

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.,
HTC CORPORATION, HTC AMERICA, INC.,
and ZTE (USA) INC.,
Petitioner,

v.

INVT SPE LLC,
Patent Owner.

IPR2018-01475
Patent 7,760,815 B2

Before THU A. DANG, KEVIN F. TURNER, and
BARBARA A. BENOIT, *Administrative Patent Judges*.

DANG, *Administrative Patent Judge*.

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

In response to a Petition (Paper 1, “Pet.”) filed by Apple Inc., HTC Corporation, HTC America, Inc., and ZTE (USA), Inc. (collectively, “Petitioner”), we instituted *inter partes* review of claims 1–18 (the “challenged claims”) of U.S. Patent No. 7,760,815 B2 (Ex. 1001, “the ’815 patent”). Paper 9. During trial, INVT SPE LLC (“Patent Owner”) filed a Response (Paper 11, “PO Resp.”), to which Petitioner filed a Reply (Paper 20, “Pet. Reply”). In turn, Patent Owner filed a Sur-reply. Paper 26 (“PO Sur-reply”). An oral hearing was held with the parties on January 8, 2020. A transcript of the hearing has been entered into the record. Paper 27 (“Tr.”).

We have jurisdiction under 35 U.S.C. § 6. This Decision is a Final Written Decision under 35 U.S.C. § 318(a) as to the patentability of claims 1–18 on which we instituted trial. Based on the record before us, Petitioner has shown, by a preponderance of the evidence, that claims 1–18 of the ’815 patent are unpatentable.

I. BACKGROUND

A. *The ’815 Patent (Ex. 1001)*

The ’815 patent, titled “Apparatus and Method for Transmission/Reception,” issued July 20, 2010, from an application filed May 11, 2006, which in turn is a continuation of an application filed on June 29, 2000, that issued as Patent No. 7,072,416. Ex. 1001, codes (54), (45), (22), (63). In the ’815 patent, a “modulation method” is provided in which a sender device expresses a “symbol” by using three or more bits, “important information” is arranged at least at only one of the first and second bits, a receiver device extracts the important information from at least one of the first and second

bits of the received signal, and communication control is carried out based on the important information. *Id.* at Abstract.

According to the '815 patent, in a conventional Orthogonal Frequency Division Multiplexing ("OFDM") transmission/reception apparatus, a parallel-serial ("P/S") converter inserts important information into transmission data. *Id.* at 1:18–24. The "important information" refers to "a kind of information normal communication of which is likely to be difficult to be maintained if the other end of communication has a poor error rate characteristic during reception," i.e., "a kind of information requiring a better-error rate characteristic than other information," such as "transmission data, for example." *Id.* at 1:24–30. According to the '815 patent, in a conventional apparatus, as the transmission efficiency is improved, the channel quality deteriorates, and the more the transmission efficiency is improved, the higher the probability that the receiver will not correctly receive the signal. *Id.* at 2:36–42. Thus, the objective of the '815 patent is achieved "using 3 or more bits by placing information selected from all information to be communicated on at least one of the 1st bit or 2nd bit only." *Id.* at 3:23–26.

Figure 3, reproduced below, illustrate a configuration of a transmission/reception apparatus. *Id.* at 3:35–37.

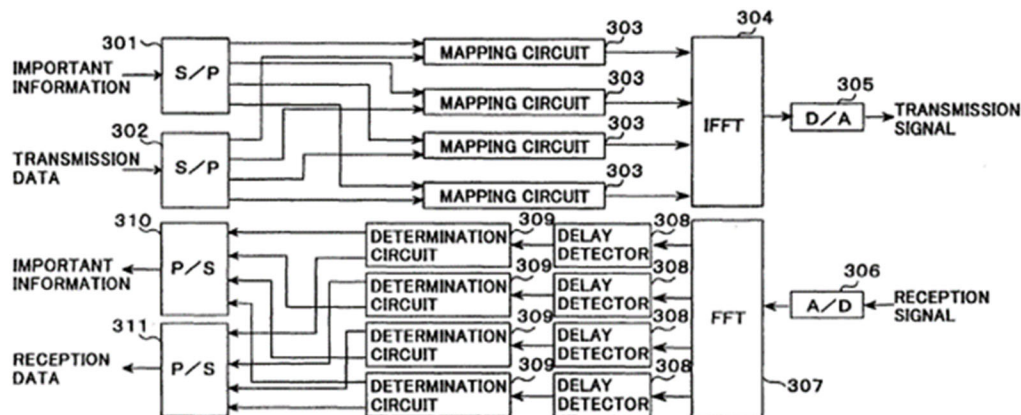


FIG.3

Figure 3 depicts “important information” being converted to a plurality (e.g., 4) of signals by serial-parallel (“S/P”) converter 301, and “transmission data” being converted to a plurality (e.g., 4) of signals by S/P converter 302. *Id.* at 4:1–4. Here, examples of “important information” can be “retransmission information or control information,” wherein S/P converter 301 places important information on at least one of the 1st or 2nd bit only. *Id.* at 4:5–22.

Figures 4–5, reproduced below, illustrate a method of placing important information. *Id.* at 4:50–51.

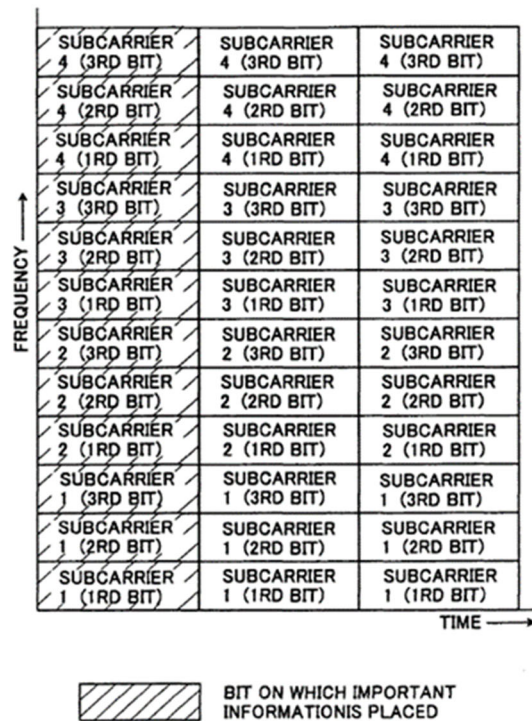


FIG.4

Figure 4 depicts “a case in the prior art where important information is placed on all bits at a certain time on the time axis.” *Id.* at 4:51–55. As shown in Figure 4, bits on which important information is placed (shaded with diagonal lines) could be the 1st bit, 2nd bit, or 3rd bit. *Id.*

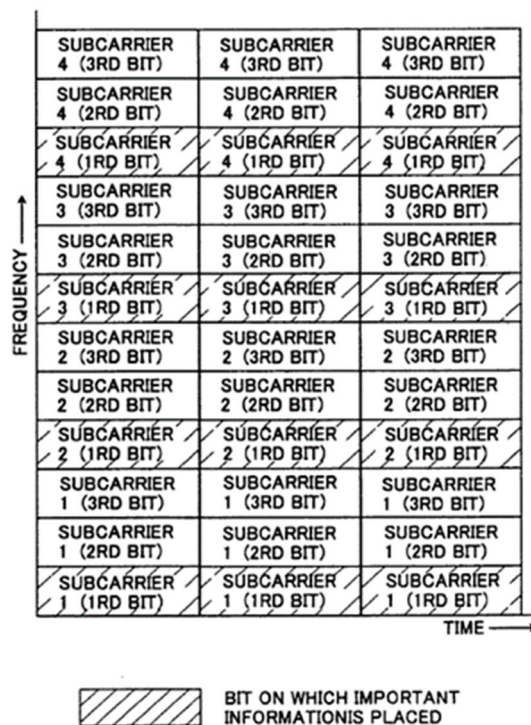


FIG.5

Figure 5 depicts “a case where important information is placed on the 1st bit only.” *Id.* at 4:51–57. As shown in Figure 5, the bits on which important information is placed (shaded with diagonal lines) are only the 1st bits. *Id.* Therefore, “placing important information only on the 1st bit allows important information to be sent with high quality.” *Id.* at 5:2–4.

B. Illustrative Claim

Of the challenged claims, claims 1, 10, and 15 are independent. Claims 2–9 depend from claim 1, claims 11–14 depend from claim 10, and claims 16–18 depend from claim 15.

Claim 1 is illustrative:

1. A transmission apparatus comprising:

a converting section that has input thereto through different routes a first information sequence comprising a plurality of bits and a second information sequence comprising a plurality of bits and that generates a sequence of bits including at least one bit of the first information sequence and at least one bit of the second information sequence; and

a modulation section that modulates the sequence of bits into symbols such that each of the symbols is expressed using three or more bits, wherein:

the first bits and the second bits of the symbols comprise bits of a set comprising bits corresponding to the first information sequence and bits corresponding to the second information sequence,

in each symbol, the bits corresponding to the first information sequence have a relation to the bits corresponding to the second information sequence,

the more lower bits than the second bits of the symbols are comprised of bits corresponding to the second information sequence, and

a bit corresponding to the second information sequence is arranged on the second bit of at least one of the symbols.

Ex. 1001, 10:50–11:5.

C. Evidence of Record

Petitioner relies upon the references listed below (Pet. 9–10):

Reference		Exhibit
Tomlinson et al.	US 4,700,363, issued October 13, 1987 (“Tomlinson”)	1007
Malkamaki et al.	US 5,563,895, issued October 8, 1996 (“Malkamaki”)	1008
Davis	US 4,346,473, issued August 24, 1982 (“Davis”)	1009
Wei	US 5,105,442, issued April 14, 1992 (“Wei”)	1010

Petitioner also relies on the Declarations of Andrew C. Singer, Ph.D. Exs. 1003, 1022. Patent Owner relies on the Declarations of Raymond Nettleton, Ph.D. Exs. 2001, 2004. Dr. Singer was cross-examined by Patent Owner, and a transcript of his deposition was entered into record. Ex. 2008. Dr. Nettleton was cross-examined by Petitioner, and a transcript of his deposition was entered into the record. Ex. 1021.

D. Asserted Grounds of Unpatentability

We instituted *inter partes* review on all grounds in the Petition on all challenged claims. Petitioner asserts the following grounds of unpatentability (Pet. 9–10):

Claims Challenged	35 U.S.C. §	Reference(s)/Basis
1–18	103 ¹	Tomlinson, Malkamaki
1, 2, 4, 10, 11	103	Davis, Wei

II. ANALYSIS

A. Claim Construction

The Board accorded the Petition a filing date of August 21, 2018. (Paper 7, 1). In an *inter partes* review filed before November 13, 2018, claim terms in an unexpired patent are given their broadest reasonable construction in light of the specification of the patent. *See* 37 C.F.R. § 42.100(b) (2018); *see also* *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2142 (2016) (affirming that USPTO has statutory authority to construe claims according to 37 C.F.R. § 42.100(b)).² Under the broadest reasonable

¹ The Leahy-Smith America Invents Act (“AIA”), which amended 35 U.S.C. § 103, was signed into law in 2011. Changes to § 103 apply to applications filed on or after March 16, 2013. Because the ’815 patent’s filing date is prior to March 16, 2013, we refer to the pre-AIA version of § 103.

