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571-272-7822

Paper 65
Entered: January 19, 2021

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

NEVRO CORP.,
Petitioner,

v.

BOSTON SCIENTIFIC NEUROMODULATION CORP.,
Patent Owner.

IPR2019-01284
Patent 7,822,480 B2

Before ROBERT A. POLLOCK, SCOTT C. MOORE, and RICHARD J. SMITH, *Administrative Patent Judges*.

POLLOCK, *Administrative Patent Judge*.

FINAL WRITTEN DECISION

Determining All Challenged Claims Unpatentable
35 U.S.C. § 318(a)

GRANTING PATENT OWNER'S MOTION TO EXPUNGE
37 C.F.R. § 42.7(a)

I. INTRODUCTION

This is a Final Written Decision in an *inter partes* review challenging the patentability of claims 2–4 and 6–8 of U.S. Patent No. 7,822,480 B2 ("the '480 patent," Ex. 1001).[1] We have jurisdiction under 35 U.S.C. § 6.

Petitioner has the burden of proving unpatentability of a claim by a preponderance of the evidence. 35 U.S.C. § 316(e) (2018). Having reviewed the arguments of the parties and the supporting evidence, we find that Petitioner has demonstrated by a preponderance of the evidence that the challenged claims are unpatentable.

A. Procedural Background

Nevro Corp. ("Petitioner") filed a Petition for *inter partes* review of claims 1–4 and 6–8 of the '480 patent. Paper 1 ("Pet."). Boston Scientific Neuromodulation Corp. ("Patent Owner") timely filed a Preliminary Response. Paper 6 ("Prelim. Resp."). Along with its Preliminary Response, Patent Owner filed a Statutory Disclaimer of claim 1 of the '480 patent. Prelim. Resp. 1–2; Ex. 2001. In view of the then-available, preliminary record, we concluded that Petitioner satisfied the burden, under 35 U.S.C. § 314(a), to show that there was a reasonable likelihood that Petitioner would prevail with respect to at least one of the challenged claims. Accordingly, on behalf of the Director (37 C.F.R. § 42.4(a) (2018)), and in accordance with *SAS Inst. Inc. v. Iancu*, 138 S. Ct. 1348, 1353 (2018) and the Office's Guidance on the Impact of *SAS* on AIA Trial Proceedings (Apr.

[1] As discussed below, the Petition also challenged claim 1, which Patent Owner disclaimed prior to our institution decision.

26, 2018),[2] we instituted an *inter partes* review of claims 2–4 and 6–8 on all the asserted grounds. Paper 7 ("Inst. Dec."), 35.

After institution, Patent Owner filed a Response. Paper 31 ("PO Resp.").[3] Petitioner filed a Reply. Paper 46 ("Reply"). Patent Owner filed an authorized Sur-reply. Paper 54 ("Sur-reply").

In Paper 53, we addressed the Parties' contentions regarding the deposition transcript (Ex. 1062) and errata (Ex. 2019) of Patent Owner's expert, Dr. Darrin Young. As per our Order, Patent Owner filed a revised version of Dr. Young's transcript and errata (Exs. 2020 and 2021, respectively) and the parties filed supplemental briefing addressing those exhibits (Papers 57 and 58).

On November 9, 2020, the parties presented arguments at oral hearing, the transcript of which is of record. Paper 64 ("Tr.").

B. Real Parties in Interest

Petitioner identifies itself, Nevro Corp., as the real party-in-interest. Pet. 2. According to Patent Owner, its real parties-in-interest are Boston Scientific Neuromodulation Corp. and Boston Scientific Corp. Paper 4, 2.

C. Related Proceedings

The '480 patent is at issue in *Boston Scientific Corp. et al. v. Nevro Corp.*, 1:18-cv-00644 (D. Del.). *See* Paper 4, 3.

Patent Owner notes the '480 patent is related to U.S. Patent Nos. 7,587,241 B2 ("the '241 patent") and 9,162,071 B2 ("the '071 patent"),

[2] https://www.uspto.gov/patents-application-process/patent-trial-and-appeal-board/trials/guidance-impact-sas-aia-trial.
[3] Patent Owner inadvertently filed a duplicative copy of its Patent Owner Response and related exhibits. In section II.G, below, we grant its motion to expunge the duplicative copies.

which are the subject of recent proceedings. Paper 4, 2. The Board issued a Final Written Decision finding claims 1–20 of the '241 patent unpatentable in IPR2017-01899, which the Federal Circuit affirmed in *Boston Scientific Neuromodulation Corp. v. Nevro Corp.*, 813 Fed.Appx. 543 (Fed. Cir. 2020). Petitioner's challenge to claims 1–10 of the '071 patent in IPR2019–01318 is before the Board and awaiting final decision.

D. Legal Effect of Patent Owner's Statutory Disclaimer

We address first the legal effect of Patent Owner's Statutory Disclaimer of claim 1 of the '480 patent. Ex. 2001. After the filing the Petition, Patent Owner filed a Statutory Disclaimer cancelling claim 1 to "focus the issues and simplify [the] proceedings both here and before the district court." Prelim. Resp. 1. Patent Owner argued that "no *inter partes* review should be instituted based on claim 1 of the '480 Patent (*i.e.*, grounds 1 and 2 of the Petition) as only Petitioner's challenges to claims 2–4 and 6–8 (*i.e.*, grounds 3 and 4 of the Petition) are at issue here." *Id.* at 2 (citing 37 C.F.R. § 42.107(e)).

The United States Supreme Court has held that a decision to institute an *inter partes* review under 35 U.S.C. § 314 may not proceed on fewer than all claims challenged in the petition. *SAS*, 138 S. Ct. at 1355. The Court recognized, however, that all "claims challenged 'in the petition' will not always survive to the end of the case; some may drop out thanks to the patent owner's actions." *Id*. at 1357. Here, Patent Owner has statutorily disclaimed challenged claim 1 of the '480 patent such that it is no longer regarded as a claim challenged in the Petition. *See Vectra Fitness, Inc. v. TNWK Corp.*, 162 F.3d 1379, 1383 (Fed. Cir. 1998) ("This court has interpreted the term 'considered as part of the original patent' in section 253

to mean that the patent is treated as though the disclaimed claims never existed.") (citing *Guinn v. Kopf*, 96 F.3d 1419, 1422 (Fed. Cir. 1996)). Accordingly, neither *SAS*, nor the precedent of our reviewing court, is at odds with Rule 42.107(e), which states that a patent owner, in a preliminary response, "may file a statutory disclaimer under 35 U.S.C. 253(a) . . . disclaiming one or more claims in the patent. No *inter partes* review will be instituted based on disclaimed claims." 37 C.F.R. § 42.107(e).

In light of the above, we treat claim 1 as having never been part of the '480 patent, such that Petitioner cannot seek *inter partes* review of that claim. Grounds 1 and 2, which are directed solely to claim 1, are deemed withdrawn. Because no *inter partes* review can be instituted based on a disclaimed claim, we did not institute an *inter partes* review of claim 1. Accordingly, our analysis of Petitioner's Grounds relates to claim 1 only to the extent the remaining challenged claims depend from it.

E. Asserted Grounds of Unpatentability

The Petition sets forth four grounds of unpatentability. Pet. 4. But because Grounds 1 and 2 are directed solely to claim 1, for which we did not institute *inter partes* review, we address only Grounds 3 and 4.

Ground	Claims	Basis	Asserted References
3	2–4, 6, 8	103(a)[4]	Grevious[5] with or without Fitch[6]

[4] The Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) ("AIA"), amended 35 U.S.C. §§ 102 and 103. Because the challenged claims of the '480 patent have an effective filing date before the effective date of the applicable AIA amendments, we refer to the pre-AIA versions of 35 U.S.C. § 103 throughout this Decision.
[5] U.S. Patent No. 6,443,891 B1, issued Sept. 3, 2002. Ex. 1005.
[6] U.S. Patent No. 4,807,225, issued Feb. 21, 1989. Ex. 1006.

Ground	Claims	Basis	Asserted References
4	6, 7	103(a)	Grevious and Bradshaw[7], with or without Fitch

In support of its patentability challenges, Petitioner relies on, *inter alia*, the Declaration of Mr. Ben Pless. Ex. 1003. Mr. Pless's Declaration refers to several background references including Kruse,[8] Thompson,[9] Brenig,[10] Oetting,[11] Silvian,[12] Torgerson,[13] and Ohno.[14] *See* Ex. 1003 ¶¶ 127–143. Patent Owner relies, *inter alia*, on the Declaration of Darrin Young, Ph.D. Ex. 2005.

F. The '480 Patent and Relevant Background

1. Specification

The '480 patent is directed to telemetry systems and methods for communicating with an implantable stimulator. Ex. 1001, Abstract, 2:41–60. According to the '480 patent's Specification, implantable stimulators include spinal cord stimulators, cochlear implants, deep brain stimulators, and microstimulators "to stimulate tissue to alleviate urinary incontinence, reduce pain, or otherwise provide therapy for various disorders." *Id.* at 3:27–39.

[7] U.S. Patent No. 4,327,441, issued Aug. 27, 1982. Ex. 1009.
[8] U.S. Patent No. 6,201,993 B1, issued Mar. 13, 2001. Ex. 1007.
[9] U.S. Patent No. 6,577,901 B2, issued June 10, 2003. Ex. 1008.
[10] Theodore Brenig, *Data Transmission for Mobile Radio,* Vol. VT-27 IEEE TRANSACTIONS ON VEHICULAR TECHNOLOGY 77–85 (1978). Ex. 1020.
[11] John D. Oetting, *A Comparison of Modulation Techniques for Digital Radio*, IEEE 1752–1762 (1979). Ex. 1021.
[12] U.S. Patent No. 5,466,246, issued Nov. 14, 1995. Ex. 1011.
[13] U.S. Patent No. 7,167,756 B1, issued Jan. 23, 2007. Ex. 1017.
[14] U.S. Patent No. 6,045,042, issued Apr. 4, 2000. Ex. 1026.

The Specification discloses that "[a] typical stimulator or microstimulator is configured to transcutaneously communicate with an external device." *Id.* at 3:44–46. "Several types of implantable stimulators and external devices utilize a magnetic field to achieve transcutaneous communication via a bidirectional telemetry link." *Id.* at 2:42–44. Both implantable and external devices may include a radio frequency ("RF") coil that functions as the transmitter and receiver of the magnetic field. *Id.* at 2:45–47. The implantable stimulator may include a precise reference clock to synchronize timing of data transmission to and from the implantable stimulator and the external device for accurate communication. *Id.* at 2:47–53. The precise reference clock may be provided by a precision circuit that receives calibration data from the external device via the bidirectional telemetry link. *Id.* at 2:54–60. The Specification states, however, "in some instances, the bidirectional telemetry link may fail due to a number of factors including, but not limited to, a loss of battery power in the stimulator, interference, and/or coil malfunction." *Id.* at 2:60–63. Failure of the telemetry link may result in the implantable stimulator not receiving calibration data from the external device. *Id.* at 2:63–67.

The '480 patent Specification discloses an implantable stimulator with a first telemetry receiver for receiving a first telemetry scheme and a second telemetry receiver for receiving a second telemetry scheme. Ex. 1001, 3:5–9. "In some embodiments, the first telemetry scheme includes frequency shift keying (FSK) modulation and the second telemetry scheme includes on-off keying (OOK) modulation." *Id.* at 3:9–12. The Specification further describes an embodiment wherein, if the first telemetry scheme using a bidirectional telemetry link fails, a second telemetry scheme using a frequency independent telemetry link may be used to transmit the calibration

data to the reference clock. *Id.* at 5:57–6:4. The calibration data may then be used to resynchronize the reference clock and reestablish transmission via the bidirectional telemetry link. *Id.* 6:5–9. According to the Specification, such resetting is possible "[b]ecause the OOK receiver compares pulse widths, the frequency of the clock signal generated by the clock generation circuit does not have to be synchronized with the frequency of the external device in order for the OOK receiver to function." *Id.* at 7:25–32 (internal numbering omitted).

Figure 1 of the '480 patent is reproduced below:

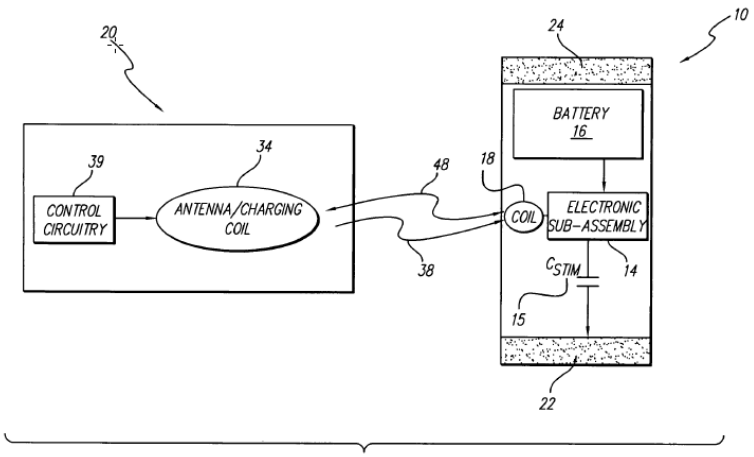

FIG. 1

Figure 1 of the '480 patent shows implantable stimulator 10 and external device 20. Ex. 1001, 3:25–26, 57–62.

