A above shows Petitioner's identification of the claimed "microcontroller" (i.e., microprocessor 90, annotated in yellow); the claimed "array of input touch terminals of a keypad" (i.e., capacitive touch cell array 10, annotated in green); the claimed "periodic output signal" (i.e., scan pulse signal output from microprocessor 90 to driver circuit 92, annotated in blue); and the claimed "signal output frequencies" (i.e., signals

provided from driver circuit 92 to rows a–f of touch cell array 10, annotated in red) present in Chiu.

Referencing Figure 6A, Petitioner asserts that Chiu teaches “the microcontroller selectively providing signal output frequencies” to an “array of input touch terminals of a keypad” because Chiu describes that each of outputs R₀–R₅ of microprocessor 90 are “coupled to rows a–f of capacitive touch cell array 10” through driver circuit 92 and that driver circuit 92 amplifies the scan pulse signals and provides the amplified signals to the rows of capacitive touch cell array 10. Pet. 31 (citing Ex. 1005, 8:45–55, 9:20–25; Ex. 1003 ¶ 104). Petitioner also presents an annotated version of Figure 7 of Chiu (not reproduced herein) and argues that, as shown in Figure 7, the scan pulses generated on outputs R₀–R₅ of microprocessor 90 are *sequentially provided* to rows a–f of capacitive touch cell array 10 during the repeating scan cycles. *Id.* at 31–32 (citing Ex. 1005, 9:7–25, 10:31–34, Fig. 7). Citing the testimony of Dr. Wright, Petitioner asserts that a person of ordinary skill in the art would have understood that the repeating scan pulse signals on outputs R₀–R₅ are “selectively” provided to rows a–f of touch cell array 10. *Id.* at 32–33 (citing Ex. 1003 ¶ 105).

In addition, Petitioner asserts that Chiu teaches “a closely spaced array of input touch terminals of a keypad,” as recited in the challenged independent claims because Chiu describes that its techniques allow for “closer spacing of touch switch cells for greater switch density on” touch cell array 10. *Id.* at 33 (citing Ex. 1005, Abstract). Referencing Figure 6A, Petitioner further contends that Chiu describes the amplified scan pulse signals (the claimed “signal output frequencies”) being provided to

capacitive touch cell array 10 (the claimed “closely spaced array of input touch terminals.”) *Id.* at 33–34. Referencing Figures 5A and 5B of Chiu, Petitioner argues that Chiu’s touch pad 42 shown in those figures teaches the claimed “input touch terminals.” *Id.* at 34–36 (citing Ex. 1005, 6:31–48, Figs. 5A, 5B).

Patent Owner contends that Chiu does not teach the “selectively providing limitation” because “Chiu does *not* disclose providing a frequency, selected from multiple possible frequencies, to a touchpad. Chiu only discloses providing a scan signal with a *single* (unidentified) frequency to the touchpad.” PO Resp. 32. Patent Owner’s argument is predicated on its proposed construction of the claim term “the microcontroller selectively providing signal output frequencies to a closely spaced array of input touch terminals of a keypad.” Patent Owner’s argument is unpersuasive because we decline to adopt Patent Owner’s interpretation for the reasons discussed above in Section III.B.1.

As discussed in that section, we construe the term “the microcontroller selectively providing signal output frequencies to a[n] . . . array of input touch terminals of a keypad” to encompass “the microcontroller selecting a row or a portion of an array of touch terminals to provide signal output frequencies to the array.” We are persuaded by Petitioner’s argument and evidence that Chiu’s microprocessor 90 “selectively provid[es] signal output frequencies to a[n] . . . array of input touch terminals of a keypad” under this construction because, as argued by Petitioner and explained by Dr. Wright, Chiu describes that each of outputs R₀–R₅ of microprocessor 90 provides, through driver circuit 92, scan pulse

signals to the rows of capacitive touch cell array 10, where the scan pulses are sequentially (i.e., selectively) provided to rows a–f of touch cell array 10 during the repeating scan cycles. Pet. 31–33 (citing Ex. 1005, 8:45–55, 9:7–25, 10:31–34, Figs. 6A, 7; Ex. 1003 ¶¶ 104–105).

Patent Owner asserts that the Federal Circuit’s remand in the Samsung Appeal Opinion “requires ‘provid[ing] a frequency, selected from multiple possible frequencies,’ to the touch pad.” PO Resp. 32. As discussed in Section III.B.1. above, this requirement for frequency selection may be satisfied by the designer selecting the frequencies during the design stage, which the microcontroller provides to an array of touch terminals during operation. And there is no requirement that more than one frequency be selected.

Citing the deposition testimony of Patent Owner’s declarant, Dr. Cairns, as well as the declaration testimony of Petitioner’s declarant, Dr. Wright, Petitioner argues that, when a designer designs a circuit, such as the circuit described in Chiu, the circuit designer necessarily selects an oscillator with a particular frequency and designs the rest of the circuit to work with that selected frequency. Reply 13–14 (citing Ex. 1033, 29:1–16, 30:7–12; Ex. 1034 ¶¶ 11–12).

Patent Owner points out that Chiu does not specify the particular frequency of the scan pulses applied to the keypad, and does not disclose any selection criteria for the frequency, let alone the criteria discussed in the ’183 patent to “minimiz[e] contamination-based crosstalk between adjacent touch terminals.” PO Resp. 33–34. However, other than for claims such as dependent claims 98, 99, and 100, the broader claims do not specify any

particular frequency requirement. *See, e.g.*, Ex. 1001, Reexam. Cert. C2, 7:17–25. As the Federal Circuit held in the Samsung Appeal Opinion, and as discussed in Section III.B.1. above, claims such as claim 40 (at issue in that proceeding), and claims 37, 94, and 105 at issue here, do not impose requirements regarding how a frequency is selected, or require specific frequency values. 775 F. App’x at 697 n.2.

Patent Owner also argues that Schwarzbach discloses that the internal 500 kilohertz clock frequency of the microprocessor can be adjusted, and that the scan frequency of the pulses applied to the keypad of Schwarzbach is only 60 Hertz, as compared to the 500 kilohertz microprocessor clock frequency. Sur-reply 10–11. From this Patent Owner argues that the cited art does not disclose selecting a frequency, because “Chiu’s mere selection of the TMS 1670 microprocessor does not ‘select’ a frequency, because the TMS 1670 can scan at multiple different frequencies, and nothing in Chiu discloses the selection of a particular frequency.” *Id.* at 11.

We are not persuaded by Patent Owner’s argument. As discussed above in Section III.C.3.b(2), Petitioner maps the signal generator circuitry of Chiu’s microprocessor 90 to the claimed “oscillator providing a periodic output signal having a predefined frequency.” Pet. 22–27 (citing Ex. 1005, 4:49–50, 9:7–25, 8:1, Figs. 6A & 7; Ex. 1001, 13:33–39; Ex. 1003 ¶¶ 93–94, 96). Thus, even assuming the implementation details of Schwarzbach’s microprocessor also apply to Chiu, at one point in time the signal generator circuitry of Chiu’s microprocessor 90 would have been configured to generate the scan pulses at some frequency, which would be a selected

frequency.¹⁵ Likewise, regardless of the relationship between the microprocessor clock frequency and the scan pulse frequency, once the designer determines that relationship, the pulse frequency would also be selected.

Patent Owner also argues that Chiu would not have taught or suggested the requirement that the signal output frequencies are provided to a “closely spaced array,” because, according to Patent Owner, this requirement “means that the array must be sufficiently closely-spaced that, if high frequencies were not used, surface contamination would cause significant crosstalk between adjacent terminals.” PO Resp. 38 (citing Ex. 2004 ¶ 106) (emphasis omitted). As discussed in Section III.B.2. above, this interpretation of “closely space array” is without merit.

Based on the complete record and for the reasons explained by Petitioner, we are persuaded that Petitioner has demonstrated sufficiently that Chiu teaches “the microcontroller selectively providing signal output frequencies to a closely spaced array of input touch terminals of a keypad,” as recited in claims 37, 94, and 105.

(5) Touch Terminals Limitations

Claims 37, 94, and 105 each recite “the input touch terminals comprising first and second input touch terminals” and “the first and second touch terminals defining areas for an operator to provide an input by proximity and touch.” Ex. 1001, Reexam. Cert. C1, 2:51–54 (claim 37); *id.*,

¹⁵ Also, the adjustability that Schwarzbach refers to involves ensuring that the microprocessor clock frequency is “*exactly 500 Khz.*” Ex. 1014, 8:16–20 (emphasis added).

Reexam. Cert. C2, 6:50–51, 6:54–56 (claim 94), 7:49–50, 7:55–57 (claim 105).

