

**United States Court of Appeals
for the Federal Circuit**

**WASICA FINANCE GMBH,
BLUEARC FINANCE AG,**
Appellants

v.

**CONTINENTAL AUTOMOTIVE SYSTEMS, INC.,
SCHRADER-BRIDGEPORT INTERNATIONAL,
INC., SENSATA TECHNOLOGIES HOLDING NV, SI
INTERNATIONAL (TOPCO), INC.,**
Cross-Appellants

2015-2078, 2015-2079, 2015-2093, 2015-2096

Appeals from the United States Patent and Trade-
mark Office, Patent Trial and Appeal Board in Nos.
IPR2014-00295, IPR2014-00476.

Decided: April 4, 2017

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LINGL, Ann Arbor, MI; THEMI ANAGNOS, Continental Automotive Systems, Inc., Deer Park, IL.

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Before PROST, *Chief Judge*, SCHALL, and CHEN, *Circuit Judges*.

SCHALL, *Circuit Judge*.

These consolidated appeals come to us following two related *inter partes* review proceedings before the U.S. Patent & Trademark Office’s Patent Trial and Appeal Board (“Board”). Both proceedings involve now-expired U.S. Patent No. 5,602,524 (“the ’524 patent”) owned by Wasica Finance GmbH and Bluearc Finance AG (“Wasica”). The ’524 patent has 21 claims. Claim 1 is the sole independent claim. The first proceeding, IPR2014-00295, arose from a petition filed by Continental Automotive Systems, Inc. (“Continental”) (“the ’295 proceeding”). In the ’295 proceeding, the Board found claims 1–3, 5, 10–19, and 21 of the ’524 patent unpatentable as anticipated or obvious and claims 6–9 and 20 patentable. The Board declined to institute review of claim 4. *Cont’l Auto. Sys., Inc. v. Wasica Fin. GmbH*, No. IPR2014-00295, 2015 WL 3811738, at *1, *19 (June 17, 2015) (“*Continental Decision*”). The second proceeding, IPR2014-00476, arose from a petition filed by Schrader-Bridgeport International, Inc., Sensata Technologies Holdings NV, and SI International (TOPCO), Inc. (collectively, “Schrader”) (“the ’476 proceeding”). In the ’476 proceeding, the Board found claims 1–5, 10, 12–19, and 21 of the ’524 patent unpatentable as anticipated or obvious and claims 6 and 9

patentable. The Board declined to institute review of claim 11.¹ *Schrader-Bridgeport Int’l v. Wasica Fin. GmbH*, No. IPR2014-00476, 2015 WL 4500655, at *1, *20 (July 22, 2015) (“*Schrader Decision*”).

Wasica now appeals those portions of the Board’s decisions in the ’295 and ’476 proceedings finding claims 1–5, 10–19, and 21 unpatentable. For their part, Continental and Schrader cross-appeal, respectively, those portions of the Board’s decisions in the ’295 and ’476 proceedings finding claims 6–9 and 20 patentable.

For the reasons set forth below, we affirm the decisions of the Board in the ’295 and ’476 proceedings that claims 1–5, 10–19, and 21 of the ’524 patent are unpatentable as anticipated or obvious. We also affirm the decisions of the Board in the ’295 and ’476 proceedings that claims 6–8 and 20 of the ’524 patent are patentable. We reverse, however, the decisions of the Board in the ’295 and ’476 proceedings that claim 9 of the ’524 patent is patentable.

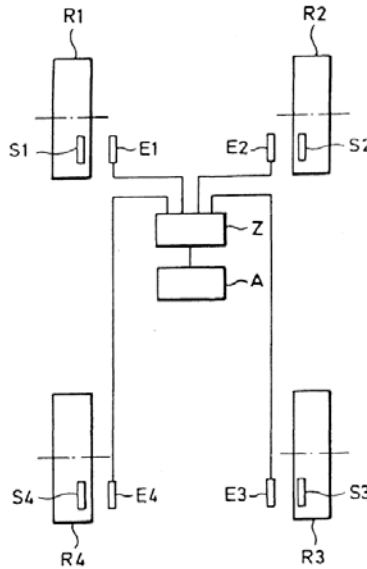
BACKGROUND

I. The ’524 Patent

Wasica owns the ’524 patent, which describes systems for monitoring tire pressure in vehicles. *See* ’524 patent, Abstract. Typically, these systems communicate pressure readings through electromagnetic signals. *Id.*, 1:52–59. According to the patent, prior art systems fail to relay accurate pressure data due to interference from internal and external sources. *Id.*, 1:59–67. As a result, the patent asserts, drivers experience under- and over-reporting of tire pressure warnings. *Id.*, 2:1–10.

¹ Schrader’s petition did not challenge the patentability of claims 7, 8, and 20.

The '524 patent purports to address this problem by synchronizing components of the tire pressure system. As illustrated below, each tire (R1–R4) includes a pressure measuring device and a transmitter (S1–S4). The transmitter sends pressure data received from the pressure measuring device to a corresponding receiver (E1–E4):



Id., Fig.1; *see also id.*, 6:1–2, 6:12–15, Fig.2. To distinguish signals from different transmitters, transmissions to each receiver include an “identification signal” specifying the originating transmitter. *Id.*, 6:61–7:9. The receiver stores this identifying information and processes pressure data only from the designated transmitter. *Id.*, 3:4–15. The system can further synchronize its units by entering a “pairing mode.” *Id.*, 10:1–7. In this mode, a transmitter couples with the receiver to which it broadcasts the strongest signal. *Id.* Tire pressure data is displayed to the driver of the vehicle by means of a “display device.” *Id.*, 13:34–38.

