

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO. LTD., SAMSUNG ELECTRONICS
AMERICA, INC., SAMSUNG TELECOMMUNICATIONS AMERICA,
LLC, and SAMSUNG AUSTIN SEMICONDUCTOR, LLC,
Petitioner,

v.

REMBRANDT WIRELESS TECHNOLOGIES, LP,
Patent Owner.

Case IPR2014-00895
Patent 8,457,228 B2

Before JAMESON LEE, HOWARD B. BLANKENSHIP, and
JUSTIN BUSCH, *Administrative Patent Judges*.

BUSCH, *Administrative Patent Judge*.

FINAL WRITTEN DECISION
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

I. BACKGROUND

Samsung Electronics Co. Ltd., Samsung Electronics America, Inc.,
Samsung Telecommunications America, LLC, and Samsung Austin
Semiconductor, LLC (collectively, “Petitioner”) filed a request for *inter*

partes review of claims 26–29, 31, 36–41, 43, and 47–52 of U.S. Patent No. 8,457,228 B2 (“the ’228 patent,” Ex. 1501) under 35 U.S.C. §§ 311–319. Paper 2 (Petition or “Pet.”). The Board instituted an *inter partes* review of claims 26–29, 31, 36–41, 43, and 47–52 on an asserted ground of unpatentability for obviousness. Paper 8 (“Dec. on Inst.”).

Subsequent to institution, Patent Owner Rembrandt Wireless Technologies, LP, filed a patent owner response (Paper 17, “PO Resp.”). Petitioner filed a reply to the Patent Owner Response (Paper 27, “Pet. Reply”).

Oral hearing was held on July 21, 2015.¹

The Board has jurisdiction under 35 U.S.C. § 6(c). This final written decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73.

For the reasons that follow, we determine that Petitioner has shown by a preponderance of the evidence that claims 26–29, 31, 36–41, 43, and 47–52 of the ’228 patent are unpatentable.

A. Related Proceedings

According to Petitioner, the ’228 patent is involved in the following lawsuit: *Rembrandt Wireless Technologies, LP v. Samsung Electronics Co.*, No. 2:13-cv-00213 (E.D. Tex. 2013). Pet. 1. The ’228 patent also has been challenged in the following cases: *Samsung Electronics Co. v. Rembrandt Wireless Technologies, LP*, IPR2014-00889 (not instituted); *Samsung Electronics Co. v. Rembrandt Wireless Technologies, LP*, IPR2014-00890 (not instituted); *Samsung Electronics Co. v. Rembrandt Wireless Technologies, LP*, IPR2014-00891 (not instituted); *Samsung Electronics Co.*

¹ The record includes a transcript of the oral hearing. Paper 43.

v. Rembrandt Wireless Technologies, LP, IPR2014-00892 (final decision being issued concurrently); and *Samsung Electronics Co. v. Rembrandt Wireless Technologies, LP*, IPR2014-00893 (final decision being issued concurrently). *Id.* at 2.

B. The '228 Patent

The '228 Patent issued from an application filed August 4, 2011, which claimed priority under 35 U.S.C. § 120 through a chain of intervening applications to an application filed December 4, 1998, and which further claimed priority under 35 U.S.C. § 119 to a provisional application filed December 5, 1997.

The technical field of the patent relates to data communications and modulators/demodulators (modems), and in particular to a data communications system in which a plurality of modems use different types of modulation in a network. Ex. 1501, 1:21–25, 1:58–2:23.

C. Illustrative Claim

Of the challenged claims, only claim 26 is independent.

26. A master communication device configured to communicate according to a master/slave relationship in which a slave communication from a slave device to the master communication device occurs in response to a master communication from the master communication device to the slave device, the master communication device comprising:

a transceiver configured to transmit signals over a communications medium to a slave device using at least two different types of modulation methods and to receive one or more responses over the communication medium that comprise at least respective response data that is modulated according to one of the at least two different types of modulation methods,

the at least two different types of modulation methods comprising a first modulation method and a second modulation method, wherein the transmitted signals comprise first transmitted signals and second transmitted signals, the first transmitted signals comprise at least two transmission sequences, the at least two transmission sequences include a first transmission sequence and a second transmission sequence, the transceiver is configured to transmit the first transmission sequence using the first modulation method, and the transceiver is configured to transmit the second transmission sequence using the second modulation method wherein:

