

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

HUAWEI DEVICE CO., LTD.,

Petitioner,

v.

OPTIS WIRELESS TECHNOLOGY, LLC,

Patent Owner.

Case IPR2018-00655
Patent 8,208,569 B2

Before KEVIN F. TURNER, MIRIAM L. QUINN, and
JOHN P. PINKERTON, *Administrative Patent Judges*.

PINKERTON, *Administrative Patent Judge*.

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

I. INTRODUCTION

Huawei Device Co., Ltd. (“Petitioner”) filed a Petition for *inter partes* review of claims 1–10, 21–30, 41, and 42 of U.S. Patent No. 8,208,569 B2 (Ex. 1101, “the ’569 patent”). Paper 1 (“Pet.”). In the Decision on Institution (Paper 11, “Dec. on Inst.”), we instituted trial as to claims 1–10, 21–30, 41, and 42 of the ’569 patent on the asserted ground of unpatentability. Optis Wireless Technology, LLC (“Patent Owner”) filed a Patent Owner Response. Paper 21 (“PO Resp.”). Petitioner filed a Reply (Paper 24, “Pet. Reply”), and Patent Owner filed a Surreply (Paper 32, “PO Surreply”). On June 24, 2019, an oral hearing was held.

We have jurisdiction under 35 U.S.C. § 6. This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a). For the reasons that follow, we determine that Petitioner has shown by a preponderance of the evidence that claims 1–10, 21–30, 41, and 42 of the ’569 patent are unpatentable.

A. *Related Proceedings*

Petitioner has filed a separate Petition for *inter partes* review of claims 11–20, 31–40, 43, and 44 of the ’569 patent. *See* IPR2018–00653. Petitioner asserts the same ground of unpatentability in IPR2018–00653, and a final written decision is being issued concurrently in that proceeding. Patent Owner and Petitioner are also involved in a pending district court action involving the ’569 patent (*Optis Wireless Technology, LLC, et al. v. Huawei Techs. Co., et al.*, Case No. 2:17-CV-12-JRG-RSP (E.D. Tex.)). *See* Pet. 3.

B. The '569 Patent

The '569 patent is directed to an orthogonal frequency division multiplexing (“OFDM”) multicarrier communication system, and, specifically, to adjusting the arrangement of the transmitted signal in code block units in both a time axis direction and a frequency axis direction, to reduce the error rate of the received multicarrier signal. Ex. 1101, Abstract, 2:31–39, 4:20–16. The '569 patent explains that “[a] mobile communication system using OFDM signals is affected by the SNR [signal to noise ratio] variation in the time axis direction due to fading and affected by the SNR variation in the frequency axis direction due to frequency selective fading caused by multipaths.” *Id.* at 2:13–17.

Figure 2 of the '569 patent is reproduced below.

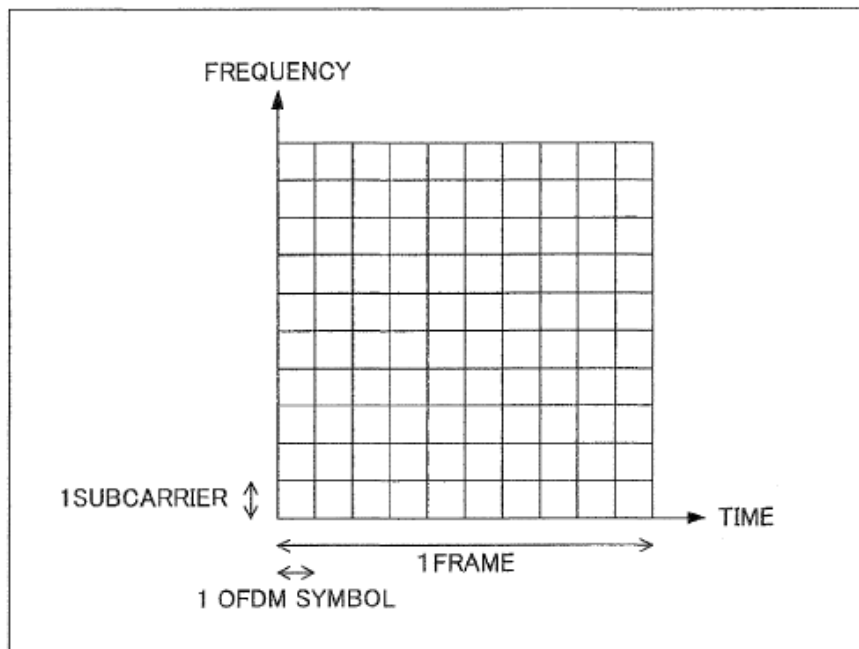
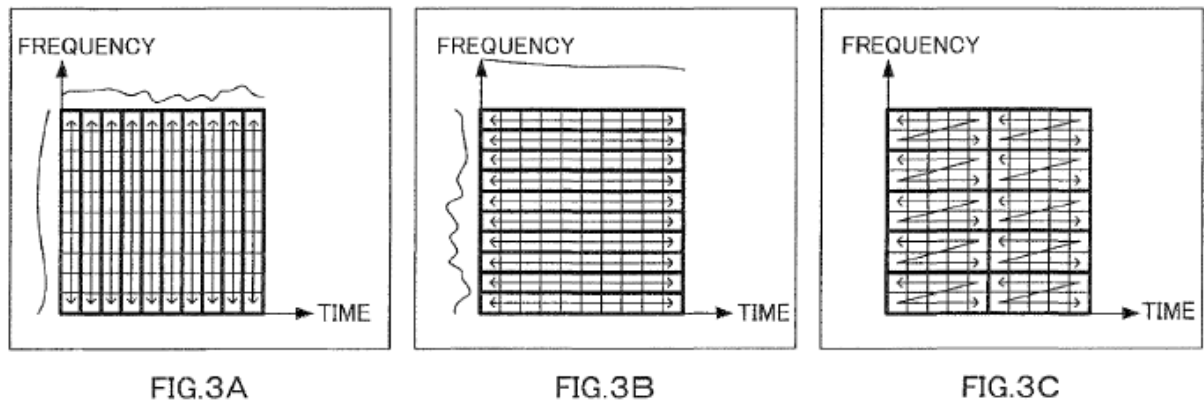


Figure 2 illustrates an example of 1 frame of an OFDM signal consisting of a total of 100 symbols—10 symbols in the time axis (horizontal) direction and 10 symbols in the frequency axis (vertical) direction. *Id.* at 3:23–24; 4:31–36. The '569 patent discloses that, in this example, a “code block” generated by error correction coding on the OFDM symbol is assumed to consist of 10 symbols and that “it is possible to arrange 10 code blocks in 1 frame.” *Id.* at 4:37–40. Three examples of how the code blocks can be arranged are shown in Figure 3, which is reproduced below.



The '569 patent discloses that Figure 3A illustrates ten code blocks of 10 symbols that are arranged continuously in the frequency axis direction when a variation of reception quality is larger in the time axis direction than in the frequency axis direction, “for example, when the receiver is moving at a high speed.” *Id.* at 3:25–29, 4:52–58. The patent discloses that Figure 3B illustrates the ten code blocks of 10 symbols are arranged continuously in the time axis direction when variation of reception quality is larger in the frequency axis direction than in the time axis direction. *Id.* at 3:30–33; 4:58–61. The patent discloses that Figure 3C illustrates the ten code blocks

are arranged “according to variation of reception quality in the frequency axis direction and time axis direction.” *Id.* at 3:34–38. In particular, Figure 3C shows “code blocks each consisting of 5 symbols in the time axis direction having small SNR variation and 2 symbols in the frequency axis direction having larger SNR variation.” *Id.* at 4:66–5:2.

The '569 patent also discloses adjusting the arrangements of the code blocks in other combinations. For example, Figure 4B is reproduced below.

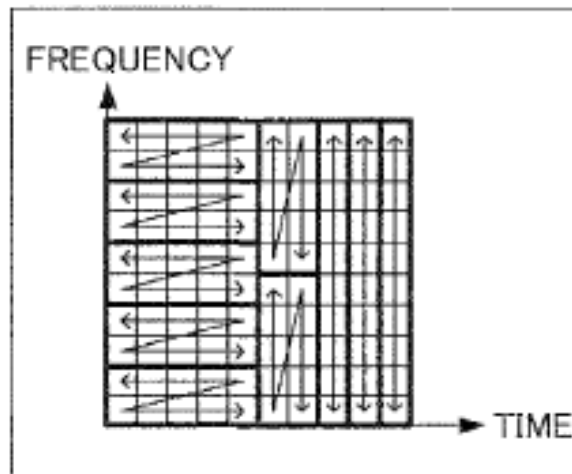


FIG. 4B

Figure 4B illustrates an example arrangement in which modes of code blocks, each consisting of 10 symbols in 1 frame, are modified. *Id.* at 5:18–20. The '569 patent explains that, in terms of “frequency axis direction×time axis direction,” there can be a mixture of code blocks consisting of three “10 symbols×1 symbol” code blocks, two “5 symbols×2 symbols” code blocks, and five “2 symbols×5 symbols” code blocks. *Id.* at Fig. B., 5:20–23.

Another example is illustrated in Figure 4C, which is reproduced below.