The Specification states that "external device (20) may be embodied by . . . external components (20) shown in FIG. 1 of the present application's parent application (U.S. patent application Ser. No. 10/607,962)," which issued as U.S. Pat. No. 7,177,698 ("the '698 patent").[15] *Id.* at 4:6–9. Figure 1 of the '698 patent is reproduced below:

[15] The '480 patent is a continuation-in-part of and claims priority to "U.S. patent application Ser. No. 10/607,962, filed Jun. 27, 2003 now U.S. Pat.

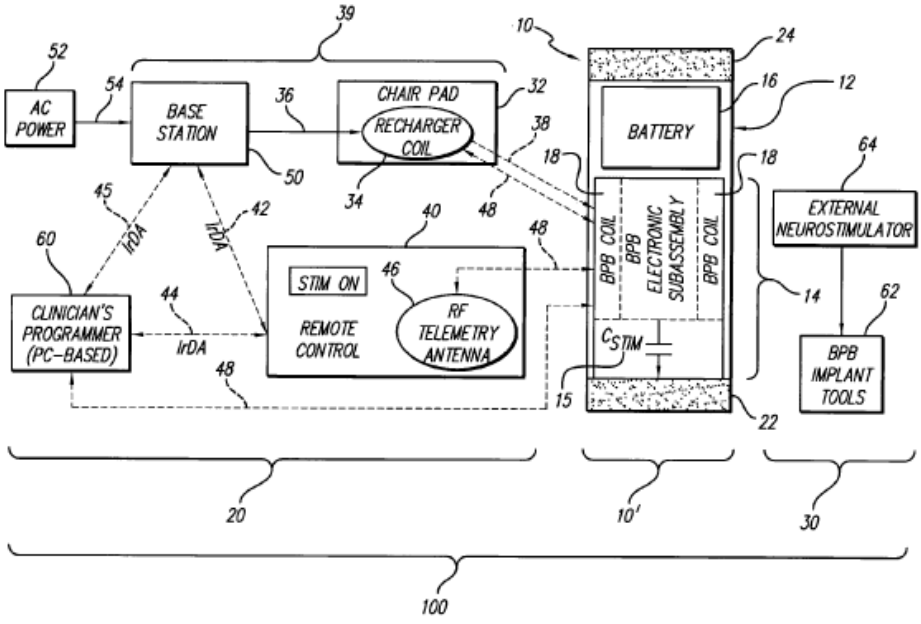

FIG. 1

Figure 1 of the ’698 patent is a block diagram for a battery powered implantable microstimulator system including external device 20, implantable components 10′ and surgical components 30. *See* Ex. 1012, 4:49–51, 10:1–4.

According to the ’480 patent, external device 20 includes control circuitry 39 that controls the operation of coil 34 configured to emit and receive a magnetic field to communicate with implantable stimulator 10. Ex. 1001, 4:19–24. Coil 34 may communicate via bidirectional link 48 with coil 18 of implantable stimulator 10. *Id.* at 4:24–27. The Specification states that “RF signals sent across . . . bidirectional telemetry link (48) may be modulated using a frequency dependent telemetry scheme, such as frequency shift keying (FSK), or by some other modulation scheme.” *Id.* at 4:27–31. The Specification states that coil 34 and coil 18 “may also

No. 7,177,698, and which is incorporated herein by reference in its entirety.” Ex. 1001, 1:7–11.

communicate via . . . forward telemetry link (38)," which "may use an on/off keying (OOK) modulation scheme." *Id.* at 4:31–34.

The '480 patent's Specification shows an exemplary implantable stimulator in Figure 2, reproduced below:

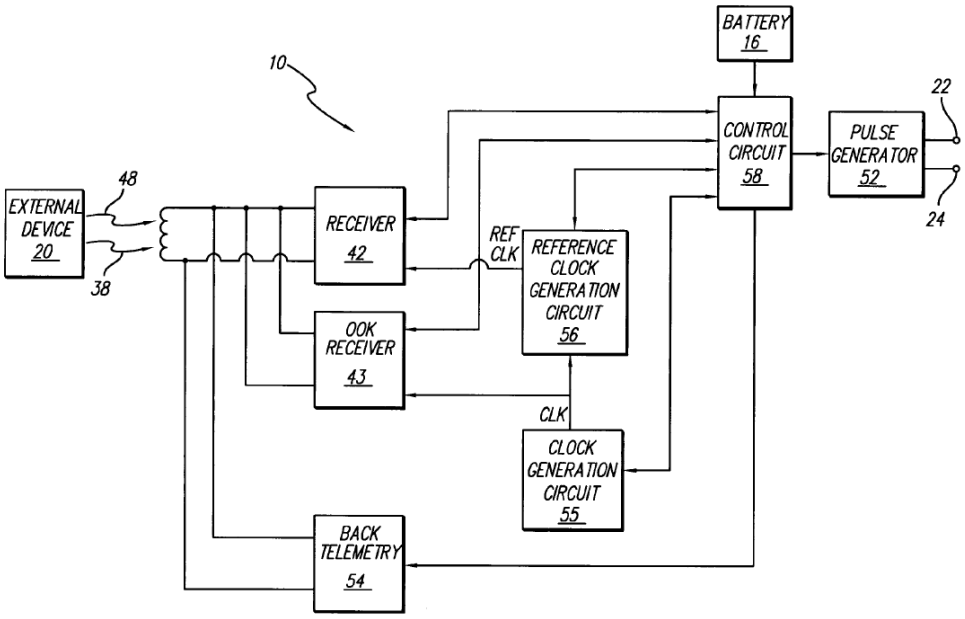

FIG. 2

Figure 2 shows a functional block diagram of implantable stimulator 10 and external device 20. Ex. 1001, 2:15–17; 4:52–5:7.

Implantable stimulator 10 includes coil 18 (not labeled) coupled to receiver 42 configured to receive a signal via bidirectional link 48. Ex. 1001, 4:52–55. External device 20 may send a carrier signal having modulated control data to receiver 42. *Id.* at 4:62–67. Receiver 42 rectifies the carrier signal to provide charging power to battery 16 and demodulates the carrier signal to extract control data. *Id.* The '480 patent's Specification also discloses embodiments wherein coil 18 is connected to OOK receiver 43 to receive OOK modulated data. *Id.* at 5:17–24. "OOK receiver (43) may be integrated into . . . receiver (42)." *Id.* at 5:27–28.

The '480 patent's Specification states that "OOK telemetry link (38) allows . . . external device (20) to communicate with . . . stimulator (10) even when . . . stimulator (10) is not actively listening for an RF signal to be transmitted via the bidirectional telemetry link (48)," e.g., when the stimulator is in hibernation or storage state. Ex. 1001, 6:30–35. "OOK telemetry link (38) also provides a communication interface . . . that may be used in emergency situations, e.g., when . . . bidirectional telemetry link (48) fails or when there is an emergency power shutdown." *Id.* at 6:35–40.

The '480 patent's Specification provides an embodiment including first and second modulated signals (*see* Ex. 1001, 6:41–54), shown in Figure 3, reproduced below:

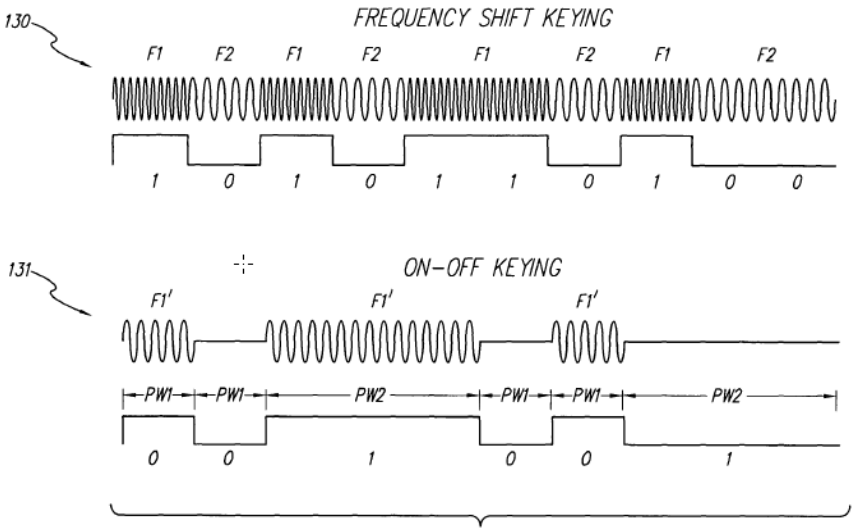

FIG. 3

Figure 3 shows "first signal (130) including control data that has been modulated using FSK and . . . second signal (131) including control data that has been modulated using OOK, or [pulse wave modulation] PWM." *Id.* at 6:41–44.

The signals communicate bits of binary code by changing frequency or pulse width. Ex. 1001, 6:41–67. Second signal 131 represents OOK

modulation, wherein pulse widths PW1 and PW2 designate a binary code regardless if the signal is on or off. Ex. 1001, 6:55–67. As explained by the '480 patent Specification:

> A transmitted signal having a first pulse width, PW1, regardless of whether the frequency is F1' or zero (off), is interpreted as, e.g., a binary "0"; whereas a transmitted signal having a second pulse width, PW2, regardless of whether the frequency is F1' or zero (off), is interpreted as, e.g., a binary "1". Alternatively, a "1" may correspond to PW1 and a "0" may correspond to PW2. A change from the F1' frequency to the zero (off) frequency is used to indicate a data transition from one bit to the next bit in the data stream.

Id. "Because . . . OOK receiver (43) compares pulse widths, the frequency of the clock signal . . . does not have to be synchronized with the frequency of . . . external device (20) in order for . . . OOK receiver (43) to function. Hence, . . . OOK telemetry link (38) is considered to be 'frequency independent.'" *Id.* at 7:26–33.

2. Challenged Claims

The '480 patent includes 8 claims. Of these Petitioner challenges claims 1–4 and 6–8. As discussed above, claim 1 was disclaimed. But because claim 2 depends from claim 1, and claims 3, 4, and 6–8 all depend from claim 2, we reproduce claims 1 and 2 below:

> 1. A system, comprising:
>
> an external device, comprising:
>
> first modulation circuitry for producing from first data a first signal modulated with on-off keying (OOK) modulation, wherein the first modulated signal comprises logic '0' bits of a first pulse width and logic '1' bits of a second pulse width different from the first pulse width, wherein each bit further comprises either an ON state with a signal that varies with a first frequency or an OFF state, wherein a transition between adjacent bits in the first

signal is marked by a change in the first modulated signal between the ON and OFF states;

a coil configured to wirelessly transmit the first modulated signal to the implantable medical device; and

an implantable medical device, comprising a first telemetry receiver in the implantable medical device for demodulating the first modulated signal to recover the first data.

2. The system of claim 1, further comprising:

second modulation circuitry in the external device for producing from second data a second signal modulated with frequency modulation, wherein the coil is further configured to wirelessly transmit the second modulated signal to the implantable medical device; [and]

a second telemetry receiver in the implantable medical device for demodulating the second modulated signal to recover the second data.

Ex. 1001, 11:1–28. Among the dependent claims before us, claim 3 recites "the frequency modulation comprises frequency shift keying (FSK) modulation. *Id.* at 12:1–2. Depending from claim 2, claim 6 recites "the first data comprises a start bit and a number of control bits, the start bit being transmitted before the control bits." *Id.* at 12:12–14. Claim 6 further requires, *inter alia*, "a bit threshold counter configured to measure a pulse width of the start bit to generate a bit width threshold." *Id.* at 12:15–24.

3. Relevant Prosecution History

During the prosecution leading to the issuance of the '480 patent, the Examiner rejected claims 54 and 57–61 (now claims 1 and 4–8) as obvious over Lenzkes[16] (Ex. 1015) or Borkan.[17] Ex. 1002, 166–170. The Examiner

[16] U.S. Patent No. 3,727,616, issued Apr. 17, 1973.
[17] U.S. Patent No. 4,612,934, issued Sept. 23, 1986. A typographical error in the rejection lists the patent number as U.S. Pat. No. 6,612,934 (Ex. 1016).

also rejected claims 55 and 56 (now claims 2 and 3) as obvious over Lenzkes or Borkan, further in view of Eisenberg[18] (Ex. 1010). *Id*. at 169.