² The Office changed the claim construction standard used in *inter partes* review proceedings. 37 C.F.R. § 42.100(b) (2019). As stated in the Federal Register notice, however, the new rule applies only to petitions filed on or after November 13, 2018. *See* Changes to the Claim Construction Standard

construction standard, and absent any special definitions, we generally give claim terms their ordinary and customary meaning, as would be understood by a person of ordinary skill in the art (“POSITA”), at the time of the invention. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). Any special definitions for claim terms must be set forth with “reasonable clarity, deliberateness, and precision.” *In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994). In addition, the broadest reasonable construction of a claim term cannot be so broad that the construction is 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 Prods., Inc. v. Matal*, 872 F.3d 1290 (Fed. Cir. 2017) (en banc) (“A construction that is unreasonably broad and which does not reasonably reflect the plain language and disclosure will not pass muster.” (internal quotation marks and citation omitted)). We apply these principles in our analysis.

Petitioner proposes “all claim terms should be given their plain and ordinary meaning in light of the specification.” Pet. 10.

Patent Owner contends that, “[t]he broadest reasonable interpretation does not simply mean the broadest interpretation,” but rather, must “be reasonable in light of general claim construction principles.” PO Resp. 13. Patent Owner proposes claim construction for “first information sequence”

for Interpreting Claims in Trial Proceedings Before the Patent Trial and Appeal Board, 83 Fed. Reg. 51,340, 51,340 (Oct. 11, 2018) (stating “[t]his rule is effective on November 13, 2018 and applies to all IPR, PGR and CBM petitions filed on or after the effective date”).

and “bits of a set comprising bits corresponding to the first information sequence and bits corresponding to the second information sequence.” *Id.* at 14 (citing Ex. 1001, 10:50–11:3 (claim 1)). In particular, Patent Owner contends “first information sequence,” when read in the context of the claims, supports a construction of “important information.” *Id.* at 15 (citing Ex. 1001, 10:61–64 (claim 1)). Further, Patent Owner contends that a POSITA would understand that the plain meaning of the claim term “bits of a set” refers to a “set of two bits,” wherein “the claim element ‘comprising bits corresponding to the first information sequence and bit corresponding to the second information sequence’ modifies the claim element ‘bits of a set.’” *Id.* at 19. According to Patent Owner, the limitation “bits of a set” includes “bits corresponding to the first information sequence, the second information sequence, or both and may differ across symbols.” *Id.* at 19–20.

In its Reply, Petitioner takes issue with Patent Owner’s proposed construction of “first information sequence” as “important information.” Pet. Reply 1 (citing PO Resp 15). In particular, Petitioner responds that “first information sequence comprising a plurality of bits” and “second information sequence comprising a plurality of bits” do not “limit the type of information included in either ‘information sequence,’” but rather “they merely distinguish the two sequences and subsequently describe the distinct processing the claimed invention applies to each sequence.” Pet. Reply 1 (citing *3M Innovative Props. Co. v. Avery Dennison Corp.*, 350 F.3d 1365, 1371 (Fed. Cir. 2003) (“The use of the terms ‘first’ and ‘second’ is a common patent-law convention to distinguish between repeated instances of an element or limitation.”)).

Further, Petitioner contends that a construction replacing an unambiguous claim limitation with a term such as “important” that depends on purely subjective opinion “should not be adopted because it renders the claim indefinite.” Pet. Reply 3–4 (citing *Intellectual Ventures I LLC v. T-Mobile USA, Inc.*, 902 F.3d 1372, 1381 (Fed. Cir. 2018) (noting a claim term that is “‘purely subjective’ and depends ‘on the predictable vagaries of any one person’s opinion’ is indefinite”) (quoting *Datamize, LLC v. Plumtree Software, Inc.*, 417 F.3d 1342, 1350–51 (Fed. Cir. 2005))). Petitioner points out that Patent Owner’s expert, Dr. Nettleton, conceded that the ’815 patent specification “is not explicit about” how to determine if information is “important.” Pet. Reply 3 (citing Ex. 1021, 27:3–17). In particular, Petitioner contends that Dr. Nettleton admitted “in some cases, that the determination as to what information is ‘important’ is subjective.” *Id.* Thus, Petitioner contends that “adding a subjective term into the claim . . . would be introducing ambiguity.” Tr. 20–21 (citing Ex. 1021, 27:2–17).

Although we agree with Patent Owner that the broadest reasonable interpretation does not simply mean the broadest interpretation (PO Resp. 13), we are not persuaded by Patent Owner’s contention that the broadest reasonable claim construction for “first information sequence” should be “important information.” *Id.* at 15. As Petitioner points out during oral arguments, the claims are not specific as to what “first information” is other than “first” is merely used to “differentiate” it from “second” information, “a very common thing when it comes to patent claim drafting.” Tr. 18. As Petitioner points out, “the Federal Circuit said the use of terms first and second is a common patent law convention to distinguish between repeated

instances of an element or limitation, which is exactly how Patent Owner has used it here.” *Id.* (citing *3M Innovative*, 350 F.3d at 1371).

Further, as Petitioner points out, dependent claims 5–6 and 13–14 limit the “first information sequence” from the respective independent claims to “specific types of information,” including “retransmission information” and information “used for an error control.” Pet. Reply 1–2. That is, “where the applicant intended to limit an information sequence to a specific type, it made those narrowing characteristics express.” *Id.* at 2 (citing *Phillips v. AWH Corp.*, 415 F.3d 1303, 1314 (Fed. Cir. 2005) (*en banc*) (“Other claims . . . can also be valuable sources of enlightenment as to the meaning of a claim term.”)). As Petitioner points out, here, Applicant chose not to limit (at least in the independent claims) the sequences of bits “to any particular type.” *Id.*

Accordingly, we are unpersuaded by Patent Owner’s contention that the Specification shows that (1) “features of the present invention as a whole” limit the scope of the claims and (2) the Specification’s repeated descriptions mapping “important information” to “the first and second bits.” PO Sur-reply 5. Given the broadest reasonable interpretation in view of the Specification, we construe the term “first” information sequence as a particular information sequence, and “second” information sequence as another information sequence distinguishable from the “first.” The Specification, including the claim language and the prosecution history, do not compel any different conclusion.

We also are persuaded by Petitioner’s contention that adding a subjective term such as “important” into the claim construction would

introduce ambiguity. Tr. 20–21. Thus, we agree that we should not adopt a construction that replaces an unambiguous claim limitation with one that depends on purely subjective opinion. *See Intellectual Ventures*, 902 F.3d at 1381.

Thus, we conclude “first information sequence” can be any information sequence that is different from a “second information sequence,” wherein “a sequence of bits” are generated including “at least one bit” of each of the first and second information sequences. Ex. 1001, 10:50–67.

We are persuaded, however, by Patent Owner’s contention that, given the broadest reasonable interpretation, claim 1 requires “a set of two bits containing bits corresponding to the first information sequence, bits corresponding to the second information sequence, or bits corresponding to both the first and second information sequence.” PO Resp. 23. Even Petitioner agrees with this construction. Pet. Reply 5.

As for the other claim limitations, we determine that we need not further construe expressly any other claim terms to resolve the arguments before us. *See Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (explaining that only claim terms that are in controversy need to be construed and only to the extent necessary to resolve the controversy); *see also Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (applying *Vivid Techs.* in the context of an *inter partes* review).

B. Principles of Law

To prevail in challenging Patent Owner’s claims, Petitioner must demonstrate by a preponderance of the evidence that the claims are unpatentable. 35 U.S.C. § 316(e) (2012); 37 C.F.R. § 42.1(d). “In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.” *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify “with particularity . . . the evidence that supports the grounds for the challenge to each claim”)); *see also* 37 C.F.R. § 42.104(b) (requiring a petition for *inter partes* review to identify how the challenged claim is to be construed and where each element of the claim is found in the prior art patents or printed publications relied on). Petitioner, ultimately, has the “burden of persuasion . . . to prove ‘unpatentability by a preponderance of the evidence,’” and this burden never shifts to Patent Owner. *See Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) (quoting 35 U.S.C. § 316(e); citing *Tech. Licensing Corp. v. Videotek, Inc.*, 545 F.3d 1316, 1326–27 (Fed. Cir. 2008)) (discussing the burden of proof in *inter partes* review). Furthermore, Petitioner cannot satisfy its burden of proving obviousness by employing “mere conclusory statements.” *In re Magnum Oil Tools Int’l, Ltd.*, 829 F.3d 1364, 1380 (Fed. Cir. 2016).

A patent claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said

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) objective evidence of nonobviousness.³ *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

C. Level of Ordinary Skill in the Art

In determining the level of ordinary skill in the art, various factors may be considered, including the type of problems encountered in the art; prior art solutions to those problems; rapidity with which innovations are made; sophistication of the technology; and educational level of active workers in the field. *In re GPAC, Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995) (citation omitted). In that regard, Petitioner's expert, Dr. Singer, testifies that a POSITA at the time of the invention

would have been [a person] having a Bachelor's degree in electrical engineering or the equivalent plus 2 years of experience working with communication systems or a related field or a Master's degree in electrical engineering with an emphasis on communication systems.

Pet. 9; Ex. 1003 ¶ 47.

Patent Owner does not challenge the Petition's definition of the level of skill of a POSITA. *See generally* PO Resp. We adopt and apply Dr. Singer's assessment of the level of ordinary skill in the art, which is

³ Neither party has presented arguments regarding objective evidence of nonobviousness in the instant proceeding.

consistent with the level of ordinary skill in the art to be reflected by the prior art of record. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1354–55 (Fed. Cir. 2001) (holding that absent evidence to the contrary, “the prior art itself [may] reflect[] an appropriate level” of ordinary skill in the art).

D. Obviousness over Tomlinson and Malkamaki

Petitioner contends that claims 1–18 are unpatentable under § 103 as obvious over Tomlinson in view of Malkamaki. Pet. 11–55. Patent Owner disputes Petitioner’s contentions. PO Resp. 33–46.

For the reasons provided below, we determine that Petitioner has demonstrated that claims 1–18 would have been obvious over Tomlinson and Malkamaki. We provide a brief description of Tomlinson and Malkamaki before turning to the parties’ contentions.

1. Tomlinson

Tomlinson, titled “Data Communication Method and Apparatus,” issued on October 13, 1987, from a PCT application filed June 7, 1985. Ex. 1007, codes (54), (45), (22). Tomlinson discloses a data stream impressed on a carrier by forming a succession of binary symbol words that control the modulation level of the carrier. *Id.* at Abstract. To generate the symbol words from the data stream, the latter is first divided into a base bit stream and one or more second bit streams, wherein the second streams are subjected to error control coding before being used to define the least significant bits of the symbol words, while the most significant bits are provided by the base bit stream. *Id.* Figure 3, showing a transmitter section according to an embodiment (*id.* at 4:43–45), is reproduced below:

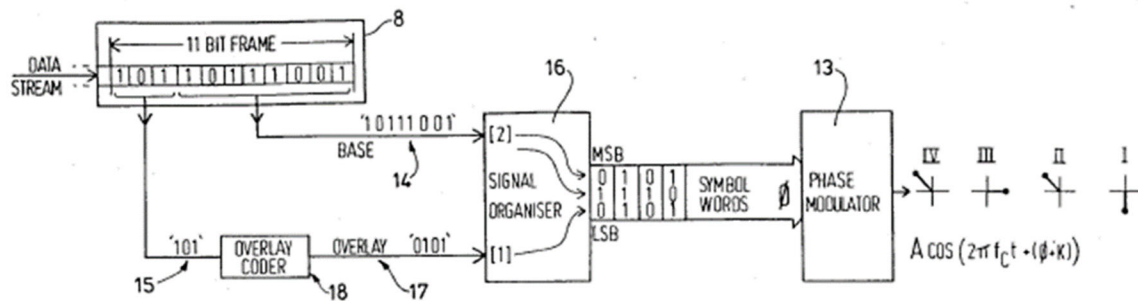


FIG 3

Figure 3 shows a “transmitting section of a data modem,” which includes phase modulator 13 arranged to receive a succession of three-bit symbol words. *Id.* at 5:59–63. As shown Figure 3, the data bit stream to be transmitted is divided in block 8 into bit streams, namely first, or base, bit stream 14 and second bit stream 15. *Id.* at 6:3–6. For each eleven bits of the data stream, eight bits are used to form base stream 14 and three bits are used for second stream 15. *Id.* at 6:6–8.