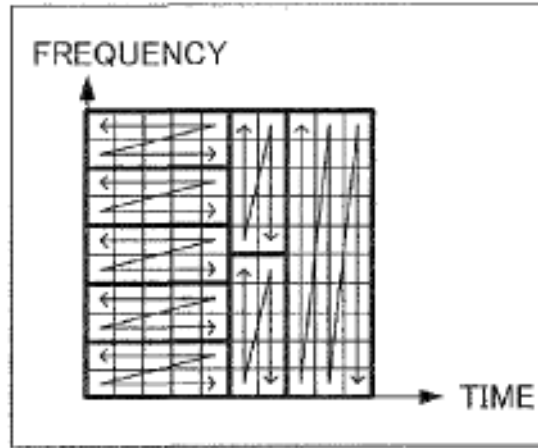


FIG. 4C

Figure 4C illustrates an arrangement in which the size of a code block (the number of symbols) is changed as appropriate according to a characteristic of error correcting codes. *Id.* at 3:45–48. Figure 4C shows the arrangement of ten 10-symbol code blocks in Figure 4B modified to eight code blocks—“7 code blocks of 10 symbols and 1 code block of 30 symbols.” *Id.* at 5:33–34.

The '569 patent discloses various embodiments of transmitters and receivers for an OFDM multicarrier communication system. A representative embodiment of such a system is illustrated in Figure 6, which is reproduced below.

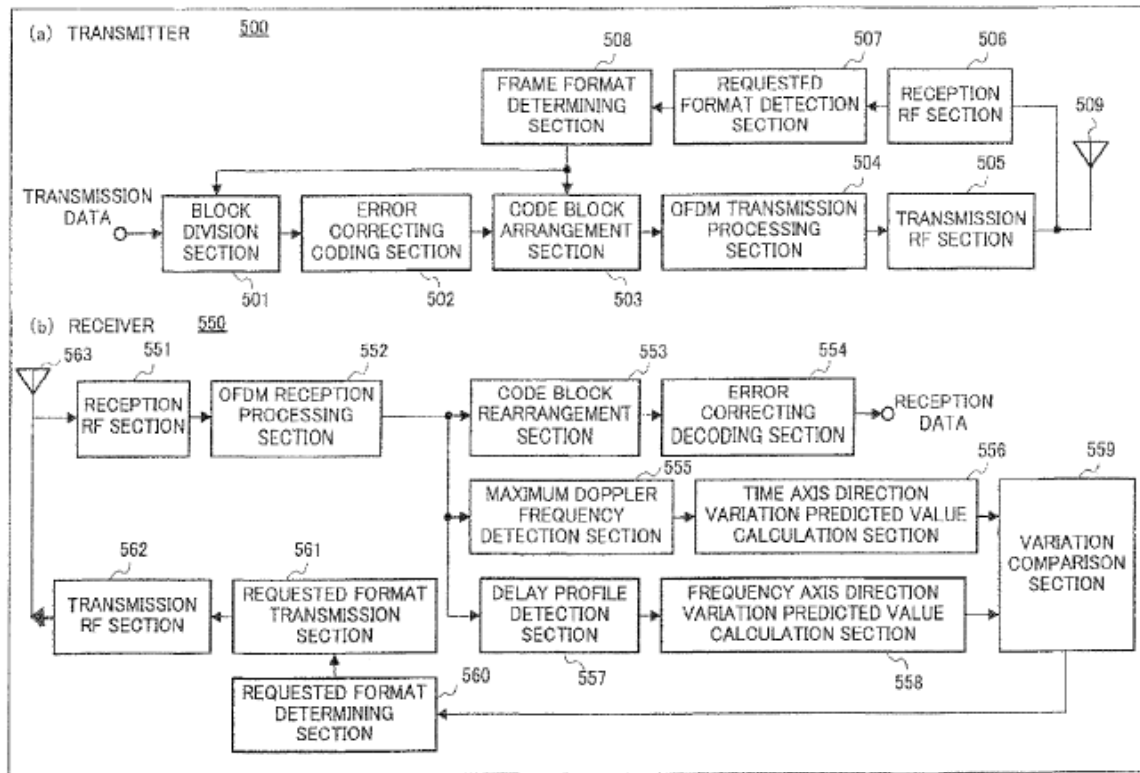


FIG.6

Figure 6 is a block diagram showing the configuration of transmitter 500 and receiver 550. *Id.* at Fig. 6, 6:18–20. Transmitter 500 is provided with block division section 501, error correcting coding section 502, code block arrangement section 503, OFDM transmission processing section 504, transmission radio frequency (RF) section 505, reception RF section 506, requested format detection section 507, frame format determining section 508, and antenna element 509. *Id.* at 6:20–26. The '569 patent discloses that block division section 501 initially divides transmission data into portions of predetermined size that are then input to error correcting coding section 502, where the data are subjected to error correcting coding processing. *Id.* at 6:37–45. The patent discloses that the encoded data are

then “input to code block arrangement section 503 and rearranged in an arrangement instructed by frame format determining section 508, in other words, in an arrangement instructed in 1 frame converted into an OFDM signal.” *Id.* at 6:45–49. As the patent further discloses, the OFDM frame arrangement is then subjected to “publicly known” processing for generating OFDM signals in section 504, after which the signal is input to transmission RF section 505 for signal processing, and then transmitted by radio from antenna element 509. *Id.* at 6:49–60.

The ’569 patent also discloses that the transmitted OFDM signal is received by receiver 550, where it is input to reception RF section 551 and OFDM reception processing section 552. *Id.* at 6:61–7:3. Other portions of receiver 550 then return the received OFDM signal to its original arrangement, decode the error correction coding, and output the initial data transmitted. *Id.* at 7:3–13. The ’569 patent further discloses a feedback mechanism whereby the arrangement of the symbols in the transmitted OFDM signal can be modified according to the reception state of the received signal. For example, receiver 550 includes various elements that analyze the received OFDM signal and provide information to a requested format determining section 560 that “determines an arrangement of code blocks that minimizes the SNR variations per symbol of the code blocks according to the variation ratio in total view of 1 frame of the OFDM signal.” *Id.* at 7:14–56. The new OFDM signal arrangement determined by requested format determining section 560 is then sent back to transmitter 500 using “publicly known signal processing.” *Id.* at 7:62–67. This information is received by transmitter 500 and, via requested format

detection section 507 and frame format determining section 508, is used to instruct the transmitter on the size (number of symbols) of one code block and an arrangement of code blocks in the next OFDM transmission. *Id.* at 8:1–18.

C. Illustrative Claims

Among the challenged claims, claims 1, 21, and 41 are independent. Claims 2–10 depend directly from claim 1, claims 22–30 depend directly from claim 21, and claim 42 depends directly from claim 41. Claims 1 and 7 are illustrative of the claimed subject matter and are reproduced below (with paragraph lettering added as in the Petition):

1. A transmission apparatus comprising:

(a) a coding section configured to encode first data and second data; and

(b) a mapping section configured to map the encoded first data to symbols in a first part of a domain comprising a time index and a frequency index, and the encoded second data to groups of symbols in a second part of the domain, wherein:

(c) at least a part of the encoded first data is mapped to at least a part of the symbols in the first part of the domain in an increasing order according to the frequency index;

(d) at least a part of the encoded second data is mapped to at least a part of the groups of symbols in the second part of the domain and each group of the at least a part of the groups of symbols is aligned in an increasing order according to the time index; and

(e) each symbol within each of the groups of symbols is aligned along the frequency index.

Ex. 1101, 12:36–54.

7. The transmission apparatus according to claim 1, wherein at least a part of the encoded second data is not continuously mapped to each symbol within each of the groups of symbols aligned along the frequency index.

Id. at 13:7–10.

D. Evidence of Record

Petitioner relies on the references in the table below, as well as the Declaration of Jonathan Wells, Ph.D (Ex. 1108). Patent Owner relies on the Declaration of James Womack, Ph.D (Ex. 2003).

Reference	Exhibit	Patent
Wallace	1106	U.S. Patent No. 6,473,467 B1
Ishikawa	1107	U.S. Patent No. 5,646,935

E. Instituted Ground of Unpatentability

Petitioner challenges the patentability of claims 1–10, 21–30, 41, and 42 of the ’569 patent based on the following ground under 35 U.S.C. § 103(a),¹ and we instituted trial based on this ground:

¹ The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112-29, 125 Stat. 284, 287–88 (2011), amended 35 U.S.C. § 103. Because the ’569 patent was filed before the effective date of the relevant amendment, the pre-AIA version of § 103 applies.

Claims Challenged	Basis
1–10, 21–30, 41, and 42	Obvious under 35 U.S.C. § 103(a) based on Wallace in view of Ishikawa

F. Person of Ordinary Skill in the Art

Petitioner asserts that a person of ordinary skill in the art at the time of the alleged invention of the '569 patent would have been someone with a working knowledge of wireless networking. Pet. 6. Petitioner also asserts that such a person would have gained this knowledge through an undergraduate Bachelor of Science degree in Electronic Engineering or a related field, and around two years of education, training or experience in developing wireless communication applications. *Id.* (citing Ex. 1108 ¶ 19). Petitioner further asserts the applied prior art reflects the appropriate level of skill at the time of the claimed invention. *Id.* (citing *Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001)). Patent Owner has not expressed a position on the level of ordinary skill in the art. *See generally* PO Resp. After reviewing the full record in this case, we adopt Petitioner's description of the person of ordinary skill in the art because it is consistent with the asserted prior art and the '569 patent, and we apply this level of ordinary skill in our analysis below.

II. DISCUSSION

A. Claim Construction

In this *inter partes* review, claim terms in an unexpired patent are interpreted according to their broadest reasonable construction in light of the

specification of the patent in which they appear. *See* 37 C.F.R. § 42.100(b) (2017).² Under that standard, and absent any special definitions, we give claim terms their ordinary and customary meaning, as they would be understood by one of ordinary skill in the art in the context of the entire patent disclosure. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). “[A] claim construction analysis must begin and remain centered on the claim language itself.” *Innova/Pure Water, Inc. v. Safari Water Filtration Sys., Inc.*, 381 F.3d 1111, 1116 (Fed. Cir. 2004). “Though understanding the claim language may be aided by the explanations contained in the written description, it is important not to import into a claim limitations that are not a part of the claim.” *SuperGuide Corp. v. DirecTV Enters., Inc.*, 358 F.3d 870, 875 (Fed. Cir. 2004). Furthermore, “we need only construe terms ‘that are in controversy, and only to the extent necessary to resolve the controversy.’” *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)).