Petitioner cites the disclosures in Chiu describing an array of touch sensitive switch cells and touch pads and asserts that Chiu teaches these limitations (the “touch terminals limitations”). Pet. 37–38 (citing Ex. 1005, Abstract, 4:1–9, Fig. 5A). Patent Owner does not dispute Chiu teaches these touch terminals limitations. *See* PO Resp. 32–49.

Based on the complete record and for the reasons explained by Petitioner, we are persuaded that Petitioner has demonstrated sufficiently that Chiu teaches “the input touch terminals comprising first and second input touch terminals” and “the first and second touch terminals defining areas for an operator to provide an input by proximity and touch,” as recited in claims 37, 94, and 105.¹⁶

(6) Detector Circuit Limitations

Claim 37 recites

a detector circuit coupled to said oscillator for receiving said periodic output signal from said oscillator, and coupled to said first and second touch terminals, said detector circuit being responsive to signals from said oscillator via said microcontroller and a presence of an operator’s body capacitance to ground coupled to said first and second touch terminals when proximal or touched by the operator to provide a control output signal for actuation of the controlled device, said detector circuit being configured to generate said control output signal when the operator is proximal or touches said second touch terminal after the operator is proximal or touches said first touch terminal.

¹⁶ We also find that Patent Owner has waived any argument directed to these claim limitations. *See* Paper 13, 7.

Ex. 1001, Reexam. Cert. C1, 2:55–67 (the “detector circuit limitation”). Claims 94 and 105 recite essentially identical limitations. *Id.*, Reexam. Cert. C2, 6:57–7:2 (claim 94), 7:58–8:10 (claim 105).

An example of this claim requirement is disclosed in the ’183 patent as the combination of touch circuit 400, shown in detail in Figure 8, and portions of microcontroller 500. Ex. 1001, Figs. 4, 8, 11. Both touch circuit 400 and microcontroller 500 receive the periodic output signal from oscillator 200. *Id.* at 12:17–22. The detector circuit is also coupled to each of the touch terminals 900 depicted in Figure 11. *Id.* at 18:39–44. When a touch terminal is touched, the detector circuit is triggered and provides an output to microcontroller 900. *Id.* at Figs. 4, 8, 11, 12:24–28, 15:30–47. Depending on which touch pads are touched, the microcontroller outputs appropriate control signals, including a control signal triggered by successively touching two particular switches in a given order. *Id.* at 6:27–30, 12:29–32.

As Petitioner establishes, Chiu discloses a similar arrangement that embodies the detector circuit limitation: signal detection circuitry 58 and portions of microprocessor 90 depicted in Figure 6A. Pet. 39–46 (citing Ex. 1005, Fig. 6A, 8:63–68, 10:46–51; Ex. 1003 ¶¶ 115–123). The detection circuitry is implemented in an integrated circuit, which is coupled to the oscillator within microprocessor 90 (as discussed in Section III.C.3.b(2) above), via scan pulses from microprocessor outputs R₀–R₅, applied to the touch cell array, and then to inputs C₁–C₅ of the detection circuitry. Pet. 39–40 (citing Ex. 1005, 8:63–68, Fig. 6A; Ex. 1003 ¶ 115). Depending on which cells are touched, the detection circuitry outputs corresponding

signals to inputs K₁, K₂, K₄, and K₈ of microprocessor 90. Ex. 1005, 8:56–9:6, 9:43–47, 9:54–10:19. Microprocessor 90 initiates the appropriate programmed response to the touching of a particular pad. *Id.* at 10:50–51. According to Petitioner, Chiu also describes that the “body capacitance of the user, which is added to the switch circuit when a touch pad is touched,” affects a scan signal, which is then used to “signify[] to the associated control circuitry that the pad has been touched.” Pet. 42–43 (citing Ex. 1005, 4:17–26, 4:65–5:1, Figs. 2A, 2B). Petitioner contends, therefore, Chiu teaches “a detector circuit coupled to said oscillator for receiving said periodic output signal from said oscillator, and coupled to said first and second touch terminals, said detector circuit being responsive to signals from said oscillator via said microcontroller and a presence of an operator’s body capacitance to ground coupled to said first and second touch terminals when proximal or touched by the operator to provide a control output signal for actuation of the controlled device,” as recited in claim 37 and similarly recited in claims 94 and 105. *Id.* at 39–44.

Addressing the recitation “said detector circuit being configured to generate said control output signal when the operator is proximal or touches said second touch terminal after the operator is proximal or touches said first touch terminal” of the “detector circuit limitation,” Petitioner asserts that Chiu teaches that its “signal detector circuit” generates an “output signal” (the claimed “control output signal”) after a touch pad is touched by a user because Chiu describes

if a touch pad in a row being scanned is touched, the signal detector circuit will detect a change in the level of the scanned signal for that column containing the touched pad and generate a

“coded output signal coupled to microprocessor 90 [to] indicate[] which column, if any, contains a touched pad.

Id. at 44 (citing Ex. 1005, 8:63–68). Petitioner relies on Figure 1 of Chiu (not reproduced herein) and accompanying text in the specification of Chiu describing the operation of a capacitive touch panel for controlling an electric cooking range to argue that Chiu’s signal detector circuit generates an output signal “when the operator is proximal or touches said second touch terminal after the operator is proximal or touches said first touch terminal.” Citing the testimony of Dr. Wright, Petitioner asserts that a person of ordinary skill in the art would have understood that that the “HI” button (“second touch terminal”) shown in Chiu’s Figure 1 would respond to a user’s touch or proximity to turn on the device at a high power level only after the user touched or was proximal to the “ON” button (a first touch terminal) to turn on a particular appliance. *Id.* at 44–46 (citing Ex. 1005, Fig. 1, 8:63–68; Ex. 1019, 5:12–29; Ex. 1003 ¶¶ 121–123).

Patent Owner does not dispute Chiu teaches the “detector circuit limitation.”

Based on the complete record and for the reasons explained by Petitioner, we are persuaded that Petitioner has demonstrated sufficiently that Chiu teaches the “detector circuit limitation” recited in claims 37, 94, 105.¹⁷

¹⁷ We also find that Patent Owner has waived any argument directed to these claim limitations. *See* Paper 13, 7.

c. Independent Claim 94

In addition to the common limitations, claim 94 also recites “wherein the selectively providing comprises the microcontroller selectively providing a signal output frequency to each row of the closely spaced array of input touch terminals of the keypad.” Ex. 1001, Reexam. Cert. C2, 6:46–50. Claim 105 recites an identical limitation. *Id.* at 7:51–54.

Petitioner relies on Chiu to teach the limitation of this wherein clause. Similar to Petitioner’s contentions on the “selectively providing” limitation discussed above, Petitioner relies on Figure 6A of Chiu to teach that the signal output frequency is “selectively” provided to “each row” of the array of touch terminals. Pet. 49–50. Referencing another annotated version of Figure 6A (not reproduced herein), Petitioner asserts that microprocessor 90 (the claimed “microcontroller”) controls driver circuit 92 to *sequentially* (i.e., “selectively”) generate respective scan pulses for each microcontroller outputs R₀–R₅ to provide a signal output frequency to each rows of input touch terminals of touchpad 10 via capacitor banks 94(a)–94(f). *Id.* (citing Ex. 1005, 8:45–55, Fig. 6A).

Patent Owner does not specifically dispute Chiu teaches the limitation of this wherein clause aside from contesting that Chiu teaches the “selectively providing limitation,” which the wherein clause modifies. *See* PO Resp. 32–49.

Based on complete the record and for the reasons explained by Petitioner, we are persuaded that Petitioner has demonstrated sufficiently that Chiu teaches “the microcontroller selectively providing a signal output

frequency to each row of the closely spaced array of input touch terminals of the keypad,” as recited in claims 94 and 105.

Claim 94 also recites “wherein a peak voltage of the signal output frequencies is greater than a supply voltage.”¹⁸ Ex. 1001, Reexam. Cert. C2, 6:51–53. Petitioner contends that the combination of Chiu and Schwarzbach teaches this limitation. Pet. 51–53.

As discussed above, Petitioner asserts that Schwarzbach describes a “supply voltage of approximately +16 volts is supplied to the microprocessor 100,” which is the same TMS 1670 microprocessor used by Chiu. *Id.* at 29 (citing Ex. 1014, 6:6–9, 15:62–63). Petitioner also contends that Chiu teaches the driver circuitry amplifies the pulse signals to a peak voltage of “30 volts.” *Id.* at 51 (citing Ex. 1005, 9:20–23). Thus, Petitioner argues that, in the proposed combination of Chiu and Schwarzbach, the peak voltage of the amplified pulse signals (the claimed “signal output frequencies”) produced by the driver circuitry of Chiu is greater than the supply voltage of the TMS 1670 microprocessor (the claimed “microcontroller”). *Id.* at 51–52.