As shown in Figure 3, base stream 14 is passed to one input of signal organizer 16, which takes two bits at a time to form the two most significant bits (MSBs) of successive symbol words, while second bit stream 15 is subjected to error control coding before being passed as overlay bit stream 17 to a second input of signal organizer 16 to form the least significant bit of each successive symbol word. *Id.* at 6:14–23. In Figure 3, although bits are taken in pairs from the base stream and singly from the overlay stream to form the symbol words, “it is possible to vary this arrangement with any appropriate number of bits being taken from each stream to form each symbol.” *Id.* at 12:39–44. For example, in certain applications, “only one

bit will be taken from the base stream,” and “two or more bits of an overlay stream are used for each symbol word.” *Id.* at 12:44–52.

2. Malkamaki

Malkamaki, titled “Digital Mobile Radio Communication System,” issued on October 8, 1996, from an application filed October 29, 1993. Ex. 1008, codes (54), (45), (22). Malkamaki discloses a digital mobile radio communication system, in which a burst of speech or data, is transmitted, and an error check is carried out for each burst, wherein, when the burst is incorrect, information about the incorrect burst is transmitted to the transmitter. *Id.* at Abstract.

In particular, a receiver carries out an error check after each data burst is received and informs the transmitter if an error has been detected in the data burst, the transmitter being capable of retransmitting an individual data burst or a substantial part thereof if an error has been detected. *Id.* at 3:22–30. “A speech burst typically includes an error check for detecting incorrect bursts, such as [cyclic redundancy check,] CRC,” in which “parity bits are generated by encoding, and errors producing during the transmission are detected by means of a decoding algorithm.” *Id.* at 4:61–67.

3. Independent Claims 1, 10, and 15

We first discuss Petitioner’s contentions and Patent Owner’s arguments regarding whether the combination of Tomlinson and Malkamaki as set forth by Petitioner at least suggests the limitations recited in independent claims 1, 10 and 15. Next, we address Petitioner’s contentions and Patent Owner’s arguments regarding whether Petitioner has provided sufficient articulated reasoning with some rational underpinning regarding

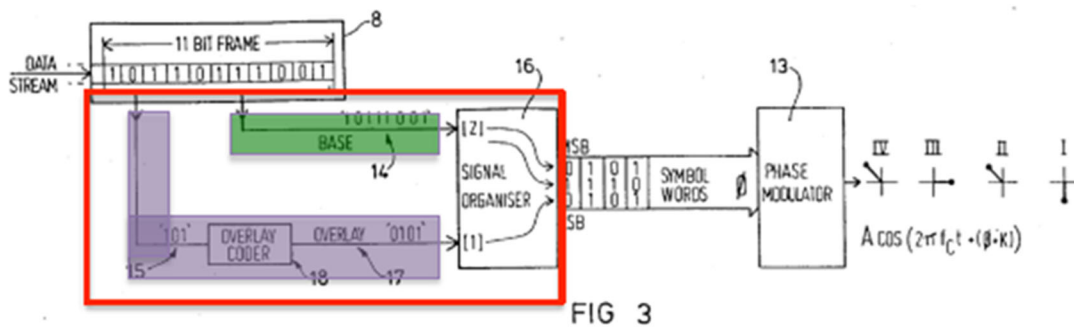
reasons one of ordinary skill in the art would have combined the references in the manner set forth by Petitioner.

a. Preamble (claims 1, 10, and 15)

Petitioner contends that Tomlinson discloses a “transmitting section of a data modem” (claim 1), a “transmission apparatus implementing a ‘method of data communication including transmitting a binary data stream’” (claim 10), and a “reception apparatus” (claim 15). Pet. 14, 43–45 (citing Ex. 1007, 5:59–60, 4:43–45, 1:52–55, 5:4–6, Figs. 3, 4, 8, 9). Patent Owner does not dispute Petitioner’s analysis of the preamble of claims 1, 10, and 15. Regardless of whether the preamble is limiting, Petitioner has demonstrated persuasively that the Tomlinson teaches the recitation in the preamble.

b. “a converting section” that “has input thereto through different routes a first information sequence comprising a plurality of bits and a second information sequence comprising a plurality of bits,” and that “generates a sequence of bits including at least one bit of the first information sequence and at least one bit of the second information sequence” (claim 1, similarly recited in claim 10)

According to Petitioner, as shown in annotated Figure 3 reproduced below, Tomlinson discloses a “converting section” (denoted in red), that has input through different routes “base stream 14” (i.e., “first information sequence”) (denoted in green) and “second stream 15” that is coded to form “overlay stream 17” (i.e., “second information sequence”) (denoted in purple):



Pet. 15. The annotation of Tomlinson's Figure 3 shows a transmitting section of a data modem. Ex. 1007, 5:59–63.

According to Petitioner, each of Tomlinson's first and second information sequences comprises a plurality of bits. Pet. 16 (citing Ex. 1007, Abstract). In one exemplary embodiment in Tomlinson, the data bit stream to be transmitted is divided in block 8 into bit streams, namely first, or base, bit stream 14 and second bit stream 15, wherein, for each eleven bits of the data stream, eight bits are used to form base stream 14 and three bits are used for second stream 15. *Id.* (citing Ex. 1007, 6:3–8). In this embodiment, the three second-stream bits derived from each eleven bit data-stream frame are thus converted in overlay coder block 18 to a four-bit biorthogonal codeword, which is output as overlay bit stream 17. *Id.* (citing Ex. 1007, 6:49–52, 6:19–28, 1:52–60, Fig. 3).

Petitioner contends that Tomlinson's converting section then generates 12 bits per frame including 8 bits from the base stream and 4 bits from the second/overlay stream. Pet. 17. In particular, according to Petitioner, base stream 14 is passed to one input of signal organizer 16, which takes two bits at a time from this stream (as indicated by the figure in square brackets) to form the two most significant bits of successive symbol

words, while second bit stream 15 is subjected to error control coding before being passed as overlay bit stream 17 to a second input of signal organizer 16, the bits of this overlay stream being taken one at a time to form the least significant bit of each successive symbol word. *Id.* (citing Ex. 1007, 6:3–23). Petitioner contends that signal organizer 16 then forms four three-bit symbol words from the eight base-stream bits derived from one data-stream frame and the corresponding four overlay-stream bits, the least significant bits of which are determined by the bits of the overlay bit stream. *Id.* at 18 (citing Ex. 1007, 6:49–60).

However, Patent Owner contends that the '815 patent requires the “first information sequence” to be “important information.” PO Resp. 33. Thus, Patent Owner contends that “[t]he Petition, relying solely on Tomlinson, fails to show that Tomlinson teaches the required ‘first information sequence.’” *Id.*

Patent Owner also contends that Tomlinson does not disclose anything other than “an 11 bit frame that is then converted to *two* separate sequence of bits.” PO Resp. 36–37. In particular, Patent Owner contends that Tomlinson does not disclose the claimed converting section that has input a first and second sequence of bits that “then ‘*generates a sequence of bits*’ from these inputs such that it ‘includ[es] at least *one bit of the first information sequence* and at least *one bit of the second information sequence*.’” *Id.* (citing Ex. 1001, Claims 1, 10). According to Patent Owner, in Tomlinson, “an 11 bit frame is divided into a base bit stream and an overlay bit stream . . . which are separately taken to form *multiple symbol words*,” but this disclosure “does not describe ‘a sequence of bits’ composed

of at least ‘one bit of the first information sequence’ and at least ‘one bit of the second information sequence.’” *Id.* at 37–38. That is, according to Patent Owner, Tomlinson only discusses a data stream that is divided into two separate streams, and bits from the streams are then used “to form *symbol words*.” *Id.* at 38 (citing Ex. 2004 ¶¶ 14–16). In other words, although “*four* three-bit *symbol words*” are formed, Patent Owner contends that the symbol words are not “*a sequence* of bits” generated “from two separate sequences of bits.” *Id.* (citing Ex. 2004 ¶¶ 12–17).

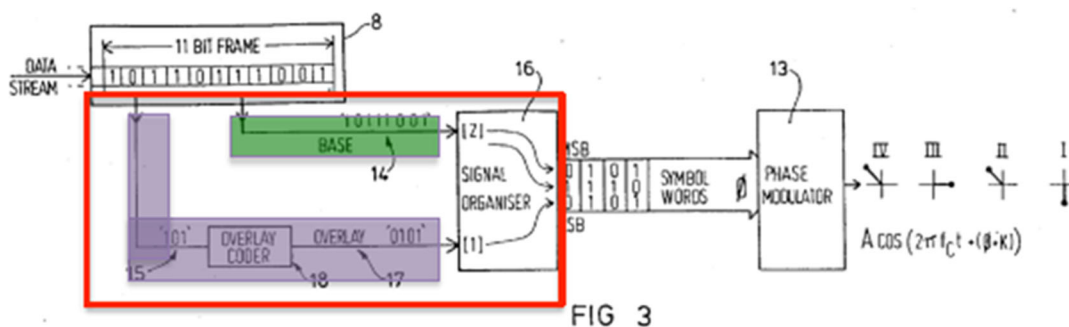
In its Sur-reply, Patent Owner acknowledges that Petitioner “characterize[s] the *four discrete symbol words* output from the signal organizer as a 12-bit sequence.” PO Sur-reply 15 (citing Pet. Reply 13). However, Patent Owner contends that Petitioner’s contention is “contrary” to the claim language and is “mere attorney argument” that is “unsupported by expert testimony.” *Id.* Relying on its expert, Dr. Nettleton, Petitioner contends that Tomlinson does not follow the operation of the apparatus or method of claims 1, 10, and 15. *Id.* (citing Ex. 2004 ¶¶ 12–17; Ex. 1021, 46:17–48:20).

In weighing the evidence before us, we find more persuasive the position of Petitioner.

As to Patent Owner’s argument that the ’815 patent requires the “first information sequence” to be “important information” (PO Resp. 33), this argument is not persuasive because it is based upon a claim construction that we do not adopt, as stated above in Section II.A. As discussed in Section II.A, given the broadest reasonable construction for “first information

sequence,” we conclude the claims merely require a particular information sequence that is distinguishable from a “second information sequence.”

Here, we are persuaded by Petitioner’s contention that Tomlinson discloses a converting section that has input through different routes “first information sequence” (i.e., base stream), and “second information sequence” (i.e., overlay stream). Pet. 15. Petitioner’s annotation of Figure 3 is reproduced below:



The annotation of Tomlinson’s Figure 3 shows Tomlinson discloses “a converting section” (red), that has input “first information sequence” (green) and “second information sequence” (purple). Pet. 15. We find Tomlinson discloses “a converting section” that has input thereto through different routes “a first information sequence comprising a plurality of bits” and “a second information sequence comprising a plurality of bits,” as recited in claims 1 and 10.

Furthermore, as Petitioner points out, the Petition also proposes modifying Tomlinson to include Malkamaki’s bursts of retransmission bits, which Patent Owner defines as “important information.” Pet. Reply 11 (citing Pet. 24–28, 44, 46). In particular, according to Patent Owner, examples of “important information” can be “retransmission information or

control information.” PO Resp. 10. Thus, even assuming *arguendo* that “first information sequence” is “important information,” we are persuaded by Petitioner’s contention that inputting “important information” to a converting section would have been obvious in view of the combination of Tomlinson and Malkamaki.