the first transmission sequence includes information that is indicative of an impending change in modulation method from the first modulation method to the second modulation method,

the second transmission sequence includes a payload portion that is transmitted after the first transmission sequence,

the first transmitted signals include first address information that is indicative of the slave device being an intended destination of the payload portion,

the second transmitted signals comprise at least a third transmission sequence and a fourth transmission sequence,

the transceiver is configured to transmit the third transmission sequence using the first modulation method,

the transceiver is configured to transmit the fourth transmission sequence using the first modulation method,

the third transmission sequence includes information indicative that the fourth transmission sequence will be transmitted using the first modulation method,

the fourth transmission sequence includes a second payload portion that is transmitted after the third transmission sequence, and

the second transmitted signals include second address information that is indicative of a specified slave device being an intended destination of the second payload portion.

D. Prior Art

Boer US 5,706,428 Jan. 6, 1998 (Ex. 1504)

E. Asserted Ground of Unpatentability

The Board instituted *inter partes* review on the following asserted ground of unpatentability under 35 U.S.C. § 103(a) (Dec. on Inst. 16): claims 26–29, 31, 36–41, 43, and 47–52 of the ’228 patent on the ground of obviousness over Admitted Prior Art (“APA”) and Boer.

II. ANALYSIS

A. Claim Interpretation

In an *inter partes* review, the Board construes claim terms in an unexpired patent using their broadest reasonable construction in light of the specification of the patent in which they appear. 37 C.F.R. § 42.100(b); *In re Cuozzo Speed Techs., LLC*, 793 F.3d 1268, 1275–79 (Fed. Cir. 2015). The claim language should be read in light of the specification as it would be interpreted by one of ordinary skill in the art. *In re Am. Acad. of Sci. Tech. Ctr.*, 367 F.3d 1359, 1364 (Fed. Cir. 2004). The Office must apply the broadest reasonable meaning to the claim language, taking into account any definitions presented in the specification. *Id.* (citing *In re Bass*, 314 F.3d 575, 577 (Fed. Cir. 2002)). The “ordinary and customary meaning” is that which the term would have to a person of ordinary skill in the art in

question. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007).

1. Modulation Methods

Illustrative claim 26 recites a transceiver configured to transmit signals “using at least two different types of modulation methods”

Petitioner submits that the ordinary meaning of “modulation” is “[t]he process by which some characteristic of a carrier is varied in accordance with a modulating wave.” Pet. 14 (citing Ex. 1526² ¶¶ 82–88 (Declaration of Dr. David Goodman); Ex. 1520 (technical dictionary)). Patent Owner submits that “modulation method” is generally recognized in the pertinent art to mean “a technique for varying one or more characteristics of a carrier wave in a predetermined manner to convey information.” PO Resp. 9. Patent Owner submits further, and we agree, that there appears to be no significant difference between these two proffered constructions of “modulation.” *Id.* at 11.

Later in its Patent Owner Response, however, Patent Owner advocates a narrower definition for “modulation method” for the purpose of addressing the prior art. *See id.* at 13. In particular, Patent Owner submits that the only three characteristics of a carrier wave are frequency, phase, and amplitude and, thus, “modulation” is limited to varying one or more of the frequency, phase, and amplitude of the carrier wave. *Id.* Patent Owner relies on the Declaration of Dr. Christopher R. Jones (Ex. 2914 ¶ 40). Dr. Jones, in turn, relies on a definition in one of several technical dictionaries that have been

² Petitioners erroneously refer to the Declaration of Dr. David Goodman as Exhibit 1523 throughout the Petition, but Dr. Goodman’s declaration was submitted as Exhibit 1526.

provided by Patent Owner. Ex. 2914 ¶ 39. In the particular technical dictionary upon which Dr. Jones relies,³ two of the six definitions of “modulation” use the terms amplitude, frequency, and phase. Ex. 2915, 3. The entry contains broader definitions for “modulation,” as, for example, the first definition, which states that modulation is the process of varying some characteristic of a carrier wave, whereby the carrier wave can be a direct current, an alternating current, or “a series of regularly repeating, uniform pulses called a pulse chain.” *Id.*

Patent Owner does not point to anything in the ’228 patent’s disclosure that would limit the definition of “modulation” to varying the amplitude, frequency, or phase of the carrier wave. Our reviewing court has “cautioned against relying on dictionary definitions at the expense of a fair reading of the claims, which must be understood in light of the specification.” *Interval Licensing LLC v. AOL, Inc.*, 766 F.3d 1364, 1377 (Fed. Cir. 2014). We, therefore, interpret “modulation” in accordance with its customary and ordinary meaning as the process by which some characteristic of a carrier is varied in accordance with a modulating wave.