Petitioner contends that a person of ordinary skill in the art would have been motivated to modify Chiu to use the supply voltage of

¹⁸ As discussed above in Section III.B.3., we adopt the parties’ agreed construction that the term “supply voltage” recited in claim 94 means “a supply voltage of the microcontroller.” Pet. 12–14, 51; PO Resp. 44–45. Although claim 94 does not expressly recite that the “supply voltage” is for the microcontroller, for purposes of this Decision, we need not resolve the issue of whether the recited “supply voltage” is for the “oscillator” or the “microcontroller,” because, as discussed above, Petitioner maps both to the same chip in Chiu. *See* Pet. 22–24, 30–31.

Schwarzbach because both references use the same TMS 1670 microprocessor. *Id.* at 19. Petitioner argues that because Chiu does not teach any particular supply voltage for the microprocessor, a person of ordinary skill in the art would have looked to well-known supply voltages used with the specific microprocessor described in Chiu—such as the supply voltage described in Schwarzbach. *Id.* (citing Ex. 1005, 9:7–9, Fig. 6A; Ex. 1014, 4:50–5:1; Ex. 1003 ¶ 83).

Patent Owner argues that this claim requirement is not met by the combination of Chiu and Schwarzbach, because the relevant “‘peak voltage’ is the voltage of the signal output by the microprocessor 90, not by the ‘driver circuitry 92.’” PO Resp. 47. Patent Owner further argues that Chiu does not disclose the output voltage of microprocessor 90, and therefore Petitioner has failed to prove that it is greater than the 16 volt supply voltage as required by the claim. *Id.* at 48; Sur-reply 17–18.

As discussed in Section III.B.3. above, we construe the term “peak voltage of the signal output frequencies” to mean “the peak voltage of the signal provided to the array of touch terminals.” Under this construction, we agree with Petitioner that the combination of Chiu and Schwarzbach teaches “a peak voltage of the signal output frequencies is greater than a supply voltage,” as recited in claim 94, because Chiu describes that the voltage provided to the touch terminals is 30 volts, which is greater than Schwarzbach’s supply voltage of 16 volts.

Patent Owner also challenges Petitioner’s reliance on Schwarzbach for the supply voltage value because it is an “*unrelated US patent*” that “has nothing to do with capacitive touch pads,” and because Schwarzbach

discloses at least two supply voltages that are provided to the TMS 1670 microprocessor: a “V_{DD} supply” of 16 volts and a “V_{SS} supply” of 25 volts. PO Resp. 40, 42 (*citing* Ex. 1014, 6:5–24). However, Petitioner is simply using Schwarzbach as a logical source that one of ordinary skill would have referenced to determine the actual supply voltage value used for the TMS 1670 microprocessor disclosed in Chiu, since Chiu does not disclose that implementation detail. Pet. 19 (*citing* Ex. 1003 ¶ 83). As Patent Owner observes, Petitioner could just as well have referenced the manufacturer’s data sheet for the TMS 1670—even further removed from the subject matter of Chiu. PO Resp. 40–41.

Patent Owner also characterizes Schwarzbach as giving “conflicting information” about the supply voltage, given that two voltage values are provided. *Id.* at 41. But, as shown in Figure 4B of Schwarzbach, the TMS 1670 has separate V_{DD} and V_{SS} inputs, and so there is no conflict. Ex. 1014, Fig. 4B. Significantly, the claim limitation at issue only requires “a supply voltage” to be less than a peak voltage, and so there is nothing erroneous about Petitioner focusing on the V_{DD} value for purposes of its challenge. And in any event the 25 volt V_{SS} supply is also less than the 30 volt peak voltage of Chiu.¹⁹

Patent Owner also argues that Petitioner has not proved a reasonable expectation of success in combining Chiu with Schwarzbach, because

¹⁹ In addition, inputs labeled “V_{DD}” typically denote the supply voltage of an electronic component, whereas inputs labeled “V_{SS}” typically denote a connection to ground. Ex. 1033, 10:20–11:3. Thus, one of ordinary skill would have looked first to the V_{DD} value of Schwarzbach in selecting the supply voltage in Chiu. Reply 17–18.

Petitioner only asserts that a person of ordinary skill would have applied the 16 volt V_{DD} signal to the TMS 1670 microprocessor of Chiu, whereas that chip also requires the V_{SS} voltage input. PO Resp. 42–43; Sur-reply 13–14. Patent Owner asserts that “Apple has made no effort to explain how the TMS 1670 microprocessor could be powered by a single supply voltage.” Sur-reply 14.

Petitioner does not contend, however, that a V_{SS} voltage input would not be provided to the microprocessor or that the TMS 1670 microprocessor would be powered by a single supply voltage. Indeed, Petitioner argues that Patent Owner’s declarant, Dr. Cairns, admitted during his deposition, the abbreviation “ V_{DD} ” denotes a supply voltage, and the abbreviation “ V_{SS} ” denotes a ground voltage. Reply 18 (citing Ex. 1033, 10:20–11:3). Patent Owner does not cite, nor do we discern, anything in the record that indicates Petitioner asserting or suggesting no ground voltage would be provided in Petitioner’s combination of Chiu and Schwarzbach. Patent Owner’s argument is unpersuasive because it appears to be directed to an argument Petitioner did not make.

Based on the complete record and for the reasons explained by Petitioner, we determine that Petitioner has shown by a preponderance of the evidence that the subject matter of claim 94 of the ’183 patent would have been obvious over the combination of Chiu and Schwarzbach.

d. Independent Claim 105

In addition to the common limitations, claim 105 also recites “wherein the selectively providing comprises the microcontroller selectively providing a signal output frequency to each row of the closely spaced array of input

touch terminals of the keypad.” Ex. 1001, Reexam. Cert. C2, 7:51–54. As discussed above, claim 94 recites an identical limitation. *Id.* at 6:51–53. Thus, for the same reasons discussed above for claim 94, we are persuaded that Petitioner has demonstrated sufficiently that Chiu teaches “the microcontroller selectively providing a signal output frequency to each row of the closely spaced array of input touch terminals of the keypad,” as recited in claim 105.

Beyond the common limitations discussed above and this wherein clause, claim 105 recites no further limitations. *See* Ex. 1001, Reexam. Cert. C2, 7:42–8:10. As discussed above, Petitioner relies on Chiu to teach all of the identical or nearly identical limitations common to the challenged independent claims. Thus, as discussed in our Institution Decision, Petitioner relies on Chiu alone to teach all limitations of claim 105. Inst. Dec. 48.

In the Patent Owner Response, Patent Owner asserts “[w]hile Apple potentially could have argued obviousness based on Chiu alone, it did not.” PO Resp. 44. Patent Owner argues that “Apple did not assert a theory of obviousness over Chiu alone” and, therefore, “the Board may not ‘deviate from the grounds in the petition and raise its own obviousness theory’ based on Chiu alone.” *Id.*

Patent Owner, however, does not identify which specific combined teachings of Chiu and Schwarzbach it disputes with respect to claim 105 (aside from contesting Chiu teaches the limitations of claim 105). *See id.* at 43–44. In the Petition, Petitioner indicates that it relies on Chiu and Schwarzbach for the recited “microcontroller” because both references

describe using the same TMS 1670 processor. Pet. 17, 19. Indeed, Patent Owner recognizes that Petitioner separately relies on Chiu and Schwarzbach for their disclosure of the TMS 1670 processor. *See* Sur-reply 10–11. Although Patent Owner argues that “Chiu Does Not Disclose ‘Selectively Providing Signal Output Frequencies,’”²⁰ Patent Owner does not dispute that Chiu and Schwarzbach, either separately or in combination, teaches the claimed “microcontroller.” *Id.*

To the extent Patent Owner argues Petitioner must establish the motivation to combine Chiu and Schwarzbach with respect to claim 105, we determine Petitioner has demonstrated sufficiently that a person of ordinary skill in the art would have been motivated to combine the teachings of the TMS 1670 processor from Chiu and Schwarzbach for the reasons discussed above with respect to claim 94.

Regarding Patent Owner’s argument on the “theory of obviousness over Chiu alone,” although we recognize that it would “not be proper for the Board to deviate from the grounds in the petition and raise its own obviousness theory,” *Sirona Dental Systems GmbH v. Institut Straumann AG*, 892 F.3d 1349, 1356 (Fed. Cir. 2018), such is not the case here. We need not recite the grounds from the Petition *in haec verba* as long as we rely on the discussion in the Petition and on the same citations from the prior art and, in doing so, do not change unpatentability theories from those of the Petition. *See id.* In any event, Patent Owner’s argument is moot because, for the reasons discussed above, Petitioner demonstrates sufficiently that the

²⁰ As discussed above in Section III.C.3.b(4), we find Patent Owner’s argument unpersuasive.

combination of Chiu and Schwarzbach teaches or renders obvious all limitations of claim 105 and also sufficiently establishes the motivation to combine.