As noted, the '524 patent includes 21 claims. Claim 1 is the sole independent claim and recites as follows:

1. A device for monitoring the air pressure in the air chamber of pneumatic tires fitted on vehicle wheels comprising:

a pressure measuring device mounted on a vehicle wheel which measures the air pressure in the air chamber of the wheel end outputs an electrical pressure signal representative of the air pressure in the vehicle wheel;

a transmitter mounted to the vehicle wheel which receives the electrical pressure signal output from the pressure measuring device and sends out a pressure transmitting signal corresponding to said air pressure;

a receiver associated with the transmitter and mounted at a distance to the vehicle wheel which receives the pressure transmitting signal transmitted from the associated transmitters[;]

a display device which is connected with the receiver and displays data as numbers or symbols which have been taken from the pressure transmitting signal received from the receiver;

wherein the transmitter comprises an emitter-control device which controls the emittance of the pressure transmitting signal and a signal-generating device which generates an identification signal which is unique for the transmitter and clearly identifies same;

the emitter-control device works such that the identification signal is transmitted at least once before or after the emittance of the pressure transmitting signal;

the receiver comprises at least a memory in which is stored an identification reference signal

related to the associated transmitter in accordance with a predetermined relationship criteria;

the receiver comprises a comparison device which checks if an identification signal transmitted from a transmitter has the relationship criteria to identification reference signal stored in the receiver, and that further processing of the pressure transmission signal taken from the receiver only takes place if the identification signal received by the receiver and the identification reference signal stored in the receiver fulfill the relationship criteria;

the identification reference signal stored in the receiver is changeable in order that the identification signal from the associated transmitter matches the identification reference signal of the receiver; and

the receiver is connected with a switching device which enables the receiver to switch over from normal operating mode, in which the air pressure is monitored, to pairing mode, in which the receiver collects the identification signal of the transmitter and stores this as an identification signal.

Id., 13:19–14:3.

II. Proceedings Before the Board

Continental and Schrader each filed *inter partes* review (“IPR”) petitions challenging the patentability of the ’524 patent. In the ’295 proceeding, Continental challenged all 21 claims as anticipated by Italian Patent No. 1,219,753 (“Oselin”) and/or as obvious over some combination of Oselin and U.S. Patent Nos. 5,109,213 (“Williams”), 5,803,457 (“Schultz”), 4,067,376 (“Barabino”), 4,912,463 (“Li”), and 4,750,118. In the ’476 proceeding,

Schrader challenged claims 1–6, 9–19, and 21 as anticipated by Oselin and/or as obvious over some combination of Oselin, Schultz, Barabino, and U.S. Patent No. 5,285,189 (“Nowicki”). The Board subsequently instituted separate trials on the two petitions.

Both trials focused primarily on the Oselin reference. That reference, like the ’524 patent, relates to vehicular systems for monitoring tire pressure. J.A. 939.² In their petitions to the Board, both Continental and Schrader argued that Oselin discloses or suggests most of the features in the challenged claims.

Wasica disputed the petitioners’ reading of Oselin, contending that Oselin does not disclose or suggest all of the limitations of independent claim 1. Specifically, Wasica argued that Oselin fails to teach a “pressure measuring device,” an “electrical pressure signal,” and a “pressure transmitting signal,” as Wasica construed those terms. Wasica also separately argued the patentability of various dependent claims by relying on its constructions of the terms “bit sequence” and “emittance.”

III. The Board’s Decisions

The ’295 and ’476 proceedings culminated in two Final Written Decisions from the Board. In those decisions, the Board first construed the terms “pressure measuring device” from independent claim 1, “bit sequence” from claim 9, and “emittance” from claim 17. *Continental Decision*, 2015 WL 3811738, at *4–7; *Schrader Decision*, 2015 WL 4500655, at *5–7. Armed with those constructions, the Board found that Oselin anticipated claims 1, 2, 5, 10, 13, 15, 17–19, and 21. *Continental Decision*, 2015 WL 3811738, at *19–20; *Schrader Decision*, 2015 WL

² For ease of reference, our citations to Oselin point to its certified translation in the Joint Appendix.

4500655, at *20. The Board also found that Oselin—alone or in combination with Williams, Schultz, Nowicki, Barabino, and/or Li—rendered claims 3, 4, 10–12, 14, 16, and 17 obvious.³ The Board further determined, however, that Continental and Schrader had failed to establish how Oselin (alone or in combination with Williams) rendered claims 6–9 and 20 unpatentable. *Continental Decision*, 2015 WL 3811738, at *13–14, *17; *Schrader Decision*, 2015 WL 4500655, at *10–12 (claims 6 and 9).

Wasica appeals the Board’s decisions that claims 1–5, 10–19, and 21 are unpatentable. Continental and Schrader each cross-appeal the Board’s decisions that claims 6–9 and 20 are patentable. We have jurisdiction under 28 U.S.C. § 1295(a)(4)(A) and 35 U.S.C. § 141(c).

DISCUSSION

I. Standard of Review

In an appeal from an IPR decision, we review the Board’s legal conclusions *de novo* and its factual findings for substantial evidence. 5 U.S.C. § 706(2); *Synopsys, Inc. v. Mentor Graphics Corp.*, 814 F.3d 1309, 1314 (Fed. Cir. 2016). Anticipation is a question of fact reviewed for substantial evidence. *Synopsys*, 814 F.3d at 1317; *In re Rambus Inc.*, 694 F.3d 42, 46 (Fed. Cir. 2012). Obviousness is a question of law based on underlying facts. *In re Magnum Oil Tools Int’l, Ltd.*, 829 F.3d 1364, 1373 (Fed. Cir. 2016). We thus review the Board’s ultimate obvious-

³ These are the claims that Continental or Schrader separately argued as being obvious. Because “anticipation is the epitome of obviousness,” *Connell v. Sears, Roebuck & Co.*, 722 F.2d 1542, 1548 (Fed. Cir. 1983), the Board noted that Oselin rendered claims 1, 2, 5, 10, 13, 15, 17–19, and 21 obvious by virtue of its anticipation of them. *Continental Decision*, 2015 WL 3811738, at *19–20; *Schrader Decision*, 2015 WL 4500655, at *20.