2. Types of Modulation Methods

As we have noted, the claims recite “types” of modulation methods. Petitioner and Patent Owner disagree with respect to the meaning of a “type” of modulation method. Patent Owner submits that the broadest reasonable interpretation of different “types” of modulation methods does not extend to modulation methods that are known merely to be incompatible with each other, but is limited to different “families” of modulation techniques, e.g.,

³ Rudolf F. Graf, MODERN DICTIONARY OF ELECTRONICS, 6th ed. (1997).

the FSK (frequency shift keying) “family” of modulation methods and the QAM (quadrature amplitude modulation) “family” of modulation methods. PO Resp. 12. Petitioner, on the other hand, contends that the broadest reasonable interpretation of a different “type” of modulation method means an “incompatible” modulation method. Pet. 9–14.

Patent Owner contends that a “special definition” was provided during prosecution of the ’228 patent, which defined the term different “types” of modulation to mean different “families” of modulation. PO Resp. 12. At the outset, we agree with Petitioner (Pet. Reply 16) to the extent that prosecution history is entitled to little weight under the broadest reasonable interpretation standard. *See Tempo Lighting, Inc. v. Tivoli, LLC*, 742 F.3d 973, 978 (Fed. Cir. 2014) (“This court also observes that the PTO is under no obligation to accept a claim construction proffered as a prosecution history disclaimer, which generally only binds the patent owner.”). In any event, Patent Owner relies on the following statements during prosecution for the asserted “special definition”:

Applicant thanks [the Examiner] for the indication that claims 1-18, and 37-57 are allowed (office action, p. 7). Applicant has further amended claims 1-2, 9-15, 18, 37-38, and 45-46 with additional recitations to more precisely claim the subject-matter. For example, the language of independent claim 1 has been clarified to refer to two *types* of modulation methods, *i.e.*, different families of modulation techniques, such as the FSK family of modulation methods and the QAM family of modulation methods.

Ex. 1518, 20 (Reply Pursuant to 37 CFR § 1.111 in parent application 12/543,910).

As made plain in the above remarks, the claim amendments with respect to two “types” of modulation methods were not made in response to a rejection, as the relevant claims had been allowed. *Cf. Tempo Lighting*, 742 F.3d at 978 (“[I]n this instance, the PTO itself requested Tivoli rewrite the ‘non-photoluminescent’ limitation in positive terms. Tivoli complied, and then supplied clarification about the meaning of the ‘inert to light.’”). Nor do the above remarks explain what a “family” might be, or why FSK is considered to be member of one “family” and QAM a member of another “family.” “Although an inventor is indeed free to define the specific terms used to describe his or her invention, this must be done with reasonable clarity, deliberateness, and precision.” *In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994). Patent Owner’s purported “definition” is anything but clear or precise. Further, the only modulation methods named in the text of the ’228 patent are QAM, carrierless amplitude and phase (CAP) modulation,⁴ and discrete multitone (DMT) modulation, each of which the patent calls “high performance modulation.” *See, e.g.*, Ex. 1501, 2:3–7.

Patent Owner provides, as an exhibit, Provisional Application No. 60/067,562 (Ex. 2901), which the ’228 patent purports to incorporate by reference (Ex. 1501, 1:8–17). That provisional distinguishes between “high performance modulation, such as QAM, CAP, or DMT,” which are optimized for high performance, and “low performance modulation, such as FSK, PAM or DSB,” which may be implemented in much less expensive

⁴ According to Patent Owner, the patent contains a typographical error in that “[c]arrier” should be “[c]arrierless.” PO Resp. 10 n.3.

devices. Ex. 2901, 4.⁵ An objective reading of the above-noted remarks during prosecution suggests that, contrary to Patent Owner's arguments, the "different families of modulation techniques" refer to high performance modulation (such as QAM) and low performance modulation (such as FSK). The prosecution history is, at best, ambiguous. "It is inappropriate to limit a broad definition of a claim term based on prosecution history that is itself ambiguous." *Inverness Med. Switz. GmbH v. Warner Lambert Co.*, 309 F.3d 1373, 1382 (Fed. Cir. 2002).