The Examiner found the prior art disclosed implantable devices that receive communications using pulse width modulation. Ex. 1002, p. 168–169. The Examiner indicated that Lenskes taught an implantable device having a second receiver. *Id.* at 168. And with respect to Borkan, the Examiner determined that "[a] back up receiver is envisioned for when the first one breaks down. A clock and a bit counter are part of the circuitry." *Id.* at 169. As to claim 55 (now claim 2), the Examiner determined that it would have been obvious "[t]o have provided second circuitry for transmitting and receive [pulse wave modulation] PWM or FSK modulation for the benefits taught by [Eisenberg]." *Id.*

In response, Patent Owner argued that neither Lenzkes nor Borkan taught that a "transition between adjacent bits in the first signal is marked by a change in the first modulated signal between the ON and OFF states." Ex. 1002, p. 303–305. In light of this argument, the Examiner entered an Examiner's Amendment in the Notice of Allowance as follows:

> In claim 1
> At line 6, after ", wherein";
> "the first modulated" has been deleted
> - - each bit - - has been inserted
> At line 7, before "an OFF state",
> "signal further comprises an ON state of a first frequency and"
> has been deleted

The correct number is listed in the Notice of References cited. *See* Ex. 1002, 122.

[18] U.S. Patent No. 6,434,194 B1, issued Aug. 13, 2002. Ex. 1010.

- - further comprises either an ON state with a signal that varies with a first frequency or - - has been inserted.

Id. at 314. According to the Examiner, "[t]he amendment clarifies that the first frequency is in a bit signal rather that a series of bit signals." *Id.* at 315.

II. ANALYSIS

A. Legal Standards

"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 of persuasion never shifts to Patent Owner. *See Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) (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 subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which that 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 ordinary skill in the art; and (4) when in evidence, objective evidence of nonobviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

In analyzing the obviousness of a combination of prior art elements, it can be important to identify a reason that would have prompted one of skill in the art "to combine . . . known elements in the fashion claimed by the patent at issue." *KSR*, 550 U.S. at 418. A precise teaching directed to the specific subject matter of a challenged claim is not necessary to establish obviousness. *Id.* Rather, "any need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed." *Id.* at 420. Accordingly, a party that petitions the Board for a determination of unpatentability based on obviousness must show that "a skilled artisan would have been motivated to combine the teachings of the prior art references to achieve the claimed invention, and that the skilled artisan would have had a reasonable expectation of success in doing so." *In re Magnum Oil Tools Int'l, Ltd.*, 829 F.3d 1364, 1381 (Fed. Cir. 2016) (internal quotations and citations omitted).

B. Level of Ordinary Skill in the Art

In determining the level of skill in the art, we consider the types of problems encountered in the art, the prior art solutions to those problems, the rapidity with which innovations are made, the sophistication of the technology, and the educational level of active workers in the field. *Custom Accessories, Inc. v. Jeffrey-Allan Indus., Inc.*, 807 F.2d 955, 962 (Fed. Cir. 1986); *Orthopedic Equip. Co. v. U.S.*, 702 F.2d 1005, 1011 (Fed. Cir. 1983).

Petitioner contends that a person of ordinary skill in the art as of the relevant date "would have had (1) at least a bachelor's degree in electrical engineering, biomedical engineering, or equivalent coursework, and (2) at least one year of experience researching or developing implantable medical

devices." Pet. 15 (citing Ex. 1003 ¶¶ 50–56). Patent Owner does not dispute Petitioner's proposed definition, but qualifies that electrical engineers and biomedical engineers with one year of experience would only have experience in telemetry if they had been assigned projects requiring telemetry design. PO Resp. 6 (citing Ex. 2013, 68:23–70:13). As the subject matter at issue involves implantable medical devices that communicate via telemetry, we find Patent Owner's argument well taken. Insofar as Petitioner's proposed definition—qualified such that the definition focuses on the subset of electrical or biomedical engineers with experience in telemetry—is consistent with the cited prior art, we adopt it for the purposes of this Decision.[19] *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (explaining that specific findings regarding ordinary skill level are not required "where the prior art itself reflects an appropriate level and a need for testimony is not shown" (quoting *Litton Indus. Prods., Inc. v. Solid State Sys. Corp.*, 755 F.2d 158, 163–64 (Fed. Cir. 1985))).

C. Claim Construction

We interpret the challenged claims "using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. [§] 282(b)." *See* 37 C.F.R. § 42.100(b) (2019). Under that standard, we presume that a claim term carries its "ordinary and customary meaning," which "is the meaning that the term would have to a person of

[19] To the extent Patent Owner appears to imply that the relevant person of ordinary skill in the art ("POSA") or ("POSITA") would have experience with only one telemetry modality and would, therefore, "find it challenging to implement a telemetry system that included several different modulation schemes," Patent Owner presents no evidence or reasoned argument that such implementation would have presented an undue challenge for the ordinarily skilled artisan.

ordinary skill in the art in question" at the time of the invention. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007) (quoting *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313 (Fed. Cir. 2005)). Any special definition for a claim term must be set forth in the specification with reasonable clarity, deliberateness, and precision. *In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994). Limitations, however, may not be read from the specification into the claims (*In re Van Geuns*, 988 F.2d 1181, 1184 (Fed. Cir. 1993)), nor may the Board "construe claims during [an *inter partes* review] so broadly that its constructions are unreasonable under general claim construction principles" (*Microsoft Corp. v. Proxyconn, Inc.*, 789 F.3d 1292, 1298 (Fed. Cir. 2015), *overruled on other grounds by Aqua Products, Inc. v. Matal*, 872 F.3d 1290 (Fed. Cir. 2017)); *see also, Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) ("[W]e need only construe terms 'that are in controversy, and only to the extent necessary to resolve the controversy.'" (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

1. "stimulator" and "control bit

Petitioner refers us to the express definitions of "stimulator" and "control bit" at columns 3–5 of the '480 patent's Specification and contends that no further construction is necessary. Pet. 15–16; *see also* Ex. 1001, 3:39–45 (defining "stimulator" as "any implantable medical device that may be implanted within a patient for therapeutic purposes" and "typical[ly] . . . configured to transcutaneously communicate with an external device"; 4:67–5:4 (defining "control bits" as "any . . . bits that are transmitted from the external device (20) to the implantable stimulator (10) or from the implantable stimulator (10) to the external device (20)." Patent Owner does not dispute Petitioner's proposed claim construction. Prelim. Resp. 6; PO

Resp. 8. To the extent necessary, we apply the express definitions of those terms as set forth in the Specification.

2. "frequency modulation"

Patent Owner contends that we should construe the term "frequency modulation" ("FM") because "the challenged claims require that the first and second modulation circuity, signals and receivers are differentiated by their use of OOK versus frequency modulation," and our patentability analysis requires a determination of whether it would have been obvious to modify Grevious to include frequency modulation as the second modulation circuitry, signals, and receivers. Sur-reply 2. Patent Owner, therefore, proposes we apply the plain and ordinary meaning of "frequency modulation" ("FM") as meaning "encoding information into a carrier wave by varying the instantaneous frequency of the carrier wave." PO Resp. 8–10; Sur-reply 2–3.

Although Petitioner contends no construction of this term is necessary, neither it, nor its expert, disputes Patent Owner's proposed definition. Reply 2; PO Resp. 9–10 (citing Pet. 6; Ex. 2013, 98:12–16, 99:3–8, 100:4–19; Ex. 1003 ¶ 34). We agree with Patent Owner that the proposed definition comports with the ordinary meaning and is likewise clear from the intrinsic and extrinsic evidence. *Id.* (citing e.g., Ex. 1001, 2:18–22, 6:47–51; Ex. 1012 12:8–13; Ex. 2005 ¶¶ 33–38; Ex. 2007, 703; Ex. 2008, 677; Ex. 2010, 306). Because Patent Owner's proposed meaning of "frequency modulation" is both undisputed and relevant to our patentability analysis, we adopt it here for clarity.

3. "second modulation circuitry," "second telemetry receiver," and "second data"

Independent claim 1 requires a "first modulation circuitry," a "first telemetry receiver," and "first data" configured for OOK modulation. Depending from claim 1, claim 2 recites a "second modulation circuitry," a "second telemetry receiver," and "second data" and configured for frequency modulation. Patent Owner contends that the two sets of terms should be construed as "different." PO Resp. 12. We focus here on the meaning of "second modulation circuitry" and "second telemetry receiver," and address the construction of "second data" in section II.1.k, below.

We find Patent Owner's basic premise reasonable insofar as the terms recited in claim 1 refer to OOK (amplitude) modulation, whereas those newly-recited in claim 2 refer to frequency modulation. Patent Owner, however, appears to argue that "second modulation circuitry" and "second telemetry receiver" must be separate and distinct from the "first modulation circuitry" and "first telemetry receiver." PO Resp. 12–14; Sur-reply 11–12. For the reasons set forth on pages 2 and 3 of Petitioner's Reply, we disagree. *See e.g.*, Reply 3 (noting that the '698 patent discloses a single circuit configurable to produce both OOK an FSK signals). Claim 2 specifies no structural differences between the first and second modulation circuitry and telemetry receiver. To the extent the "second modulation circuitry" and "second telemetry receiver," are configured to performed their intended functions, claim 2 is agnostic as whether their hardware is separate, overlapping, or coextensive with that of the "first modulation circuitry" and "first telemetry receiver." As we find no evidence that either the claim language or the '480 patent impart any special meaning to these claim terms, we apply the customary and ordinary meaning.

4. "start bit"

Claim 6 recites, "wherein the first data comprises a start bit and a number of control bits, the start bit being transmitted before the control bits." Depending from claim 6, claim 7 recites "a bit threshold counter configured to measure a pulse width of the start bit to generate a bit width threshold." Patent Owner contends that, in accord with the intrinsic and extrinsic evidence we should construe "start bit" according to its plain and ordinary meaning of "a fixed pulse width signal sent before any other control bits." PO Resp. 10 (citing Ex. 2005 ¶¶ 39–43). In support, Patent Owner points to, for example, the Specification's teaching that "[i]n order for the OOK receiver (43) to distinguish between the first and second pulse widths (PW1 and PW2), a start bit having a fixed pulse width may be sent to the implantable stimulator (10) before any other control bits are sent." PO Resp. 10–11 (citing Ex. 1001, 27:12–16, 7:47–8:8. Patent Owner notes that in one embodiment, a comparator (142) compares the bit threshold to the pulse width of each incoming control bit. *Id.* at 11 (citing Ex. 1001, 7:56–8:3). "[I]f the pulse width of a particular control bit is greater than the pulse width of the start bit, the comparator (142) outputs a '1'. Likewise, if the pulse width of a particular control bit is less than or equal to the pulse width of the control bit, the comparator (142) outputs a '0'." *Id.* (quoting Ex. 1001, 8:4–8.) As further explained in the Sur-reply:

> The specification explains that "[t]he OOK receiver (43) may … increment a counter for the duration of the ***fixed pulse width*** to determine a 'bit width threshold,'" which is then used to compare the width of the start bit to the widths of the subsequent control bits. (EX1001, 7:18-21 (emphasis added); *see id.*, 7:21-25, 7:34-8:51, Figs. 4-7.) Thus, consistent with Claim 7, the reason to measure the fixed pulse width of the start bit is to determine whether the subsequent control bits are 0s

> and 1s by comparing the pulse width of each control bit to the measured pulse width of the start bit. (POR, at 11; EX2005 ¶ 41.)

Sur-reply, 6.

As indicated above, Patent Owner relies on Dr. Young's testimony that, "[i]n the context of the '480 patent, the start bit is a known fixed pulse width that enables a receiver to determine subsequent data bits." Ex. 2005 ¶ 41 (cited at Sur-reply 6). Patent Owner still further references technical dictionaries, which define start bit as, for example, "the first bit used to indicate the beginning of a character; normally, a space condition that serves to prepare the receiving equipment for the reception and registration of the character." PO Resp. 10–11 (citing e.g., Ex. 2010, 731; Ex. 2005 ¶ 42).

Petitioner responds that, consistent with the claims and Specification, we should more broadly construe "start bit" to mean a "bit indicating the start of a data message." Reply 4 (citing Ex. 1001, 8:39–40). Petitioner further points to technical dictionary definitions describing a "start bit" as a bit or timing signal used to indicate the start of a character. *Id.* at 4–5 (citing Ex. 2010; 4, Ex. 2011, 4; Ex. 2012, 3).