ness determination *de novo* and its underlying factual findings for substantial evidence. *Id.*

Claim construction is a question of law with underlying questions of fact. *Teva Pharm. U.S.A., Inc. v. Sandoz, Inc.*, 135 S. Ct. 831, 837–38 (2015). We review the Board’s claim constructions *de novo* and its underpinning factual determinations involving extrinsic evidence for substantial evidence. *Microsoft Corp. v. Proxyconn, Inc.*, 789 F.3d 1292, 1297 (Fed. Cir. 2015). If the intrinsic record fully governs the proper construction of a term, we review the Board’s claim construction *de novo*. *Id.*

As noted, we have before us consolidated appeals from two IPR proceedings. Wasica appeals some aspects of the Board’s decisions in the ’295 and ’476 proceedings, while Continental and Schrader cross-appeal, respectively, other aspects of those decisions. We turn first to Wasica’s appeal.

II. Wasica’s Appeal

A. Claims 1–5, 10–16, 18, 19, and 21

1. The Parties’ Arguments

Wasica contends that the Board erred by finding claims 1–5, 10–19, and 21 unpatentable based upon Oselin.⁴ Oselin discloses a “pressure sensor P” that detects the air pressure in a tire. J.A. 942. When the pressure falls outside an acceptable range, a floating switch closes, causing a signal to pass from a transmitter

⁴ Wasica does not distinguish between the claims found unpatentable as anticipated by Oselin (1, 2, 5, 10, 13, 15, 17–19, and 21) and those found unpatentable as obvious over Oselin alone or in combination with other references (3, 4, 10–12, 14, 16, and 17). For the sake of brevity, we therefore refer to the claims at issue simply as “unpatentable.”

to a receiver. J.A. 942–43. This signal includes a data bit (S₁₈) serving as “an alarm message indicating that the pressure detected by [the] sensor P has reached an anomalous level.” J.A. 946. Oselin’s binary signal thus signifies whether a measured pressure is abnormal, but it does not encode an exact numeric value for that pressure.

In the ’295 and ’476 proceedings, Wasica argued that Oselin does not contain claim 1’s “pressure measuring device” because, as properly construed, the claim requires a numerical representation of the tire’s pressure. According to Wasica, Oselin’s binary alarm bit does not contain such precision.

The Board disagreed, holding that nothing in the claims limits the pressure measuring device to numeric values. *Continental Decision*, 2015 WL 3811738, at *4–5; *Schrader Decision*, 2015 WL 4500655, at *4–5. In support of its ruling, the Board pointed to embodiments of the ’524 patent using binary, switch-based pressure sensors like those described in Oselin. *Id.* Based upon its claim construction, the Board found claims 1–5, 10–19, and 21 unpatentable.

On appeal, Wasica shifts its focus from the “pressure measuring device” to the “electrical pressure signal” and “pressure transmitting signal” terms of claim 1, but the thrust of its position remains unchanged. Namely, Wasica maintains that the claimed signals must contain numerical values of pressure. Wasica Opening Br. 13. Wasica acknowledges that the ’524 patent discloses using switch-based sensors like Oselin as part of the invention, but it urges that these devices are used *in addition to*, not in lieu of, quantitative measuring devices. *Id.* 15–17. Therefore, argues Wasica, the Board misconstrued the signal terms of claim 1 and erred in finding claims 1–5, 10–19, and 21 unpatentable over Oselin and other references. *Id.* 17–18.

Continental and Schrader respond that the Board correctly construed the signal and pressure measuring device limitations of claim 1. In their view, the claims describe these limitations in broad language, and nothing confines them to purely numerical values. Continental Response Br. 25–28; Schrader Response Br. 22–23. The ’524 patent’s specification further supports the Board’s construction, they contend, because it discloses using non-numeric pressure sensors within the claimed invention. Continental Response Br. 28–35; Schrader Response Br. 17–21.

2. Analysis

Wasica does not dispute that claims 1–5, 10–16, 18, 19, and 21 are unpatentable under the Board’s construction of claim 1. Therefore, the only question before us with respect to these claims is whether the Board erred in construing “electrical pressure signal” and “pressure transmitting signal” to encompass non-numeric representations of pressure. For the reasons discussed below, we hold that the Board did not err in construing these terms.

The Board construes claims of an expired patent in accordance with *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). *Straight Path IP Grp., Inc. v. Sipnet EU S.R.O.*, 806 F.3d 1356, 1360 (Fed. Cir. 2015). Under that standard, words of a claim are generally given their ordinary and customary meaning. *Phillips*, 415 F.3d at 1312. The claims themselves often provide significant guidance as to the meaning of a particular term. *Id.* at 1314. Claims also are read in light of the patent’s specification, of which they are a part. *Id.* at 1315. “[T]he specification ‘is always highly relevant to the claim construction analysis. Usually, it is dispositive’” *Id.* (quoting *Vitronics Corp. v. Conceptor, Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996)).

In this case, the claim language indicates that the signal terms are not limited to numeric values. Claim 1 recites displaying data “as numbers *or symbols* which

have been *taken from the pressure transmitting signal.*” ’524 patent, 13:35–38 (emphases added). Using the disjunctive “or” as in “numbers or symbols” designates numbers and symbols as distinct alternatives to one another. See *SkinMedica, Inc. v. Histogen Inc.*, 727 F.3d 1187, 1199 (Fed. Cir. 2013) (“The disjunctive ‘or’ plainly designates that a series describes alternatives.”); *Schumer v. Lab. Comput. Sys., Inc.*, 308 F.3d 1304, 1311 (Fed. Cir. 2002) (“We have consistently interpreted the word ‘or’ to mean that the items in the sequence are alternatives to each other.”) (citing cases). And because these “numbers or symbols” are “taken from the pressure transmitting signal” directly, claim 1 plainly contemplates a pressure transmitting signal that encodes only non-numerical “symbols.” Wasica concedes the point in its briefing, acknowledging that the pressure transmitting signal includes “the numerical value of the pressure verbatim *and/or symbols that inform the driver which tire has low pressure.*” Wasica Reply Br. 3 (emphasis added).