Moreover, Patent Owner's proffered construction (*e.g.*, PO Resp. 13) of "types" of modulation methods being based on "one or more" of the carrier wave's frequency, phase, and amplitude "families" is, itself, ambiguous. We reproduce the following exchange during oral argument in related case IPR2014-00518, which concerns U.S. Patent No. 8,023,580 B2 (which issued from the parent application (12/543,910) of the '228 patent):

JUDGE LEE: How do you summarize your position?
What is the definition of different family?

MR. MOLLAAGHABABA: Okay. I believe these three characteristics, phase, amplitude and frequency of the carrier wave, define these three families.

Now, if two methods are using the same characteristic to modulate the wave, then they are not different types. I mean, DBPSK and DQPSK, they both use the phase, that characteristic of the carrier wave to modulate and convey information.

⁵ The first page of Exhibit 2901 is unnumbered, and page 4 is numbered as page 3. *Cf.* 37 C.F.R. § 42.63(d)((2)(i) ("Each page must be uniquely numbered in sequence.").

JUDGE LEE: Okay. So phase is one family, amplitude is one, and frequency is another. So those are broad categories.

MR. MOLLAAGHABABA: Yes.

JUDGE LEE: So you can only have three types then.

MR. MOLLAAGHABABA: But you can have situations where the modulation can belong to two categories.

I mean, there are some intersections. QAM modulates both amplitude and phase.

JUDGE LEE: So to which family would they belong?

MR. MOLLAAGHABABA: Well, they are part of both families. I mean, they belong to two -- both families. There is some intersections where some modulation techniques use more than one characteristic. They use two characteristics.

JUDGE LEE: Then are they of different types? If there is just only partial overlap, are they still different types, or is it the same type because they also share something in common?

MR. MOLLAAGHABABA: Yes, our contention is that they are not of different types. They are different in the sense that they are different methods, like QAM and PSK, but they share a family so, therefore, they are not different types. They share the family for both.

IPR2014-00518, Paper 46 at 88:8–89:17. Thus, according to counsel for Patent Owner, two modulation methods that are different in one characteristic but the same in another, e.g., one varying phase and amplitude and the other varying frequency and amplitude, would be regarded as belonging in the same family. Such an understanding of the classification or categorization of “family” in case of partial overlap was not a part of any

representation during prosecution history. It reflects ambiguity in the construction proposed by Patent Owner.

The '228 patent describes Type A and Type B modulation methods (and tributary modems, or “tribs”), but does not associate directly any particular modulation method with a Type A or a Type B method (or “trib”). *See, e.g.*, Ex. 1501, 5:47–7:33. The provisional application, however, associates lower-cost FSK modems with Type B “tribs.” Ex. 2901, 6; *see also* '228 patent —

While it is possible to use high performance tribs running state of the art modulation methods such as QAM, CAP, or DMT to implement both the high and low data rate applications, significant cost savings can be achieved if lower cost tribs using low performance modulation methods are used to implement the lower data rate applications.

Ex. 1501, 5:41–46.

Further, the '228 patent does not draw distinctions between “families” of modulation techniques directed to differences in modulation with respect to amplitude, phase, or frequency. Rather, the '228 patent draws distinctions between relatively expensive high performance techniques and relatively inexpensive low performance techniques. The '228 patent attempts to remedy the asserted deficiency in the prior art that all modems in a system must use a single modulation method, and thus must all be high-performance modems, with the high-performance, relatively expensive modems merely lowering the data rate for lower data-rate applications. As the '228 patent explains:

All users in the system will generally have to be equipped with a high performance modem to ensure modulation compatibility. These state of the art modems are then run at their lowest data

rates for those applications that require relatively low data throughput performance. The replacement of inexpensive modems with much more expensive state of the art devices due to modulation compatibility imposes a substantial cost that is unnecessary in terms of the service and performance to be delivered to the end user.