In the Decision on Institution, because Petitioner and Patent Owner agreed that the term “group of symbols” should be construed to mean “an arrangement of symbols to which data is mapped” and that the term “groups of symbols” should be construed to mean “more than one arrangement of

² The recent revisions to our claim construction standard do not apply to this proceeding, which was accorded the filing date of February 15, 2018 (Paper 5, 1), because the new “rule is effective on November 13, 2018 and applies to all . . . petitions filed on or after the effective date.” Changes to the Claim Construction Standard for Interpreting Claims in Trial Proceedings Before the Patent Trial and Appeal Board, 83 Fed. Reg. 51,340 (Oct. 11, 2018).

symbols to which data is mapped,” we adopted these constructions for purposes of that Decision. Dec. on Inst. 13. Although the parties continue to express their agreement to these constructions, Patent Owner’s arguments, as discussed *infra*, seek further construction of the limitations “data which is mapped to symbols” and “data which is mapped to groups of symbols.” The parties also disagree on the meaning of the phrase “encoded second data is not continuously mapped to each symbol within each of the groups of symbols aligned along the frequency index,” as recited in claims 7 and 27. We did not construe this phrase in the Decision on Institution. We address these disputed limitations below.

1. “group of symbols,” “groups of symbols,” “mapped to symbols,” and “mapped to groups of symbols”

- a. *The Parties’ Arguments*

Petitioner notes that claims 1 and 21 recite the terms “group of symbols” and “groups of symbols.”³ Pet. 22–23. Petitioner also notes that neither the parties nor the court construed these terms in the related district court action and asserts that a construction is not necessary here. *Id.* at 23 n.4 (citing Ex. 1113). However, Petitioner asserts that the broadest reasonable interpretation for “group of symbols” must encompass (at a minimum) “an arrangement of symbols to which data is mapped,” and the broadest reasonable interpretation for “groups of symbols” must encompass (at a minimum) “more than one arrangement of symbols to which data is mapped.” *Id.* Petitioner notes that, although the specification does not use

³ Petitioner also notes that claims 11 and 31, which are the subject of IPR2018–00653, also recite the terms “group of symbols” and “groups of symbols.” Pet. 22–23.

the terms “group of symbols,” “groups of symbols,” or “mapping” of signals or data to groups of symbols, the applicant for the ’569 patent argued that Figures 4A–4F and 5, and their accompanying disclosures, provide support for “groups of symbols” and mapping thereof. *Id.* at 23 (citing Ex. 1102, 447). Petitioner asserts that the ’569 patent refers to Figures 4A–4F and 5 as an “example of arrangement” and describes different arrangements of code blocks in each Figure. *Id.* at 24 (citing Ex. 1101, 3:39–67, 5:9–6:17).

Petitioner also notes that the ’569 patent discloses “code block arrangement section 503” in transmitter 500 and “code block rearrangement section 553” in receiver 550 and asserts these disclosures “support the claimed mapping of encoded data to groups of symbols.” *Id.* Thus, Petitioner argues that a person of ordinary skill in the art would understand that “group of symbols” means “arrangement of symbols to which data is mapped” and that “groups of symbols” means “more than one arrangement of symbols to which data is mapped.” *Id.* (citing Ex. 1108 ¶¶ 58–62).

In Patent Owner’s Response, Patent Owner notes that Petitioner argues the broadest reasonable interpretation of “group of symbols” is “an arrangement of symbols to which data is mapped” and the broadest reasonable interpretation of “groups of symbols” is “more than one arrangement of symbols to which data is mapped.” PO Resp. 21. Patent Owner states that it “agrees with those constructions and requests that the Board adopt them.” *Id.*

Patent Owner then argues “it appears that Petitioner does not actually apply” these definitions and “Petitioner appears to believe” that whether symbols form a “group of symbols” can be determined “*after* the data is

mapped,” because Petitioner has drawn “arbitrary boxes” around portions of Figure 2 of Wallace and “declared that the data in these boxes are mapped to ‘groups of symbols.’” *Id.* at 21–22. Patent Owner argues this is inconsistent with the agreed-upon constructions because “[w]hether symbols form a ‘group of symbols’ must be determined before data has been mapped in the time-frequency domain” and “data can only be mapped to a group of symbols if that group of symbols is defined prior to mapping data.” *Id.* at 22 (citing Ex. 2003 ¶¶ 54–56).

Patent Owner also argues that its understanding of “group of symbols” and “groups of symbols” is the only understanding that is reasonable in light of the ’569 patent’s specification. *Id.* at 22–23. In that regard, Patent Owner cites to Figure 6 and its description as teaching “mapping code blocks, which have a known, pre-determined size, and mapping those code blocks to pre-existing arrangements of symbols in the time-frequency domain (or groups of symbols).” *Id.* at 23–24 (citing Ex. 1101, 6:37–8:16; Ex. 2003 ¶¶ 57–58, 61–62). Patent Owner also cites to Figure 7 of the ’569 patent and argues it “illustrates various formats of code block arrangements, which can also be called groups of symbols, that requested format determining section 560 could select.” *Id.* at 25–26 (citing Ex. 1101, 8:18–31; Ex. 2003 ¶ 63). Patent Owner further cites to Figure 4B of the ’569 patent as a good example showing use of the code block arrangements in Figure 7 having five symbols in the time direction and two symbols in the frequency direction (5 code blocks shown), two symbols in the time direction and five symbols in the frequency direction (2 code blocks shown), and one symbol in the time direction and ten symbols in the frequency direction (3 code blocks shown).

Id. at 26 (citing Ex. 1101, 5:18–25; Ex. 2003 ¶ 65). Thus, according to Patent Owner, it is clear from the specification that the arrangement of symbols into the claimed “group of symbols” and “groups of symbols” is defined *before* the code blocks are both formed and mapped, and are not “determined *after* the code blocks have been mapped.” *Id.* at 27 (citing Ex. 2003 ¶ 66).

Patent Owner also argues “[t]his conclusion that the group(s) of symbols are defined prior to mapping of data is reinforced by the patentee’s use of different claim language”—“mapped to symbols” and “mapped to groups of symbols”—because “different claim terms are presumed to have different meanings.” *Id.* at 27–28 (citing *Helmsderfer v. Bobrick Washroom Equip., Inc.*, 527 F.3d 1379, 1382 (Fed. Cir. 2008)). Patent Owner further argues “[a] plain reading of ‘mapped to symbols’ is that data is mapped on a symbol-by-symbol basis,” and “data ‘mapped to groups of symbols’ must mean something different, or the claim language would be redundant.” *Id.* at 28. According to Patent Owner, “interpreting ‘mapped to groups of symbols’ to mean data that is deliberately mapped to a particular arrangement of symbols that exists prior to mapping is just such a different interpretation that is consistent with the ’569’s patent specification.” *Id.* (citing Ex. 2003 ¶¶ 66–67).

Patent Owner also contends that claims 7 and 27, which recite “at least a part of the encoded second data is not continuously mapped within each of the groups of symbols,” support the requirement that a group of symbols is defined prior to mapping of data because “a symbol within a

group of symbols cannot be skipped when mapping unless the group of symbols is already defined.” *Id.* (citing Ex. 2003 ¶ 68).

In Petitioner’s Reply, Petitioner argues that Patent Owner’s proposed construction of “mapped to groups of symbols” to mean “data that is deliberately mapped to a particular arrangement of symbols that exists prior to mapping” is not the broadest reasonable construction “because it improperly imports limitations.” Pet. Reply 3 (citing *In re Van Geuns*, 988 F.2d 1181, 1184 (Fed. Cir. 1993)). In particular, Petitioner initially argues that Patent Owner fails to explain why the plain meaning of “mapped to groups of symbols” would not have been understood by a person of ordinary skill in the art and instead would need to be narrowly construed as Patent Owner proposes. *Id.* at 3–4 (citing Ex. 1120 ¶¶ 18–21). Second, Petitioner argues that Patent Owner attempts to rewrite the claim term “mapped” as “*deliberately* mapped” and the claim term “groups of symbols” as “a particular arrangement of symbols that exists prior to mapping.” *Id.* at 4. Petitioner notes that Patent Owner asserts “the ’569 Patent teaches mapping code blocks, which have a known, *pre-determined size*, and mapping those code blocks to *pre-existing arrangement of symbols in the time-frequency domain* (or groups of symbols),” but also asserts that “the ’569 Patent does not limit the term ‘mapped to groups of symbols’ as Patent Owner contends.” *Id.* at 4 (citing PO Resp. 23). Petitioner argues that Patent Owner’s narrow construction relies on Figure 6 showing “requested format determining section 560” at the receiver that may use the code block arrangements depicted in Figure 7. *Id.* (citing PO Resp. 23–26). Petitioner also argues, however, that “those Figures relate to only the first embodiment,

out of four embodiments” of the ’569 patent, and “[a] requested format determining section does not even appear in Figure 9 (the third embodiment).” *Id.* (citing Ex. 1101, 4:1–15, Fig. 9). Petitioner further argues that, although the ’569 patent describes a first embodiment including information on Figures 6 and 7, Patent Owner “errs by alleging that such information must necessarily be read into the claims.” *Id.* at 4–5 (citing *Tinnus Enter., LLC v. Telebrands Corp.*, 733 F. App’x 1011, 1020 (Fed. Cir. 2018); *Ventana Med. Sys., Inc. v. Biogenex Labs., Inc.*, 473 F.3d 1173, 1181 (Fed. Cir. 2006)).