We also see no reason to limit the “electrical pressure signal” to numerical values. Claim 1 requires the electrical pressure signal to be only “*representative of the air pressure.*” ’524 patent, 13:22–25 (emphasis added). The ordinary and customary meaning of “representative” is “serving to . . . symbolize” or “standing for.” 13 THE OXFORD ENGLISH DICTIONARY 660 (2d ed. 1989). We think that a non-numeric signal can be “representative of” air pressure in much the same way as a vehicle’s gas warning light might “serve to symbolize” a low fuel level (without specifying a precise volume) or a picture of a sun may “stand for” a hot day (without indicating an exact temperature). See *Honeywell Int’l Inc. v. Universal Avionics Sys. Corp.*, 488 F.3d 982, 992–93 (Fed. Cir. 2007) (refusing to construe “signals representative of” various items as confined to numerical values of those items).

The specification of the ’524 patent confirms this construction. The patent includes an embodiment in which a

sensor monitors a tire’s pressure and outputs a pressure signal “as is described in EP-A-0417712 or in EP-A-0417704.” ’524 patent, 5:1–9. The Board found, and Wasica does not dispute, that this family of European applications discloses switch-based pressure sensors and non-numeric pressure signals.⁵ *Continental Decision*, 2015 WL 3811738, at *5; *Schrader Decision*, 2015 WL 4500655, at *5. The ’524 patent thus uses non-numeric expressions of pressure to practice the purported invention. See *Verizon Servs. Corp. v. Vonage Holdings Corp.*, 503 F.3d 1295, 1305 (Fed. Cir. 2007) (“We normally do not interpret claim terms in a way that excludes disclosed examples in the specification.”). On appeal, Wasica contends only that these switch-based pressure sensors *supplement* other sensors measuring the pressure quantitatively. We see no merit to this argument, however. The pertinent passage of the specification describes monitoring tire pressures with “a mechanical device” that “causes transmission of the pressure signal” under certain conditions. ’524 patent, 5:1–9. Nothing in the description of this embodiment suggests that the pressure signal comes from a secondary, undisclosed sensor.

Accordingly, we hold that the Board did not err in construing the signal terms broadly enough to encompass non-numeric representations of air pressure. Because Wasica does not challenge the Board’s findings that claims 1–5, 10–16, 18, 19, and 21 are unpatentable under that construction, we affirm the Board’s decision that those claims are unpatentable.

⁵ For example, EP-A-0417712 discloses a membrane that “activate[s] a switch when the tire pressure is excessively high or low.” J.A. 2853. When this occurs, a “signal-generating device” outputs an “alarm impulse” to a receiver. *Id.*; J.A. 2855.

B. Claim 17

1. The Parties' Arguments

Wasica separately argues the patentability of dependent claim 17. Claim 17 depends from claim 13, which depends from claim 1. Claim 13 recites “[a] device according to claim 1 wherein a pressure measuring device and a transmitter are provided on at least two of the wheels of a vehicle.” ’524 patent, 14:59–61. Claim 17 then recites:

17. A monitoring device according to claim 13 wherein each transmitter comprises a detector device which recognizes *emittance of a predetermined switching signal* and, therefore, switches the transmitter into a pairing mode in which the identification signal and an additional signal indicating the pairing mode is emitted.

Id., 15:11–16 (emphasis added). The claim thus puts a transmitter in “pairing mode” with a receiver after detecting a “switching signal” sent from an unspecified source.

The Board construed “emittance of a predetermined switching signal” to include both wired and wireless transmissions. *Continental Decision*, 2015 WL 3811738, at *7; *Schrader Decision*, 2015 WL 4500655, at *6–7. Wasica disputes this construction, arguing that the claimed “emittance” must be limited to wireless communications. Wasica Opening Br. 18–19. According to Wasica, the ordinary meaning of “emit” in the context of the specification connotes only wireless signals. *Id.* In Wasica’s view, the prior art references successfully cited against claim 17 do not disclose or suggest such a wireless transmission of the switching signal. Wasica Opening Br. 20. Wasica acknowledges, however, that claim 17 is unpatentable under the Board’s construction. Wasica Opening Br. 20.

Continental and Schrader respond that “emit” means “to send out,” which does not preclude wired transmis-

sions. Continental Response Br. 40–41; Schrader Response Br. 26. They also contend that the specification includes embodiments where the switching signal passes via wired components. Continental Response Br. 41–43; Schrader Response Br. 27–28.

2. Analysis

Because Wasica accepts that claim 17 is unpatentable under the Board’s construction of “emittance,” the sole issue before us is whether the Board erred by construing “emittance” to include wired transmissions. We conclude that the Board did not err.

“It is axiomatic that we will not narrow a claim term beyond its plain and ordinary meaning unless there is support for the limitation in the words of the claim, the specification, or the prosecution history.” *3M Innovative Props. Co. v. Tredegar Corp.*, 725 F.3d 1315, 1333 (Fed. Cir. 2013). If the intrinsic record supports several definitions of a term, the term may be construed to encompass all such consistent meanings. *See Rexnord Corp. v. Laitram Corp.*, 274 F.3d 1336, 1343 (Fed. Cir. 2001). Therefore, absent a clear disavowal or alternative lexicography by a patentee, he or she “is free to choose a broad term and expect to obtain the full scope of its plain and ordinary meaning.” *Thorner v. Sony Comput. Entm’t Am. LLC*, 669 F.3d 1362, 1367 (Fed. Cir. 2012).