Ex. 1501, 2:10–18.

Further, the '228 patent refers to an objective of using multiple modulation methods to facilitate communication among a plurality of modems in a network, which have heretofore been “incompatible.” *Id.* at 2:19–23.

In view of the foregoing, we do not interpret a “type” of modulation method as referring to some vague or undefined “family” of modulation methods. We interpret different “types” of modulation methods as modulation methods that are incompatible with one another. Thus, contrary to Patent Owner’s construction, two modulation methods that are based on varying the same one of the frequency, amplitude, or phase of the carrier wave may be different “types” of modulation methods.

B. Prior Art

1. Admitted Prior Art

Petitioner contends that the '228 patent’s disclosure of polled multipoint communications using masters and slaves, depicted in Figures 1 and 2 and described in column 3, line 64 through column 5, line 7, and the '228 patent’s disclosure of training signals, data fields, and trailing signals in such a multipoint communication system, described within that disclosure at column 4, lines 5 through 19, constitute material that may be used as prior art against the patent under 35 U.S.C. § 103(a). We agree. Figure 1 of the

patent is labeled as “Prior Art.” Pet. 5; Ex. 1501, Fig. 1. Moreover, the ’228 patent’s specification refers to “prior art” multipoint communication system 22 comprising master modem or transceiver 24, which communicates with a plurality of tributary modems (“tribs”) or transceivers 26. Pet. 5–6; Ex. 1501, 3:64–4:1. Further, the ’228 patent describes Figure 2 as illustrating the operation of the multipoint communication system of (prior art) Figure 1. Pet. 7; Ex. 1501, 3:33–34.

2. Boer

Boer describes a wireless LAN that includes first stations that operate at 1 or 2 Mbps (Megabits per second) data rate and second stations that operate at 1, 2, 5, or 8 Mbps data rate. Ex. 1504, Abstract.

Figure 1 of Boer is reproduced below.

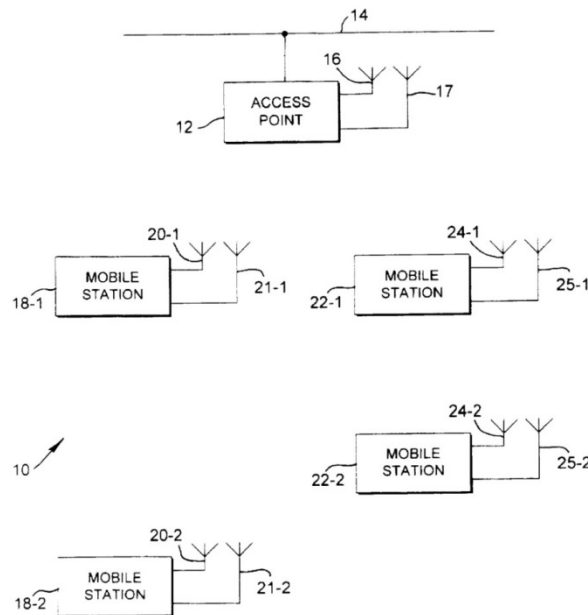


FIG.1

Figure 1 is said to be a block diagram of a wireless LAN embodying Boer’s invention. Ex. 1504, 1:53–54. LAN 10 includes access point 12,

serving as a base station. *Id.* at 2:6–9. The network includes mobile stations 18-1 and 18-2 that are capable of transmitting and receiving messages at a data rate of 1 or 2 Mbps using DSSS (direct sequence spread spectrum) coding. *Id.* at 2:16–22. When operating at 1 Mbps, a station uses DBPSK (differential binary phase shift keying) modulation. *Id.* at 2:23–25. When operating at 2 Mbps, a station uses DQPSK (differential quadrature phase shift keying) modulation. *Id.* at 2:25–27. Mobile stations 22-1 and 22-2 are capable of operating at the 1 and 2 Mbps data rates using the same modulation and coding as stations 181 and 182. *Id.* at 2:34–39. In addition, stations 22-1 and 22-2 can operate at 5 and 8 Mbps data rates using PPM/DQPSK (pulse position modulation–differential quadrature phase shift keying) in combination with the DSSS coding. *Id.* at 2:39–44.