Third, Petitioner argues that Patent Owner’s proposed construction of “mapped to groups of symbols” to mean “data that is deliberately mapped to a particular arrangement of symbols that exists prior to mapping,” in effect disclaims other types of data from the broadest reasonable scope of the claims, such as, for example, “data that is mapped to a particular arrangement of symbols that does not exist prior to mapping,” without a “clear and unmistakable” disclaimer during prosecution. *Id.* at 5 (citing *Aylus Networks, Inc. v. Apple Inc.*, 856 F.3d 1353, 1359 (Fed. Cir. 2017)).

Fourth, Petitioner argues that the prosecution history of the ’569 patent does not support Patent Owner’s narrow construction of “mapped to groups of symbols.” *Id.* at 5–7. In that regard, Petitioner argues that, during prosecution of the application that led to the ’569 patent, “the applicant added new claims 22–61⁴ and cited Figures 2, 4A–4F and 6, and

⁴ Petitioner notes that the added claims correspond to claims 1–9, 11–19, 21–29, 31–39, and 41–44 as issued.

paragraphs [0005], [0008], [0039], [0042] and [0048]^[5] as written description support.” *Id.* at 5–6 (citing Ex. 1102, 324). Petitioner also argues that, in an interview with the Examiner about the pending rejection of the claims under 35 U.S.C. § 112, first paragraph, for lack of written description, applicant stated with respect to claims 22–61 (issued as claims 1–44), that Figures 4A–4F and 5 and “the accompanying description in specification paragraphs [0039]–[0046]^[6]” provide written description support for the “*first data*,” the “*second data*,” and “*the mapping thereof*.” *Id.* at 6 (citing Ex. 1102, 431, 446–447). Petitioner further argues that, “[c]ritically, the applicant also stated that ‘[t]he code blocks (*mapped as in the above-noted Figs. 4A–4F and Fig. 5*), each of which contains a number of symbols, are examples of *support for the first and second data and the mapping thereof*.’” *Id.* (citing Ex. 1102, 447). Petitioner notes the Examiner agreed that the written description rejection was overcome and issued a Notice of Allowance. *Id.* at 6–7 (citing Ex. 1102, 447, 456). According to Petitioner, “the prosecution history indicates that the applicant did not discuss Figures 6 or 7 in the interview that overcame the Section 112 rejection.” *Id.* at 7 (citing Ex. 1102, 447).

Regarding the limitation “mapped to symbols,” Petitioner argues that Patent Owner offers no plausible explanation for why “mapped to symbols” means “data is mapped on a symbol-by-symbol basis,” but “mapped to

⁵ Petitioner asserts that these paragraphs correspond to 1:53–59, 2:31–39, 5:3–8, 5:26–34, 6:37–60 in the specification.

⁶ Petitioner asserts that these paragraphs correspond to 5:3–6:17 in the specification.

groups of symbols” must mean something different, as discussed *supra*. *Id.* (citing PO Resp. 28). Petitioner also argues that, as Dr. Wells explained, a person of ordinary skill in the art “would understand that mapping to group(s) of symbols, as disclosed in Figures 4A–4F and 5, does not preclude mapping to symbols.” *Id.* (citing Ex. 1108 ¶¶ 71–82; Ex. 1120 ¶¶ 18–26). Petitioner further argues that Patent Owner’s arguments are undermined by Dr. Womack’s declaration testimony that “mapped to symbols” means “data that is mapped dynamically on a symbol-by-symbol basis” because Dr. Womack “does not cite any intrinsic evidence.” *Id.* at 7–8 (citing Ex. 2003 ¶¶ 67–68). Moreover, Petitioner argues that, although the applicant for the ’569 patent identified Figures 4A–4F and 5 as support for the mapping of “first data,” at his deposition, Dr. Womack could not identify any examples of data in Figures 4A–4F and 5 that is mapped on a symbol-by-symbol basis. *Id.* at 8 (citing Ex. 1121, 10:12–18, 26:14–27:20).

In Patent Owner’s Surreply, Patent Owner responds as follows. First, regarding Petitioner’s argument that Patent Owner fails to explain why a person of ordinary skill would not have understood the plain meaning of “mapped to groups of symbols” and instead the phrase would need to be narrowly construed, Patent Owner argues it is Petitioner that is attempting to change the meaning of “mapped to groups of symbols” because “[t]hat the ‘group of symbols’ must exist prior to mapping is inherent in the claim language itself.” PO Surreply 3. Patent Owner also argues that the parties’ agreed constructions “contemplate that data is mapped to groups of symbols,” but “if the groups do not exist prior to mapping, it cannot be said that data is mapped to such groups of symbols.” *Id.* Patent Owner further

argues this understanding of “group(s) of symbols” is supported by the specification, as Patent Owner previously argued, particularly with respect to Figure 6 (showing “frame format determining section 508” in transmitter 500 and “requested format determining section 560” in receiver 550) and Figure 7, which illustrates various code block arrangements that requested format determining section 560 could select and send back to the transmitter for input into frame format determining section 508 to instruct other portions of the transmitter on the size and appropriate arrangement of code blocks in a frame. *Id.* at 3–4 (citing PO Resp. 23–25; Ex. 1101, 6:38–8:31, Figs. 6, 7).

Second, in regard to Petitioner’s argument that Figures 6 and 7 relate only to the first embodiment and that Figure 9, which relates to the third embodiment, does not have a requested format determining section, Patent Owner argues that “the other three embodiments all teach determining the arrangement of code blocks *before* mapping data.” *Id.* at 4–5. In that regard, Patent Owner argues Petitioner “appears to concede that the second and fourth embodiments contain the same requested format determining section of Figure 6, and accordingly arrange code blocks before mapping to the time-frequency domain.” *Id.* at 4 (citing Pet. Reply 4). Patent Owner further argues that, although the third embodiment does not disclose a requested format determining section in the receiver, “it does disclose that the transmitter has a channel information detection section 807 that ‘analyzes the reception state of an OFDM signal transmitted from receiver 850 . . . and thereby determines the arrangement of code blocks in 1 frame of the OFDM signal.’” *Id.* at 5 (citing Ex. 1101, 10:20–25, Fig. 9). Thus, according to Patent Owner, “like the other three embodiments, the third

embodiment also teaches arranging the code blocks before mapping data to the time-frequency domain.” *Id.* at 5–6.

Third, Patent Owner argues it “is not relying on the specification to import limitations into the claims,” and Patent Owner’s “understanding of ‘group(s) of symbols’ is dictated by the language of the claims and the parties’ agreed construction.” *Id.* at 6. Patent Owner also argues, “But the claims must be read in light of the specification.” *Id.* (citing *Microsoft Corp. v. Proxyconn, Inc.*, 789 F.3d 1292, 1298 (Fed. Cir. 2015)). Moreover, Patent Owner argues the specification confirms that Patent Owner’s understanding of the plain claim language is correct—“it reveals that the invention of the ’569 patent is the arrangement of code blocks *before* mapping of data to optimize data throughput. This is the invention that the applicant[] claimed.” *Id.* at 6–7.

Fourth, Patent Owner argues that Petitioner’s argument that Patent Owner has not shown a disavowal of claim scope “is a red herring” because Patent Owner’s understanding of “group(s) of symbols” is not based on any purported disclaimer, but is instead “based on the claim language and the parties’ agreed construction, and is supported throughout the specification.” *Id.* at 7.

Fifth, Patent Owner argues that the prosecution history does not undermine its understanding of the claims because, when the applicant added the claims that ultimately issued as claims 1–9, 11–19, 21–29, 31–39, and 41–44, the applicant cited “Figures 2, 4A–4F, and Figure 6 as support,” and paragraph 48 (now 6:37–60), which explains Figure 6. *Id.* (citing Ex. 1102, 324).

Sixth, regarding Petitioner’s argument that Patent Owner offers no plausible explanation for why “mapped to symbols” means “data is mapped on a symbol-by-symbol basis,” but “mapped to groups of symbols” must mean something different,” Patent Owner argues that Petitioner “ignores” that these terms must mean something different because “different claim terms are presumed to have different meanings.” *Id.* at 8 (citing *Helmsderfer v. Bobrick Washroom Equip., Inc.*, 527 F.3d 1379, 1382 (Fed. Cir. 2008)). Patent Owner further argues that “[r]egardless of whether ‘mapped to symbols’ means that data is mapped on a symbol-by-symbol basis as Patent Owner argues, it must mean something different than ‘groups of symbols,’” and “Patent Owner has articulated an understanding of ‘groups of symbols’ that respects this principle,” but “Petitioner has not.” *Id.* at 8.

b. Analysis

Regarding the terms “group of symbols” and “groups of symbols,” the parties continue to express their agreement to the constructions of these terms that we adopted in the Decision on Institution. *See* Pet. 23–24; PO Resp. 21. Thus, consistent with the parties’ agreement, we determine that the term “group of symbols” should be construed to mean “an arrangement of symbols to which data is mapped” and that the term “groups of symbols” should be construed to mean “more than one arrangement of symbols to which data is mapped.”

Regarding the terms “mapped to symbols” and “mapped to groups of symbols,” we are not persuaded by Patent Owner’s arguments that “mapped to symbols” should be construed to mean “data is mapped on a symbol-by-symbol basis” and that “mapped to groups of symbols” should be construed

to mean “data that is deliberately mapped to a particular arrangement of symbols that exists prior to mapping,” for several reasons. First, Patent Owner’s proposed constructions include limitations that are not in the claims. Claims 11, 31, and 41 recite “first data which is mapped to symbols.” See Ex. 1101, 13:28–29, 15:2–3, 16:29–30. These claims do not recite the method or manner in which the data is mapped, such as “on a symbol-by-symbol basis,” as Patent Owner proposes. Claims 11, 31, and 41 also recite “second data which is mapped to groups of symbols.” See Ex. 1101, 13:31–32, 15:4–5, 16:31–32. These claims do not recite second data, which is “deliberately” mapped or which is mapped to “a particular arrangement of symbols that exists prior to mapping,” as Patent Owner proposes.