We conclude that, in the context of the ’524 patent, the word “emittance” includes both wired and wireless transmissions. As Wasica itself recognizes, the plain and ordinary meaning of “emit” is simply “to send out.” Wasica Opening Br. 18; *see also* 5 THE OXFORD ENGLISH DICTIONARY 181 (2d ed. 1989) (defining “emit” as “to send forth”). Wasica does not dispute that electrical signals can be “sent out” over wired connections. Nor does Wasica urge that any special definition or disavowal applies to the term “emittance.” Thus, “emittance of a predetermined switching signal” should be granted its full scope

and construed to encompass both hardwired and wireless transmissions, as either mode of communication “sends out” the switching signal. See *Thorner*, 669 F.3d at 1367; *Kara Tech. Inc. v. Stamps.com Inc.*, 582 F.3d 1341, 1347–48 (Fed. Cir. 2009) (declining to construe a broad claim term narrowly because “[t]he patentee is entitled to the full scope of his claims”).

The specification supports this construction. The ’524 patent is rife with exemplary embodiments where the switching signal propagates in both wireless and wired form. See, e.g., ’524 patent, 12:46–67 (wireless transmissions), 13:13–17 (wired transmissions). “We normally do not interpret claim terms in a way that excludes disclosed examples in the specification,” *Verizon*, 503 F.3d at 1305, and Wasica has not provided us a compelling reason to depart from such guidance here.

Furthermore, the specification and claims use the words “emit” and “transmit” interchangeably.⁶ This drafting choice equates the two terms for claim construction purposes. See *Bid for Position, LLC v. AOL, LLC*, 601 F.3d 1311, 1317 (Fed. Cir. 2010) (construing “bid” and “value of the bid” identically because the claim used the terms interchangeably); *Edwards Lifesciences LLC v. Cook Inc.*, 582 F.3d 1322, 1330 (Fed. Cir. 2009) (“The

⁶ For example, claim 1 includes a “transmitter” that not only “emit[s]” a pressure transmitting signal to a receiver, but also “transmit[s]” an identification signal to the same receiver. ’524 patent, 13:31–43. This equivocation is prevalent throughout the claims. See *id.*, 14:4–6, 14:21–24, 14:28–39, 16:4–7. Similarly, the written description at times conflates “transmitter” and “emitter.” See *id.*, 4:43–47, 6:50–52. Further, the specification uses “transmit” to refer to wireless communications, suggesting that it has not reserved the term “emit” for this purpose. See *id.*, 12:28–33.

interchangeable use of the two terms is akin to a definition equating the two.”). The word “transmit” can mean “to send out electric signals.” 18 THE OXFORD ENGLISH DICTIONARY 415 (2d ed. 1989). Unquestionably, electric signals may be “transmitted” or “sent out” through wired circuitry.

We therefore see no error in the Board’s conclusion that “emittance” in claim 17 includes both wired and wireless transmissions. As noted, Wasica does not argue that claim 17 is patentable under this construction. Accordingly, we affirm the Board’s decision in the ’295 and ’476 proceedings that claim 17 is unpatentable.

III. Continental and Schrader’s Cross-Appeals

The appeals from cross-appellants Continental and Schrader involve claims 6–9 and 20. In the ’295 and ’476 proceedings, the Board found these claims patentable over Oselin and other references. *Continental Decision*, 2015 WL 3811738, at *11, *13–14, *17; *Schrader Decision*, 2015 WL 4500655, at *10–11 (claims 6 and 9). Continental and Schrader appeal those decisions. We turn first to claim 6.

A. Claim 6

1. The Parties’ Arguments

Claim 6 depends from claim 2, which depends from claim 1. Claim 2 recites “[a] monitoring device according to claim 1, additionally comprising a converter device which converts and digitally codes the signals transmitted from the transmitter.” ’524 patent, 14:4–6. Claim 6 then recites:

6. A monitoring device according to claim 2 wherein transmission of the signals from the transmitter to the receiver is carried out with electromagnetic waves of *constant frequency* acting as carrier waves.

Id., 14:21–24 (emphasis added). As claimed, the signals passing from the transmitter to the receiver have a constant, unchanging frequency.⁷

Oselin explains that its “transmissions from the sensors 10 use structurally analogous signals, on a frequency that is the working frequency common to the oscillators 11 of all transmitters 10 of the group of the receiver 20.” J.A. 945. In the ’295 and ’476 proceedings, both Continental and Schrader argued that this embodiment discloses the constant frequency limitation of claim 6, thus rendering claim 6 unpatentable over Oselin. J.A. 204, 2089. The Board rejected this contention, holding that one of ordinary skill in the art would have understood Oselin’s “common” working frequency to allow for carrier waves of changing frequencies. In doing so, the Board accepted Wasica’s evidence to this effect. *Continental Decision*, 2015 WL 3811738, at *10; *Schrader Decision*, 2015 WL 4500655, at *10. The Board also dismissed the petitioners’ obviousness arguments, finding them conclusory and unsubstantiated, *Continental Decision*, 2015 WL 3811738, at *13–14, or omitted entirely, *Schrader Decision*, 2015 WL 4500655, at *14.

Continental and Schrader each appeal the Board’s decision, but they do so on different grounds. Schrader argues that Oselin discloses transmitting signals at “a” frequency, suggesting that this frequency must be constant. Schrader Response Br. 34–38. For its part, Continental contends that the Board overlooked pertinent evidence. Continental Response Br. 49–53. According to Continental, Oselin discloses how it can work with “any

⁷ The “frequency” of a wave is the number of cycles of the wave in a unit of time. A wave has a “constant frequency” when the number of cycles per unit of time does not change—*i.e.*, it is “constant.”

modulating scheme,” which could include the constant frequency signals of claim 6. *Id.*

Wasica defends the Board’s decisions. With respect to the ’476 proceeding, Wasica argues that the Board reasonably relied on Wasica’s expert testimony concerning Oselin’s disclosure, particularly because Schrader offered no such testimony of its own. Wasica Response Br. 15–17. As for the ’295 proceeding, Wasica asserts that Oselin discloses a broad genus of all modulating schemes, but not the constant-frequency species recited in claim 6. *Id.* 18–20. Wasica additionally argues that Continental’s obviousness position is waived for failing to adequately develop it before the Board. *Id.* 21–24.