C. Claims 26–29, 31, 36–41, 43, and 47–52 – APA and Boer

1. Asserted Ground

Petitioner applies the teachings of APA and Boer to demonstrate obviousness of the subject matter of illustrative claim 26, relying on APA for teaching of master/slave communication systems. Pet. 16–34. Petitioner submits that a person having ordinary skill in the art have would been motivated to combine Boer with APA, referring to the Declaration of Dr. David Goodman (Ex. 1526 ¶¶ 112–116, 120–122, 124–127). *Id.* at 19–21.

Dr. Goodman testifies that polled multiport master/slave communications systems were well known to those of ordinary skill in the art for simplicity and determinacy, referring to Exhibit 1522. Ex. 1526 ¶ 124. Petitioner submits Exhibit 1522 as a November 1994 publication that compares various strengths and weaknesses for communication protocols for

embedded systems. Ex. 1522, 7. The document states that polling is one of the more popular protocols for embedded systems “because of its simplicity and determinacy.” *Id.* In that protocol, a centrally assigned master periodically sends a polling message to the slave nodes, giving them explicit permission to transmit on the network. *Id.* The protocol “is ideal for a centralized data-acquisition system where peer-to-peer communication and global prioritization are not required.” *Id.*

2. Motivation to Combine

Patent Owner in its Response argues that Upender does not reflect a proper motivation from the prior art for the proffered combination of Boer and APA. Patent Owner submits a Declaration from a co-author of Upender to show that the article did not suggest the use of a master/slave communication system. Ex. 2908 (Declaration of Dr. Philip Koopman).

We have considered Patent Owner’s arguments and evidence but find that the clear teachings in Upender are not diminished or rebutted. Upender investigates tradeoffs in different communication protocols. The article concludes that CSMA/CA (carrier sense multiple access with collision avoidance), or RCSMA (reservation CSMA), is a good choice for some embedded systems. Ex. 1522, 10–11. The article also indicates that polling may not provide sufficient flexibility for “advanced systems,” classifying polling as “simple,” but noting that the discussion of the different protocol strengths and weaknesses “should allow you to select the best protocol to match your needs.” *Id.* In fact, Dr. Koopman admits that there are some systems for which master/slave is a better match for the design requirements. Pet. Reply 10; Ex. 1527, 40:2–20.

That Upender may identify some advantages of CSMA/CA over a master/slave protocol is not a “teaching away” from the master/slave protocol. Upender teaches that master/slave protocols were widely used and a good choice for simple systems. *See In re Gurley*, 27 F.3d 551, 553 (Fed. Cir. 1994) (“[A] person seeking to improve the art of flexible circuit boards, on learning from [a reference] that epoxy was inferior to polyester-imide resins, might well be led to search beyond epoxy for improved products. However, [the reference] also teaches that epoxy is usable and has been used for Gurley’s purpose.”).

Patent Owner’s position appears to be that the prior art teaches that one and only one communication protocol should ever be used, which is directly contrary to the clear teachings of Upender. In view of Upender, one of ordinary skill in the art would have found it obvious to use a different prior art communication protocol (e.g., a simpler protocol) when using multiple data rates as described by Boer.

Further, we agree with Petitioner that Boer does not describe CSMA as central to an alleged goal of seeking a “reduction of overhead-in-time per transmission,” but relates that reduction to the use of short acknowledgment (ACK) messages. PO Resp. 42–43; Pet. Reply 12; Ex. 1504, 8:16–29.

Patent Owner submits that Dr. Goodman’s Declaration (Ex. 1526) is unreliable because it is unclear what level of skill it attributes to the ordinary artisan. PO Resp. 33–34. The alleged lack of clarity, however, does not affect the outcome. We note that specifying the level of ordinary skill in terms of an academic degree in a field of study and the number of years of practical working experience is generally unhelpful, as a practical matter, because it does not convey whether one with ordinary skill in the art would

have been aware of anything specific or particular. Patent Owner has not directed us to evidence establishing what someone who has earned a certain degree or who has a certain number of years of experience necessarily knows. It is not always necessary, however, to have an express proposition on the level of ordinary skill in the art. The level of ordinary skill in the art may be reflected by the prior art of record. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001); *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995); *In re Oelrich*, 579 F.2d 86, 91 (CCPA 1978).