Second, we are not persuaded by Patent Owner’s argument that different claim terms are presumed to have different meanings because the argument is directed to the same word, “mapped,” not different terms. Here, based on the agreed construction of “group of symbols” and “groups of symbols,” these terms have been interpreted to have different meanings in that data is “mapped” to either one arrangement of symbols or more than one arrangement of symbols. There is no claim construction principle requiring that we construe the identical term “mapped” differently. Moreover, as we stated in the Decision on Institution, Patent Owner has not sufficiently demonstrated that mapping data to “symbols” is different than mapping data to “groups of symbols.” Dec. on Inst. 13. In his declaration, Dr. Womack testified that “mapped to symbols” means “data that is mapped dynamically on a symbol-by-symbol basis.” Ex. 2003 ¶ 67. This testimony is, however,

factually unsupported and, as Petitioner argues, “does not cite any intrinsic evidence.” *See* Pet. Reply 7–8 (citing Ex. 2003 ¶¶ 67–68). Accordingly, it is entitled to little or no weight. *See* 37 C.F.R. § 42.65(a). In addition, we determine that Dr. Womack’s testimony is insufficient to demonstrate that mapping data to “symbols” is different than mapping data to “groups of symbols” because, as Petitioner also argues, although the applicant for the ’569 patent identified Figures 4A–4F and 5 as support for the mapping of “first data,” “[a]t his deposition, Dr. Womack could not identify any examples of data in Figures 4A–4F and 5 that is mapped on a symbol-by-symbol basis.” *Id.* at 8 (citing Ex. 1121, 10:12–18, 26:14–27:20).

Third, Patent Owner’s reliance on the specification is unpersuasive. Patent Owner argues that, like the first embodiment of the ’569 patent, the second and fourth embodiments “contain the same requested format determining section of Figure 6 and accordingly arrange code blocks before mapping to the time-frequency domain.” PO Surreply 5 (citing Ex. 1101, Fig. 8 (block 560), 9:50–54, Fig. 10 (block 560), 11:18–22). With respect to the third embodiment, Patent Owner argues that, although it does not disclose a requested format determining section in the receiver, it also teaches arranging the code blocks before mapping data to the time-frequency domain because it discloses the transmitter has a channel information detection section 807 that determines the arrangement of code blocks in one frame of the signal, and “this information is fed to frame format determining section 508, which, just like in Figure 6, provides instructions to block division section 501 and code block arrangement section 503.” *Id.* at 5–6 (citing Ex. 1101, 10:20–25, Fig. 9). Thus, Patent Owner argues that the

specification confirms its understanding of the claim language is correct, as “it reveals the invention of the ’569 patent is the arrangement of code blocks *before* mapping of data to optimize data throughput. This is the invention that the applicant[] claimed.” *Id.* at 6–7. Even if we were to agree with Patent Owner that the four embodiments of the specification teach the arrangement of code blocks before mapping of data, we do not agree with Patent Owner that this is the claimed invention or that the claims of the ’569 patent limit the term “mapped to groups of symbols” as Patent Owner contends. Instead, we agree with Petitioner that Patent Owner’s proposed construction improperly attempts to import limitations from the specification and to rewrite the claims. PO Reply 3–4. As Petitioner argues, and we agree, Patent Owner attempts to rewrite the claim term “mapped” as “*deliberately* mapped” and the claim term “groups of symbols” as “a particular arrangement of symbols that exists prior to mapping.” *Id.* at 4. “The written description, however, is not a substitute for, nor can it be used to rewrite, the chosen claim language Though understanding the claim language may be aided by the explanations contained in the written description, it is important not to import into a claim limitations that are not a part of the claim. For example, a particular embodiment appearing in the written description may not be read into a claim when the claim language is broader than the embodiment.” *SuperGuide*, 358 F.3d at 875 (citing *Electro Med. Sys. S.A. v. Cooper Life Sci., Inc.*, 34 F.3d 1048, 1054 (Fed.Cir.1994)). Here, as Petitioner argues, and we agree, the term “mapped to groups of symbols” is broader than Patent Owner’s proposed construction of “data that is deliberately mapped to a particular arrangement of symbols that exists

prior to mapping,” because it includes data that is mapped to a particular arrangement of symbols that does not exist prior to mapping, which would be excluded under Patent Owner’s construction. *See* Pet. Reply 5.

Fourth, as Petitioner argues, and we agree, the prosecution history of the ’569 patent does not support Patent Owner’s narrow construction of “mapped to groups of symbols.” *Id.* at 5–7. During prosecution that led to the ’569 patent, when the applicant added claims 22–61, which issued as claims 1–44, Figures 2, 4A–4F, and 6, and the portions of the specification described in footnote 4 *supra*, were cited as written description support. Ex. 1102, 324. However, in an interview with the Examiner about the rejection of claims 22–61 under 35 U.S.C. § 112, first paragraph, for lack of written description, applicant noted that “Figs. 4A–4F and Fig. 5, and the accompanying description in [the] specification,” as described in footnote 5 *supra*, provide support for the “first data,” the “second data,” and “the mapping thereof.” *Id.* at 431, 446–447. Moreover, as Petitioner argues, “[c]ritically, the applicant also stated that ‘[t]he code blocks (mapped as in the above-noted Figs. 4A–4F and Fig. 5), each of which contains a number of symbols, are examples of support for the first and second data and the mapping thereof.’” Pet. Reply 6 (citing Ex. 1102, 447). As Petitioner notes, the Examiner agreed that the written description rejection was overcome and issued a Notice of Allowance. *Id.* at 6–7 (citing Ex. 1102, 431, 447, 456). Thus, we agree with Petitioner that “the prosecution history indicates that the applicant did not discuss Figures 6 or 7 in the interview that overcame the Section 112 rejection.” *Id.* at 7 (citing Ex. 1102, 447).

Fifth, we are not persuaded by Patent Owner’s argument that claims 7 and 27 support the requirement that a group of symbols is defined prior to mapping of data because “a symbol within a group of symbols cannot be skipped when mapping unless the group of symbols is already defined.” PO Resp. 28 (citing Ex. 2003 ¶ 68). Instead, we agree with Petitioner that Patent Owner “fails to provide any support from the intrinsic evidence for its assertion, citing only to conclusory expert testimony,” which is entitled to little or no weight. *See* 37 C.F.R. § 42.65(a).

Thus, for these reasons, we do not adopt Patent Owner’s proposed constructions that “mapped to symbols” means “data is mapped on a symbol-by-symbol basis” and that “mapped to groups of symbols” means “data that is deliberately mapped to a particular arrangement of symbols that exists prior to mapping.” Instead, we determine that the terms “mapped to symbols” and “mapped to groups of symbols” should have their plain and ordinary meanings, wherein “mapped to symbols” does not require mapping data on a symbol-by-symbol basis and “mapped to groups of symbols” does not require deliberate mapping to a particular arrangement of symbols that exists prior to mapping.

2. *“encoded second data is not continuously mapped to each symbol within each of the groups of symbols aligned along the frequency index”*

- a. *The Parties’ Arguments*

This phrase is recited in dependent claims 7 and 27. Patent Owner notes that Petitioner has not proposed any construction for dependent claims 7 and 27, but argues that Petitioner “appears to believe that this language focuses on discontinuity *between* groups of symbols.” PO Resp. 29. In

particular, Patent Owner argues that “Petitioner appears to believe that claims 7 and 27 require that groups of data (as opposed to symbols within groups of data) not be continuous with one another,” and this “construction is at odds with the claim language because it ignores the word ‘within.’” *Id.* at 30. Thus, Patent Owner requests that we confirm that claims 7 and 27 have their plain and ordinary meaning, which requires “that a part of the encoded second data is not continuously mapped to each symbol *within* the groups of symbols aligned along the frequency index.” *Id.*

Petitioner argues that Patent Owner’s argument fails because it does not consider claims 7 and 27 in the context of their respective independent claims 1 and 21. Pet. Reply 8. Petitioner also argues that a person of ordinary skill in the art would recognize that “each symbol within each of the groups of symbols . . . aligned along the frequency index” is recited in both limitation 1[e] and claim 7, and therefore that the term “each symbol within each of the groups of symbols aligned along the frequency index” in claim 7 should refer to the same thing to which limitation [1e] refers, which is all of the groups of symbols in the second part of the domain. *Id.* at 9 (citing Ex. 1108 ¶¶ 118–121). Thus, according to Petitioner, a person of ordinary skill would recognize that “a part of the encoded second data is not continuously mapped” can be “(1) data that has a discontinuity in at least one of the time or frequency indices between two or more groups of symbols (i.e., there is one or more sub-channels or time slots between two or more groups of symbols), or (2) data that has a discontinuity in at least one of the time or frequency indices within a single group of symbols.” *Id.* (citing Ex. 1108 ¶¶ 116–127; Ex. 1120 ¶¶ 47–54). Petitioner further argues that Patent

Owner's narrow construction is limited to *only* the second case, and mischaracterizes [Petitioner's] construction as limited to *only* the first case. *Id.* Moreover, Petitioner argues that, in any event, "the prior art still renders claims 7 and 27 unpatentable even under [Patent Owner's] unduly narrow construction." *Id.* at 10 (citing *id.* § III.C (p. 21–24)).

In addition, Petitioner argues that Figure 4D of the '569 patent supports both Petitioner's and Patent Owner's constructions of claims 7 and 27. *Id.* at 21–22. Figure 4D of the '569 patent is shown below. *Id.* at 22.