Petitioner also contends, "[b]ecause a message is a series of characters, a start bit may be sent after the control bits of the preceding character." *Id.* at 5. Petitioner argues that the Specification merely refers to an embodiment in which "a start bit '***may*** be sent… before any other control bits are sent,' and thus, it need not always be sent before any other control bits." *Id.* (citing Ex. 1001, 7:12–16). Similarly, claim 6 specifies that "the first data comprises a start bit and a number of control bits," and that "the start bit [is] transmitted before the control bits" such that the particular start bit referenced in claim 6 (and claim 7, as it depends from claim 6)

necessarily precedes a number of control bits in the first data message. But as Petitioner points out, the permissive language of claim 6 admits of additional control bits without specifying where they occur in the first data message relative to the start bit. Reply 5; Tr. 82:3–16.

Petitioner also takes issue with Patent Owner's proposal that we construe start bit as requiring "a fixed pulse width signal." Reply 5–6. Petitioner argues that "[b]oth claim 7 and the specification provide that the implanted device measures the start bit's width to set a bit threshold . . . . If the start bit had a fixed width known by the implanted device, there would be no reason for the implanted device to use the measured . . . start bit's width to set a bit threshold—the device would already know what the correct width should be." *Id.* (citing Ex. 7:47–52, 8:1–8, 37–51, 12:16–24); Tr. 84:18–86:2); *see also* Ex. 2013, 82:8–83:2 (Petitioner's expert admitting that having a fixed pulse width "is *one way* that that the '480 patent describes being able to distinguish a one width from a zero width.") (emphasis added). Moreover, Petitioner argues, "claim 7 would be rendered meaningless if a start bit was limited to a fixed, known duration." *Id.* at 6. Although the arguments are close, we find Petitioner's position better accords with our understanding of the claims and the specification and, thus, is more compelling.

In view of the above, we adopt Petitioner's definition of "start bit" to mean a bit indicating the start of a data message, with the caveat that the start bit precedes at least some of the control bits in a data message.

D. Overview of Asserted References

1. Grevious (Ex. 1005)

Grevious discloses implantable medical systems having "a standardized telemetry system that automatically selects a modulation protocol configuration to establish a reliable symmetric telemetry link between medical devices and programmers." Ex. 1005, Abstract, 2:51–55. The system will automatically select any one of the following modulation formats depending on the type of hardware in the corresponding implanted medical device and external programmer: "(1) a pulse or burst width modulation (PWM) format; a pulse or burst width modulation (PWM) plus pulse interval modulation format; (3) a modified phase shift keying (MPSK) modulation format; (4) pulse position modulation (PPM); or (5) pulse interval modulation (PIM)." *Id.* at 2:58–3:4. "In one preferred embodiment [illustrated in Figure 6], there are nine different modulation protocol configurations 210 that can provide a communications interface for a broad range of products." *Id.* at 10:48–51; *see* 12:31–35 (stating that "other modulation protocol configurations are possible to address pragmatic business and product needs").

A particular "modulation protocol configuration is automatically selected that is best suited for the hardware being used." *Id.* at 3:6–9. The selected "modulation protocol configurations vary in modulation format complexity and data rate capability to match the requirements of the application and/or products being used" and, thus, can "be used in a wide array of medical devices and programmers for patient treatment." *Id.* at 2:29–40, 6:24–27; *see id.* at 2:45–48.

Grevious also supports "on the fly" switching between modulation protocols to ensure that a communications link is not lost. *Id.* at 11:4–19.

"This switching of modulation protocol configuration can be done repeatedly to automatically select a different modulation format than the current communications link modulation format. The telemetry system automatically selects the best modulation format, and then switches 'on the fly', to transmit and receive information and data in the most efficient and timely manner possible." *Id.* at 11:19–26.

Grevious further discloses typical system components for a telemetry systems implemented in a medical device, such as an Implantable Neuro Stimulator ("INS"), in Figure 2, reproduced below:

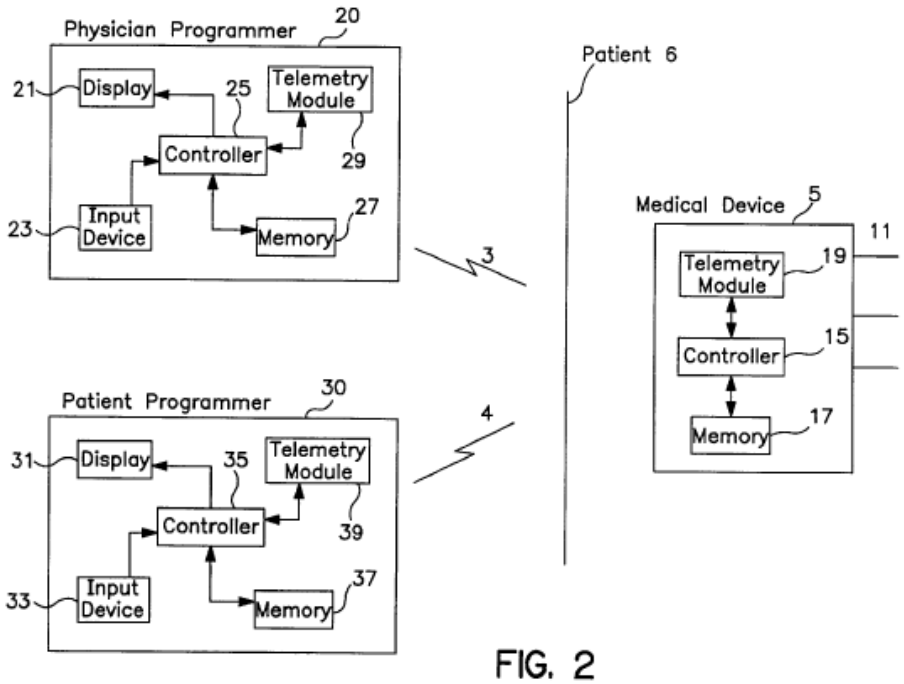

FIG. 2

Figure 2 shows a system including medical device 5, physician programmer 20 and patient programmer 30. Ex. 1005, 4:46–51.

Grevious discloses that physician programmer 20 and patient programmer 30 "can use the telemetry system of the present invention for either bi-directional or uni-directional communication with . . . medical device 5." Ex. 1005, 4:50–54. More specifically, "[i]nformation, commands and instructions can then be communicated back and forth between the

devices via telemetry 3 and 4 when in a bi-directional system. In a uni-directional system, . . . physician programmer 20 or patient programmer 30 communicate with . . . medical device 5." *Id.* at 4:54–59. The telemetry module of each component may include a telemetry coil, a receiver, a transmitter, and a telemetry process, as illustrated in Figure 3, reproduced below:

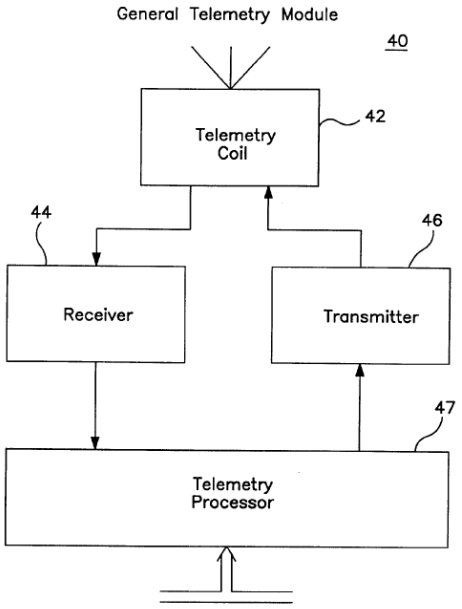

FIG. 3

Figure 3 shows a block diagram of a "typical telemetry module 40" that "enables the medical device 5 and programmers 20 and 30 to communicate bi-directionally with each other via telemetry 3 and 4." *Id.* at 5:13–18 (referencing Figure 2, shown above). "[T]elementary module 40 comprises a telemetry coil 42, a receiver 44, a transmitter 46, and a telemetry processor 47." *Id.* at 5:18–21.

According to Grevious, communication between the programmers and the implantable device may occur using at least five modulation formats, including preferred modulation formats: Formats A, B, and C. Ex. 1005,

6:19–40; 11:51–67; 12:35–39. Format B "uses pulse or burst width modulation (PWM) plus pulse interval modulation (PIM)." *Id*. at 12:1–3.

Figure 7, reproduced below, "shows a message envelope for Format A & B messages used in a preferred embodiment of" Grevious's telemetry system:

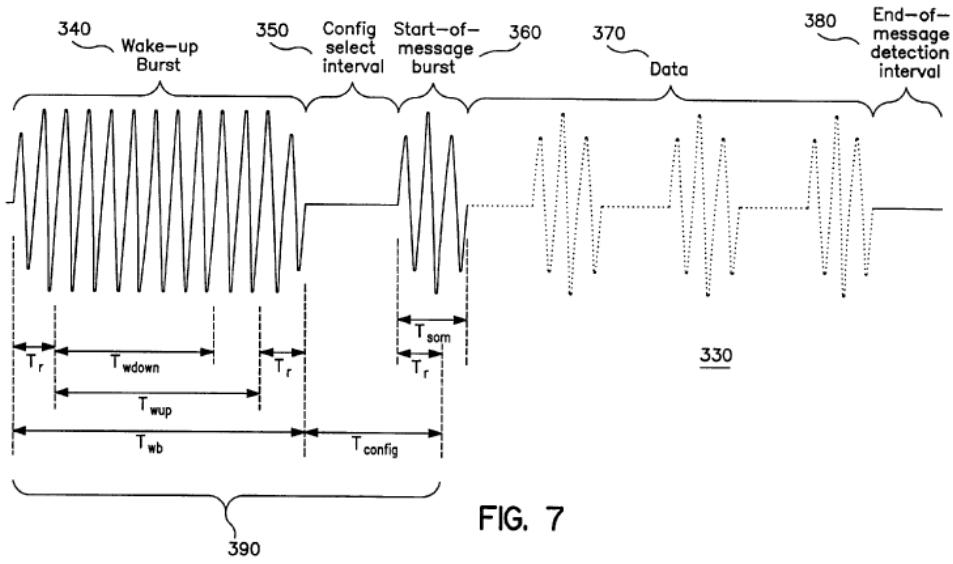

FIG. 7

Figure 7 depicts a message format comprising "a Wake-up burst 340, a configuration select interval 350, a Start-of Message (SOM) burst 360, data 370, and an End-of Message (EOM) interval 380." *Id.* at 12:61–64. According to Grevious: "All transmissions begin with a wake-up burst 340, a configuration select interval 350 and a Start-of-Message burst 360. These three message elements make up the message preamble 390." *Id.* at 12:64–67.

Figure 9, reproduced below, shows greater detail of Format B modulation:

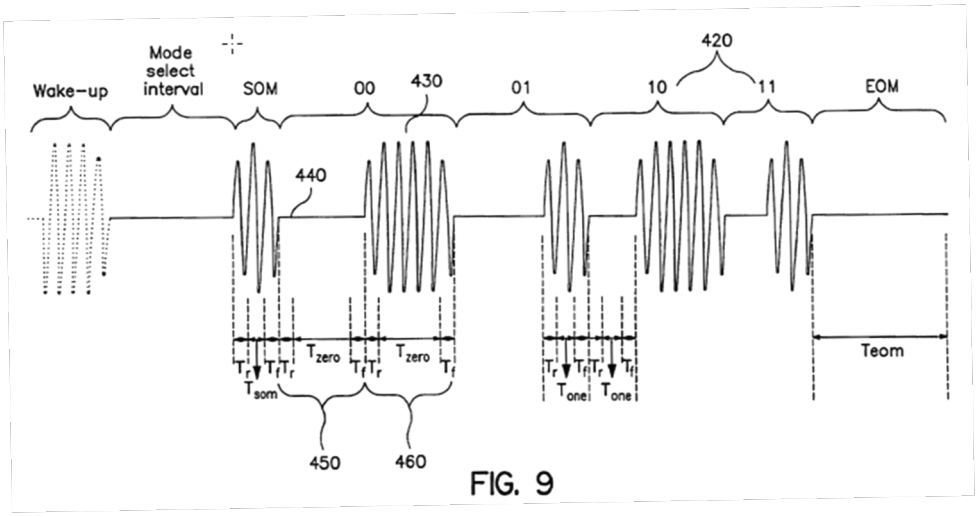

FIG. 9

Figure 9 shows data bits transmitted in pairs 420, wherein each bit is represented by burst 430 or not burst 440. Ex. 1005, 15:38–43.

Grevious further describes:

> In a preferred embodiment of Format B, . . . first bit 450 of each dibit begins with a "not burst" 440. The size of the not burst is simply the length of time measured from the end of the previous burst to the start of the next (T_{zero} or T_{one}). The second bit 460 of the dibit is a burst. This period is measured from the start to the end of a burst. Those skilled in the art will readily recognize that the "not burst"-burst sequence of the first and second bits can be easily varied, for example into burst-"not-burst" sequence.