Although Patent Owner contends that Petitioner argued “for the first time” in the Reply that a “first information sequence” is met by the “combination of Tomlinson and Malkamaki” (PO Sur-reply 11–12 (citing Pet. Reply 10)), as Petitioner points out, the argument is set forth in the Petition. *See* Pet. Reply 11 (citing Pet. 24–28, 44, 46). Further, Petitioner’s arguments that address Patent Owner’s new claim construction for a term such as “first information sequence” (*see* Pet. Reply 10) will not be considered new argument.

We are also unpersuaded by Patent Owner’s contention that Tomlinson does not disclose a converting section that “generates a sequence of bits” such that it includes at least one bit of the first information sequence and at least one bit of the second information sequence. PO Resp. 36 (citing Ex. 1001, claim 1). In particular, as Petitioner responds, as shown in Figure 3 of Tomlinson, the signal organizer is arranged to receive the base and overlay streams and “**to generate therefrom a succession of symbol words of binary form.**” Pet. Reply 12 (citing Ex. 1007, 16:54–56, 6:53–60). That is, according to Petitioner, signal organizer 16 outputs a 12-bit sequence 101010111010 (the succession of symbol words 101, 010, 111, 010), which is then input to phase modulator 13 to output corresponding modulation symbols I, II, III, IV. *Id.* at 13 (citing Ex. 1007, Fig. 3, 8:22–27).

Although Petitioner acknowledges that Patent Owner relies on Dr. Nettleton to dispute that Tomlinson's 12-bit sequence of symbol words is a "sequence of bits," Petitioner contends that "Dr. Nettleton later recanted that opinion." Pet. Reply 13 (citing Ex. 1021, 18:23–19:22). In particular, Petitioner contends that Dr. Nettleton "confirmed" that Tomlinson's signal organizer "recombines bits from the base and overlay stream into 'a sequence of bits,' i.e., the symbol words." *Id.* at 14 (citing Ex. 1021, 48:10–20). That is, in Dr. Nettleton's deposition, he confirmed that in Figure 3 of Tomlinson, "the information bits from the base stream and the overlay stream are . . . recombined back into a sequence of bits," wherein "that sequence of bits" are the "symbol words." Ex. 1021, 48:10–20.

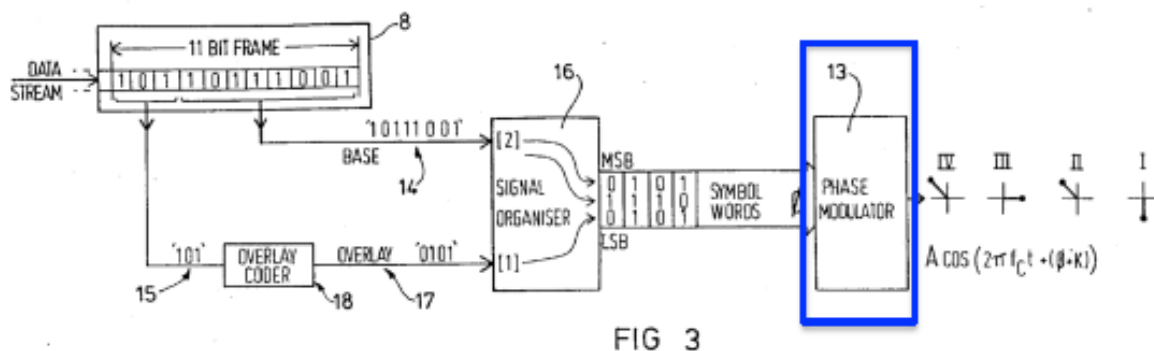
We agree with Petitioner that Tomlinson's signal organizer 16 is arranged to receive the base and overlay streams and to generate "a succession of symbol words of binary form." *See* Ex. 1007, 16:54–56. Based on this teaching by Tomlinson, and the deposition of Dr. Nettleton (Ex. 1021, 48:10–20), we are persuaded by Petitioner's contention that Tomlinson's signal organizer generates 12 bits per frame including 8 bits from the base stream and 4 bits from the second/overlay stream. Pet. 17.

Accordingly, Petitioner has demonstrated persuasively that Tomlinson, in combination with Malkamaki, teaches "a converting section" that "has input thereto through different routes a first information sequence comprising a plurality of bits and a second information sequence comprising a plurality of bits," and that "generates a sequence of bits including at least one bit of the first information sequence and at least one bit of the second

information sequence” as recited in the claim 1, and similarly recited in claim 10.

c. “a modulation section” that “modulates the sequence of bits into symbols such that each of the symbols is expressed using three or more bits” wherein “the first bits and the second bits of the symbol comprise bits of a set comprising bits corresponding to the first information sequence and bits corresponding to the second information sequence” (claim 1, similarly recited in claims 10 and 15)

According to Petitioner, as shown in annotated Figure 3 below, Tomlinson discloses a modulation section (denoted in blue) including phase modulator 13 that modulates the sequence of bits into three-bit symbols:

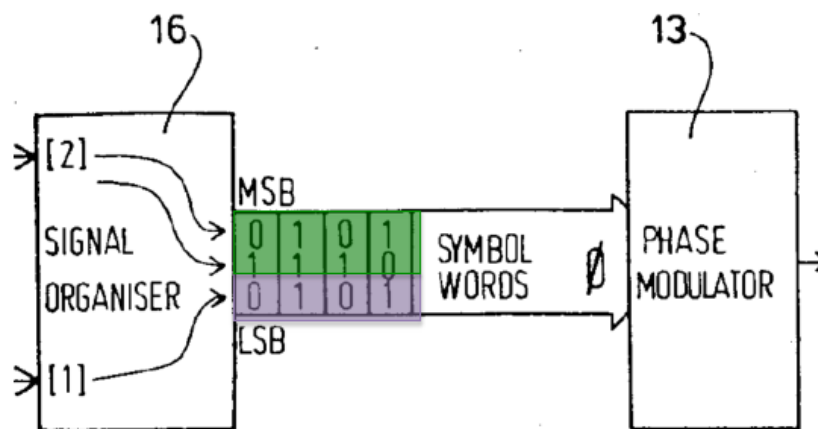


Pet. 18 (citing Ex. 1007, 5:61–62). The annotation of Tomlinson’s Figure 3 shows a “transmitting section of a data modem.” Ex. 1007, 5:59–63.

Petitioner contends that, in Tomlinson, the transmitting section includes phase modulator 13 arranged to receive a succession of three-bit symbol words, wherein phase modulator 13 acts as a standard eight-level PSK modulator.” Pet. 18–19 (citing Ex. 1007, 5:61–6:2). In particular, signal organizer 16 takes eight base-stream bits derived from one data-stream frame and the corresponding four overlay-stream bits, to form four

three-bit symbol words, the least significant bits of which are determined by bits of the overlay bit stream. *Id.* (citing Ex. 1007, 6:53–60).

Petitioner contends that Tomlinson discloses, in one embodiment, the first two bits of each symbol comprise bits from the base stream and the third bit of each symbol is a bit from the second/overlay stream, i.e., in a “(B, B, O)” pattern where “B” represents a base stream bit and “O” represents an overlay stream bit. Pet. 19. In particular, Petitioner references an annotation of Figure 3 of Tomlinson, reproduced below:



Pet. 28–29 (citing Ex. 1007, Fig. 3). The annotation of Tomlinson’s Figure 3 shows “phase modulator 13 arranged to receive a succession of three-bit symbol words.” Ex. 1007, 5:59–63.

According to Petitioner, in Tomlinson,

The signal organiser 16 operating in the manner already described, takes the eight base-stream bits derived from one data-stream frame and the corresponding four overlay-stream bits, to form four three-bit symbol words, the least significant bits of which are determined by the bits of the overlay bit stream. The four symbol words in turn control the generation of four modulation symbols I, II, III, IV.

By way of example, arbitrary [sic] values have been assigned to the bits of the data-stream frame illustrated in FIG. 3; the resulting values of the base and overlay streams, of the symbol words and of the transmitted symbols are also shown.

Pet. 20–21 (citing Ex. 1007, 6:53–65; Ex. 1003 ¶ 53).

Although Figure 3 of Tomlinson shows the succession of three-bit symbol words are in a “(B, B, O)” pattern, Petitioner contends Tomlinson also discloses that “it is possible to vary this arrangement with any appropriate number of bits being taken from each stream to form each symbol.” Pet. 21. That is, Petitioner contends that, in another exemplary arrangement, the first bit of a symbol comprises a bit from the base stream and the remaining two bits of the symbol comprise bits from the overlay stream, i.e., in a “(B, O, O)” pattern. *Id.* In particular,

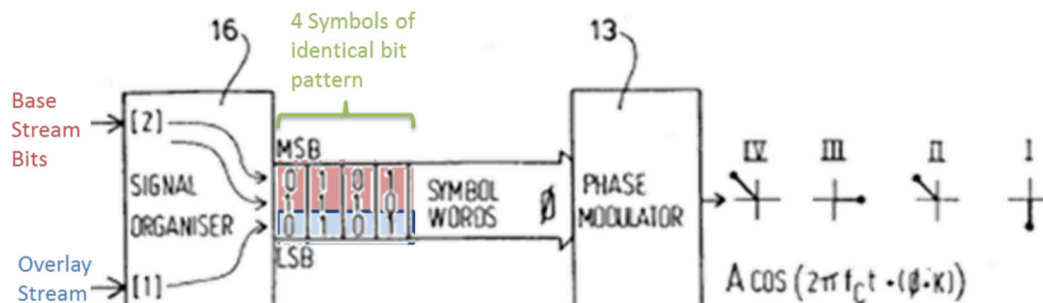
It is also to be noted that while in the embodiments described, bits are taken in pairs from the base stream and singly from the overlay stream to form the symbol words, it is possible to vary this arrangement with any appropriate number of bits being taken from each stream to form each symbol; it is envisaged, for example, that **in certain applications only one bit will be taken from the base stream** as well as from the overlay streams in forming each control word. **Where two or more bits of an overlay stream are used for each symbol word** then the security of the error control coding used for that overlay stream should be appropriately high as the spacing between possible phase states is being reduced by a proportionally larger amount.

Id. (citing Ex. 1007, 12:39–47).