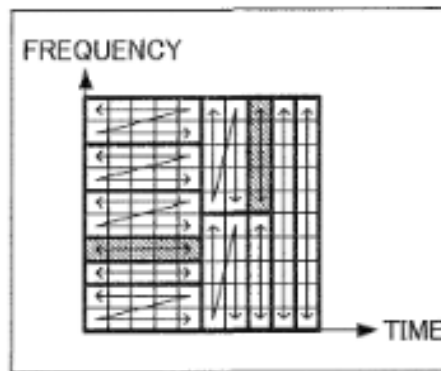


FIG.4D

Figure 4D illustrates an example of one frame of an OFDM signal consisting of a total of 100 symbols in which code blocks vary in number and orientation in the time axis (horizontal) direction and in the frequency axis (vertical) direction. Petitioner argues that, in describing Figure 4D, the '569 patent states: "1 code block is divided and the divided portions are arranged away from each other, that is, 2 code blocks each consisting of 5 symbols are arranged away from each other (see hatching of FIG. 4D)." *Id.* at 21 (citing Ex. 1101, 5:35–39). Petitioner also argues that, in support of the Petition, "Dr. Wells explained that Figure 4D supports claims 7 and 27

under [Petitioner's] construction.” *Id.* (citing Ex. 1108 ¶¶ 116–127, 135–36; *see also* Ex. 1120 ¶¶ 55–56).

In its Surreply, Patent Owner asserts that, for the first time in its Reply, Petitioner argued that “a part of the encoded second data is not continuously mapped” can be interpreted in the two ways set forth above. PO Surreply 13–14. Thus, Patent Owner argues the parties appear to agree that claims 7 and 27 cover “discontinuous mapping of data *within* a single group of symbols,” as does Dr. Wells. *Id.* at 14–15 (citing PO Reply 9; Ex. 1120 ¶ 52; Ex. 2012, 69:5–17).

With respect to the first part of Petitioner's construction, Patent Owner asserts that claims 7 and 27 “exclude[] discontinuity between two groups of symbols” because they recite “at least a part of the encoded second data is not continuously mapped to each symbol *within each* of the groups of symbols aligned along the frequency index,” and Petitioner's construction ignores the words “within each of the groups of symbols.” *Id.* at 15. Patent Owner argues that Petitioner's contention that there is discontinuous mapping “within each of the groups of symbols” in any time-frequency domain in which two groups of symbols are arranged away from each other, so they are not contiguous, is unsupported by Petitioner's annotated version of Figure 4D of the '569 patent. *Id.* at 15–18. In that regard, Patent Owner argues that “neither Petitioner nor Dr. Wells squares this example with the actual language of the claims, which require discontinuous mapping “*within each of the groups of symbols.*”” *Id.* at 18. Patent Owner also argues the claims require that the groups of symbols be “aligned along the frequency index,” but the two “groups” identified by Petitioner are “one-by-five

groupings of symbols that are arranged orthogonally to each other,” and “it is impossible for them to both be aligned along the frequency index.” *Id.* at 18–19.

b. Analysis

Patent Owner requests we confirm that claims 7 and 27 have their plain and ordinary meaning, which is a recitation of the limitation of the claims with the term “within” emphasized. PO Resp. 30. Petitioner argues that the claim limitation is subject to a broader and a narrower interpretation and that, in any event, the claims read on the prior art, even under Patent Owner’s narrow construction. Pet. Reply 9–10 (*see* § II.B.4 *infra*). In view of the parties’ arguments, we determine it is not necessary to expressly construe the phrase “encoded second data is not continuously mapped to each symbol within each of the groups of symbols aligned along the frequency index,” as recited in claims 7 and 27. Although Petitioner argues this limitation is subject to two interpretations, we resolve the dispute *infra* when addressing the parties’ arguments concerning whether Wallace teaches claims 7 and 21.

B. Asserted Obviousness of Claims 1–10, 21–30, 41, and 42 Over Wallace in View of Ishikawa

In its obviousness analysis, Petitioner contends that Wallace teaches or suggests every limitation of claims 1–10, 21–30, 41, and 42, except the limitations reciting mapping data “in an increasing order according to” the frequency index or the time index, which Petitioner contends are disclosed by Ishikawa. Pet. 32–91. Petitioner also contends that a person of ordinary skill would have had multiple reasons to combine Wallace and Ishikawa in the manner set forth in the claims. *Id.* at 32 (citing Ex. 1108 ¶¶ 166, 190–

194, 246, 275). On the other hand, Patent Owner contends that the challenged claims are patentable over Wallace and Ishikawa for three reasons. PO Resp. 31–54. First, Patent Owner argues that claims 1–10 and 21–30 are patentable because Wallace does not disclose mapping to “groups of symbols” as required by independent claims 1 and 21. *Id.* at 31–40. Second, Patent Owner argues that all challenged claims are patentable because Wallace does not disclose a “first part” of a domain and a “second part” of a domain as required by independent claims 1, 21, and 41. *Id.* at 31, 40–44. Third, Patent Owner argues that, if we do not agree with either of its first two arguments, we should determine that claims 7 and 27 are patentable because Wallace fails to disclose data that is not mapped continuously within each group of symbols aligned along the frequency index. *Id.* at 31, 44–54. As discussed below, we conclude Petitioner has demonstrated by a preponderance of the evidence that claims 1–10, 21–30, 41, and 42 would have been obvious over the combination of Wallace and Ishikawa.

1. *Principles of Law*

To prevail in challenging claims 1–10, 21–30, 41, and 42 of the ’569 patent, Petitioner must demonstrate by a preponderance of the evidence that the claims are unpatentable. 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d).

A claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which 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 skill in the art; and (4) when in evidence, objective evidence of nonobviousness, i.e., secondary considerations.⁷ See *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

A patent claim “is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art.” *KSR*, 550 U.S. at 418. An obviousness determination requires finding “both ‘that a skilled artisan would have been motivated to combine the teachings of the prior art references to achieve the claimed invention, and that the skilled artisan would have had a reasonable expectation of success in doing so.’” *Intelligent Bio-Sys., Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1367–68 (Fed. Cir. 2016) (citation omitted); see *KSR*, 550 U.S. at 418 (for an obviousness analysis, “it can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does”). A reason to combine or modify the prior art may be found explicitly or implicitly in market forces, design incentives, the “interrelated teachings of multiple patents,” “any need or problem known in the field of endeavor at the time of invention and addressed by the patent,” and “the background knowledge, creativity, and common sense of the person of ordinary skill.” *Perfect Web Techs., Inc. v. Info-USA, Inc.*, 587 F.3d 1324, 1329 (Fed. Cir. 2009) (quoting *KSR*, 550 U.S. at 418–21). Further, an assertion of obviousness “cannot be sustained

⁷ The record here contains no arguments or evidence related to secondary considerations of nonobviousness of the challenged claims.

by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *KSR*, 550 U.S. at 418 (quoting *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)); see *In re Nuvasive, Inc.*, 842 F.3d 1376, 1383 (Fed. Cir. 2016) (a finding of a motivation to combine “must be supported by a ‘reasoned explanation’” (citation omitted)).

2. *Prior Art*

a. *Wallace*

Wallace is directed to techniques for a communication system to precondition transmissions between transmitter units and receiver units using channel state information (CSI). Ex. 1106, Abstract. Wallace teaches mapping data to symbols and groups of symbols in a time-frequency domain. *Id.* at; 10:27–42, 10:66–11:18, Fig. 2.

Figure 2 of Wallace is reproduced below.

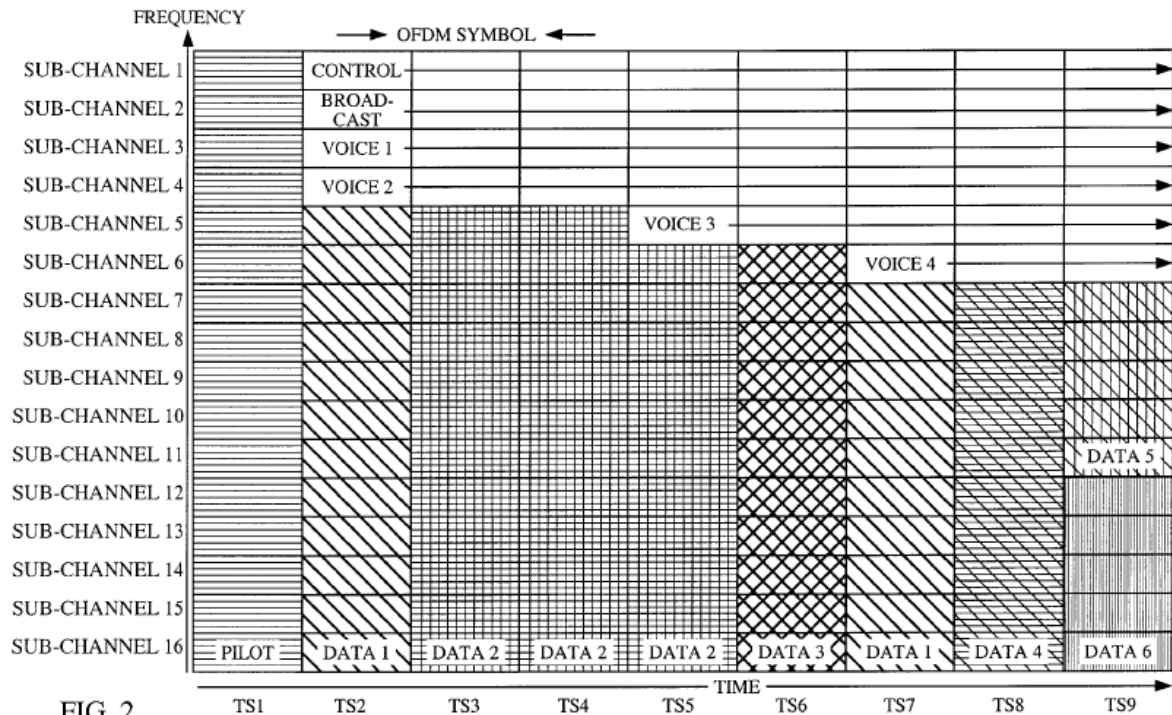


Figure 2 is a diagram illustrating a specific example of a transmission from a transmit antenna at a transmitter unit. *Id.* at 3:12–14. In Figure 2, the horizontal axis is the time index, which covers 9 timeslots—TS1 (an earlier timeslot at the left) through TS9 (a later timeslot at the far right). *Id.* at 10:31–33. The vertical axis is the frequency index covering 16 sub-channels, which are labelled with numbers (SUB-CHANNEL 1 at the top and SUB-CHANNEL 16 at the bottom). *Id.* at 10:33–37. In this example, the transmission channel is used to transmit a sequence of OFDM symbols, with each OFDM symbol covering all 16 sub-channels. *Id.* Figure 2 also illustrates a time-division multiplexing (TDM) structure in which the data transmission is partitioned into timeslots, with each timeslot having the duration of one OFDM symbol. *Id.* at 10:37–42.