Ex. 1005, 15:44–52.

2. Fitch (Ex. 1006)

Fitch describes a telephone line carrier system having a data communication channel designed to be an inexpensive technique for reliable communications. Ex. 1006, Abstract, 6:5–6. Fitch discloses "multiplexer and demultiplexer equipment (500, 600) for frequency shifting voice and data channels between base band and RF Frequency modulation and full duplex transmission are used for voice communication while amplitude modulation

and half-duplex transmission are used for data communication." *Id.*, Abstract.

Fitch also describes a data transmitter responsive to a binary digital signal "encoded into a series of pulses having alternating polarity in which a '1' has a duration of 1 ms and a '0' has a duration of 2 ms. . . . This signaling scheme is known as the Pulse Width Encoded - Non Return to Zero (PWE-NRz) format." *Id.* 6:19–28. Fitch describes "on/off carrier keying" as shown in Figure 10, reproduced below:

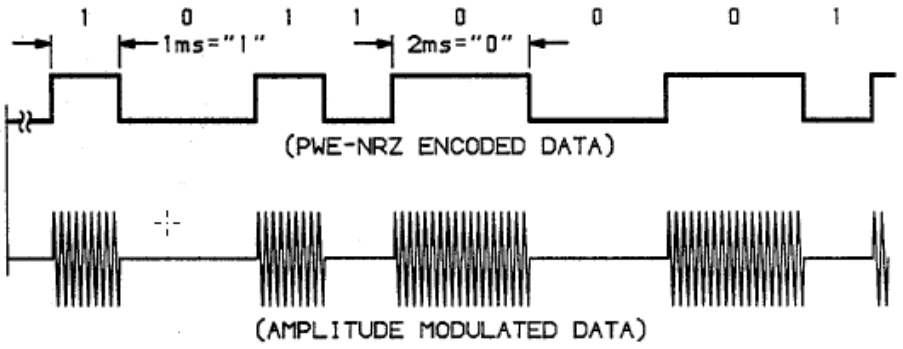

FIG. 10

Figure 10 "illustrates various waveforms associated with data transmission using a pulse width encoded - non return to zero format and on/off carrier keying." Ex. 1006, 3:5–7. According to Mr. Pless, "Fitch's PWE-NRz scheme is equivalent to the OOK scheme disclosed by the '480 patent. *Compare* Ex. 1001 ('480 Patent), Fig. 3 *with* Ex. 1006 (Fitch), Fig. 10. Bradshaw (Ex. 1009)." Ex. 1003 ¶ 110.

3. Bradshaw (Ex. 1009)

Bradshaw discloses a method for synchronizing and calibrating a receiver to a pulse width modulation transmitter. Ex. 1009, Abstract, 1:32–42. Bradshaw explains that "pulse width modulated communication systems have generally required manual tuning to calibrate, i.e., align the pulse width

discrimination circuits in[] the receiver." *Id.* at 1:22–25. These systems "generally require frequent manual readjustment in order to fully compensate for temperature and age induced drift." *Id.* at 1:26-29.

To address this issue, Bradshaw discloses transmitting a modulated control signal having a synchronizing pulse 1, a reference pulse 2 and then a number of control function pulses 3 through N. Ex. 1009, 2:25–37. Bradshaw's Figure 1a is reproduced below:

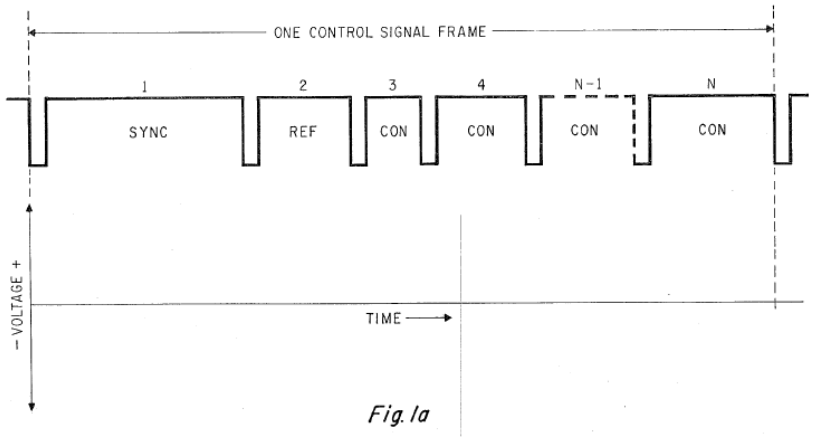

Figure 1 depicts an exemplary control sequence with a synchronizing pulse 1, a reference pulse 2, and multiple control function pulses 2–N. Ex. 1009, 2:25–37. The reference pulse can be used to characterize a value for the control function pulses. *Id.* at 1:43–60. Bradshaw explains that this technique is "simple and straightforward in its operation," and allows for the rapid calibration of the receiver to the transmitter to minimize any error. *Id.* at 1:35- 42.

In one embodiment, a reference signal is compared against the control bits in a binary fashion. *Id.* at 1:43–60 ("A function controller compares the width of the detected control function pulse to the width of the timing pulse, and performs a control function in response to a predetermined compared width difference therebetween."), 2:25–53, 4:30–50, claim 1. Timing circuit

18 measures the width of the reference pulse to generate a timing pulse. *Id.* at 1:43–60, 2:25–53, claim 1, Fig. 1. If a control function pulse is shorter than the reference pulse, it is interpreted as a logical high signal, i.e., a '1.' *Id.* at 4:37–47. If a control function pulse is longer than the reference pulse, it is interpreted as a logical low signal, i.e., a '0.' *Id.*

E. Obviousness in view of Grevious and Fitch (Ground 3)

As Ground 3, Petitioner challenges claims 2–4, 6, and 8 as obvious in view of Grevious with or without Fitch. Pet. 46–62. Petitioner's challenge of claim 2 refers to the challenge of claim 1 (Ground 1), from which claim 2 depends, and includes a detailed mapping of the teachings of these references to each element of claim 2. *Id.* at 46–56. In section II.E.1–2, we address the parties' arguments with respect to each element of claim 2. In section II.E.3–4, we address the parties' arguments with respect to the additionally contested elements of dependent claims 3, 4, 6, and 8.

1. Analysis of Claim 2

In addressing Petitioner's argument that claim 2 is obvious over Grevious, with or without Fitch, we also address the elements of disclaimed claim 1, from which claim 2 depends.

a) "A system, comprising:"

Petition asserts that Grevious discloses a schematic block diagram of a system in Figure 2. Pet. 19.

Patent Owner does not contest this assertion.

b) "an external device, comprising"

Petitioner asserts that Grevious discloses physician and patient programmers 20 and 30 that are each external devices that communicate with implanted medical device 5. Pet. 20.

Patent Owner does not contest this assertion.

c) "first modulation circuitry for producing from first data a first signal"

Petitioner asserts that Grevious discloses telemetry transmitter 46 and telemetry processor 47 that satisfy the claimed "first modulation circuitry." Pet. 21–24.

Patent Owner does not contest this assertion.

d) "modulated with on-off keying (OOK) modulation"

Petitioner asserts that Grevious discloses a telemetry system that supports multiple modulation formats, including pulse width modulation, also known as on/off keying (OOK) modulation. Pet. 24–28.

Patent Owner does not contest this assertion.

e) "wherein the first modulated signal comprises logic '0' bits of a first pulse width and logic '1' bits of a second pulse width different from the first pulse width"

Petitioner asserts that Grevious discloses a first modulated signal, Format B, which uses alternating burst (ON) and not burst (OFF) pulses of varying widths to encode bits. Pet. 28–29. Mr. Pless states that each '0' data bit in Grevious's Figure 9 corresponds to a pulse width of T_{zero} and each '1' data bit corresponds to a pulse width of T_{one}, which has a different width than T_{zero}. *Id.* (citing Ex. 1003 ¶ 88). Petitioner further relies on Fitch for this limitation. Petition at 39–42.

Patent Owner does not contest these assertions.

f) "wherein each bit further comprises either an ON state with a signal that varies with a first frequency or an OFF state"

Petitioner asserts that Grevious discloses modulation Format B using alternating burst (ON) and not burst (OFF) pulses to encode data bits. Pet.

30–31. Mr. Pless states that each data bit comprises either a burst (ON) or not burst (OFF) state. *Id.* (citing Ex. 1003 ¶ 92).

Patent Owner does not contest these assertions.

> *g) "wherein a transition between adjacent bits in the first signal is marked by a change in the first modulated signal between the ON and OFF states;"*

Petitioner asserts that Grevious discloses that "both the transitions between the data bits represented by the burst (ON) pulses preceding and following the data bit represented by the not burst (OFF) pulse are marked by a change between the ON and OFF state in the signal." Pet. 31–32. Mr. Pless states that the following annotated Figures 9 and 3 correspond with a transition in the signal between a burst/ON (blue) and a not burst/OFF (red) state:

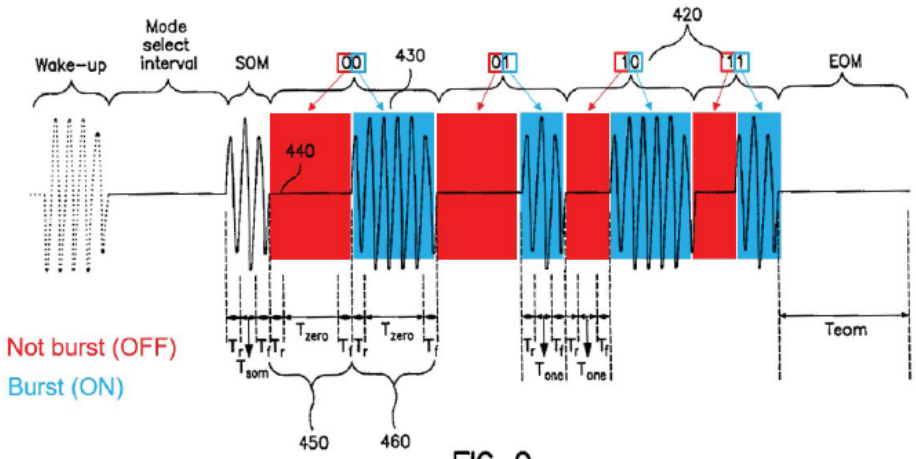

FIG. 9

Grevious Figure 9 is annotated by Petitioner's expert to show burst/ON pulses in blue and not burst/OFF pulses in red, which correspond to binary code 00011011. *Id.* (citing Ex. 1003 ¶ 96).

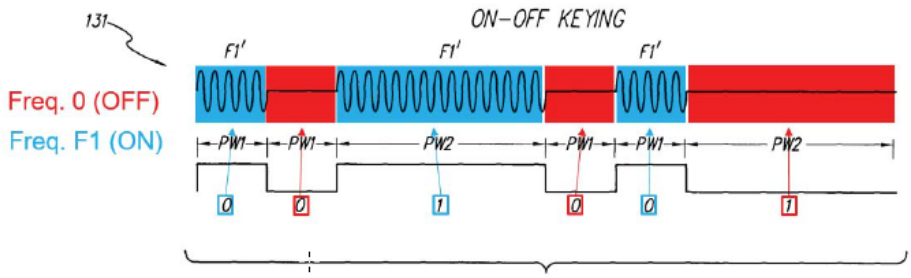

FIG. 3

The '480 patent's Figure 3 is annotated by Petitioner's expert to show ON pulses in blue and OFF pulses in red which correspond to binary code 001001. *Id.* (citing Ex. 1003 ¶ 97).

Alternatively, Petitioner asserts that Fitch discloses on/off keying modulation, having logic bits '0' and '1' with different pulse widths, wherein a transition between adjacent bits is marked by a change in the signal between ON and OFF states. *See* Pet. 39–43.

Patent Owner does not contest these assertions.

> *h) "a coil configured to wirelessly transmit the first modulated signal to the implantable medical device; and"*

Petitioner asserts that Grevious discloses telemetry module 40 that includes telemetry coil 42 that enables bidirectional communication. Pet. 33–35.

Patent Owner does not contest this assertion.

> *i) "an implantable medical device, comprising a first telemetry receiver in the implantable medical device for demodulating the first modulated signal to recover the first data."*

Petitioner asserts that Grevious discloses implantable medical device 5 including a telemetry module that includes telemetry processor 47 and telemetry receiver 44. Pet. 35–39. Petitioner relies on Grevious to show that telemetry processor receives a predetermined protocol including a type of

telemetry modulation (e.g., Format B) that is demodulated by telemetry receiver 44 from a time base[d] signal into data pulses. *Id.* at 38.