Accordingly, Petitioner contends, “[b]ased on *Tomlinson’s* express suggestion, a [person having ordinary skill in the art] would have been

motivated to enable *Tomlinson's* signal organizer 16 to vary the mapping of the base and second/overlay stream bits to the symbols across modulation intervals.” Pet. 22 (citing Ex. 1003 ¶ 55). Specifically, “it would have been obvious to enable the signal organizer 16 to map bits according to the (B, B, O) patterns for some intervals and map bits according to the (B, O, O) pattern for other intervals.” *Id.*

In its Response, Patent Owner contends nothing in Tomlinson discloses a modulator that modulates a sequence of bits to form the first bits and the second bits of the symbols comprised of bits of a set, nor that is capable of changing the information to be placed on the first or second bits at any time. PO Resp. 40 (citing Ex. 1001, 7:39–44). In particular, Patent Owner contends that Tomlinson merely describes a signal organizer that forms symbol words of “identical bit patterns.” *Id.* Patent Owner references an annotation of Figure 3 of Tomlinson, reproduced below:

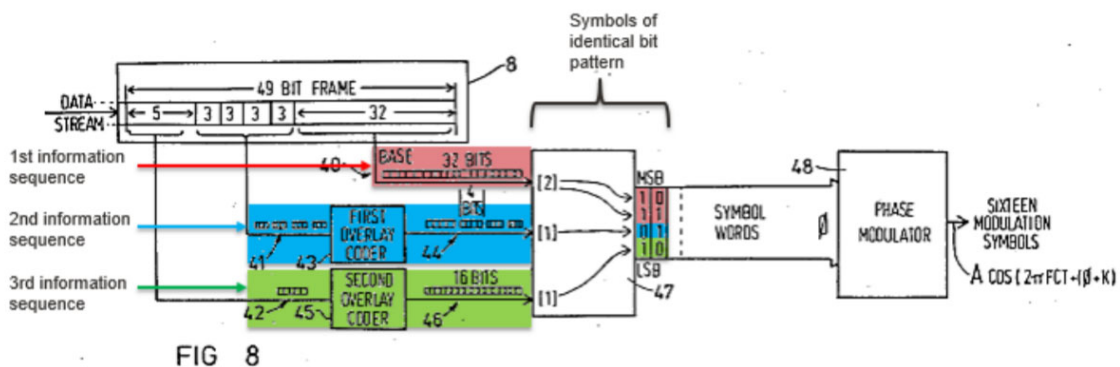
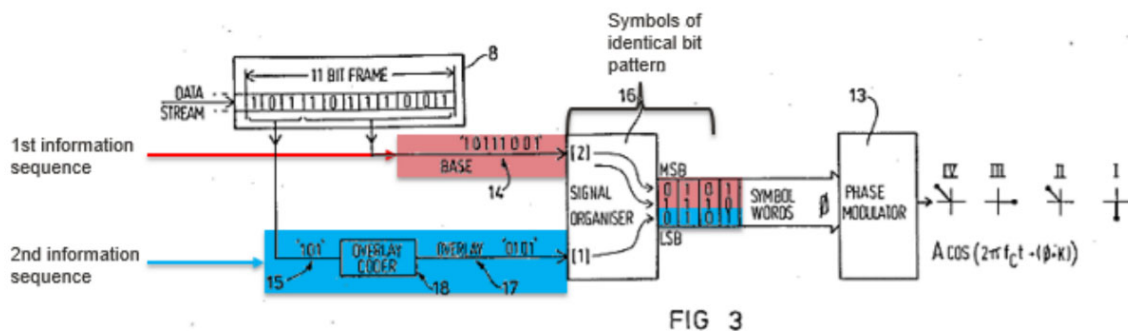


PO Resp. 40 (citing Ex. 1007, Fig. 3). The annotation of Tomlinson's Figure 3 shows phase modulator 13 arranged to receive a succession of three-bit symbol words. Ex. 1007, 5:59–63.

According to Patent Owner, the passages of Tomlinson cited by Petitioner only teach that the signal organizer arranges the bits from the base

stream and overlay stream “in an identical pattern for each symbol,” but they do not teach that the signal organizer “can vary this arrangement at any time.” PO Resp. 40–41 (citing Pet. 21). Patent Owner contends that Tomlinson only maps error corrected bits on the least significant bits. *Id.* at 41 (citing Ex. 1007, 9:17–24, Abstract, 2:1–9, 3:55–65). Accordingly, Patent Owner contends that Tomlinson does not disclose that the first bits and the second bits of the symbols are formed “by bits from either the first or second information sequences (e.g., in an (O, O, _) pattern or an (O, B, _) pattern).” *Id.* (citing Ex. 2001 ¶ 52).

In its Sur-reply, Patent Owner provides annotations to Figures 3 and 8 of Tomlinson to explain:



PO Sur-reply 17 (citing Ex. 1007, Figs. 3 and 8). The annotation of Tomlinson's Figure 3 shows a phase modulator 13 arranged to receive a succession of three-bit symbol words, while the annotation of Tomlinson's Figure 8 shows phase modulator 48 receiving a succession of four-bit symbol words. Ex. 1007, 5:59–63, 10:1–39.

Patent Owner contends that Tomlinson teaches that error corrected/overlay bits are mapped to the least significant bits of each symbol, and thus, any symbol would consist of a base stream bit mapped to the most significant first bit, and overlay stream bits to the least significant bits. PO Sur-reply 17 (citing Ex. 1007, Figs. 3, 8, 1:61–68. 2:1–10, 6:14–23). Thus, according to Patent Owner, “Tomlinson never teaches mapping bits from the error corrected second information sequence on the most significant bit (first bit).” *Id.* at 17–18. Although Patent Owner acknowledges that Petitioner relies on Tomlinson for teaching “both (B, B, O) and (B, O, O) symbols” (*see* Pet. Reply 15), Patent Owner contends that “Tomlinson discusses error controlling coding of *additional overlay streams* which are still mapped to only the least significant bits.” PO Sur-reply 18 (citing Ex. 1007, 12:39–60).

In weighing the evidence before us, we find more persuasive the position of Petitioner.

Although Patent Owner contends that Tomlinson's signal organizer is not “capable of changing ‘the information to be placed on the [first] or [second] bits at any time’” and instead forms symbol words of “identical bit patterns” (PO Resp. 40), this argument is not persuasive because it is not based upon the broadest reasonable claim construction, as discussed above

in Section II.A. In particular, claim 1, for example, does not require that the signal organizer be “capable of changing” information to be placed on the first or second bits “at any time,” or preclude symbol words being formed of “identical bit patterns.” PO Resp. 40. As Petitioner points out during oral arguments, “Patent Owner’s expert also agrees that varying the patterns is not required.” Tr. 13 (citing Ex. 1021, 56:6–10). As discussed in Section II.A, given the broadest reasonable construction, and as both Petitioner and Patent Owner agree, claim 1, for example, merely requires “bits corresponding to the first information sequence, bits corresponding to the second information sequence, or bits corresponding to both the first and second information sequence.” PO Resp. 23; Pet. Reply 5.

Although we agree with Patent Owner’s contention that Tomlinson maps error corrected bits on the least significant bits (PO Resp. 41), we are unpersuaded by Patent Owner’s contention that the claims require that Tomlinson’s symbols be formed by bits “in an (O, O, _) pattern or an (O, B, _) pattern.” *Id.* (citing Ex. 2001 ¶ 52). That is, as discussed above in Section II.A, as agreed by the parties, given the broadest reasonable construction, the set of bits could contain “bits corresponding to the first information sequence, bits corresponding to the second information sequence, or bits corresponding to both the first and second information sequence.” PO Resp. 23. Thus, we agree with Petitioner that the claimed set of bits could encompass a “(B, O, O)” pattern. Pet. 21. As Petitioner pointed out during oral arguments, Patent Owner’s expert concedes that a “B, O, O” pattern would “satisfy the limitations of claim 1 in the 815 patent.” Tr. 13. That is, according to Petitioner, given the broadest

reasonable interpretation, the claimed set of bits may comprise “the first information sequence bit in the first spot, the second information bit in the second spot, and again, the second, which always fills that third spot.”

Tr. 10.

Here, as Petitioner contends, although Figure 3 of Tomlinson shows the succession of three-bit symbol words are in a “(B, B, O)” pattern, Tomlinson also discloses that “it is possible to vary this arrangement with any appropriate number of bits being taken from each stream to form each symbol.” Pet. 21. Thus, Petitioner refers to an exemplary arrangement in Tomlinson, wherein the first bit of a symbol comprises “a bit from the base stream and the remaining two bits of the symbol comprise bits from the overlay stream (i.e., in a (B, O, O) pattern).” *Id.* In particular, in this exemplary embodiment, Tomlinson discloses that “only one bit will be taken from the base stream” and “two or more bits of an overlay stream are used for each symbol word.” *See* Ex. 1007, 12:39–47. Thus, although Patent Owner contends that “Tomlinson discusses error controlling coding of *additional overlay streams* which are still mapped to only the least significant bits” (PO Sur-reply 18), in this embodiment, only one bit will be taken from the base stream, which is mapped to the most significant bit, while bits from the overlay stream will still be mapped to the other (least significant) bits, including the second bit. As Petitioner points out, in this embodiment, Tomlinson discloses symbols expressed using three bits, i.e., (B, O, O), wherein the first bits and the second bits of the symbol, i.e., (B, O), comprise bits (B) from the base stream and bits (O) from the overlay stream. Pet. 22.

Accordingly, Petitioner has demonstrated persuasively that Tomlinson, in combination with Malkamaki, teaches a modulator that “modulates the sequence of bits into symbols such that each of the symbols is expressed using three or more bits” wherein “the first bits and the second bits of the symbol comprise bits of a set comprising bits corresponding to the first information sequence and bits corresponding to the second information sequence,” as recited in claim 1, and similarly recited in claims 10 and 15.

d. Remaining Limitations (claims 1, 10, and 15)

Patent Owner does not address separately Petitioner’s explanations and supporting evidence regarding the remaining limitations in independent claims 1, 10 and 15. *See generally* PO Resp. We have reviewed Petitioner’s explanations and supporting evidence regarding these remaining limitations, and find them sufficient. *See generally* Pet. 28–30, 43–44, 46–51. In particular, based on a plain reading of the cited portions of Tomlinson, Petitioner has demonstrated persuasively that Tomlinson discloses that the third bit of the 8 phase-shift-key (“8PSK”) symbols are comprised of bits corresponding to the second/overlay stream (Pet. 28–30 (citing Ex. 1007, 6:14–23, 16:54–60, Fig. 3)). Thus, Petitioner has demonstrated persuasively that Tomlinson, in combination with Malkamaki, teaches “the more lower bits than the second bits of the symbols are comprised of bits corresponding to the second information sequence” (*id.*, *see* claim 1; *id.* at 44, *see* claim 10; *id.* at 46, *see* claim 15).

Petitioner also has demonstrated persuasively that Tomlinson discloses the first bit of a symbol comprises a bit from the base stream and the remaining two bits of the symbol comprise bits from the second/overlay

stream (Pet. 30) for the reasons discussed above in Section II.D.3.c. *See* Pet. 19–23. Thus, Petitioner has demonstrated persuasively that Tomlinson, in combination with Malkamaki, teaches “bit corresponding to the second information sequence is arranged on the second bit of at least one of the symbols” (*id.* at 30, *see* claim 1; *id.* at 44, *see* claim 10; *id.* at 46, *see* claim 15).

For these reasons, we conclude that Petitioner demonstrates, by a preponderance of the evidence, that the combination of Tomlinson and Malkamaki teaches these limitations.

e. Motivation to Combine Tomlinson and Malkamaki

Petitioner contends, like the ’815 patent, Tomlinson is also directed to a transmission and reception apparatus, and to the problem of “determining which information to encode on which bits” of a multi-bit symbol, “recognizing that the first bits are less error prone than the last bits.” Pet. 12–13 (citing Ex. 1007, 2:1–12, 4:43–45, Figs. 3–4). Therefore, Petitioner contends that Tomlinson is in the same field of endeavor, is analogous to the ’815 patent, and is reasonably pertinent to the problem sought to be solved by the ’815 patent. *Id.* Similarly, Petitioner contends that Malkamaki discloses both transmitter and receiver apparatuses in the same field of endeavor, and is analogous to the ’815 patent. *Id.* at 14 (citing Ex. 1001, 4:5–18; Ex. 1008, 4:61–67). In particular, in the ’815 patent, “important information” to be encoded on robust bits can be “retransmission information,” whereas, in Malkamaki, transmissions can include an error

check, such as a “CRC” that the system uses to detect an incorrect speech package and send a “request for retransmission.” *Id.*

Petitioner contends that a POSITA would have understood that Tomlinson’s data stream would include “any type of digital information stream,” and based on the teachings of Malkamaki, it would have been obvious for Tomlinson’s base stream to include information bits, “such as speech, data, or retransmission information,” and for Tomlinson’s second stream to include “CRC bits corresponding to the frame’s base stream bits,” as taught by Malkamaki. Pet. 26 (citing Ex. 1003 ¶¶ 63–64, 67). In particular, Petitioner contends that the combination “would have predictably enabled the receiver to check the received frame for errors and request retransmission as necessary.” *Id.* at 27.