Based on the complete record, we determine that Petitioner has demonstrated, by a preponderance of the evidence, that claim 105 is unpatentable under § 103(a) over the combination of Chiu and Schwarzbach.

e. Independent Claim 37

In addition to the common limitations, claim 37 recites “wherein an oscillator voltage is greater than a supply voltage.” Ex. 1001, Reexam. Cert. C1, 2:46–47. Petitioner relies on Schwarzbach to teach this limitation. Pet. 28–30.

As discussed above in Section III.B.5., Petitioner implicitly assumes “oscillator voltage” means the output voltage of an oscillator. Pet. 29. Patent Owner agrees with this implicit construction. PO Resp. 44. And, as discussed above in Section III.C.3.b(2), Petitioner maps the “oscillator” recited in claim 37 to the signal generator circuitry Chiu’s microprocessor 90 that generates the periodic scan pulse signals. Pet. 24–25 (citing Ex. 1005, 8:1, 9:7–25, Figs. 6A & 7; Ex. 1001, 13:33–39; Ex. 1003 ¶¶ 93–94). Petitioner argues that Chiu’s microprocessor 90 is “a TMS 1670 microprocessor commercially available from Texas Instruments Incorporated.” *Id.* at 28 (citing Ex. 1005, 9:7–9).

Petitioner asserts that Schwarzbach describes that a “supply voltage of approximately +16 volts is supplied to the microprocessor 100,” which is the same TMS 1670 microprocessor used by Chiu. *Id.* at 29 (citing Ex. 1014, 6:6–9, 15:62–63). Petitioner also contends that Schwarzbach teaches “an

oscillator voltage” that is “greater than a supply voltage” because Schwarzbach describes that “the TMS 1670 microprocessor *includes a ‘transmitter/modulator [110]’* that functions as a ‘150 KHz oscillator’” the output of which is “18 volts,” which is greater than the 16 volt supply voltage. *Id.* (emphasis added) (citing Ex. 1014, 9:33–48).

Patent Owner asserts that Schwarzbach’s “150 kHz” oscillator is not used to generate scan signals to the keypad in Schwarzbach, but instead is used to “send *control signals* over the building’s power lines, to the remote “slave units” that control lamps, etc.” PO Resp. 35–36 (citing Ex. 1014, 8:21–9:50). Patent Owner argues that “Schwarzbach’s 150 kHz carrier wave signal has *nothing to do* with scanning Schwarzbach’s keypad,” and, therefore, cannot be the “periodic output signal” provided to “input touch terminals,” as recited in the claims. *Id.* at 36–37 (citing Ex. 1014, 9:20–21, 8:21–26, Figs. 4A, 4B).

We agree with Patent Owner that Petitioner’s has presented no evidence that in Schwarzbach, transmitter/modulator 110 is included in the TMS 1670 microprocessor. In the portion of Schwarzbach cited by Petitioner, Schwarzbach describes that “[t]he *central control unit 30* also *includes a transmitter/modulator*, generally designated by the numeral 110, for transmitting signals to the remote slave units 200, 300 and 400.” Ex. 1014, 8:21–24 (emphases added), Fig. 4A. As discussed above, Figures 1 and 4B of Schwarzbach describe that central control unit 30 is a controller box that includes electrical circuit 50, which in turn includes the TMS 1670 microprocessor. *Id.* at 3:66–4:1, 4:9–11, Figs. 1 & 4B. Although Figure 4B shows that the TMS 1670 microprocessor is included in electrical

circuit 50 of Schwarzbach, there is no indication in Schwarzbach that transmitter/modulator 110, which is separately depicted in Figure 4A, is included in the TMS 1670 microprocessor, as Petitioner contends.

In disputing Petitioner's contention, Patent Owner provides a detailed analysis of Schwarzbach's Figures 4A and 4B, supported by declaration testimony from Dr. Cairns, and persuasively argues that transmitter/modulator 110 is on a different portion of Schwarzbach's circuit from the keypad (which includes the TMS 1670 microprocessor). PO Resp. 36–37 (citing Ex. 1014, 8:21–26, 9:20–21, Figs. 4A, 4B; Ex. 2004 ¶¶ 100–102). Thus, Patent Owner argues that “Schwarzbach's transmitter/modulator 110 is not part of the TMS 1670 microprocessor – rather, it is a *completely separate* part of Schwarzbach's circuit, which is *wholly uninvolved* in scanning the keypad. *Id.* at 45 (citing Ex. 2004, ¶¶ 121–122). Patent Owner further argues that, Dr. Wright, Petitioner's declarant, has admitted that Schwarzbach's transmitter/modulator 110 is not used to scan the keyboard. *Id.* at 37 (citing Ex. 2003, 267:1–13).

Based on the complete record, we agree with Patent Owner that Petitioner does not demonstrate sufficiently that the proposed combination of Chiu and Schwarzbach teaches or renders obvious “an oscillator voltage is greater than a supply voltage,” as recited in claim 37.

In its Reply, Petitioner contends that it describes how Schwarzbach teaches “an oscillator voltage is greater than a supply voltage” in “overview sections presented prior to the analysis of the individual elements of the claims of the '183 patent.” Reply 19 (citing Pet. 17–21). Petitioner asserts that its arguments based on transmitter/modulator 110 of Schwarzbach

discussed above are “secondary arguments” and that its “core” argument is presented in the overview sections of the Petition that describe the combination. *Id.* at 20.

In the purported “overview sections” of the Petition, however, we do not discern any discussion of “an oscillator,” “an oscillator voltage,” or “an oscillator voltage” being greater than a “supply voltage.” *See* Pet. 17–21. As discussed above, Petitioner relies on an implicit construction of “oscillator voltage” to mean the output voltage of an oscillator. *Id.* at 29. No such construction is suggested or mentioned in the “overview sections” cited by Petitioner, so it is not apparent that in that section Petitioner makes the alleged “core” argument that the combination of Chiu and Schwarzbach teaches or renders obvious the limitation “an oscillator voltage is greater than a supply voltage.” *See id.* at 17–21. Nor do we find Petitioner’s alleged “core” argument included in its analysis of the limitation of claim 37 at issue here. *See id.* at 28–30.

Patent Owner asserts that the Petition was required to contain detailed identification of “where each element of the claim is found in the prior art” under 37 C.F.R. § 42.104(b)(4) and that Petitioner’s explanations about the alleged “core” and “secondary” arguments amount to rewriting the Petition after institution. Sur-reply 14. We agree with Patent Owner that the Petition, as presented, does not explain adequately how the combination of Chiu and Schwarzbach teaches or renders obvious the limitation “an oscillator voltage is greater than a supply voltage.”

A petition for *inter partes* review (“IPR”) must identify “with particularity, each claim challenged, the grounds on which the challenge to

each claim is based, and the evidence that supports the grounds for the challenge to each claim.” 35 U.S.C. § 312(a)(3); *see also* 37 C.F.R. § 42.104(b) (specifying necessary elements of a petition). As the Federal Circuit has explained, “[i]n an IPR, the petitioner has the burden *from the onset* to show with particularity why the patent it challenges is unpatentable.” *Harmonic*, 815 F.3d at 1363 (emphasis added) (citing 35 U.S.C. § 312(a)(3)); *see also* *Intelligent Bio-Sys., Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1369 (Fed. Cir. 2016) (“It is of the utmost importance that petitioners in the IPR proceedings adhere to the requirement that the initial petition identify ‘with particularity’ the ‘evidence that supports the grounds for the challenge to each claim.’” (quoting 35 U.S.C. § 312(a)(3))). Under the particular facts and circumstances in this case, we decline to consider Petitioner’s argument in the Reply that was not present in the Petition.

Based on the complete record, we determine that Petitioner has not proven by a preponderance of the evidence that the subject matter of claim 37 of the ’183 patent would have been obvious over the combination of Chiu and Schwarzbach.

f. Dependent Claim 101

Claim 101 depends from claim 94 and further recites “wherein the supply voltage is a battery supply voltage.” Ex. 1001, Reexam. Cert. C2, 7:26–28. In its challenge to claim 101, Petitioner relies on the disclosure in Schwarzbach of the option to use a backup battery to “retain any information stored in the microprocessor 100 when the AC power fails.” Pet. 56 (citing Ex. 1014, 19:51–55; Ex. 1003 ¶ 133). Citing the testimony of Dr. Wright,

Petitioner asserts that a person of ordinary skill in the art would have been motivated to add such a feature to make Chiu's appliance more resilient in the event of power failures, and to avoid inconvenient user experiences, such as having to reset the temperatures of the various cooking surfaces in response to a power failure. *Id.* at 20 (citing Ex. 1014, 19:51–55; Ex. 1003 ¶ 85). Petitioner additionally argues that adding battery power would allow Chiu's microprocessor to continue to sequentially drive the touch pads on the keypad, and therefore allow it to continue to accept touch input. *Id.* (citing Ex. 1003 ¶ 85).