Patent Owner does not contest these assertions.

> *j) "The system of claim 1, further comprising:* ***second modulation circuitry in the external device for producing from second data a second signal modulated with frequency modulation****, wherein the coil is further configured to wirelessly transmit the second modulated signal to the implantable medical device;*
>
> *k) "****a second telemetry receiver*** *in the implantable medical device for demodulating the second modulated signal to recover the second data."*

With respect to element *j*, Petitioner asserts that Grevious discloses a system that supports at least five modulation formats. Pet. 46–47. Petitioner argues Grevious's "[t]elemetry transmitter 46 and telemetry processor 47, as configured with FSK . . . satisfy the claimed '*second modulation circuitry*." *Id.* at 47. Petitioner argues "[t]elemetry processor 47 is first configured with the appropriate telemetry protocol to communicate, including one of these at least five modulation protocols, and then processes binary data ('*second data*') into time based digital pulses." *Id.*, 6:6–12. According to Petitioner, "[t]ransmitter 46 then modulates the digital signal into an RF signal ('*second [modulated] signal*')." *Id.* (citing Ex. 1001 6:12–13; Ex. 1003 ¶ 124). In addition:

> The '480 patent discloses a single "control circuitry (39)" that controls the operation of coil 34 to transmit data using either FSK or the OOK modulation schemes disclosed by the '480 patent. Ex. 1001, 4:19-39. The claimed "*first modulation circuitry*" and "*second modulation circuitry*" therefore must encompass a single control circuitry capable of a "*first modulation*" and a "*second modulation*."

Id. at 47–48 (citing Ex. 1003 ¶ 125).

Petitioner further argues that "[a]lthough Grevious does not expressly disclose '*frequency modulation*' as a modulation format (*see* Ex. 1005, 6:22–37), it does expressly contemplate the use of "[o]ther modulation formats" in addition to the five exemplary formats (*id*., 12:35–39)." Pet. 48. Mr. Pless states that "FSK was routinely used as a modulation format for telemetry communications between implantable medical devices and external devices." Ex. 1003 ¶¶ 127–128 (citing Kruse and Thompson). Petitioner argues "[i]t would have been obvious to a person having ordinary skill in the art in 2002 to modify Grevious . . . to incorporate frequency shift-keying (FSK) as an additional modulation format supported by Grevious's telemetry modules in programmers 20 and 30 and medical device 5." Pet. 50 (citing Ex. 1003 ¶¶ 130–132).

With respect to the requirement that "the coil is further configured to wirelessly transmit the second modulated signal to the implanted device," Petitioner relies on Grevious as disclosing a typical telemetry module 40 used in programmers 20 and 30, including telemetry coil 42 for wirelessly communicating with implanted medical device 5. Pet. 52. Petitioner argues "[a]fter transmitter 46 of programmers 20 or 30 modulates the digital signal into an RF signal ('*second modulated signal*'), the modulated telemetry signal is transmitted via the telemetry coil 42 to implanted medical device 5." *Id.* at 52–53.

With respect to element *k*, involving a "second telemetry receiver . . . for demodulating the second modulated signal," Petitioner asserts that Grevious discloses that "[t]elemetry receiver 44 and telemetry processor 47, as configured with FSK as discussed above, satisfy the claimed '*second telemetry receiver*.'" Pet. 53 (citing Ex. 1003 ¶ 138). Petitioner notes that "[t]he '480 patent explains that a receiver 'may be any circuit configured to

receive and process an RF signal,' such as, for example, 'a microprocessor, [DSP], [ASIC], processor with firmware, [FPGA], or any other combination of hardware and/or software'" and that "OOK receiver (43) may be integrated into the receiver (42)." *Id.* at 54 (citing Ex. 1005 4:55–61; 5:27–28). Petitioner argues that Grevious's receiver 44 and processor 47 configured to receive and demodulate "Format B satisfies the '*first telemetry receiver*'" and Grevious's receiver 44 and processor 47 configured to receive and demodulate "FSK satisfies the '*second telemetry receiver*.'" *Id.* (citing Ex. 1003 ¶ 139).

Petitioner argues in the alternative, if "*first telemetry receiver*" and "*second telemetry receiver*" are "mutually exclusive and non-overlapping, such a distinction would have been obvious." Pet. 54 (citing Ex. 1003 ¶¶ 140–146). Mr. Pless states that "[i]t was known by 2002 to implement different receivers and modulation techniques in different hardware or software elements." Ex. 1003 ¶¶ 141–143 (citing Silvian, Torgerson, and Ohno). Petitioner argues "[i]t would have been obvious to further modify Grevious to implement the different modulation formats as separate hardware or software functionality." Pet. 55 (citing Ex. 1003 ¶ 144). Petitioner argues that "[m]odifying Grevious to implement its different modulation formats as separate hardware or software modules simply 'arranges old elements with each performing the same function it had been known to perform and yields no more than one would expect from such an arrangement,' and would have been obvious." *Id.* at 56 (citing *KSR*, 550 U.S. at 417).

Addressing elements *f* and *g*, Patent Owner contends that Grevious, alone, or in combination with any other asserted reference, fails to disclose either the "second modulation circuitry in the external device for producing

from second data a second signal" or the corresponding "second telemetry receiver in the implantable medical device for demodulating the second modulated signal." PO Resp. 23–33; Sur-reply 10–13. Patent Owner focuses on the terms "second data," "second modulation circuitry," and "second telemetry receiver," which we address in turn.

(1) "second data"

In arguing that Petitioner has not shown that the cited references disclose or render obvious "second data," Patent Owner interprets claim 2 as requiring "second data" to have a different and distinguishable content from "first data." PO Resp. 12–14, 23–26; Sur-reply 12–13. Patent Owner provides little support for this construction. At best, Patent Owner's expert, Dr. Young, argues that "[i]n the '480 Patent the first and second data are not the same; they are different data used for different purposes and by different components." Ex. 2005 ¶ 61. Pointing to a passage in the incorporated-by-reference '698 patent, Dr. Young further states: "For example, the OOK modulated data ("first data") is used by the charging system, and the frequency modulated data ("second data") is used by any of the remote control, clinician's programmer, and/or the charging system." *Id.* (citing Ex. 1012, 9:34-53).

We do not agree with Patent Owner that its limited argument and evidence "preclud[es] the possibility that the first and second data are the same," irrespective of whether that date is encoded and transmitted in the same or different formats. *See* PO Resp. 25–26 (citing Ex. 2005 ¶ 61). "Though understanding the claim language may be aided by the explanations contained in the written description, it is important not to import into a claim limitations that are not a part of the claim." *SuperGuide Corp. v. DirecTV Enters., Inc.*, 358 F.3d 870, 875 (Fed. Cir. 2004). "Even

when the specification describes only a single embodiment, the claims of the patent will not be read restrictively unless the patentee has demonstrated a clear intention to limit the claim scope using 'words or expressions of manifest exclusion or restriction.'" *Hill-Rom Services, Inc. v. Stryker Corp.*, 755 F.3d 1367, 1372 (Fed. Cir. 2014) (alteration in original). On the present record, we find insufficient reason to incorporate the example from the '698 patent into claim 2 of the '480 patent.

Absent such incorporation, we do not read the plain language of claim 2 as excluding a system that that transmits a stream of similar information in both a first modality (first data) and in a second modality (second data) as set forth in the Petition. In this aspect, Claim 2 merely requires the transmission of first data via OOK modulation, and the transmission of second data via frequency modulation. Nothing in the claim requires that the first and second data comprise different types of information.

With that construction in mind, we note that Grevious provides a "telemetry system [that] automatically selects the best modulation format, and then switches 'on the fly', to transmit and receive information and data in the most efficient and timely manner possible." Ex. 1005, 2:36–48, 11:22–26. Although, as Patent Owner points out, this encompasses the transmission of the same type of data, regardless of protocol, Grevious expressly contemplates the use of "[o]ther modulation formats." Ex. 1005, 12:35–39). *See* PO Resp. 25. For the reasons discussed in section II.E.1.l, below, we agree with Petitioner that one of ordinary skill in the art would have been motivated to modify Grevious to include frequency shift keying as an additional transmission modality in the manner contemplated by the "second data" limitation of claim 2.

We also agree with Petitioner's contention that Grevious renders claim 2 obvious under Patent Owner's proposed construction where the recited first and second data must be of different types. *See* Reply 18–19. In short, Grevious discloses the transmission of several different types of downlink messages. Ex. 1005, 8:56-62 ("Downlink messages or transmissions perform a variety of functions."). Programming messages, for example, "alter or enable therapy," whereas link control messages "control the medical device communication" e.g., by "acknowledgment of received transmissions, requests for retransmission and link status or 'handshake' messages." *id.* at 8:61–62, 9:7–10. Because these messages may be sent with different telemetry modulation protocols, Grevious discloses transmitting different types of data using different modalities. *See* Ex. 1005, 14:25–35 ("The new message can have the same or different telemetry modulation protocol configuration than a prior message."). Grevious discloses, for example that, "the programmer may elect to send some messages in one configuration and send others in a higher performance configuration." Ex. 1005, 14:25–28. Upon the conclusion of a first message, "a new message sequence can be initiated from the programmer . . . [using] the same or different telemetry modulation protocol configuration than a prior message"—i.e., different "second data" transmitted via a different modality. *Id.* at 14:32–35.[20] Thus, even under Patent Owner's proposed construction, Grevious, modified as Petitioner proposes, renders obvious the "second data" of claim 2.

[20] In light of the preceding, we do not find persuasive Dr. Young's testimony that "Grevious discloses that the same data are transmitted no matter which modulation format is used." *See* Ex. 2005 ¶ 60.

(2) "second modulation circuitry"

According to Patent Owner: "Petitioner also fails to show that Grevious discloses a 'second modulation circuitry' that is different from the 'first modulation circuitry,' as the '480 Patent requires." PO Resp. 26–31. As an initial matter, claim 2 of the '480 patent requires that the first and second modulation circuitries are "different" only insofar as they are configured for producing a signal modulated with OOK modulation or frequency modulation, respectively. *See* section II.E.k.1, above.

With respect to Patent Owner's contention that Petitioner "fails to show that Grevious discloses a "second modulation circuitry," we note that Petitioner admits that Grevious "does not expressly disclose '*frequency modulation*' as a modulation format" and accordingly, does not disclose a "second modulation circuitry . . . for producing from second data a second signal modulated with frequency modulation" as required by claim 2. *See* PO Resp. 23, Pet. 46. But that does not end our analysis because, as discussed in section II.E.1.l, below, Petitioner reasonably contends that one of ordinary skill in the art would have been motivated with a reasonable expectation of success to modify Grevious to include frequency modulation as an additional modulation format. So modified, the resulting device would embody the required "second modulation circuitry" irrespective of whether the circuity for the frequency modulation modality is physically coextensive, overlapping, or distinct from that of the "first modulation circuitry for producing from first data a first signal modulated with on-off keying (OOK) modulation," recited in claim 1 from which claim 2 depends.

(3) "second telemetry receiver"

Patent Owner similarly contends that "Petitioner also fails to show that Grevious discloses a "second telemetry receiver" that is different from

the "first telemetry receiver," as the '480 Patent requires." PO Resp. 31–33. Again, claim 2 of the '480 patent requires that the first and second telemetry receivers are "different" only insofar as they are configured to demodulate signals modulated with OOK modulation or frequency modulation, respectively. *See* section II.E.1.k.1, above. [21]

With respect to Patent Owner's contention that Petitioner "fails to show that Grevious discloses a "second telemetry receiver," we note that Petitioner admits that Grevious "does not expressly disclose '*frequency modulation*' as a modulation format" and accordingly, does not disclose "a second telemetry receiver . . . for demodulating the second modulated signal [modulated with frequency modulation] to recover the second data" as required by claim 2. *See* PO Resp. 31; Pet. 48. But that does not end our analysis because, as discussed in section II.E.1.l, below, Petitioner reasonably contends that one of ordinary skill in the art would have been motivated with a reasonable expectation of success to modify Grevious to include frequency modulation as an additional modulation format. So modified, the resulting device would embody the required "second telemetry receiver" irrespective of whether the circuity for receiving and demodulating the frequency modulation signal is physically coextensive, overlapping, or distinct from that of the "first telemetry receiver . . . for demodulating the first [on-off keying (OOK)] modulated signal to recover the first data," as recited in claim 1 from which claim 2 depends.