According to Petitioner, Malkamaki teaches that adding CRC or other error checking codes to every burst allows the receiver “to quickly detect errors and request retransmission of individual erroneous bursts,” and a POSITA would have been motivated “to similarly include CRC bits in each of *Tomlinson*’s frames” to enable the receiver to individually check each frame for errors and request retransmission of only erroneous frames. Pet. 27–28 (citing Ex. 1008, 4:17–21, 5:31–40; Ex. 1003 ¶ 68). That is, a POSITA would have appreciated that modifying Tomlinson in this way would have “predictably resulted in *Tomlinson*’s base stream bits having a relation to the second stream bits, which are the bits of a CRC code calculated as a mathematical function of the frame’s base stream bits.” *Id.* at 28 (citing Ex. 1003 ¶ 70).

Although Petitioner argues that Patent Owner contended “[a] skilled artisan would understand that Malkamaki’s bursts are analogous to Tomlinson’s frames . . . and would have therefore been motivated to similarly include CRC bits in each of Tomlinson’s frames to enable the receiver to individually check each frame for errors and request retransmission of only erroneous frames,” Patent Owner disagrees. PO Resp. 43 (citing Pet. 27–28; Ex. 1003 ¶ 68). Patent Owner contends that “Petitioners’ conclusory statements are underscored when viewed in light of Tomlinson’s teachings as a whole.” *Id.* Patent Owner contends that the object of Tomlinson is to provide data communication “with good bandwidth and power efficiency.” *Id.* at 44 (citing Ex. 1007, 1:47–49; Ex. 2001 ¶ 58). Accordingly, Patent Owner contends that Petitioner’s motivation to combine Tomlinson and Malkamaki “is not supported by the teachings of Tomlinson.” *Id.*

According to Patent Owner, in addition to being “directed at different fields of communication and using different error correction schemes” (PO Resp. 44 (citing Ex. 2001 ¶ 71)), Tomlinson “employs [forward error correction,] FEC to protect the [least significant bit,]LSB of a transmitted symbol in order to decrease power requirements and maintain bandwidth efficiency.” *Id.* (citing Ex. 1007, 1:46–49, 2:1–12; Ex. 2001 ¶ 58). Thus, relying on Dr. Nettleton’s testimony, Patent Owner contends that “a POSITA would have explicitly avoided modifying the error protection scheme of Tomlinson to include either CRC bits or enable [automatic repeat request,] ARQ/retransmission because of the complexity of such systems.” *Id.* at 45 (citing Ex. 2001 ¶ 70). That is, according to Patent Owner,

modifying Tomlinson's frames to include CRC bits and to request retransmission would "increase power demands," because adding a back channel and enabling retransmission "increases channel traffic, can decrease system throughput, and requires significantly greater power levels." *Id.* (citing Ex. 2001 ¶¶ 70–71; Ex 2004 ¶ 20).

In weighing the evidence before us, we find more persuasive the position of Petitioner.

In particular, we are unpersuaded by Patent Owner's and Dr. Nettleton's apparent contention that Tomlinson's communication apparatus is incompatible with Malkamaki's use of ARQ and CRC codes. *See* PO Resp. 44–45; Ex. 2001 ¶¶ 58, 70–71; Ex. 2004 ¶ 20. Here, Petitioner contends that Malkamaki discloses both transmitter and receiver apparatuses, in the same field of endeavor and is analogous to the '815 patent. Pet. 14 (citing Ex. 1001, 4:5–18; Ex. 1008, 4:61–67). As Petitioner points out in its Reply, Petitioner is relying on Malkamaki for teaching the inclusion of CRC bits in data stream, wherein Tomlinson "does not place any limitations on the type of information included in the data stream." Pet. Reply 17 (citing Ex. 1007, 1:52–54). Using Dr. Singer's declaration as supporting evidence, Petitioner contends that it would have been obvious to a POSITA that Tomlinson's data stream "would include any type of digital information stream including speech or other types of data" as taught by Malkamaki. Pet. Reply 17 (citing Ex. 1003 ¶ 63).

Here, the question is not whether one having ordinary skill in the art would have bodily incorporated Malkamaki's ARQ system into Tomlinson's system disclosing frames transmitted in FEC coded symbols, but, as

Petitioner explains, whether a POSITA would have been motivated “to similarly include CRC bits in each of *Tomlinson*’s frames to enable the receiver to individually check each frame for errors and request retransmission of only erroneous frames.” Pet. 27–28 (citing Ex. 1008, 4:17–21, 5:31–40; Ex. 1003 ¶ 68).

We are also not persuaded by Patent Owner’s contention that Tomlinson “employs FEC to protect the LSB of a transmitted symbol in order to decrease power requirements and maintain bandwidth efficiency,” and thus, “a POSITA would have explicitly avoided modifying the error protection scheme of Tomlinson to include either CRC bits or enable ARQ/retransmission because of the complexity of such systems.” PO Resp. 44–45 (citing Ex. 1007, 1:46–49, 2:1–12; Ex. 2001 ¶ 58, 70). As Petitioner responds, a POSITA would understand “nothing about *Tomlinson*’s apparatus is specific to satellite communications,” wherein “the problems Tomlinson solves, including obtaining an improved bit rate despite transmit power and bandwidth constraints, are applicable to all wireless communication systems.” Pet. Reply 18 (citing Ex. 1022 ¶¶ 6–7). As Petitioner points out, Petitioner does not rebut Dr. Singer’s testimony that a POSITA would understand that Tomlinson’s communication apparatus “would be applicable to a wide variety of communication systems including mobile radio communication system” such as Malkamaki’s. *Id.* (citing Ex. 1003 ¶ 73; Ex. 1022 ¶ 8).

Furthermore, as Petitioner points out, Patent Owner’s expert, Dr. Nettleton, admitted during his deposition that Tomlinson is “not only compatible with two-way communications [such as that of Malkamaki] but

must also include two-way communication.” Pet. Reply 19 (citing Ex. 1021, 35:20–24 (“By definition, satellite communication has to be two-way”)).

That is, Dr. Nettleton conceded in his deposition that “implementing ARQ in a satellite communication system would be feasible” albeit “difficult.” *Id.* (citing Ex. 1021, 36:4–14). As Dr. Singer points out, ARQ “was a formal part of the Standard-C satellite communications protocol by the late 1980s.” *Id.* at 19–20 (citing Ex. 1022 ¶ 13). Here, Petitioner contends that Malkamaki expressly suggests combining “the same FEC techniques as Tomlinson (e.g., block coding) in addition to CRC and retransmission to correct data,” and thus, the combination of Tomlinson to Malkamaki “utilizes FEC and ARQ/CRC per Malkamaki’s express teaching.” *Id.* at 20 (citing Ex. 1008, 6:64–7:17, 8:62–9:3; Ex. 1022 ¶¶ 9–10).

In its Sur-reply, Patent Owner contends that Petitioner’s contention that Tomlinson and Malkamaki are related to the same technology is “insufficient” to identify why a POSITA would have modified Tomlinson with Malkamaki. PO Sur-reply 20. However, as Petitioner’s expert, Dr. Singer, provides further support that

[a POSITA] would have understood that including CRC bits in each of Tomlinson’s frames would have yielded the same benefits and would have therefore been motivated to similarly include CRC bits in each of Tomlinson’s frames to enable the receiver to individually check each frame for errors and request retransmission of only erroneous frames instead of a larger portion of the data stream comprising a plurality of frames.

Ex. 1003 ¶ 68.

We are persuaded by Petitioner’s contention that a POSITA would have been motivated to include Malkamaki’s CRC bits in each of

Tomlinson's frames to enable the receiver to individually check each frame for errors and request retransmission of only erroneous frames because a POSITA would have appreciated that "modifying *Tomlinson* in this way would have predictably resulted in *Tomlinson*'s base stream bits having a relation to the second stream bits." Pet. 27–28 (citing Ex. 1008, 4:17–21, 5:31–40; Ex. 1003 ¶¶ 68–70). We find Petitioner has provided sufficient support in Malkamaki that "adding CRC or other error checking codes to every burst allows the receiver to quickly detect errors and request retransmission of individual erroneous bursts thereby preventing the system from having to retransmit entire speech/data packets." *Id.* at 27 (citing Ex. 1008, 4:17–21, 5:31–40; Ex. 1003 ¶ 68). As Petitioner contends, Malkamaki's arrangement "advantageously reduces delay and increases channel capacity." *Id.* (citing Ex. 1008, 5:31–40). Here, we find the specific passages in Malkamaki cited by Petitioner facially support its contentions. That is, we find Petitioner's rationale that a person of ordinary skill in the art would have found it obvious to combine the teachings of Tomlinson and Malkamaki is sufficiently supported.

Accordingly, Petitioner has demonstrated persuasively that one of ordinary skill in the art would have combined Tomlinson and Malkamaki.

4. Dependent claims 2–9, 11–14, and 16–18

Patent Owner does not address separately Petitioner's explanations and supporting evidence regarding dependent claims 2–9, 11–14, and 16–18. *See generally* PO Resp. We have reviewed Petitioner's explanations and supporting evidence regarding the dependent claims, and find them sufficient because a plain reading of the cited portions of Tomlinson and

Malkamaki adequately supports Petitioner’s contentions. *See generally* Pet. 30–43, 45, 51–55. In particular, Petitioner has demonstrated persuasively that: 1) Tomlinson discloses that bits from the base stream are arranged on the first bit and second bit of the symbols (Pet. 30–32, 45 (citing Ex. 1007, 1:61–68 (“the most significant bit or bits of each symbol word being derived from the base bit stream”), 6:14–18, 15:34–39, 16:54–60, Fig. 3); *see* claims 2–3, 12–13); 2) Tomlinson discloses that the sequence of base stream bits 14 are separated from all of the other information to be transmitted (Pet. 32 (citing Ex. 1007, 6:3–8 (“the data bit stream to be transmitted is divided in block 8 into bit streams, namely a first, or base, bit stream and a second bit stream 15”), Fig. 3); *see* claim 4); and 3) Malkamaki discloses that data included in a burst may be retransmission information wherein a retransmission is used as an error protection method (Pet. 33–37, 45 (citing Ex. 1008, Abstract, 3:49–51, 4:61–5:5, 6:30–40, 9:62–10:6, 10:11–18); *see* claims 5–6, 13–14). We conclude that Petitioner demonstrates, by a preponderance of the evidence, that the combination of Tomlinson and Malkamaki teaches the limitations of the dependent claims.

E. Obviousness over Davis and Wei

Petitioner contends that claims 1, 2, 4, 10, and 11 are unpatentable under § 103 as obvious over Davis in view of Wei. Pet. 55–64. Patent Owner disputes Petitioner’s contentions. PO Resp. 46–56.

For the reasons provided below, we are persuaded by Petitioner’s contention that claims 1, 2, 4, 10, and 11 would have been obvious over Davis and Wei. We provide a brief description of Davis and Wei before turning to the parties’ contentions.

1. Davis

Davis, titled “Error Correction Coding Method and Apparatus for Multilevel Signaling,” published on August 24, 1982, from an application filed February 26, 1980. Ex. 1009, codes (54), (45), (22). Davis discloses techniques for only encoding the lower significance bits of the multi-bit signal, while the more significant bits are left uncoded. *Id.* at Abstract.