2. Analysis

After reviewing the record, we find that substantial evidence supports the Board’s conclusion that claim 6 is patentable over Oselin. We therefore affirm the Board’s decisions as to this claim. Because the cross-appellants’ arguments differ in material respects, we address their contentions in turn, beginning with Schrader.

a. Schrader’s Cross-Appeal

Anticipation requires that a single reference “describe the claimed invention *with sufficient precision and detail* to establish that the subject matter existed in the prior art.” *Verve, LLC v. Crane Cams, Inc.*, 311 F.3d 1116, 1120 (Fed. Cir. 2002) (emphasis added). For this reason, it has long been understood that ambiguous references do not, as a matter of law, anticipate a claim. *See, e.g., W.L. Gore & Assocs., Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1554 (Fed. Cir. 1983) (refusing to find claims anticipated when the prior art references were “unacceptably vague”); *see also In re Hughes*, 345 F.2d 184, 188 (CCPA 1965); *In re Turlay*, 304 F.2d 893, 899 (CCPA 1962) (“It is well established that an anticipation rejection cannot be predicated on an ambiguous reference.”).

As noted, claim 6 requires its carrier waves to have a constant frequency. Oselin discloses that its transmitters are all tuned to a “common” working frequency, but as the Board found in the ’476 proceeding, this statement does not necessarily suggest that the frequency of each transmitted signal is constant. *Schrader Decision*, 2015 WL 4500655, at *10. Crediting Wasica’s expert on this point, the Board determined that Oselin’s “common” working frequency could represent an *average* frequency for signals whose frequency in fact fluctuated over time. *Id.* For example, Oselin’s signals might vary in frequency due to “frequency shift keying”⁸ but maintain a “common” working frequency across the transmitters. *Id.* Thus, the Board concluded, Oselin was at best “unclear” whether its transmissions occurred at an unchanging, fixed frequency. *Id.*

We see no error in the Board’s conclusion. Record evidence suggests that Oselin could use signals of either constant or nonconstant frequency. Oselin is thus ambiguous as to whether it discloses the pertinent features of claim 6. Ambiguous references do not anticipate a claim. *E.g., In re Turlay*, 304 F.2d at 899.

Schrader’s arguments on appeal fail to show where the Board erred. Schrader relies on attorney argument in urging that Oselin’s transmitters *must* use a constant frequency, but this contention misses the point. Anticipation is an inquiry viewed from the perspective of one skilled in the art. *See Dayco Prods., Inc. v. Total Containment, Inc.*, 329 F.3d 1358, 1368 (Fed. Cir. 2003)

⁸ Frequency shift keying is the process of embedding information into a signal by changing (modulating) the signal’s frequency. *See* ’524 patent, 7:36–40. In one simple example, a signal might encode binary data by representing 0s and 1s with different frequencies. *See id.*, 7:36–42.

(“[T]he dispositive question regarding anticipation is whether *one skilled in the art* would reasonably understand or infer from the prior art reference’s teaching that every claim element was disclosed in that single reference.” (internal alterations and quotation marks omitted)). The Board found that one of ordinary skill in the art would not have read Oselin to disclose what Schrader’s counsel urges. That finding is supported by record evidence, and Schrader did not adduce any evidence to the contrary. We thus think it was reasonable for the Board to accept Wasica’s expert testimony over Schrader’s bare attorney argument. *See Gemtron Corp. v. Saint-Gobain Corp.*, 572 F.3d 1371, 1380 (Fed. Cir. 2009) (reasoning that a party’s “unsworn attorney argument . . . is not evidence” and thus cannot rebut record evidence); *Enzo Biochem, Inc. v. Gen-Probe, Inc.*, 424 F.3d 1276, 1284 (Fed. Cir. 2005) (“Attorney argument is no substitute for evidence.”).

As far as the obviousness of claim 6 is concerned, Schrader’s briefing does not advance a separate argument on this ground, nor did its petition to the Board do so. *See Schrader Decision*, 2015 WL 4500655, at *14. Accordingly, we deem Schrader to have waived any obviousness argument with respect to claim 6. *See Smithkline Beecham Corp. v. Apotex Corp.*, 439 F.3d 1312, 1319 (Fed. Cir. 2006) (“Our law is well established that arguments not raised in the opening brief are waived.”); *see also Intelligent Bio-Sys., Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1369–70 (Fed. Cir. 2016); *Fresenius USA, Inc. v. Baxter Int’l, Inc.*, 582 F.3d 1288, 1296 (Fed. Cir. 2009) (“If a party fails to raise an argument before the trial court, or presents only a skeletal or undeveloped argument to the trial court, we may deem that argument waived on appeal.”).

b. Continental's Cross-Appeal

Like Schrader, Continental argues that Oselin renders claim 6 unpatentable. In so doing, however, it advances a different theory. Continental contends that Oselin can employ “any modulation scheme,” *see* J.A. 943, and that any modulation scheme so employed can include constant-frequency signals. The Board rejected this argument in the '295 proceeding, finding it insufficiently precise and underdeveloped. *Continental Decision*, 2015 WL 3811738, at *10, *13–14.

We see no error in the Board's conclusion. “It is well established that disclosure of a genus in the prior art is not necessarily a disclosure of every species that is a member of that genus.” *Atofina v. Great Lakes Chem. Corp.*, 441 F.3d 991, 999 (Fed. Cir. 2006); *see also Eli Lilly & Co. v. Zenith Goldline Pharms., Inc.*, 471 F.3d 1369, 1376–77 (Fed. Cir. 2006); *Metabolite Labs., Inc. v. Lab. Corp. of Am. Holdings*, 370 F.3d 1354, 1367 (Fed. Cir. 2004) (“A prior art reference that discloses a genus still does not inherently disclose all species within that broad category.”). Here, the Board determined that Oselin's broad invocation of “any modulation scheme” (a genus) does not disclose with sufficient particularity the constant-frequency modulation scheme of claim 6 (a species). *Continental Decision*, 2015 WL 3811738, at *10. This factual determination was reasonably drawn from record evidence and concessions by Continental's counsel. *Id.* (relying on material found at, for example, J.A. 531, 1608–11 ¶¶ 58–59). Because the Board's findings are reasonable on this record, they are supported by substantial evidence. *See In re Jolley*, 308 F.3d 1317, 1320 (Fed. Cir. 2002) (“If the evidence in record will support several reasonable but contradictory conclusions, we will not find the Board's decision unsupported by substantial evidence simply because the Board chose one conclusion over another plausible alternative.”).