[21] Similarly, although Patent Owner challenges Mr. Pless's testimony that one of ordinary skill in the art would understand Grevious to disclose two receivers, this testimony has little relevance to the question of whether the skilled artisan would have understood Grevious to disclose or render obvious a second telemetry receiver for demodulating a frequency modulated signal. *See* PO Resp. 32 (citing Ex. 1003, ¶ 139).

l) Motivation to Modify Grevious with a Reasonable Expectation of Success

Petitioner reasonably contends that one of ordinary skill in the art would have had ample motivation to modify Grevious (or the combination of Grevious and Fitch) to include a well-known frequency modulation modality. Pet. 46–52; Reply 7–10. In particular, Petitioner points to Grevious's stated objectives of "provid[ing] a telemetry protocol system to support … the use of telemetry in a wide array of medical devices" and to "support a wide range of medical devices" Pet. 51 (quoting Ex. 1005, 2:35–40, 2:45–48). Relying on the testimony of Mr. Pless, Petitioner contends that one of ordinary skill in the art would have been motivated to support an even wider array of medical devices, such as those that only support FSK. *Id.* (citing Ex. 1003, ¶131).

Petitioner explains that Grevious exemplifies three modulation formats, where Formats A and B are amplitude shift keying (ASK) and Format C is a type of phase shift keying (PSK). *See* Reply 7–8 (citing Ex. 1005, 2:65–3:4; Ex. 1003 ¶ 33). Petitioner admits that Grevious does not explicitly identify FSK, but does teach that telemetry protocols different from or in addition to Formats A, B, and C can be used. Reply 8 (citing Ex. 1005, 6:27–37, 12:35–39). In this respect, Petitioner notes that "FSK was a "well-known and commonly used modulation format" and "routinely used as a modulation format for telemetry communications between implantable medical devices and external devices." Pet. 48 (citing Ex. 1003 ¶¶ 126–128); Reply 8–9 (further citing Ex. 1062, 9:16–22 (Dr. Young admitting that ASK, PSK, and FSK were the three main categories of digital telemetry protocols); Ex. 1020, 81 ("One of the oldest and most popular methods of binary data transmission is frequency-shift keying. . . . The

circuitry is easy to understand, it is easy to build, and it is also extensively used.").[22]

Petitioner further contends that the motivation to add a frequency modulation modality to Grevious is underscored by Kruse and Thompson, which disclose medical devices that support FSK. *Id.* at 48–49 (citing Ex. 1007, Abstract, 3:37–44, 8:42–9:19, 7:56–61, 20:28–33; Ex. 1008, Abstract, 1:13–17, 2:33–40, 2:40–42, 3:45–4:12). According to Petitioner, because "Grevious, Kruse, and Thompson are each patents filed by Medtronic, Inc. . . . [an] ordinary artisan would have been motivated to modify Grevious to support the modulation formats used or expected to be used by other Medtronic medical devices."[23] *Id.* 51 (citing Ex. 1003, ¶131).

Petitioner also asserts "[a] skilled artisan would have also been motivated to incorporate frequency modulation (FM) techniques such as FSK because they are less susceptible to interference than amplitude modulation (AM) techniques such as on-off keying (OOK). *Id.* at 51–52 (citing Ex. 1003, ¶132; Ex. 1020, 82; Ex. 1021, 1755). In this respect, Petitioner notes that "Grevious includes 'automatic selection' functionality . . . which avoids a 'lost' communications link by switching 'on the fly' to a better protocol for a given situation." *Id.* at 52 (citing Ex. 1005, 10:65-11:26). Accordingly, "[a]n ordinary artisan would have been motivated to support additional modulation formats such as FSK to ensure flexibility

[22] Theodore Brenig, *Data Transmission for Mobile Radio*, IEEE Transactions on Vehicular Technology, Vol. VT-27, No. 3, 77-85 (Aug. 1978)
[23] Medtronic, Inc. is identified as the Assignee of Grevious. Ex. 1005, code (73).

during the automatic configuration process and to avoid lost connections in high-interference situations." *Id.* (citing Ex. 1003, ¶ 132).

With respect to a reasonable expectation of success, Petitioner further states:

> Modifying Grevious to additionally support FSK would have been an "application of a known technique to a piece of prior art ready for the improvement." *KSR*, 550 U.S. at 417. Grevious already supports numerous modulation formats and explains that "[o]ther modulation formats are also possible," Ex. 1005, 12:35-39, and it would have involved only routine skill to modify Grevious to additionally support the FSK modulation format, which was also well-known in the art. Ex. 1003, ¶130.

Pet. 50; *see also* Ex. 1003 ¶ 144 (Mr. Pless explaining why "[i]t would have involved only routine skill to implement Grevious's modulation formats as separate hardware or software functionality").

In response, Patent Owner argues that motivation is lacking because adding a frequency modulation modality to Grevious would introduce an asynchronous communication protocol thereby, rendering it inoperable for its intended purpose and defeat Grevious's objectives of "of a 'standardized telemetry communications protocol or system protocol,' 'simpler than a more traditional synchronous protocol,' [and] 'eliminat[ing] the need for message based resynchronization.'" PO Resp. 2 (citing Ex. 1005, 2:29–35, 8:10–20, 12:40–52), 34–38; Sur-reply 1, 15; Ex. 2005 ¶¶ 69–73; *see also* PO Resp. 34 (stating that "a POSITA would not have had a reasonable expectation of success in modifying Grevious to add FM-FSK because the resulting device would be inoperable for Grevious's intended purpose").

Patent Owner argues, for example, that Grevious employs inherently synchronous modulation formats that transmit data and clock information together and, thus, eliminate "the need for complicated encoding schemes

and protocols." PO Resp. at 35 (citing Ex. 1005, 11:51–52, 12:40–41; Ex. 2005 ¶ 69. In support, Patent Owner cites to Grevious's preferred embodiment involving "bit-synchronous transmission methods ***that eliminate the need for message based resynchronization***. This allows the Telemetry system data link or 'message frame' protocol to be simpler than a more traditional Synchronous protocol such as SDLC." *Id.* (quoting Ex. 1005, 8:12–20). Thus, Patent Owner argues, one of ordinary skill in the art would "not consider adding FM-FSK" to Grevious because the reference "consciously avoided frequency-dependent modulation schemes [such as FSK] that require message-based resynchronization," moreover, "Grevious does not teach or suggest how to handle resynchronization." *Id.* at 35–36 (citations omitted).

Patent Owner similarly argues that one of ordinary skill in the art would "not have 'seen a benefit' to modifying Grevious with frequency-modulation telemetry schemes." *Id.* at 39 (citing KSR, 550 U.S. at 424; Ex. 2005 ¶¶ 75–76. As articulated by Patent Owner's expert, a person of ordinary skill in the art "would not have been motivated to look outside Grevious for ways to eliminate message based resynchronization using a family of modulation formats that are all frequency independent and bit-synchronous because Grevious left no relevant problem to be solved—that is, Grevious already describes solutions for eliminating message based resynchronization." Ex. 2005 ¶ 74.

The test for obviousness, however, is "n[ot] that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art." *In re Keller*, 642 F.2d 413, 425 (CCPA 1981). In view of the record as a whole, we find that Petitioner has set forth

persuasive arguments and evidence, outlined above, that one of ordinary skill in the art would have been motivated to add frequency modulation to Grevious with a reasonable expectation of success. Patent Owner's arguments do not undermine Petitioner's persuasive showing.

In short, Patent Owner focuses on Grevious's design for "eliminat[ing] the need for message based resynchronization." *See e.g.*, PO Resp. 35 (quoting Ex. 1005, 8:12–20). But Grevious stated objectives more broadly include "provid[ing] a telemetry protocol system to support and control the use of telemetry in a wide array of medical devices and products" and to "support a wide range of medical devices." *See* Ex. 1005, 2:35–48. As instructed by our reviewing court, we weigh the benefits of a proposed combination or modification "both lost and gained . . . against one another."' *See Medichem, S.A. v. Rolabo*, S.L., 437 F.3d 1157, 1165 (Fed. Cir. 2006) *Id*. (quoting *Winner Int'l Royalty Corp. v. Wang*, 202 F.3d 1340, 1349 n.8 (Fed. Cir. 2000)).

In the present instance we find that, although the addition of frequency modulation might undercut Grevious's objective to eliminate the need for message based resynchronization, this does not obviate a motivation to combine. Rather, in light of the record as a whole, and as discussed in detail above, we agree with Petitioner that one of ordinary skill in the art would have added the commonly used frequency modulation format to the modalities expressly taught by Grevious in order to communicate with an even wider array of medical devices, such as those embodying the Druse and Thomson references. We further agree with Petitioner that a skilled artisan would have been motivated to include frequency modulation modalities in Grevious because they are less susceptible to interference than amplitude modulation and thus, help "ensure

flexibility during the automatic configuration process and . . . avoid lost connections in high-interference situations." Pet. 52 (citing Ex. 1003, ¶ 132). Given the understanding in the art that frequency-shift keying is "[o]ne of the oldest and most popular methods of binary data transmission," that its "circuitry is easy to understand. . . easy to build, and . . . extensively used," including as a common modulation format for telemetry communications between implantable medical devices and external devices," we further find that one of ordinary skill in the art would have added a frequency modulation modality to Grevious with the exercise of only routine skill. *See, e.g.*, Ex. 1003 ¶¶ 126–128, 144; Ex. 1020, 81.

m) Mr. Pless's Declaration

Patent Owner contends that we should accord Mr. Pless's declaration little or no weight because it is "conclusory," and "merely repeats attorney argument and does not provide any underlying support for these arguments." PO Resp. 55–57; *see* Sur-reply 23–24. Patent Owner neither challenges Mr. Pless's credentials nor moves to exclude his testimony. *See* Reply 27 ("PO does not even allege that Petitioner's expert opinion lacks underlying support"). Patent Owner's underlying complaint appear to be that more than 120 paragraphs of Mr. Pless's 178-page declaration are essentially identical to the Petition. *See* Sur-reply 23.

While it is often helpful for the Board for an expert declaration to further explain or support a party's assertions, we find no requirement that it do so. Irrespective of the precise relationship between the declaration and a party's assertions, we consider the clarity of the expert's opinions, whether those opinions are supported in the record, the expert's experience and qualifications, and the reputation the witness puts on the line with every

submission to, and deposition before, this body. [24] In the present case, we do not find either parties' expert wanting and, accordingly, do not find Patent Owner's argument persuasive.

2. Conclusion as to Claim 2

On the record as a whole, and for the reasons set forth above, Petitioner has shown by a preponderance of the evidence that claim 2 of the '480 patent is unpatentable as obvious in light of Grevious, with or without Fitch.

3. Analysis and Conclusion with Respect to Claims 3 and 8

Patent Owner contends that claims 3, 4, 6, 8 are not obvious insofar as they depend from claim 2. PO Resp. 50. Petitioner has demonstrated by a preponderance of the evidence that claim 2 is unpatentable and Patent Owner makes no other arguments with respect to claims 3 and 8. We have reviewed Petitioner's contentions with respect to claims 3 and 8 and determine that the Petition proves by a preponderance of the evidence that Grevious, alone or together with Fitch, renders these claims obvious. *See* Pet. 57, 61–62. Patent Owner does not offer any arguments addressing Petitioner's persuasive showing. *See* PO Resp. 50.

[24] In a related matter, we address Petitioner's contention that at his deposition, Dr. Young admitted that Grevious's receiver must include a reference clock, and that we should give no weight to his errata indicating that although Grevious does requires a clock, it is not the type of clock recited in claim 4. *See e.g.*, Papers 57–58; Tr. 81:10–82:7. Considering the evidence of record, we conclude that Dr. Young mis-spoke at deposition and properly addressed his mistake in the errata.

4. Analysis of Claim 4

Depending from claim 2, claim 4 further comprises, "a reference clock generation circuit for generating a reference clock signal used by the second telemetry receiver." Petitioner contends it would have been obvious to include a reference clock when modifying Grevious to support FSK modulation, particularly in view of Grevious's preference for "'synchronous transmission formats' where 'the data and receiver clock information are transmitted together.'" Pet. 58–59 (citing Ex. 1005, 12:40–43; Ex. 1003 ¶ 152).

According to Petitioner, the skilled artisan would have been motivated to include a reference clock generation circuit, such that the FSK-modulated signal would transmit both data and receiver clock information. Ex. 1003, ¶152. "The generated reference clock signal would have been used by the receiver to measure the bit width to determine when to sample the FSK signal to recover the bits, which is the way such circuits were typically used." Reply 21 (citing Pet., 58–59; EX1003, ¶¶151–52; Ex. 1011; Ex. 1027). Petitioner contends this arrangement would "provide the benefit of avoiding the need for a separate local oscillator, reducing the complexity and power consumption of the device (Ex. 1025, 429) and would address the effects of temperature and age." Ex. 1003, ¶152; Ex. 1023, 1:22–34, 7:21–24; Pet. 59; *see also* Reply 21 (arguing that the above benefits are unrebutted).