Davis recognizes that, in the past, error correction coding has been accomplished by encoding the full data stream being transmitted, which “greatly effects the practical bit rate of transmission.” *Id.* at 1:33–37. Thus, Davis proposes providing an “improved error correcting coding system” which reduces the coding necessary while still allowing for accurate recognition of transmitted levels at the receiving station. *Id.* at 1:66–2:2. Thus, to accomplish these objectives, in Davis, prior to the transmission of the multilevel signals to a receiving station, at least one lower significance bit is encoded without encoding the most significant bit. *Id.* at 2:3–11.

Figure 3, showing an encoding system according to an exemplary embodiment, is reproduced below:

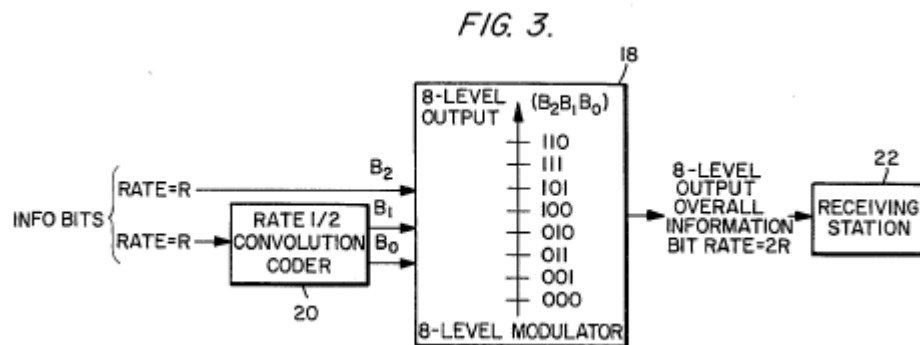


Figure 3 shows a coding system with “modulator 18,” where the most significant information bit B_2 “tags along” with the decision made for the two rate $\frac{1}{2}$ coded lower significant bits B_0 and B_1 which are coded in a coder 20. *Id.* at 4:5–10. As shown in Figure 3, bits B_0 , B_1 , and B_2 are applied to modulator 18 with the particular level assignments (i.e., 000, 001, 010, 011, 100, 101, 110, 111), wherein any set of four successive 8-ary levels contains all four rate $\frac{1}{2}$ code branches, i.e., $B_0B_1 = 00, 01, 10, \text{ and } 11$. *Id.* at 4:10–15.

2. Wei

Wei, titled “Coded Modulation with Unequal Error Protection,” issued on April 14, 1992, from an application filed November 7, 1990. Ex. 1010, codes (54), (45), (22). Wei discloses digital signals, such as “digitized television signals,” that are subjected to a source coding step in which a class of “most important” data elements represents a proportionately greater amount of the information to be communicated than the rest of the data elements. *Id.* at Abstract. The source coding step is then followed by a constellation mapping step which is carried out in such a way that those data elements have a lower probability of being erroneously detected at the receiver than the others. *Id.*

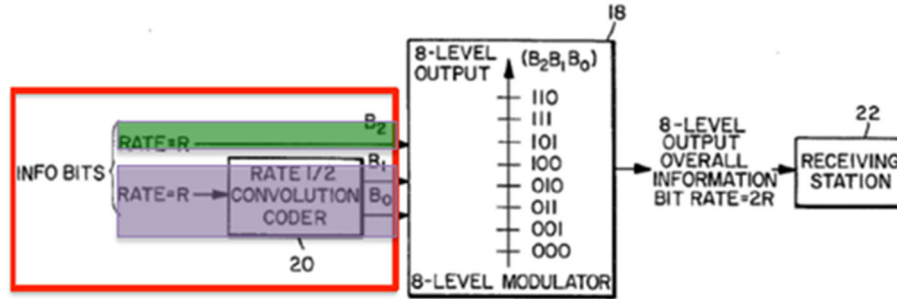
In Wei, a video signal source generates an analog video signal representing picture information or “intelligence” which signal is passed on to a source encoder. *Id.* at 3:64–67. The source encoder generates a digital signal in which at least one subset of the data elements represents a portion of the information, or intelligence, that is more important than the portion of the information, or intelligence, represented by the rest of the data elements. *Id.* at 3:67–4:4. In an embodiment, for over-the-air broadcasting of digital

TV signals, a “first” data stream carries components of the overall television signal which are regarded as the most important, for example, the audio, the framing information, and the vital portions of the video information, and that data stream is mapped such that its data elements have the lower probability of error. *Id.* at 1:55–2:8. A “second” data stream carries components of the overall television signal which are regarded as less important than those of the first data stream, and that data stream is mapped such that its data elements have a probability of error that is not as low as those of the first data stream. *Id.*

3. Independent Claims 1 and 10

a. “a converting section” that “has input thereto through different routes a first information sequence comprising a plurality of bits and a second information sequence comprising a plurality of bits,” and that “generates a sequence of bits including at least one bit of the first information sequence and at least one bit of the second information sequence” (claim 1, similarly recited in claim 10)

Petitioner contends that Davis discloses a plurality of “most significant information bits (MSBs)” that are the claimed “first information sequence” and a plurality of coded “less significant bits (LSBs)” that are the claimed “second information sequence.” Pet. 56. According to Petitioner, as shown in the annotated Figure 3 of Davis, reproduced below, a “converting section” (denoted in red) routes the MSBs through an “uncoded route” (denoted in green) and the LSBs through a different “coded route” (denoted in purple”):



Pet. 56–57. Annotated Figure 3 of Davis shows a coding system with “modulator 18.” Ex. 1009, 4:5–10.

According to Petitioner, Davis’s converting section generates a sequence of bits B_2 , B_1 , and B_0 , wherein “ B_2 is an uncoded bit from the MSB sequence (i.e., ‘first information sequence’),” the more significant bits being left uncoded, while “ B_1 and B_0 are coded LSB bits (i.e., ‘second information sequence’).” Pet. 57 (citing Ex. 1009, Fig. 3, 4:5–12).

Patent Owner contends that Davis does not disclose anything “other than a data stream that is then divided into three separate bits.” PO Resp. 48–49. Patent Owner contends that Davis does not disclose a converting section that has “input a first a second sequence of bits from different routes” that then generates a sequence of bits that includes “at least *one bit of the first information sequence* and at least *one bit of the second information sequence*.” *Id.* (citing Ex. 1001 (claim 1, 1(a)(ii), 10b); Ex. 2002 ¶¶ 22–23). Further, according to Patent Owner, “Davis’s alleged converting section does not have a first information sequence comprising a *plurality of bits* or a second information sequence comprising a *plurality of bits*.” *Id.* at 49 (citing Ex. 1009, 2:43–47, 4:5–19). In particular, Patent Owner contends that, in Davis, “information bits are separated into three bits

with the less significant bits undergoing different rate encoding in an alleged ‘converting section,’” wherein the two coded less significant bits, B_1 and B_0 and uncoded most significant bit B_2 are taken to form “an **8-level symbol**.” *Id.*

In its Sur-reply, Patent Owner adds that the ’815 patent “expressly defines important information as ‘a kind of information normal communication of which is likely to be difficult to be maintained if the other end of communication has a poor error rate characteristic during reception.’” PO Sur-reply 25 (citing Ex. 1001, 1:24–42, claims 5, 6, 13, 14, Fig. 3). According to Patent Owner, Petitioner fails to show that Davis and Wei disclose such “first information sequence” limitation. *Id.* Further, because Petitioner relies on the generation of “symbol words,” Petitioner also fails to show that Davis teaches generating “a sequence of bits” as claims. *Id.* at 25–26.

In weighing the evidence before us, we find more persuasive the position of Petitioner. In particular, Patent Owner appears to be repeating the arguments above in Sections II.A and II.D that “symbols words” are not “a sequences of bits,” and that “first information sequence” should be “important information” (PO Sur-reply 25–26), which we do not find persuasive.

Again, Patent Owner’s position that the ’815 Patent requires the “first information sequence” to be “important information” (PO Sur-reply 25–26) is based upon a claim construction that we do not adopt, as stated above in Section II.A. We are persuaded instead by Petitioner’s contention that Davis’s converting section receives “first information sequence” in the form

of uncoded input B_2 from the MSB sequence, as well as “second information sequence” B_1 and B_0 input from the LSB sequence. Pet. 57 (citing Ex. 1009, Fig. 3, 4:5–12).

Furthermore, Petitioner relies on the modification of Davis with Wei’s digital video signal comprising sequences of “most important” information bits for teaching “first information sequence.” Pet. Reply 23. As Petitioner points out during oral arguments, “Wei itself tells what it believes is the important data.” Tr. 27. That is, according to Petitioner, even if “first information sequence” were *arguendo* limited to “important information,” the combination of Davis and Wei teaches such “first information sequence.” *Id.*

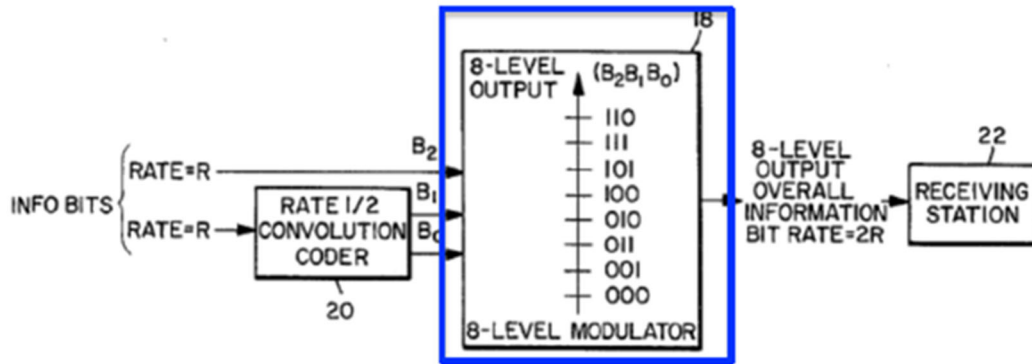
Although Patent Owner contends that Davis “does not disclose anything other than a data stream that is then divided into three separate bits” (PO Resp. 48–49), as Petitioner points out, Dr. Nettleton concedes that “Davis’s modulator 18 receives 2 separate bit streams as input and generates three-bit symbol words using the input bits.” Pet. Reply 24 (citing Ex. 1021, 20:19–21:7). We are unpersuaded by Patent Owner’s contention in its Sur-reply that “symbols words” are not “a sequences of bits.” PO Sur-reply 25–26. Instead, we agree with Petitioner that, given the broadest reasonable construction, “the three-bit symbol words generated by module 18 qualify as the claimed ‘sequence of bits including at least one bit of the first information sequence [B_2] and at least one bit of the second information sequence [B_1 and B_0].’” Pet. Reply 24. As Petitioner points out, in his deposition, Dr. Nettleton agreed that Davis “could represent an example of Claim 1” wherein “he does not dispute *Davis* satisfies this limitation.” *Id.*

(citing Ex. 1021, 23:25–24:25). Based on this teaching by Davis, and the deposition of Dr. Nettleton (Ex. 1021, 23:25–24:25), we are persuaded by Petitioner’s contention Davis’s “converting section” generates a sequence of bits $[B_2, B_1, B_0]$ that includes at least one bit of the first information sequence $[B_2]$ and at least one bit of the second information sequence $[B_1, B_0]$. Pet. Reply 24; see Ex. 1009, Fig. 3.