We agree with Patent Owner to the extent that one of skill in the art would not consider using a CSMA/CA protocol in a master/slave configuration. PO Resp. 39–41. That combination, however, is not contemplated by the asserted ground of unpatentability. As Patent Owner and Dr. Koopman recognize, the transmitted data used in Boer to effect the CSMCA/CA protocol would be “totally unnecessary” in a master/slave configuration. *Id.* at 46; Ex. 2908 ¶ 96.

3. Different Types of Modulation Methods

Illustrative claim 26 recites “using at least two different types of modulation methods . . . comprising a first modulation method and a second modulation method.” Petitioner contends that Boer’s DBPSK modulation corresponds to the claimed “first” modulation method. *E.g.*, Pet. 23. Petitioner submits that either of Boer’s DQPSK modulation and PPM/DQPSK modulation corresponds to the claimed “second” modulation method because each of DQPSK modulation and PPM/DQPSK modulation is of a different type — i.e., not compatible with — DBPSK modulation. Pet. 23–25; Ex. 1526 ¶¶ 128–136. On the record before us, we agree that

DQPSK and PPM/DQPSK modulation methods are incompatible with DBPSK modulation. *See, e.g.*, Ex. 1526 ¶¶ 147–154.

Patent Owner responds, however, that neither of DQPSK and PPM/DQPSK can be considered a modulation method of a type different from DBPSK. PO Resp. 46–55. Patent Owner argues that DBPSK and DQPSK are not different “types” of modulation methods because the methods are within the same “family,” because both vary the same fundamental characteristic of a carrier wave — its phase. *Id.* at 49–50. We do not find Patent Owner’s argument to be persuasive because we are not convinced that the broadest reasonable interpretation of “types” of modulation is so limited. *See* Claim Interpretation, § II.A.2, *supra*.

Patent Owner alleges also that Boer does not describe DBPSK and DQPSK as “incompatible” modulation methods because mobile stations are disclosed as capable of transmitting and receiving using DBPSK and also using DQPSK. PO Resp. 48–49. However, whether one “type” of modulation is incompatible with another “type” concerns the method of modulation, not necessarily the modem for carrying out that method. That is, a modem might be designed (as in Boer) to transmit and receive using, separately, two incompatible modulation methods, but that does not mean the two modulation methods are compatible with each other.

Moreover, Boer describes PPM/DQPSK modulation, which falls within the meaning of a “different type” of modulation method, with respect to DBPSK, under our construction of the term. *Cf.* Ex. 1526 ¶ 149 (“Regardless of which construction the panel adopts for type of modulation method both 5 Mbps and 8 Mbps PPM/DQPSK meet the ‘second modulation method’ claim limitation.”). According to Dr. Goodman, phase

is not used in PPM, unlike in DBPSK and DQPSK modulation. *Id.* ¶ 151. In PPM, the start and stop time of a transmission is varied in response to the information to be transmitted, with the time shift being indicative of data bits. *Id.*

Patent Owner argues that PPM as used in Boer is not a modulation method. PO Resp. 50–55. Patent Owner’s position, however, is based on the argument that a “modulation method” is limited to varying one or more of the “fundamental characteristics” of amplitude, frequency, and phase. We do not find the argument persuasive, in view of the requirement of construing the term in accordance with its broadest reasonable interpretation. *See* § II.A.1, *supra*. We acknowledge that Boer refers to PPM as “PPM type coding.” PO Resp. 53–54; Ex. 1504, 4:45–48. However, as pointed out by Petitioner, Boer appears to use the terms “coding” and “modulation” interchangeably. Pet. Reply 22–23.

Moreover, Dr. Jones’ Declaration is unclear in what is meant by PPM being not a carrier wave modulation technique “as utilized in Boer” or “within the context of Boer.” Ex. 2914 ¶ 58. Dr. Jones submits that he holds numerous patents in types of modulation that include pulse-amplitude modulation (PAM). *Id.* ¶ 7. Patent Owner provides, as an exhibit, a technical treatise on communication systems engineering⁶ that addresses PAM and PPM as two types of “Pulse Modulation Signals.” Ex. 2905, 438–44 (original page numbering). In PAM, “the information is conveyed by the amplitude of the pulse.” *Id.* at 438. In PPM (consistent with Dr. Goodman’s

⁶ John G. Proakis and Masoud Salehi, *Communication Systems Engineering*, Prentice Hall, Digital Transmission Through and AWGN Channel, Chap. 7, 438–44 (1994).

testimony (Ex. 1526 ¶ 150)), “the information is conveyed by the time interval in which the pulse is transmitted.” Ex. 2905, 439.