Relying on the testimony of Dr. Wright, Petitioner further asserts that a person of ordinary skill in the art would have been motivated to combine Chiu and Schwarzbach in the manner proposed by Petitioner because both references use the same TMS 1670 microprocessor and because the use of a backup battery in case of power failure was a well-known option. *Id.* at 19–21 (citing Ex. 1003 ¶¶ 83–87).

Patent Owner argues that the backup battery in Schwarzbach is only used “to preserve information in volatile memory, in the event of a power failure,” whereas the claimed battery supply voltage must be able to provide power to microprocessor for full operation, including sending scan signals to the keypad. PO Resp. 49–50 (citing Ex. 1014, 6:33–37, 19:50–58; Ex. 2004 ¶ 130). In addition, Patent Owner argues that one of ordinary skill would not have been motivated to combine Schwarzbach's backup battery with Chiu because the purpose of the backup battery of Schwarzbach is to preserve volatile memory and Chiu does not use volatile memory. *Id.* at 50–51 (citing Ex. 2004 ¶ 132).

Petitioner, however, presents deposition testimony from Patent Owner's declarant, Dr. Cairns, that use of backup batteries to supply the voltage needed to operate microprocessors or other electronic circuitry was well-known in the field at the time of the '183 patent. Reply 23–24 (citing Ex. 1033, 11:16–22, 13:9–13, 13:18–19, 13:25–14:4 (“Q. Devices existed at the time of the '183 patent that would use a battery to supplement mains power in the event of a failure, correct? A. Yes.”). Patent Owner does not dispute this testimony. *See* Sur-reply 18–19.

Based on the complete record, we determine that Petitioner has demonstrated, by a preponderance of the evidence, that the subject matter of claim 105 would have been obvious over the combination of Chiu and Schwarzbach.

g. Dependent Claims 96 and 106

Claim 96 depends from claim 94 and further recites “wherein each signal output frequency selectively provided to each row of the closely spaced array of input touch terminals of the keypad has a same Hertz value.” Ex. 1001, Reexam. Cert. C2, 7:8–11. Claim 106 depends from claim 105 and similarly recites “wherein each signal output frequency selectively provided to each row of the closely spaced array of input touch terminals of the keypad has a same Hertz value.” *Id.* at 8:11–14.

In challenging these claims as obvious over Chiu and Schwarzbach, Petitioner relies on the fact that Figure 7 of Chiu discloses the use of a single frequency to generate the scan pulses applied to the touch cell array, as discussed in Section III.C.3.b(2) above. Pet. 54–55 (citing Ex. 1005, 10:31–51, Fig. 7; Ex. 1003 ¶ 131), 58.

Patent Owner does not respond specifically to Petitioner’s challenge to claims 96 and 106 beyond Patent Owner’s arguments advanced with respect to the challenged independent claims discussed above. *See* PO Resp. 32–49.

Based on the complete record and for the reasons explained by Petitioner, we are persuaded that Petitioner has demonstrated by a preponderance of the evidence that the subject matter of claims 96 and 106 of the ’183 patent would have been obvious over the combination of Chiu and Schwarzbach.²¹

*D. Claims 97–99 and 107–109 as Obvious over
Chiu, Schwarzbach, and Meadows*

Claims 97–99 depend from claim 94, and claims 107–109 depend from claim 105. Claims 97 and 107 each recite “wherein each signal output frequency selectively provided to each row of the closely spaced array of input touch terminals of the keypad is selected from a plurality of Hertz values.” Ex. 1001, Reexam. Cert. C2, 7:12–16 (claim 97), 8:15–19 (claim 107). Claims 98, 99, 108, and 109 depend from claims 97 or 107, and further recite that plurality of Hertz values are “greater than 50 kHz” (claims 98 and 108) or “greater than 100 kHz” (claims 99 and 109). *Id.* at 7:17–22 (claims 98 and 99), 8:20–25 (claims 108 and 109). Petitioner contends that

²¹ We also find that Patent Owner has waived any argument directed to claims 96 and 106 aside from contesting the obviousness challenge to independent claims 94 and 105 based on the combination of Chiu and Schwarzbach. *See* Paper 13, 7.

claims 97–99 and 107–109 are unpatentable as obvious over the combination of Chiu, Schwarzbach, and Meadows. Pet. 67–73.

1. Overview of Meadows (Ex. 1013)

Meadows describes a capacitive touch panel system that includes a position measurement apparatus to generate an address signal indicative of the position of a stylus touching the touch panel. Ex. 1013, Abstract. The position measurement apparatus includes a position measurement signal source that generates a square-wave measurement signal. *Id.* In Meadows, a microprocessor of the touch panel system generates a pseudo-random number signal that is delivered to the position measurement signal source. *Id.* at 4:25–28. In response to the pseudo-random number signal, the measurement signal source generates a measurement signal with a frequency of between 150 kHz and 250 kHz in accordance with the value of the pseudo-random number. *Id.* at 4:28–32. Meadows also describes that the position measurement signal source includes a voltage controlled oscillator and a digital-to-analog converter connected to the voltage controlled oscillator that operate in conjunction to generate a measurement signal of a frequency corresponding to the value of the pseudo-random number received from the microprocessor. *Id.* at 7:27–42, Fig. 3.

2. Discussion

In its proposed combination of Chiu and Meadows, Petitioner proposes to *replace* the “oscillator of Chiu” *with* the “voltage controlled oscillator” described in Meadows (Pet. 69 (citing Ex. 1013, 7:34–38)) to “generate a pseudo-random number and provide a periodic output signal

with a frequency selected from the range of 150 and 250 kHz in accordance with the value of the pseudo-random number” (*id.* at 68 (citing Ex. 1013, 4:19–32; Ex. 1003 ¶ 150)). According to Petitioner,

Periodically, such as after a predetermined time interval or in response to a particular condition, the combined touch circuit generates a new pseudo-random number, selects a new frequency from the range based on the pseudo-random number, and provides a periodic output signal with the new frequency to the touch terminals described in Chiu.

Id. (citing Ex. 1013, 4:19–32; Ex. 1003 ¶ 150). In the proposed combination, the microprocessor of Chiu is modified based on the teachings of Meadows of a microprocessor that “generates a pseudo-random number signal that is delivered to an input” of the voltage controlled oscillator. *Id.* at 69 (citing Ex. 1013, 4:25–32). “In response to the pseudo-random number signal,” the voltage controlled oscillator “generates [a] measurement signal with a frequency of between 150 and 250 kHz in accordance with the value of the pseudo-random number.” *Id.* (citing Ex. 1013, 4:27–32). Petitioner would use this randomly varying measurement signal frequency to generate the signals provided to the touch circuit of Chiu “in the same manner as the signal from the oscillator described in Chiu.” *Id.* (citing Ex. 1003 ¶ 151).

Petitioner argues that a person of ordinary skill in the art would have been motivated to modify the touch circuit of Chiu and Schwarzbach based on the teachings of Meadows, as proposed, in order to “reduce the susceptibility of the touch circuit to electromagnetic noise,” and “generate[] reduced amounts of electromagnetic noise.” Pet. 70 (citing Ex. 1013, 3:9–11; Ex. 1003 ¶ 153). Petitioner’s declarant, Dr. Wright, testifies that “[t]he results of the combination would have been predictable

because Meadows describes the use of its techniques in a touch circuit like the one described in the combination of Chiu and Schwarzbach, operating in the same frequency range as an oscillator described in Schwarzbach (150 khz).”²² Ex. 1003 ¶ 153 (citing Ex. 1014, 9:20–24; Ex. 1013, 2:27–29, 3:29–63, 4:19–32). In addition, Dr. Wright opines that the use of a microprocessor to generate random numbers was well-known at the time of Chiu. *Id.* (citing Ex. 1028, 10:14–16; Ex. 1029, 2:35–37).