To be sure, we have recognized instances where a prior art genus may anticipate a later species, *see, e.g., Kennametal, Inc. v. Ingersoll Cutting Tool Co.*, 780 F.3d 1376, 1381–83 (Fed. Cir. 2015), but Continental has not shown how that situation exists here. For example, we have explained that a disclosed genus may anticipate a claimed species when the genus is so small that one of ordinary skill in the art would “at once envisage each member of this limited class.” *AbbVie Inc. v. Mathilda & Terence Kennedy Inst. of Rheumatology Tr.*, 764 F.3d 1366, 1379 (Fed. Cir. 2014) (internal quotation marks omitted). But in the ’295 proceeding, Continental’s petition failed to set forth the necessary “factual component[s]” needed to advance this legal theory. *See OSRAM Sylvania, Inc. v. Am. Induction Techs., Inc.*, 701 F.3d 698, 705–06 (Fed. Cir. 2012); *Sanofi-Synthelabo v. Apotex, Inc.*, 550 F.3d 1075, 1083–84 (Fed. Cir. 2008). Continental’s petition did not identify the “any modulating scheme” genus, did not establish its size, and did not name any of its modulation scheme species. *See* J.A. 204. In fact, the petition relied solely on Oselin’s “common” working frequency embodiment that we now conclude is too ambiguous to anticipate claim 6. *Id.*

Continental’s obviousness contentions suffer from similar infirmities. As we have stated, obviousness determinations “cannot be sustained by merely conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006). In its petition to the Board, Continental offered only a conclusory and sweeping allegation that “to the extent that any of the variances in claim scope are not necessarily shown in the above [anticipation analysis], such variances would have been obvious to a [person of ordinary skill in the art].” J.A. 209. The Board found this assertion lacking the factual substantiation necessary for an obviousness evaluation. *Continental*

Decision, 2015 WL 3811738, at *13–14. We see no error in the Board’s ruling. *See, e.g., Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966) (“[D]ifferences between the prior art and the claims at issue are to be ascertained.”).

We also are unpersuaded by Continental’s attempts to cure the petition’s deficiencies in its subsequent briefing to the Board and to us. *See* J.A. 435–36; Continental Response Br. 50–59. As we explained in *Illumina*:

It is of the utmost importance that petitioners in the IPR proceedings adhere to the requirement that the initial petition identify with particularity the evidence that supports the grounds for the challenge to each claim. . . . Unlike district court litigation—where parties have greater freedom to revise and develop their arguments over time and in response to newly discovered material—the expedited nature of IPRs bring with it an obligation for petitioners to make their case in their petition to institute.

821 F.3d at 1369 (internal quotation marks and citations omitted).

Here, Continental did not make out its obviousness case in its petition. It merely pointed to Oselin’s “common” working frequency embodiment and presented a conclusory allegation that any differences between Oselin and claim 6 would have been obvious. J.A. 204, 209. After Wasica pointed out the flaws of this position, Continental’s ensuing arguments to the Board and to us effectively abandoned its petition in favor of a new argument. Instead of relying on Oselin’s “common” working frequency to challenge claim 6, Continental’s new position was that one of ordinary skill in the art would have looked to a different passage of Oselin (teaching encoding binary data “using any modulating scheme”) and would then have modified Oselin to use a constant-frequency modulation scheme as taught in other references. *Compare* J.A. 204,

with J.A. 435–36, and Continental Response Br. 49–59. Rather than explaining how its original petition was correct, Continental’s subsequent arguments amount to an entirely new theory of *prima facie* obviousness absent from the petition. Shifting arguments in this fashion is foreclosed by statute, our precedent, and Board guidelines. See 35 U.S.C. § 312(a)(3) (requiring petitions to identify “with particularity . . . the grounds on which the challenge to each claim is based”); *Illumina*, 821 F.3d at 1369–70; *Dell Inc. v. Accelaron, LLC*, 818 F.3d 1293, 1301 (Fed. Cir. 2016) (vacating a finding of unpatentability when the Board relied on an argument first made during oral hearing); *Trial Practice Guide*, 77 Fed. Reg. 48,756, 48,767 (Aug. 14, 2012) (prohibiting parties from submitting evidence necessary for a *prima facie* showing of obviousness in a reply). We therefore see no error in the Board declining to engage such an argument here.

Accordingly, we hold that the Board did not err in finding claim 6 patentable over Oselin. We therefore affirm the Board’s decision on the patentability of claim 6.

B. Claims 7, 8, and 20

Claims 7, 8, and 20 depend directly or indirectly from claim 6 and limit the transmitted signals to a particular frequency range (claim 7) or designate particular schemes for modulating those signals (claims 8 and 20). Schrader did not challenge these claims in the ’476 proceeding, and thus we have nothing to review as to Schrader’s cross-appeal. In the ’295 proceeding, the Board rejected Continental’s assertion that Oselin in view of Williams rendered claims 7, 8, and 20 obvious. *Continental Decision*, 2015 WL 3811738, at *17. In doing so, the Board relied in part on the deficiencies of Oselin with respect to claim 6 just described. *Id.*

On appeal, Continental does not separately argue the unpatentability of claims 7, 8, and 20.⁹ We therefore deem these claims as standing or falling with claim 6. Accordingly, for the foregoing reasons, we affirm the Board’s decision on the nonobviousness of claims 7, 8, and 20.