With respect to whether PPM can be considered a modulation method, we credit the testimony of Petitioner’s witness, Dr. Goodman, over that of Patent Owner’s, Dr. Jones, for the additional reason that the term “modulation” is part of the descriptive name for PPM – pulse position *modulation*. Patent Owner has not explained sufficiently why pulse position *modulation* cannot be considered a *modulation* method. Although DBPSK and PPM/DQPSK may both vary the “phase” characteristic of the carrier wave, we are persuaded that with PPM the timing (start and stop time) of the transmission is another characteristic of the carrier wave that is varied. Pet. Reply 20–21; PO Resp. 52–54 (both parties referencing testimony of Dr. Goodman); § II.A.1 *supra*. We disagree with Patent Owner’s characterization of Dr. Goodman’s deposition testimony as Dr. Goodman admitting “that selection of time slots does not alter the underlying carrier wave.” PO Resp. 53. Dr. Goodman stated that “the selection of the timing wouldn’t alter the *amplitude, the phase or the frequency* of that underlying sine wave.” *Id.* (quoting Ex. 2911, 31:20–23) (emphasis added). Further, Patent Owner has not submitted sufficient evidence to show that “Dr. Goodman also agreed the PPM encoding is independent of the underlying modulated wave transmitted in the particular time slots.” PO Resp. 53.

4. Trailing Signals

Dependent claim 51 further recites that “the master communication device is configured to transmit a trailing signal to complete the master communication transmission.” Petitioner argues that APA teaches trailing

signals. Pet. 54–56; Pet. Reply 23–24; Ex. 1501, 3:64–4:25. We agree. Patent Owner argues in its Response that the CRC bits in Boer do not meet the recited trailing signal (PO Resp. 58) and, further, that “there would be no need to incorporate a trailing signal into the message 200 of Boer,” because Boer provides a header that includes a length field. *Id.* at 60. Patent Owner’s arguments address Petitioner’s argument, asserted in the Petition but not relied upon in this Decision, that trailing signals are taught by Boer. Patent Owner’s arguments do not address the assertion that the trailing signals are already present in APA. Specifically, as Petitioner points out in its Reply, Patent Owner does not address the proposed incorporation of multiple modulation methods, taught by Boer, into the multipoint communication system (including training and trailing signals), taught by APA, , which results in a combination having all of the limitations recited by and as arranged in claim 51. Pet. Reply 23–24; *see* Pet. 23–26, 56; Paper 43, 20–21.

5. APA and Boer — Conclusion

Upon review of the Petition and supporting evidence, as well as the Patent Owner Response and supporting evidence, we conclude that Petitioner has demonstrated, by a preponderance of the evidence, that claims 26–29, 31, 36–41, 43, and 47–52 are unpatentable for obviousness over APA and Boer.

6. Patent Owner’s Motion to Exclude

Patent Owner moves to exclude, under 37 C.F.R. § 42.64(c), Exhibits 1529, 1542, 1543, and 1544. Paper 34. Patent Owner submits that Exhibits 1529 and 1542 are irrelevant and constitute improper character evidence

against Patent Owner's expert Dr. Koopman. However, we do not discredit Dr. Koopman's testimony based on anything contained in Exhibits 1529 and 1542. Nor do we rely on Exhibits 1543 and 1545, which were submitted by Petitioner as further evidence to show that PPM is a modulation method. Accordingly, Patent Owner's motion to exclude is *dismissed* as moot.

III. CONCLUSION

Petitioner has demonstrated by a preponderance of the evidence that claims 26–29, 31, 36–41, 43, and 47–52 are unpatentable for obviousness over APA and Boer.

IV. ORDER

In consideration of the foregoing, it is

ORDERED that claims 26–29, 31, 36–41, 43, and 47–52 of the '228 patent are *unpatentable*; and

FURTHER ORDERED that Patent Owner's motion to exclude evidence is *dismissed*; 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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