Patent Owner challenges the motivation to combine, given that Meadows randomly varies the measurement signal to eliminate interference from the noise generate by the flyback pulses generated by the CRT display used in Meadows, which is not used in Chiu. PO Resp. 53–55 (citing Ex. 1013, 3:29–37, 6:10–48; Ex. 2004 ¶¶ 139–143). Patent Owner also argues that the proposed combination would have involved unduly complex redesign, acting as a disincentive to any combination, particularly given the absence of any flyback pulse interference problem in Chiu, and negating any reasonable expectation of success in making the combination on the part of one of ordinary skill. *Id.* at 55 (citing Ex. 2004 ¶¶ 144–145). In particular, Patent Owner argues the combination would require: (i) replacing the internal oscillator in the TMS 1670 microprocessor with an external voltage controlled oscillator; (ii) reprogramming the ROM in the microprocessor to generate and output random numbers; (iii) implementing a digital-to-analog

²² As discussed in Section III.C.3.b(2) above, Petitioner’s expert’s reliance on Schwarzbach’s 150 kHz oscillator is unpersuasive, because that oscillator is used to generate a carrier frequency used to send coded communication signals, not in any way to generate signals used to activate key pads. *See* Ex. 1014, 8:21–26, 9:20–24; Ex. 2004 ¶¶ 100–102.

converter to convert the digital “pseudo-random number” into a voltage for the voltage controlled oscillator; and (iv) implementing a lock-in detector so that only the desired measurement frequency is detected. *Id.* (citing Ex. 2004 ¶ 144). Patent Owner asserts that a person of ordinary skill in the art would not expend the time, effort or resources to introduce such complexity into Chiu, unless compelling technical reasons to do so existed. *Id.* (citing Ex. 2004 ¶ 145). Citing the testimony of Dr. Cairns, Patent Owner argues that a person of ordinary skill in the art would not have been motivated to add Meadows’s frequency-randomization technique to Chiu because Chiu does not suffer from the problem—strong noise generated by CRT flyback pulses—that motivated Meadows to introduce such complexity. *Id.* (citing Ex. 2004 ¶ 145).

In addition, Patent Owner argues that Petitioner has not demonstrated that a person of ordinary skill in the art would have had a reasonable expectation of success in implementing Meadows’s frequency-randomization technique in Chiu. *Id.* at 55–56 & n.5 (citing Ex. 2004 ¶¶ 147–149).

We agree with Patent Owner that Petitioner has not provided sufficient evidence that one of ordinary skill would have been motivated to adapt, or would have had a reasonable expectation success in adapting, the touch switch system of Chiu to use the variable frequency approach of Meadows. Petitioner does not adequately explain how the combination would be made, or how it would work.

In its Reply, Petitioner asserts that it “does not propose physically incorporating Meadows’s oscillator into the microprocessor of Chiu, because

the description of the combination treats Chiu’s microprocessor and Meadows’ oscillator as separate components.” Reply 25 (citing Pet. 69–70). In the cited portion of the Petition, however, Petitioner presents a specific combination of Chiu and Meadows, replacing Chiu’s oscillator with Meadows’s voltage controlled oscillator. *See* Pet. 69 (“In the combination, the oscillator of Chiu is *replaced* with the ‘voltage controlled oscillator’ described in Meadows.” (emphasis added)). For the reasons discussed below, Petitioner does not explain adequately how the specific combination of Chiu and Meadows it proposes would be made, or how the proposed combination would work.

As discussed above in Section III.C.3.b(2), Petitioner maps the ROM portion of Chiu’s microprocessor 90 to the “oscillator” recited in claims 94 or 105. Pet. 22–24. The same “oscillator” recitation is included in claims 97–99 and 107–109 by virtue of their dependency from claims 94 or 105. As discussed in the same section, Petitioner identifies the scan pulses (generated by Chiu’s ROM) described in Figure 7 of Chiu as the claimed “periodic output signal having a predefined frequency” provided by the recited “oscillator.” *Id.* at 24–27, 31–32.

In Petitioner’s combination of Chiu and Meadows, Petitioner proposes to replace the oscillator and scan pulse generation programming of the microprocessor ROM of Chiu with the Measurement Signal Source of Meadows, which would be a separate component added to the Chiu system outside the microprocessor. Pet. 68–69 (citing Ex. 1003 ¶¶ 150–151). According to Petitioner’s combination, the microprocessor is modified to periodically (“after a predetermined time interval or in response to a

particular condition”) generate pseudo-random number signals, which would be applied to a digital-to-analog converter inside the Measurement Signal Source, to in turn generate a control voltage of a magnitude corresponding to the value of the pseudo-random number. *Id.* The control voltage would then be delivered to an external voltage controlled oscillator, which in response to the control voltage, would generate a signal having a frequency corresponding to the magnitude of the control voltage. *Id.*

Petitioner’s explanation of how this combination would be achieved, and how it would work, is incomplete and conclusory. In Chiu, as shown in Figure 7, separate pulses are sequentially applied to each row of the touch cell array, at a frequency, pulse length, and phase totally controlled by ROM programming in the microprocessor. Ex. 1005, Fig. 7, 8:45–49, 9:7–18. Figure 7 depicts one scan cycle of pulses, with the pulses sequentially applied during each cycle. *Id.* at 10:30–31. In contrast, in Meadows, the Measurement Signal Source simply generates a single random frequency continuous square-wave signal applied to a signal touch pad. Ex. 1013, Abstract.

Petitioner’s declarant, Dr. Wright, provides no explanation whatsoever as to how the single square wave signal of Meadows would be replaced by multiple pulse train signals used in Chiu. Instead, Dr. Wright provides the conclusory assertion, “this measurement signal [i.e., the square wave signal] is provided to the touch circuit of Chiu *in the same manner* as the signal from the oscillator described in Chiu.” Ex. 1003 ¶ 151 (emphasis added). This evidences no awareness of the need to generate multiple pulses sequentially applied to the rows of a touch cell array, as opposed to a single

continuous square wave signal to a single pad. And the instruction to “provide[] . . . in the same manner” as in Chiu would mean that the microprocessor ROM would still have been programmed to do the providing, which is directly contradicted by Petitioner’s proposal to replace that ROM with some undefined circuit external to the microprocessor. *See* Pet. 69–70; PO Resp. 55–56; Sur-reply 20.

In addition, in Meadows, the microprocessor generates a pseudo-random number signal at a rate of 50 Hertz, as part of the noise suppression purpose of the Meadows’s invention. Ex. 1013, 4:25–34, 6:36–61. In contrast, Dr. Wright would have the combination only generate the pseudo-random number “[p]eriodically, such as after a predetermined time interval or in response to a particular condition.” Ex. 1003 ¶ 150. There is no explanation why one of ordinary skill would have altered this aspect of Meadows, or whether such a change would have served the purpose of reducing susceptibility to, or generation of, electronic noise, which are the purported motivations for making the combination. *See* Pet. 70–71; PO Resp. 53–55.

Also, the mechanism by which the system of Meadows reduces noise susceptibility depends on the use of lock-in detector circuits to render measurement signals incoherent with ambient noise. Ex. 1013, 2:61–64, 5:25–45, 6:36–48; Ex. 2004 ¶ 141. Petitioner does not explain whether or how such circuits would have been included in the proposed combination. *See* Pet. 68–71; PO Resp. 54–56 & n.5; Sur-reply 21; Ex. 2004 ¶¶ 148–149.

Next, Petitioner does not explain adequately how the randomized frequency of Meadows would be combined with the circuitry of Chiu to drive

the array of touch pads of Chiu. As discussed above in Section III.C.3.b(4), Petitioner identifies the scan pulses (described in Figure 7 of Chiu) provided to rows a–f of Chiu’s capacitive touch cell array through the driver circuit of Chiu as the claimed “signal output frequencies” “selectively provid[ed]” by the recited “microcontroller” to an “array of input touch terminals of a keypad,” as recited in claims 94 and 105. Pet. 31–34. In particular, Petitioner relies on the scan cycle of Chiu’s scan pulses as teaching the period and, therefore, the frequency of the “signal output frequencies” limitations recited in claims 94 and 105. *See id.* at 31–33. Thus, if Chiu’s oscillator is modified with Meadows’s teaching of randomized frequencies, as proposed by Petitioner, Chiu’s scan pulses would have randomized frequencies, and Chiu’s scan cycle would, therefore, have randomized periods.

Dr. Wright, Petitioner’s declarant, opines that

Meadows’ technique involves varying the frequency of the signal produced by the oscillator at regular intervals. This technique can be applied to various circuits, such as those described in Chiu and Schwarzbach, and does not rely on the detection of interference or other external conditions to trigger a change in the frequency.

Ex. 1003 ¶ 152 (citing Ex. 1013, 4:19–32); Pet. 69–70 (citing Ex. 1003 ¶ 152). But Dr. Wright does not explain adequately how Chiu’s scan pulses with randomized frequencies would be applied to the driver circuits of Chiu to activate the rows of Chiu’s touch pad array. Dr. Wright also does not explain adequately how Chiu’s detector circuitry would work with the scan pulses with randomized scan cycles when identifying by row and column which touch pad has been touched (*see* Ex. 1005, 8:56–58, 8:63–67, 9:5–6).