Each individual rectangle in Figure 2 represents one modulation symbol in the domain. *Id.* at 12:5–14, 20:10–33. A modulation symbol is distinct and different from an OFDM symbol, which both Wallace and the '569 patent use to refer to the combination of all of the modulation symbols along the frequency index in one timeslot. *See id.* at 10:33–36. Figure 2 shows data in their encoded form. *See id.* at 3:11–13, 19:23–45.

Wallace discloses that the available sub-channels can be used to transmit signaling, voice, traffic data, and other data. *Id.* at 10:43–44. As shown in Figure 2, pilot data use sub-channels 1–16 at timeslot 1. *Id.* at 10:43–48. The control data use sub-channel 1 at timeslots 2–9, and the broadcast data use sub-channel 2 at timeslots 2–9. *Id.* at 10:58–65. Voice data are mapped as follows in Figure 2: voice data 1 use sub-channel 3 at timeslots 2–9, voice data 2 use sub-channel 4 at timeslots 2–9, voice data 3 use sub-channel 5 at timeslots 5–9, and voice data 4 use sub-channel 6 at timeslots 7–9. *Id.* at 10:67–11:5. Traffic data are mapped to the shaded symbols in timeslots 2–9 as follows: data 1 use sub-channels 5–16 at timeslot 2 and sub-channels 7–16 at timeslot 7; data 2 use sub-channels 5–16 at timeslots 3 and 4 and sub-channels 6–16 at timeslot 5; data 3 use sub-channels 6–16 at timeslot 6; data 4 uses sub-channels 7–16 at timeslot 8; data 5 use sub-channels 7–11 at timeslot 9; and, data 6 use sub-channels 12–16 at timeslot 10. *Id.* at 11:6–19.

b. Ishikawa

Ishikawa is directed to a digital transmission system and techniques for arranging data for transmission in the system. Ex. 1107, 1:7–20. In particular, Ishikawa relates to a digital transmission system using Quadrature

Frequency Division Multiplex (QFDM) technology. Ex. 1107, 1:13–20; *see also* Pet. 28.

Figure 5 of Ishikawa is reproduced below, as annotated by Petitioner. *See* Pet. 29.

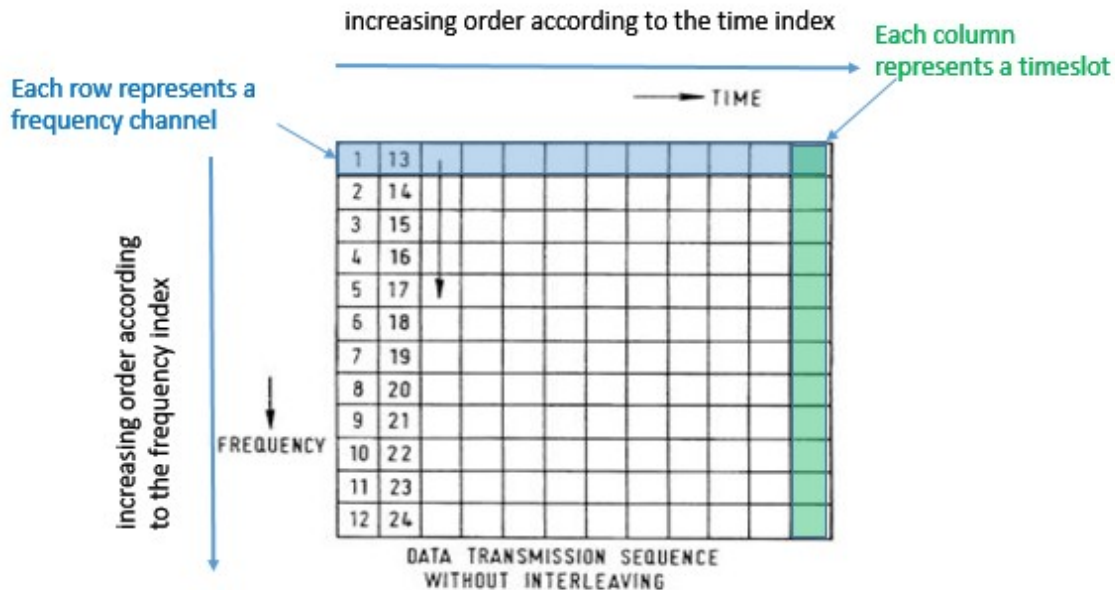


FIG. 5.

Annotated Figure 5 illustrates an exemplary hierarchical QFDM transmission frame prior to any interleaving. Ex. 1107, 6:60–6, 8:53–54. Figure 5 depicts a square frame having 12 columns, each of which represents a timeslot (as indicated in green or the shaded column, with time increasing from left to right, as indicated by the arrows above the Figure), and 12 rows, each representing a frequency channel (as indicated in blue or the shaded row, increasing in order from top to bottom, as indicated by the arrows at the left of the Figure). *See id.* at 7:30–34; Pet. 29. The intersections of the various columns and rows form 144 smaller squares (representing memories) contained within the outer square frame. In Figure 5, information

data are written into memories along the frequency direction (row direction) in a sequential order. Ex. 1107, 8:57–59. As shown in Figure 5, the small squares or data in the first two columns, beginning at the top left of the frame, are numbered sequentially 1–24. According to Petitioner, the mapping of data 1–24 in Figure 5 starts from data 1 through 12, within the frequency index in the first timeslot, and then continues from data 13 through data 24, within the frequency index in the second timeslot. Pet. 28–29 (citing Ex. 1108 ¶ 161).

Figure 6 of Ishikawa is reproduced below, as annotated by Petitioner.
See Pet. 30.

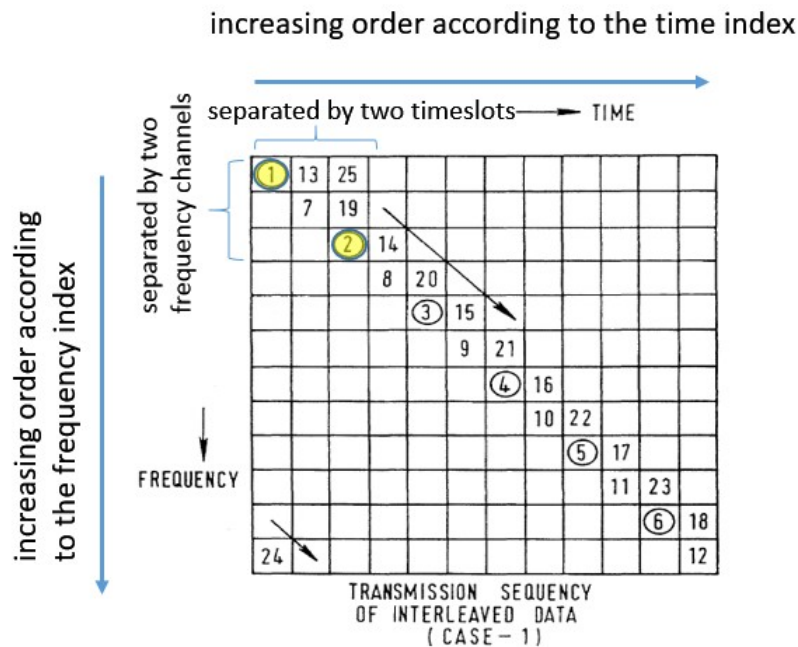


FIG. 6.

Annotated Figure 6 of Ishikawa illustrates an exemplary hierarchical QFDM transmission frame after an interleaving. *See* Ex. 1107, 6:62–63. Ishikawa teaches “interleaving” data along the frequency direction. *Id.* at Figs. 6, 7; 8:64–9:11. Like Figure 5, Figure 6 of Ishikawa depicts 144 small

squares of data within the outer square frame formed by the intersection of 12 columns, each representing a timeslot, and 12 rows, each representing a frequency channel. However, the data squares are numbered diagonally, starting in the upper left corner, from 1 to 6 with two consecutive items of data (e.g., data 1 and 2) separated by two frequency channels and two timeslots (as indicated by the annotations in the upper left portion of Figure 6), so that an interference at one frequency channel is less likely to affect the consecutive and non-adjacent data at the same time. *Id.* at 8:64–9:4. As depicted in Figure 6, sequential mapping progresses as follows:

in an increasing order along the frequency index, from data 1 through 6 in a diagonal line across the time-frequency domain, continues in an increasing order along the frequency index from data 7 through 12 in the same diagonal line, and then continues again in an increasing order along the frequency index from data 13 through 18, and 19 through 23, in another diagonal line.