Accordingly, Petitioner has demonstrated persuasively that Davis, in combination with Wei, teaches “a converting section” that “has input thereto through different routes a first information sequence comprising a plurality of bits and a second information sequence comprising a plurality of bits,” and that “generates a sequence of bits including at least one bit of the first information sequence and at least one bit of the second information sequence” as recited in the claim 1, and similarly recited in claim 10.

b. “a modulation section” that “modulates the sequence of bits into symbols such that each of the symbols is expressed using three or more bits” wherein “the first bits and the second bits of the symbol comprise bits of a set comprising bits corresponding to the first information sequence and bits corresponding to the second information sequence” and “in each symbol, the bits corresponding to the first information sequence have a relation to the bits corresponding to the second information sequence” (claim 1, similarly recited in claim 10)

Petitioner contends, as set forth in an annotation of Figure 3, Davis discloses an “8-level modulator 18 (i.e., ‘modulation section’),” which is denoted in blue:



Pet. 58 (citing Ex. 1009, Fig. 3). Annotated Figure 3 of Davis shows modulator 18, with bits B_0 , B_1 , and B_2 applied thereto. Ex. 1009, 4:5–12.

Petitioner contends that the 8-level modulator modulates bits B_2 , B_1 , and B_0 into an 8 quadrature-amplitude-modulation (“8-QAM”) symbol, (B_2, B_1, B_0) expressed using three bits. Pet. 58. Petitioner argues, “[t]he first bit of the each symbol comprises bit B_2 of the MSB sequence (i.e., first information sequence), and the second bits of each symbol comprises bit B_1 corresponding to the coded LSB sequence (i.e., second information sequence).” *Id.* (citing Ex. 1009, Fig. 3).

Furthermore, Petitioner contends that Davis discloses that the MSB bits (i.e., B_2) are derived from the same data stream as the LSB bits (i.e., B_1 and B_0), and thus, “ B_2 of each symbol is related to B_1 and B_0 since . . . these bits are derived from the same data stream.” *Id.* at 59 (citing Ex. 1009, Abstract, Fig. 3; Ex. 1003 ¶ 90).

In response, Patent Owner contends that nothing in Davis discloses a modulator that modulates a sequence of bits to form the first bits and the second bits of symbols comprised of “bits of a set” or that is capable of changing the information to be placed on the first and second bits “at any

time.” PO Resp. 52 (citing Ex. 1001, 7:39–45). Instead, according to Patent Owner, even Petitioner concedes that Davis merely teaches that the first bit of each symbol comprises bit B₂ of the MSB sequence (i.e., “first information sequence”), and the second bits of each symbol comprises bit B₁ corresponding to the coded LSB sequence. *Id.* (citing Pet. 58). Thus, “Davis discloses that *only* a bit from the first information sequence can be placed on the most significant, or first, bit” and that “each successive symbol word is composed of the same bit pattern – ‘B₂, B₁, B₀.’” *Id.* (citing Ex. 1009, Figs. 1, 3). In its Sur-reply, Patent Owner adds that Davis does not teach the “modulation” section “for the same reasons that Tomlinson does not.” PO Sur-reply 26 (citing Ex. 1021, 51:15–55:1).

In weighing the evidence before us, we find more persuasive the position of Petitioner.

Although Patent Owner contends that Davis’s modulator is not “capable of changing” the information to be placed on the first and second bits “at any time” (PO Resp. 52), for the similar reason set forth above with respect to Patent Owner’s arguments in Section II.D.c, this argument is not persuasive because claim 1, for example, does not require that the modulator be “capable of changing . . . at any time.” *See* Ex. 1001, claim 1. As discussed in Section II.A, given the broadest reasonable construction, and as both Petitioner and Patent Owner agree, claim 1, for example, merely requires “bits corresponding to the first information sequence, bits corresponding to the second information sequence, or bits corresponding to both the first and second information sequence.” PO Resp. 23; Pet. Reply 5.

Here, Patent Owner concedes that Davis teaches that the first bit of each symbol comprises bit B_2 of the MSB sequence, and the second bits of each symbol comprises bit B_1 corresponding to the coded LSB sequence. PO Resp. 52. Thus, we agree with Petitioner that Davis discloses a modulator that modulates bits B_2 , B_1 , and B_0 into an 8-QAM symbol (B_2 , B_1 , B_0) expressed using three bits, wherein “[t]he first bit of the each symbol comprises bit B_2 of the MSB sequence (i.e., first information sequence), and the second bits of each symbol comprises bit B_1 corresponding to the coded LSB sequence (i.e., second information sequence).” Pet. 58. That is, according to Petitioner, Davis teaches symbols expressed using three bits, i.e., (B_2 , B_1 , B_0), wherein the first bits and the second bits of the symbol, i.e., (B_2 , B_1), comprise bits (B_2) from the MSB and bits (B_1) from the LSB sequence. *Id.*

Accordingly, Petitioner has demonstrated persuasively that Davis, in combination with Wei, teaches a modulator that “modulates the sequence of bits into symbols such that each of the symbols is expressed using three or more bits” wherein “the first bits and the second bits of the symbol comprise bits of a set comprising bits corresponding to the first information sequence and bits corresponding to the second information sequence,” as recited in claim 1, and similarly recited in claims 10 and 15.

b. Remaining Limitations (claims 1 and 10)

Patent Owner does not address separately Petitioner’s explanations and supporting evidence regarding the remaining limitations in independent claims 1 and 10. *See generally* PO Resp. We have reviewed Petitioner’s explanations and supporting evidence regarding these remaining limitations,

and find them sufficient because a plain reading of the cited portions of the references adequately supports Petitioner's contentions. *See generally* Pet. 60–61, 64. In particular, Petitioner has demonstrated persuasively that the cited portion of Davis discloses that the third bit of each symbol is comprised of bit B₀, which is a bit corresponding to the coded LSB sequence (i.e., “second information sequence”), and the second bit of each symbol is comprised of bit B₁. Pet. 61, 64 (citing Ex. 1009, 4:7–10, Fig. 3). Thus, Petitioner has demonstrated persuasively that Davis, in combination with Wei, teaches “the more lower bits than the second bits of the symbols are comprised of bits corresponding to the second information sequence” and “a bit corresponding to the second information sequence is arranged on the second bits of at least one of the symbols” recited in claim 1 and similarly recited in claim 10. We conclude that Petitioner demonstrates, by a preponderance of the evidence, that the combination of Davis and Wei teaches these limitations in claims 1 and 10.

c. Motivation to Combine Davis and Wei

Petitioner contends that, like the '815 patent, Davis is also directed to the problem of “determining which information to encode on which bits of a multi-bit symbol.” Pet. 55 (citing Ex. 1009, Fig. 3, 1:10–13, 4:5–12). Similarly, Petitioner contends that Wei is also directed to the problem of determining which information to encode on which bits of a multi-bit symbol. *Id.* at 55–56 (citing Ex. 1010, Abstract, 3:10–13, 3:64–4:4). Thus, Petitioner contends, each of Davis and Wei “is in the same field of endeavor and is analogous to the '815 Patent and is reasonably pertinent to the problem sought to be solved by the '815 Patent.” *Id.* at 55–56.

Petitioner contends that Wei discloses splitting a digital signal such as a video signal into a sequence of a “most important” information bit and another sequence of “less important” information bits. Pet. 60 (citing Ex. 1010, 3:64–4:4). According to Petitioner, a POSITA would understand that Davis’s disclosed modulation techniques would be advantageously applied to a video such as that described by Wei. *Id.* (citing Ex. 1003 ¶ 93). As such, Petitioner contends that it would have been obvious to transmit a video signal, such as that taught by Wei, using Davis’s transmitter,” where the “MSB sequence includes the ‘most important’ information of the video signal” and “the LSB sequence includes less important related video signal data.” *Id.*

However, Patent Owner contends that Petitioner’s statements are “conclusory.” PO Resp. 54 (citing *AT&T Servs., Inc. v. Voip-Pal.com, Inc.*, IPR2017-01382, Paper 8, 22–25 (PTAB Nov. 20, 2017) (denying institution of petition to review patent claims relating to classifying a call as a public network call or a private network call)). According to Patent Owner, the Petition fails to explain how a POSITA would have modified the modulation and coding scheme of Davis to apply it to the video signal of Wei to achieve the ’815 patent. *Id.*

In its Sur-reply, Patent Owner refers to Dr. Nettleton’s declaration, where he testified that combining Davis to Wei “make [one’s] life complicated,” since Wei “is a very complicated system” wherein modifying Wei “would be kind of an absurd means of transmitting low data rate signals.” PO Sur-reply 26 (citing Ex. 1021, 49:2–50:6).

In weighing the evidence before us, we find more persuasive the position of Petitioner.

By contending that a POSITA would not have modified the modulation and coding scheme of Davis to apply it to the video signal of Wei to achieve the '815 patent, Patent Owner appears to be contending that Davis and Wei are not compatible with each other. PO Resp. 54. However, we agree with Petitioner that both Davis and Wei are “also directed to the problem of determining which information to encode on which bits of a multi-bit symbol.” Pet. 55–56 (citing Ex. 1009, Fig. 3, 1:10–13, 4:5–12; Ex. 1010, Abstract, 3:10–13, 3:64–4:4). That is, each Davis and Wei “is in the same field of endeavor and is analogous to the '815 Patent and is reasonably pertinent to the problem sought to be solved by the '815 Patent.” *Id.* at 55–56. As Petitioner contends, Wei is not limited to transmission of HD video signals, and “is equally applicable to other types of digital transmission systems.” Pet. Reply 24–25 (citing Ex. 1010, 12:43–46). In his deposition, Dr. Nettleton concedes that Wei does not exclude lower data rate transmission. *See* Ex. 1021, 41:16–18. According to Petitioner, Dr. Nettleton instead confirmed that “there are no types of digital information incompatible with *Davis*’s disclosed transmitted.” Pet. Reply 25 (citing Ex. 1021, 40:13–16).

Accordingly, Petitioner has demonstrated persuasively that one of ordinary skill in the art would have combined Davis and Wei.

4. Dependent claims 2, 4, and 11

Patent Owner does not address separately Petitioner’s explanations and supporting evidence regarding dependent claims 2, 4, and 11. *See*

generally Prelim. Resp. We have reviewed Petitioner’s explanations and supporting evidence regarding the dependent claims, and find them sufficient because a plain reading of the cited portions of Davis adequately supports Petitioner’s contentions. *See generally* Pet. 61–64. In particular, Petitioner has demonstrated persuasively that the cited portions of Davis disclose : 1) bit B₂ of the MSB sequence (i.e., “first information sequence”) is arranged on the first bit of the symbol as required by dependent claims 2 and 11 (*see* Pet. 61–62, 64 (citing Ex. 1009, 4:7–12, Fig. 3)), and 2) the first information sequence is separated from all of the other information to be transmitted as required by dependent claim 4 (*see* Pet. 62–63 (citing Ex. 1009, Fig. 3)). We conclude that Petitioner demonstrates, by a preponderance of the evidence, that the combination of Davis and Wei teaches the limitations of the dependent claims.

III. CONCLUSION

For the foregoing reasons, we are persuaded on the record at hand that Petitioner has demonstrated by a preponderance of the evidence that claims 1–18 of the ’815 patent based on the grounds discussed above are unpatentable.⁴

⁴ Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this Decision, we draw Patent Owner’s attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. *See* 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related

IV. ORDER

For the foregoing reasons, it is
ORDERED that, based on a preponderance of the evidence, claims
1–18 of U.S. Patent 7,760,815 B2 have been shown to be unpatentable; and
FURTHER ORDERED that, because this is a final written decision,
parties to this proceeding seeking judicial review of our decision must
comply with the notice and service requirements of 37 C.F.R. § 90.2.

In summary:

Claims	35 U.S.C. §	Reference(s)/ Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1–18	103(a)	Tomlinson, Malkamaki	1–18	
1, 2, 4, 10, 11	103(a)	Davis, Wei	1, 2, 4, 10, 11	
Overall Outcome			1–18	

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matters in updated mandatory notices. *See* 37 C.F.R. § 42.8(a)(3), (b)(2).

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