In its Reply, Petitioner counters that the “the configuration and arrangement of the input touch terminals of the Chiu and Schwarzbach combination need not be altered by the introduction of Meadows,” and the “physical incorporation of a voltage controlled oscillator into a touch circuit including a microprocessor, such as Chiu’s, was well within the capabilities of a POSITA.” Reply 26. But neither of these points explains or resolves the inadequacies of Petitioner’s asserted combination discussed above.

Petitioner also points to the statement in the Petition that “Meadows’ technique involves varying the frequency of the signal produced by the oscillator at regular intervals” (Reply 26 (emphasis by Petitioner) (citing Pet. 69)) and assert that “as *described* in the Petition, the circuit would operate at one scan rate (frequency) during a first interval, then would switch to a different scan rate (frequency) during a next interval” (*id.* (emphasis added) (citing Pet. 69)). There is, however, no description in page 69 of the Petition that “the circuit would operate at one scan rate (frequency) during a first interval, then would switch to a different scan rate (frequency) during a next interval.” Thus, this appears to be a supplemental argument from Petitioner to address the deficiencies in the Petition we pointed out in the Institution Decision. *See* Inst. Dec. 59.

Even considering Petitioner’s supplemental argument in the Reply, Petitioner still does not explain adequately how Chiu’s detector circuitry would work with the scan pulses when identifying by row and column which touch pad has been touched, if the scan cycle frequency changes to a randomized value “at regular intervals.” *See* Ex. 1005, 8:56–58, 8:63–67, 9:5–6. Among other reasons, Petitioner does not explain adequately how

Meadows’s “regular interval” would operate to avoid changing the scan frequency in the middle of a scan cycle. *See* Sur-reply 21 n.3 (“If the scan frequency is anything other than an integer multiple of the ‘about 50 kHz’ frequency-changing rate, then the scan frequency would change in the middle of a scan cycle.”). In addition, Petitioner does not explain adequately how Chiu’s detector circuitry would work with the varying scan pulses of Meadows in the proposed combination to achieve the row-column detection of touch inputs. *See* Sur-reply 20–21 & n.2, n.3.

Thus, Petitioner has not explained adequately *how* the proposed combination is supposed to work. *Cf. Pers. Web Techs., LLC v. Apple, Inc.*, 848 F.3d 987, 994 (Fed. Cir. 2017) (“[T]he Board nowhere clearly explained, or cited evidence showing, *how* the combination of the two references was supposed to work. At least in this case, such a clear, evidence-supported account of the *contemplated workings of the combination* is a *prerequisite* to adequately explaining and supporting a conclusion that a relevant skilled artisan would have been motivated to make the combination and reasonably expect success in doing so.” (second emphases added)).

We are mindful that, in general, “[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.” *In re Keller*, 642 F.2d at 425. Instead, the relevant issue is “what the combined teachings of the references would have suggested to those of ordinary skill in the art.” *Id.* “Combining the *teachings* of references does not involve an ability to combine their specific structures.” *In re Nievelt*, 482 F.2d at 968.

Here, however, Petitioner's position is premised on its specific proposed combination of Chiu and Meadows—i.e., replacing Chiu's oscillator with Meadows's voltage controlled oscillator. *See* Pet. 69. According to the Federal Circuit,

The amount of explanation needed to meet the governing legal standards—to enable judicial review and to avoid judicial displacement of agency authority—necessarily depends on context. A brief explanation may do all that is needed if, for example, the technology is simple and familiar and the prior art is clear in its language and easily understood. On the other hand, complexity or obscurity of the technology or prior-art descriptions may well make more detailed explanations necessary.

Pers. Web Techs., 848 F.3d at 994 (internal citation omitted). We find that this case falls into the latter category. Given the level of ordinary skill in the art as well as the complexity of the design and operation of the circuits in Chiu and Meadows, it was incumbent on Petitioner to explain how the ROM inside Chiu's microprocessor would have been replaced with Meadows's digital-to-analog converter and Meadows's voltage controlled oscillator, and how the circuit of the proposed combination, including the detector circuit, would have worked to achieve the row-column touch detection of Chiu if the scan cycle frequency changes to a randomized value “at regular intervals.” Because Petitioner has failed to do so, we determine that Petitioner has not established sufficiently that a person of ordinary skill in the art would have been motivated to combine the teachings of Chiu and Meadows to achieve the claimed invention.

Thus, based on the complete record, we determine that Petitioner has not demonstrated sufficiently that one of ordinary skill in the art would have combined Chiu and Meadows in the manner asserted.

To the extent Petitioner relies on Schwarzbach or Schwarzbach combined with Meadows to teach the frequencies recited in claims 97–99 and 107–109 (*see* Pet. 70), Petitioner’s argument is not persuasive because, for the reasons discussed above in Sections III.C.3.b(2) and III.C.3.e., Petitioner does not show sufficiently that transmitter/modulator 110 of Schwarzbach teaches “an oscillator” recited in claims 94 and 105.

Accordingly, based on the complete record and for the reasons discussed above, we determine that Petitioner has not proven by a preponderance of the evidence that the subject matter of claims 97–99 and 107–109 would have been obvious over the combination of Chiu, Schwarzbach, and Meadows.

*E. Claims 38, 39, 104, 115, and 116 as Obvious over
Chiu, Schwarzbach, and Lawson*

In this asserted ground of obviousness, Petitioner contends that dependent claims 38, 39, 104, 115, and 116 would have been obvious over Chiu and Schwarzbach, further combined with Lawson. Pet. 58–67.

1. Overview of Lawson (Ex. 1032)

Lawson describes an oven controller including a microprocessor, a keyboard, and a display. Ex. 1032, Abstract. Lawson describes using a microprocessor to change LED indicators in response to keypad input—e.g., touching a “0” will cause a single VLED to be illuminated. *Id.* at 28:4–5.

*2. Dependent Claims 38 and 39 as Obvious over
the Combination of Chiu, Schwarzbach, and Lawson*

Claims 38 and 39 depend from claim 37. Petitioner contends that Lawson teaches the additionally recited limitations of dependent claims 38 and 39. Pet. 60–66.

As discussed above, Petitioner has not proven by a preponderance of the evidence that the subject matter of claim 37, from which claims 38 and 39 depend, would have been obvious over the combination of Chiu and Schwarzbach. Petitioner’s arguments and evidence presented with respect to dependent claims 38 and 39 only address the additionally recited limitation of these claims, and, therefore, do not remedy the deficiencies in Petitioner’s analysis of independent claim 37 discussed above. *See id.*

Therefore, for the same reasons discussed above with respect to claim 37, Petitioner has not shown by a preponderance of the evidence that claims 38 and 39 are unpatentable under 35 U.S.C. § 103(a) over the combination of Chiu, Schwarzbach, and Lawson.

*3. Dependent Claims 104, 115, and 116 as Obvious over
Chiu, Schwarzbach, and Lawson*

Claim 104 depends from claim 94, and claims 115 and 116 depend from claim 105. The additionally recited limitations of these dependent claims all recite “an indicator” for indicating the detector circuit has determined that the operator is proximal or touches a touch terminal. *See* Ex. 1001, Reexam. Cert. C2, 7:38–41, 8:46–53.

Claim 104 depends from claim 94 and additionally recites “further comprising an indicator for indicating the detector circuit has determined

that the operator is proximal or touches said second touch terminal.”

Ex. 1001, Reexam. Cert. C2, 7:38–41. Claims 115 and 116 depend from claim 105 and additionally recites, respectively, “further including an indicator for indicating when said detector circuit determines that the operator is proximal or touches said first touch terminal” (claim 115), and “further including an indicator for indicating when said detector circuit determines that the operator is proximal or touches said second touch terminal (claim 116). *Id.* at 8:46–53.

As discussed above in Section III.C.3.b(6), Petitioner relies on the operation of the “ON” and “HI” buttons of Chiu to teach the identical limitation “said detector circuit being configured to generate said control output signal when the operator is proximal or touches said second touch terminal after the operator is proximal or touches said first touch terminal” recited in claims 94 and 105. Petitioner asserts that in the proposed combination of Chiu, Schwarzbach, and Lawson, Chiu’s touch control panel is modified according to the teachings of Lawson to include LED indicators that are changed in response to input a user provides on the touch control panel. Pet. 59 (citing Ex. 1005, Abstract, Fig. 1; Ex. 1003 ¶ 137). Specifically, Petitioner argues that in the combination, Chiu’s touch control panel would have used a microprocessor to change LED indicators (the claimed “indicator”), as taught by Lawson, after the user is proximal or touched the “HI” button (the claimed “second touch terminal”) or the “ON” button (the claimed “first touch terminal”). Pet. 66–67 (citing Ex. 1005, Fig. 1; Ex. 1032, 27:67–28:5; Ex. 1003 ¶ 147); *see also id.* at 64–66 (citing same).