C. Claim 9

1. The Parties’ Arguments

Both cross-appellants argue that the Board erred in ruling that dependent claim 9 is patentable. Claim 9 depends from claim 1 via claims 5 and 2. Claim 5 recites “[a] monitoring device according to claim 2 wherein the identification signal in the transmitter is stored as a digital sequence having n bits and that the identification reference signal in the associated receiver is also stored as a digital sequence having n bits.” ’524 patent, 14:16–20. Claim 9 then recites:

⁹ In its arguments on claim 6, Continental mentions in passing that the Board overlooked evidence with respect to claims 7, 8, and 20. Continental Response Br. 58. Even if we were to construe this statement as sufficiently challenging the Board’s decision as to those claims, we do not see how the Board erred. Continental’s petition attacked claims 7, 8, and 20 by relying on Williams’s use of frequency key shifting and by summarily asserting that the claims were obvious. J.A. 213–14. Not only would frequency key shifting directly contravene claim 6’s “constant frequency” requirement by creating waves of a *nonconstant* frequency, the petition offers no explanation or reasoning as to why the claims would be obvious. *Id.* It was incumbent on Continental to elaborate on these positions in its “initial petition,” *Illumina*, 821 F.3d at 1369–70. We thus see no error in the Board’s analysis.

9. A monitoring device according to claim 5 wherein every transmission from transmitter to receiver is completed with a transmission of *at least a 4 bit sequence* having a respective predetermined bit-count whereby the *first bit sequence* is a preamble, which enables the synchronization of the receiver with the transmitter, *the second, or third bit sequence* is a data sequence which represents the measured pressure signal and respectively contains the identification signal, and a *fourth and final bit sequence* as a post-amble.

Id., 14:31–39 (emphases added). In common parlance, claim 9 requires the transmitter to send data to the receiver through “at least a 4 bit sequence” having four smaller “bit sequence[s]” of information. *Id.*

As they did before the Board, the parties dispute the meaning of the term “bit sequence.” Continental and Schrader contend that “bit sequence” should be construed as a sequence of “one or more bits.” Continental Response Br. 65; Schrader Response Br. 43. Wasica disagrees, arguing that the plain meaning of “sequence” implies two or more items, so that a “bit sequence” must contain “two or more bits.” Wasica Response Br. 25–26. In the ’295 and ’476 proceedings, the Board agreed with Wasica, ruling that a “bit sequence” must include “two or more bits.” *Continental Decision*, 2015 WL 3811738, at *6–7; *Schrader Decision*, 2015 WL 4500655, at *6. Because Oselin’s pressure alarm bit S₁₈ is a single bit, the Board concluded, Oselin does not disclose or suggest using claim 9’s sequences of “two or more bits.” *Continental Decision*, 2015 WL 3811738, at *11; *Schrader Decision*, 2015 WL 4500655, at *11.

2. Analysis

We must determine whether the Board erred in its construction of “bit sequence.” We conclude that it did.

Claim 9 recites transmitting “at least a 4 bit sequence” having four component “bit sequence[s].” ’524 patent, 14:31–39. Because none of the component bit sequences may be empty, the only way to fit four of them into “a 4 bit sequence” is for each constituent bit sequence to comprise a single bit.¹⁰ Thus, a “bit sequence” in the context of claim 9 must be broad enough to include single-bit sequences.

The Board’s construction of “bit sequence” as “two or more bits” conflicts with the plain import of claim 9. The claim describes its transmission as including “at least” four bits, indicating that the signal may, in some instances, span only four bits. Under the Board’s construction, however, the transmitted signal must include at least *eight* bits—two for each component bit sequence. Not only does this approach rewrite “at least 4” to mean “at least 8,” but it also excludes signals comprising four, five, six, or seven bits that are expressly covered by the claim.

Moreover, “the context of the surrounding words of the claim also must be considered in determining the ordinary and customary meaning” of terms in a claim. *ACTV, Inc. v. Walt Disney Co.*, 346 F.3d 1082, 1088, 1090 (Fed. Cir. 2003). Here, the context of the words surrounding “bit sequence” requires them to encompass single-bit

¹⁰ Construing “bit sequence” to allow for an empty, zero-bit sequence would effectively remove the “first bit sequence,” “second, or third bit sequence,” and “fourth and final bit sequence” limitations from the claim, as it would make them optional or potentially nonexistent. *See In re Johnston*, 435 F.3d 1381, 1384 (Fed. Cir. 2006). It is highly disfavored to construe terms in a way that renders them void, meaningless, or superfluous. *See Bicon, Inc. v. Straumann Co.*, 441 F.3d 945, 950–51 (Fed. Cir. 2006) (refusing to construe claim terms in a way that made other limitations meaningless).

sequences. Indeed, the specification confirms the use of “bit sequence” in this context by providing an embodiment where a bit sequence can contain only a single bit. *See* ’524 patent, 5:1–9 (incorporating by reference a patent that employs a switch-based membrane signaling when the tire pressure is excessively high or low). Therefore, we construe the term “bit sequence” to include single-bit sequences.

Wasica does not dispute that Oselin anticipates claim 9 if “bit sequence” is construed to cover single-bit sequences. Accordingly, we reverse the Board’s decisions that claim 9 is patentable over Oselin.

CONCLUSION

For the reasons stated above, we hold that the Board did not err in finding claims 1–5, 10–19, and 21 unpatentable. We also hold that substantial evidence supports the Board’s findings that claims 6–8 and 20 are patentable. We hold that the Board did err, however, in finding claim 9 patentable. Accordingly, we affirm the Board’s decisions in the ’295 and ’476 proceedings as to claims 1–8 and 10–21 but reverse its decisions as to claim 9.

AFFIRMED-IN-PART, REVERSED-IN-PART

COSTS

Each party shall bear its own costs.