Petitioner also provides evidence that it was well-known to use a reference clock generation circuit to characterize FSK and other modulated data, including in the context of an implantable medical device. Pet. 58 (citing Ex. 1003 ¶151; Ex. 1011, 1:58–2:34, 5:39–67; Ex. 1027, 1:15–22, 3:21–33). Relying on the testimony of Mr. Pless, Petitioner argues that "[i]t

would have involved only routine skill to modify Grevious to characterize FSK signals relative to a generated reference clock." Pet. 59 (citing Ex. 1003 ¶ 153); Tr. 80:17–83:7.

Patent Owner responds that FSK systems do not invariably require a reference clock, and "even if a POSITA would modify Grevious to include an FM-FSK telemetry receiver, a simple design without a reference clock circuit would be used." PO Resp. 51–52 (citing Ex. 1005, 2:29–34, 12:40–53; Ex. 2005, ¶ 95; Ex. 2013, 117–18:19, 119:12–14; Ex. 1001, 2:47–50 ("Accurate communication between an implantable stimulator and an external device typically requires a precise reference clock within the implantable stimulator."); Tr.. 101:13–103:3). According to Patent Owner, there are tradeoffs in size, complexity and cost in determining whether to use a reference clock, for example, "FM discriminators and FSK-type demodulators that use band-pass filters to differentiate between frequencies in an FSK signal do not use clocks to demodulate FM signals and are easier to design than demodulators using clocks." PO Resp. 51 (citing Ex. 1014 at 191; Ex. 2015, 574-75; Ex. 2005, ¶ 95; Tr. 102:3–104:3.

Considering the evidence of record, we find that Petitioner has the more persuasive argument. We first note Dr. Young's testimony that "[t]here are many ways, with varying complexity, to demodulate FM signals. The simplest and most straight forward methods do not employ reference clocks." Ex. 2005, ¶ 95. Yet as evidence that reference clocks are not always required, Dr. Young points to statement in the '480 patent that "an external device *typically* requires a precise reference clock within the implantable stimulator." *Id.* (quoting Ex. 1001, 2:47–50).

Taken in context, we find that one of ordinary skill in the art would have understood that it was not merely "well-known" to use a reference

clock to demodulate FM signals, but "typical" to do so in the context of implantable medical devices. *Id.*; Ex. 1003 ¶ 151. As such, considering Grevious's system modified to include a frequency modulation modality, a reference clock generation circuit as set forth in claim 4 is but one—and indeed the "typical"—embodiment of "a finite number of identified, predictable solutions," known to a person of ordinary skill. *See KSR*, 550 U.S. at 417. Accordingly, its selection as part of a FSK modification to Grevious, would have been obvious as it merely "arranges old elements with each performing the same function it had been known to perform and yields no more than one would expect from such an arrangement." *Id.* at 421; s*ee also, Merck & Co. v. Biocraft Labs., Inc.*, 874 F.2d 804, 807 (Fed. Cir. 1989) (obvious for one of ordinary skill in the art to select a particular component from among many disclosed by the prior art as long as the prior art teaches that the selection will result in the disclosed effect).

We also consider the testimony of the parties' experts regarding the motivation to select a particular FM demodulator. According to Mr. Pless, the benefits of using a receiver clock include: "avoiding the need for a separate local oscillator, reducing the complexity and power consumption of the device (Ex. 1025, 429)[25] and . . . address[ing] the effects of temperature and age." Ex. 1003, ¶152. Dr. Young does not address these asserted benefits, but testifies that if Grevious were modified to include an FSK telemetry receiver, the skilled artisan would select a simple design, preferably a band-pass filter, that does not include a reference clock because they are easier to design than clock-based demodulators and better suited to

[25] Christopher Hitzelberger et al., *A Microcontroller Embedded ASIC for an Implantable Electro-Neutral Stimulator*, IEEE (2001).

"the relatively low data rates[26] and carrier frequency that Grevious discloses." Ex. 2005 ¶¶ 95–96. *Id.*

After reviewing both expert's testimony on this issue, we agree with Patent Owner that there are tradeoffs to using a clocked versus non-clocked FM demodulator. But "a given course of action often has simultaneous advantages and disadvantages, and this does not necessarily obviate motivation to combine." *Medichem, S.A. v. Rolabo*, S.L., 437 F.3d 1157, 1165 (Fed. Cir. 2006). "Instead, the benefits, both lost and gained, should be weighed against one another." *Id*. (quoting *Winner Int'l Royalty Corp. v. Wang*, 202 F.3d 1340, 1349 n.8 (Fed. Cir. 2000)). On balance, we find that the benefits described by Mr. Pless provide sufficient motivation to employ a reference clock as required by claim 4.

5. Conclusion as to Claim 4

On the record as a whole, and for the reasons set forth above, Petitioner has shown by a preponderance of the evidence that claim 4 is unpatentable as obvious in light of Grevious, with or without Fitch.

[26] Dr. Young references Grevious's "relatively low data rates" of 10–100 kbits/sec. Ex. 2005 ¶ 96. By comparison, Hitzelberger (relied on by Dr. Pless), appears to disclose improved clock circuits with effective data rates of 80 and 285 kbits/sec. Ex. 1025, 429. We do not discern the relevance of Dr. Young's reliance on "relatively low data rates" as set forth in Grevious, particularly in view of these apparently overlapping ranges. Nor is it "necessary that the inventions of the references be physically combinable to render obvious the invention under review." *In re Sneed*, 710 F.2d 1544, 1550 (Fed. Cir. 1983). "Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art." *Keller*, 642 F.2d at 425.

6. Analysis of Claim 6

Depending from claim 2, claim 6 requires that "the first data comprises a start bit and a number of control bits, the start bit being transmitted before the control bits." Petitioner contends that Grevious discloses this limitation as illustrated in Grevious's Figures 7 and 9. Pet. 60–61; Reply 23–26. Patent Owner contends that under its proposed construction, Grevious fails to disclose the requisite "start bit."

In section II.C.4, above, we adopted, in part, Petitioner's definition of "start bit" to mean a bit indicating the start of a data message, with the caveat that the start bit precedes at least some of the control bits in a data message. For the reasons set forth below, we agree with Petitioner that Grevious discloses all elements of claim 6 including a start bit. For simplicity we focus on the embodiment set forth in Grevious's Figure 7, in which Petitioner identifies start-of-message (SOM) burst 360 as a start bit.

According to Petitioner,

> Grevious provides that all data are sent within a message envelope. EX1005, 3:16-20. For Format B, the message envelope is comprised of a preamble (which consists of a wake-up burst, a configuration select interval, a SOM burst), the data, and an End-of-Message (EOM) interval. EX1005, 12:59-67. Grevious explains that the Start-of-Message burst "functions as the start of the data bit timing" and is transmitted before the dibits (a "*number of control bits*"). EX1005, Fig. 9, 14:45-46; *see id*., 12:59-13:9, 14:36-45, 13:23-26; EX1003, ¶157.

Reply 23; *see* Pet. 60–61. We find Petitioner's arguments persuasive.

Patent Owner contends that Grevious fails to disclose a start bit because SOM burst 360 does not have a fixed pulse width. PO Resp. 53;[27]

[27] Although Patent Owner implies that Petitioner's expert admitted at deposition that "'a start bit' in the context of the '480 Patent has a fixed pulse width and is sent before any data is sent," the relied on passage more

Sur-reply 20–21. As set forth in our construction, however, a start bit within the context of the '480 patent does not require a fixed pulse width. *See* section II.C.4, above.

Patent Owner also contends that Grevious fails to disclose a start bit because SOM burst 360 is part of the data message. Sur-reply 20–21 ("Since Grevious's SOM is itself data and cannot properly be a 'bit' and the message envelope—which includes the SOM —is the 'data message' the SOM cannot be a 'start bit'"). Patent Owner's arguments do not undermine Petitioner's persuasive showing because, under our construction, a start bit indicates the start of a data message and precedes at least some of the control bits in a data message. Nothing in our construction, or in the plain language of claim 6 prohibits the start bit from either comprising part of a data message or including information in beyond that required to indicate the start of a data message.

7. Conclusion as to Claim 6

On the record as a whole, and for the reasons set forth above, Petitioner has shown by a preponderance of the evidence that claim 6 is unpatentable as obvious in light of Grevious, with or without Fitch.

F. Obviousness in view of Grevious and Bradshaw, with or without Fitch (Ground 4)

As Ground 4, Petitioner challenges claims 6 and 7 as obvious over Grevious in view of Bradshaw, with or without Fitch. Pet. 62–68; Reply 25–26. Further to its arguments in Ground 3, Petitioner argues that Bradshaw

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accurately states that "this is *one way* that the '480 patent describes being able to distinguish a one width from a zero width." *Id.* (citing Ex. 2013 82:8–83:2) (emphasis added).

discloses "the first data comprises a start bit and a number of control bits, the start bit being transmitted before the control bits," and related elements of claim 7, which depends from claim 6. Pet. 62–68. With respect to the start bits recited in claim 6, Petitioner argues that it would have been "obvious to incorporate Bradshaw's reference pulse (a '*start bit*') into Grevious to enable rapid calibration of the receiver thereby minimizing errors." Pet. 26 (citing Ex. 1009, 1:22-29, 1:35-42; Ex. 1003, ¶¶162-69).

Patent Owner does not contest that Bradshaw discloses the alleged elements. PO Resp. 57–58; Sur-reply 21–24. Rather, Patent Owner contends that one of ordinary skill in the art would not have been motivated to combine Bradshaw and Grevious in the manner claimed. *Id.* Focusing on start bits, Patent Owner contends that "Grevious's physical data transmission formats "utilize bit-synchronous transmission methods that … do[] away with the start/stop bit overhead required by asynchronous transmissions," and eliminates the need for start bits. Sur-reply 21–22 (citing Ex. 1005, 8:10–20; Ex. 2005 ¶ 102).

In section II.E.6, above, we concluded that Grevious teaches or suggests start bits. But even if Grevious did not teach or suggest start bits, we would find that start bits are compatible with Grevious's system and their incorporation would involve no more than routine skill. *See* Pet. 64–65.

Petitioner also relies on detailed expert testimony explaining why "Bradshaw . . . provides abundant motivation to incorporate its technique into other systems." Ex. 1003, ¶¶ 168 (cited at Pet. 64–65). According to Mr. Pless:

> Bradshaw explains that the reference bit technique is "simple and straightforward in its operation," and allows for the rapid calibration of the receiver to the transmitter to minimize any error. Ex. 1009 (Bradshaw), 1:35-42. Adopting a reference bit

> technique allows for pulse width modulation communication systems to avoid "frequent manual readjustment in order to compensate for temperature and age induced drift." Ex. 1009 (Bradshaw), 1:22–29. A skilled artisan would have been particularly motivated to incorporate this technique in the context of Grevious, which discloses an implantable medical device that may be difficult or impossible to manually readjust. Ex. 1005 (Grevious), 4:13-25.

Id. at 168. In response, Patent Owner argues that neither the Petition, nor Grevious itself identified "errors due to temperature and age induced drift as a problem." Sur-reply 22. Notably, however, Patent Owner nowhere contends that these problems were not know to those of ordinary skill in the art. Absent argument or evidence to the contrary, we find unopposed Mr. Pless's reasoned explanation for why one ordinary skill in the art would have been motivated to make the asserted combination.

On the record as a whole, and for the reasons set forth above, Petitioner has shown by a preponderance of the evidence that claim 6 is unpatentable as obvious in light of Grevious, with or without Fitch, and in combination with Bradshaw as set forth in Ground 4. Patent Owner raises no additional arguments with respect to claim 7, which depends from claim 6, and we reach the same conclusion with respect to claim 7.

G. Patent Owner's Motion to Expunge

In paper 38, Patent Owner states that it inadvertently filed duplicate copies of the Patent Owner Response (Papers 31 and 32) and Exhibits 2004–2014, and requests that the duplicative copies be expunged. In the interest of clarity, we grant the motion.

III. CONCLUSION

For the foregoing reasons, Petitioner has shown by a preponderance of the evidence that claims 2–4 and 6–8 of the '480 Patent are unpatentable, as summarized in the following table:

Claims	35 U.S.C §	Reference(s)/ Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
2–4, 6, 8	103(a)	Grevious with or without Fitch	2–4, 6, 8	
6-7	103(a)	Grevious and Bradshaw with or without Fitch	6-7	
Overall Outcome			2–4, 6–8	

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that claims 2–4 and 6–8 of U.S. Patent No. 7,822,480 B2 are determined to be unpatentable;

ORDERED that Patent Owner's motion to expunge Paper 32 and duplicative copies of Exhibits 2004–2014 is granted; and

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

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