Petitioner also explains persuasively that a person of ordinary skill in the art would have been motivated to modify Chiu based on the teachings of Lawson to allow a user to receive feedback after touching a touch sensitive cell terminal on the touch panel of Chiu. *Id.* at 59–60. Citing the testimony of Dr. Wright, Petitioner argues that the visual feedback provided by the proposed combination would have allowed a user to determine when a touch input has been successfully detected, which reduces instances of a user providing additional, unnecessary inputs for an action that has already been performed. *Id.* at 59 (citing Ex. 1003 ¶ 138).

Patent Owner does not respond specifically to Petitioner’s challenge to claims 104, 115, and 116 beyond Patent Owner’s arguments advanced with respect to the challenged independent claims discussed above. *See* PO Resp. 51–52.

Based on the complete record and for the reasons explained by Petitioner, we are persuaded that Petitioner has demonstrated sufficiently that Lawson teaches the additionally recited limitations of dependent claims 104, 115, and 116. We also determine that Petitioner has established sufficiently that a person of ordinary skill in the art would have been motivated to combine Chiu, Schwarzbach, and Lawson in the manner proposed by Petitioner to obtain the subject matter recited in claims 104, 115, and 116.

Based on the complete record and for the reasons explained by Petitioner, we determine that Petitioner has demonstrated by a preponderance of the evidence that the subject matter of claims 104, 115,

and 116 would have been obvious over the combination of Chiu, Schwarzbach, and Lawson.²³

F. Claim 102 as Obvious over Chiu, Schwarzbach, and Ingraham '548

Petitioner contends that claim 102 is unpatentable as obvious over the combination of Chiu, Schwarzbach, and Ingraham '548. Pet. 74–76.

Claim 102 depends from claim 94 and further recites “wherein the supply voltage is a voltage regulator supply voltage.”

Petitioner contends that Ingraham '548 teaches the additionally recited limitation of claim 102 because the reference describes a power supply including a “voltage regulator circuit” to regulate the supply voltage provided to a “touch controlled electronic switching circuit.” *Id.* at 75 (citing Ex. 1016, Abstract, 2:32–33, 3:29–31). Petitioner also explains persuasively that a person of ordinary skill in the art would have been motivated to modify the touch circuit of Chiu based on the teachings of Ingraham '548 to ensure a constant supply voltage and protect the touch circuit from unexpected variations in the supply voltage. *Id.* at 74 (citing Ex. 1016, 3:29–38; Ex. 1003 ¶ 158). Citing the testimony of Dr. Wright, Petitioner argues that a person of ordinary skill in the art would have recognized that such variations in supply voltage can damage electronic circuits, and would have been motivated to avoid this potential damage to

²³ We also find that Patent Owner has waived any argument directed to claims 104, 115, and 116 aside from contesting the obviousness challenge to independent claims 94 and 105 based on the combination of Chiu and Schwarzbach. *See* Paper 13, 7.

the touch circuit by adding the voltage regulator described in Ingraham '548. *Id.* (citing Ex. 1003 ¶ 158).

Patent Owner does not respond specifically to Petitioner's challenge to claim 102 beyond Patent Owner's arguments advanced with respect to the challenged independent claims discussed above. PO Resp. 57.

Based on the complete record and for the reasons explained by Petitioner, we are persuaded that Petitioner has demonstrated sufficiently that Ingraham '548 teaches the additionally recited limitation of dependent claim 102. We also determine that Petitioner has established sufficiently that a person of ordinary skill in the art would have been motivated to combine Chiu, Schwarzbach, and Ingraham '548 in the manner proposed by Petitioner to obtain the subject matter recited in claim 102.

Based on the complete record and for the reasons explained by Petitioner, we determine that Petitioner has demonstrated by a preponderance of the evidence that the subject matter of claim 102 would have been obvious over the combination of Chiu, Schwarzbach, and Ingraham '548.²⁴

G. Claim 103 as Obvious over Chiu, Schwarzbach, and Tucker

Petitioner asserts that claim 103 would have been obvious over the combination of Chiu, Schwarzbach, and Tucker. Pet. 76–81. Claim 103 depends from claim 94 and additionally recites “wherein said detector circuit

²⁴ We also find that Patent Owner has waived any argument directed to claim 102 aside from contesting the obviousness challenge to independent claim 94 based on the combination of Chiu and Schwarzbach. *See* Paper 13, 7.

is configured to generate said control output signal only when the operator is proximal or touches said second touch terminal within a predetermined time period after the operator is proximal or touches said first touch terminal.”

Petitioner contends that Tucker teaches the additionally recited limitation of claim 103 because Tucker describes a disable function in a cook-top touch control pads that disables all commands for increasing the temperature except for five seconds after a first touch of the unlock control. *Id.* at 79–81 (citing Ex. 1019, Abstract, 5:13–22, 24:15–20, 26:38–55, Fig. 1). Petitioner also explains persuasively that a person of ordinary skill in the art would have been motivated to modify the touch circuit of Chiu based on the teachings of Tucker to provide for increased safety when operating the touch control panel of Chiu. *Id.* at 78. Citing the testimony of Dr. Wright, Petitioner argues that a person of ordinary skill in the art would have recognized that requiring temperature adjustment operations to be made within a predetermined time of pressing an unlock button, as taught by Tucker, would prevent inadvertent operation of the control panel (such as by children) which could result in potentially dangerous situations. *Id.* (citing Ex. 1003 ¶ 165).

Patent Owner argues “[u]nder the clear claim language, it is the *detector circuit* that must perform this function: i.e., the detector circuit must be configured to ‘only’ generate a ‘control output signal’ when the proper touch sequence is followed.” PO Resp. 58. Patent Owner further argues that, because Petitioner has identified signal detection circuit 58 of Chiu as the claimed detector circuit of independent claim 94, and yet relies on programming of microprocessor 90 to provide the delay functionality of

claim 103, Petitioner has failed to prove obviousness of these claims. *Id.* at 59–60 (citing Pet. 39–41, 77–78). This argument is without merit—as discussed at Section III.C.3.b(6) above, the claimed detector circuit in both the preferred embodiment of the ’183 patent, and in Chiu, includes a microprocessor, which outputs appropriate control signals in response to the touching of a touch pad. Petitioner’s proofs that the claimed detector circuit are taught by Chiu explicitly cite the role of the microprocessor. Pet. 40; Reply 27.

Based on the complete record, we are determine that Petitioner has demonstrated sufficiently that Tucker teaches the additionally recited limitation of dependent claim 103. We also determine that Petitioner has established sufficiently that a person of ordinary skill in the art would have been motivated to combine Chiu, Schwarzbach, and Tucker in the manner proposed by Petitioner to obtain the subject matter recited in claim 103.

Based on the complete record and for the reasons explained by Petitioner, we determine that Petitioner has demonstrated by a preponderance of the evidence that the subject matter of claim 103 would have been obvious over the combination of Chiu, Schwarzbach, and Tucker.

IV. CONCLUSION

For the foregoing reasons, we conclude that Petitioner has met its burden of proof, by a preponderance of the evidence, in showing that claims 94, 96, 101–106, 115, and 116 of the ’183 patent are unpatentable. For the reasons discussed above, Petitioner has not demonstrated, by a

preponderance of the evidence, claims 37–39, 97–99, and 107–109 of the '183 patent are unpatentable. The chart below summarizes our conclusions.

Claim(s)	35 U.S.C. §	Reference(s)/ Basis	Claim(s) Shown Unpatentable	Claim(s) Not Shown Unpatentable
37, 94, 96, 101, 105, 106	103(a)	Chiu, Schwarzbach	94, 96, 101, 105, 106	37
38, 39, 104, 115, 116	103(a)	Chiu, Schwarzbach, Lawson	104, 115, 116	38, 39
97–99, 107–109	103(a)	Chiu, Schwarzbach, Meadows		97–99, 107–109
102	103(a)	Chiu, Schwarzbach, Ingraham '548	102	
103	103(a)	Chiu, Schwarzbach, Tucker	103	
Overall Outcome			94, 96, 101–106, 115, 116	37–39, 97–99, 107–109

V. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that claims 94, 96, 101–106, 115, and 116 of the '183 patent are determined to be unpatentable;

FURTHER ORDERED that claims 37–39, 97–99, and 107–109 of the '183 patent are not determined to be unpatentable; and

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

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Patent 5,796,183

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