See Pet. 29 (citing Ex. 1108 ¶ 162–163).

3. *Independent Claims 1, 21, and 41*

In response to Petitioner’s contentions that the combination of Wallace and Ishikawa teaches or suggests all of the limitations of claims 1, 21, and 41, Patent Owner argues that Wallace does not disclose (1) “mapping second data to groups of symbols,” as required in claims 1 and 21 (*see* PO Resp. 31–40) and (2) a “first part of a domain” and a “second part of the domain,” as recited in claims 1, 21, and 41 (*see id.* at 40–44). The terms “first part of a domain,” “second part of the domain,” and “groups of symbols” are recited in limitation 1(b), the “mapping section” limitation of claim 1, as follows (with italics added):

a mapping section configured to map the encoded first data to symbols in a *first part of a domain* comprising a time index and a frequency index, and the encoded second data to *groups of symbols in a second part of the domain*, wherein:

Ex. 1101, 12:40–44. These terms are similarly recited in the “mapping” limitation of claim 21. *See id.* at 14:18–21. The terms “groups of symbols,” and “first part” and “second part” of the domain, are also recited in other limitations of claims 1 and 21. *See id.* at 12:46, 49, 51, 53; 14:23, 26, 28. Claim 41 does not recite the term “groups of symbols,” but does recite the terms “first part of a domain” and “second part of the domain.” *See id.* at 16:5–6, 8, 13–14, 19–20.

Although Patent Owner did not address all of the limitations of claims 1, 21, and 41, Petitioner still bears the burden of demonstrating by a preponderance of the evidence that the claims are unpatentable, including that the combination of Wallace and Ishikawa teaches or suggests each claim limitation. 35 U.S.C. § 316(e). Accordingly, we analyze Petitioner’s contentions as to claims 1, 21, and 41 to determine whether Petitioner has met its burden.

a. Claim 1

(1) Preamble

The preamble⁸ of claim 1 recites “[a] transmission apparatus comprising.” Ex. 1101, 12:37. Petitioner contends that Wallace discloses a “transmission apparatus” because Wallace discloses “one transmitter unit

⁸ For purposes of this Decision, we assume, without deciding, that the preamble of claim 1 is limiting.

(i.e., system 110)” in communications system 100. Pet. 33 (citing Ex. 1106, 4:28–35, Fig. 1A; Ex. 1108 ¶¶ 65–67, 167–169). Petitioner also contends that “Figure 3 of Wallace discloses a ‘transmission apparatus’ because Figure 3 ‘is a block diagram of a data processor and a modulator of the communications system shown in FIG. 1A.’” *Id.* at 34 (citing Ex. 1106, 3:15–16, 19:23–33; Ex. 1108 ¶ 170). Having considered Petitioner’s arguments and evidence set forth in the Petition, we agree with Petitioner’s showing, summarized above, and find that Wallace teaches the preamble of claim 1.

(2) *Limitation 1(a)*

Petitioner contends that Wallace discloses limitation 1(a) reciting “a coding section configured to encode first data and second data.” *Id.* at 35–39 (footnote omitted). In particular, Petitioner contends Figure 3 of Wallace discloses encoder 312 in transmitter unit 110 encodes channel data streams that “may correspond to, for example, a signaling channel, a broadcast channel, a voice call, or a traffic data transmission” (*id.* at 35 (citing Ex. 1106, 19:23–33, Fig. 3)) and, therefore, a person of ordinary skill would understand that encoder 312 is configured to encode data as shown in Figure 2 (*id.* (citing Ex. 1108 ¶ 66–67, 171–173)).

Petitioner asserts that Figure 2 of Wallace is an example of a transmission from a transmitter unit (*id.* at 36 (citing Ex. 1106, 10:30–31)) and, in particular, a graphical illustration of a transmission of OFDM symbols (*id.* (citing *id.* at 3:11–13, 10:28–42)). According to Petitioner, Figure 2 of Wallace discloses “first data” and “second data” in multiple ways (*id.* at 37), and a person of ordinary skill would understand that Figure

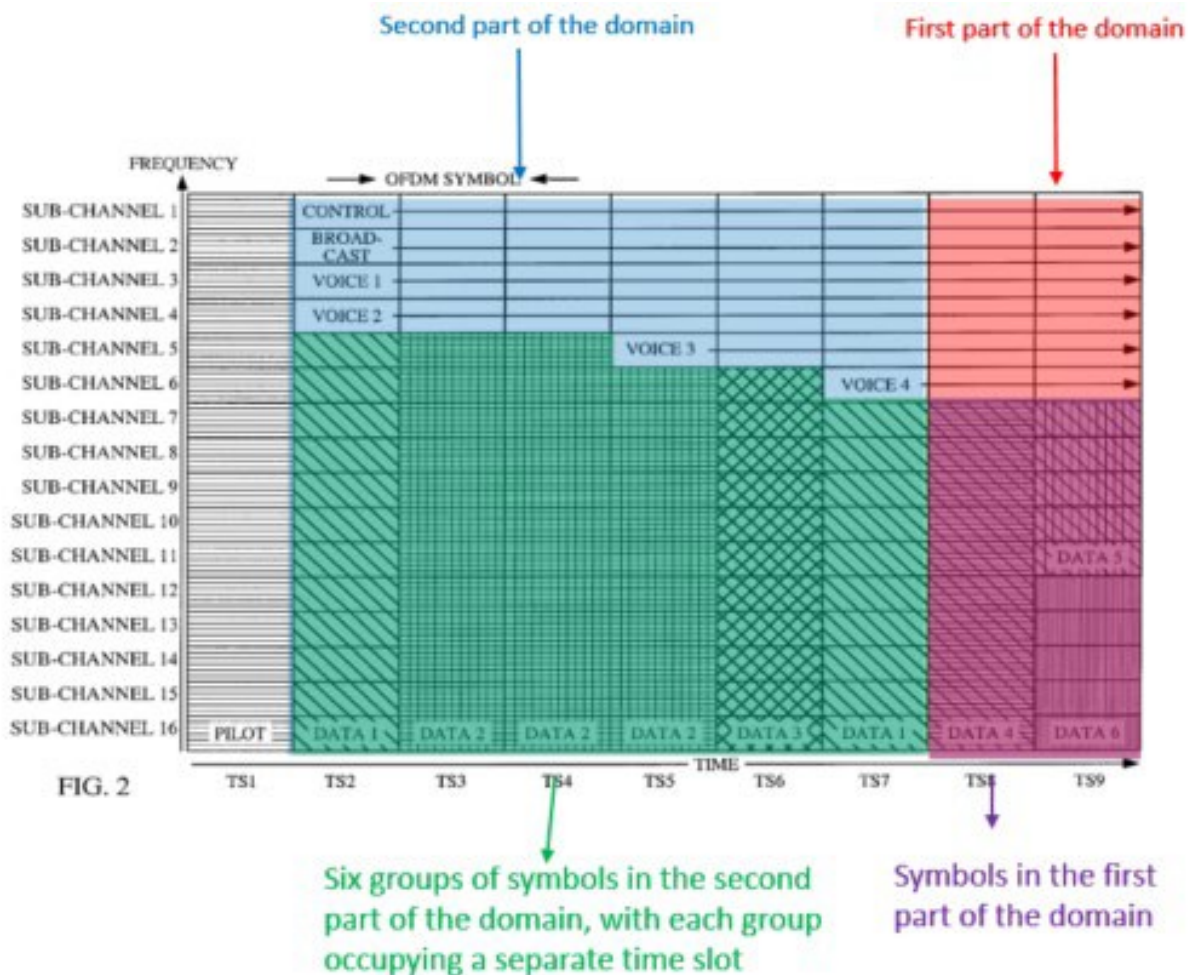
2 shows “data in its encoded form” because Figure 2 shows an example of a transmission (*id.* at n.7 (citing Ex. 1108 ¶¶ 153, 176)). As one example, Petitioner asserts “first data” consist of DATA 4–6, and “second data” consists of DATA 1–3. *Id.* at 37–38 (citing Ex. 1106, 10:66–11:18; Ex. 1108 ¶¶ 71–77, 174, 176). As a second example, Petitioner asserts “first data” consist of DATA 1–3, and “second data” consist of DATA 4–6 (*id.* at 38–39 (citing Ex. 1106, 10:66–11:18; Ex. 1108 ¶¶ 71–77, 174, 177)). Having considered Petitioner’s arguments and evidence set forth in the Petition, we agree with Petitioner’s showing, outlined above, and find that Wallace teaches limitation 1(a).

(3) *Limitation 1(b)*

Regarding limitation 1(b), the “mapping section” limitation as set forth above, Petitioner contends that Wallace discloses a “mapping section” configured to map data to symbols at least because “Figure 6 discloses channel data processors 332A through 332K, combiners 334, and IFFTs 320A through 320T that are configured to map data such as that shown in Figure 2 to symbols.” Pet. 40 (citing Ex. 1106, 20:50–58, 21:15–35, Fig. 6; Ex. 1108 ¶¶ 68–69, 178–180). Petitioner asserts Figure 2 shows a domain that includes a time index, consisting of 9 timeslots (TS1–TS9), and a frequency index, consisting of 16 sub-channels. *Id.* at 41 (citing Ex. 1106, 3:11–13, 10:28–10:42; Ex. 1108 ¶¶ 70, 181).

According to Petitioner, Figure 2 of Wallace discloses mapping “the encoded first data to symbols in a first part of a domain comprising a time index and a frequency index, and the encoded second data to groups of symbols in a second part of the domain” in multiple ways. *Id.* As one

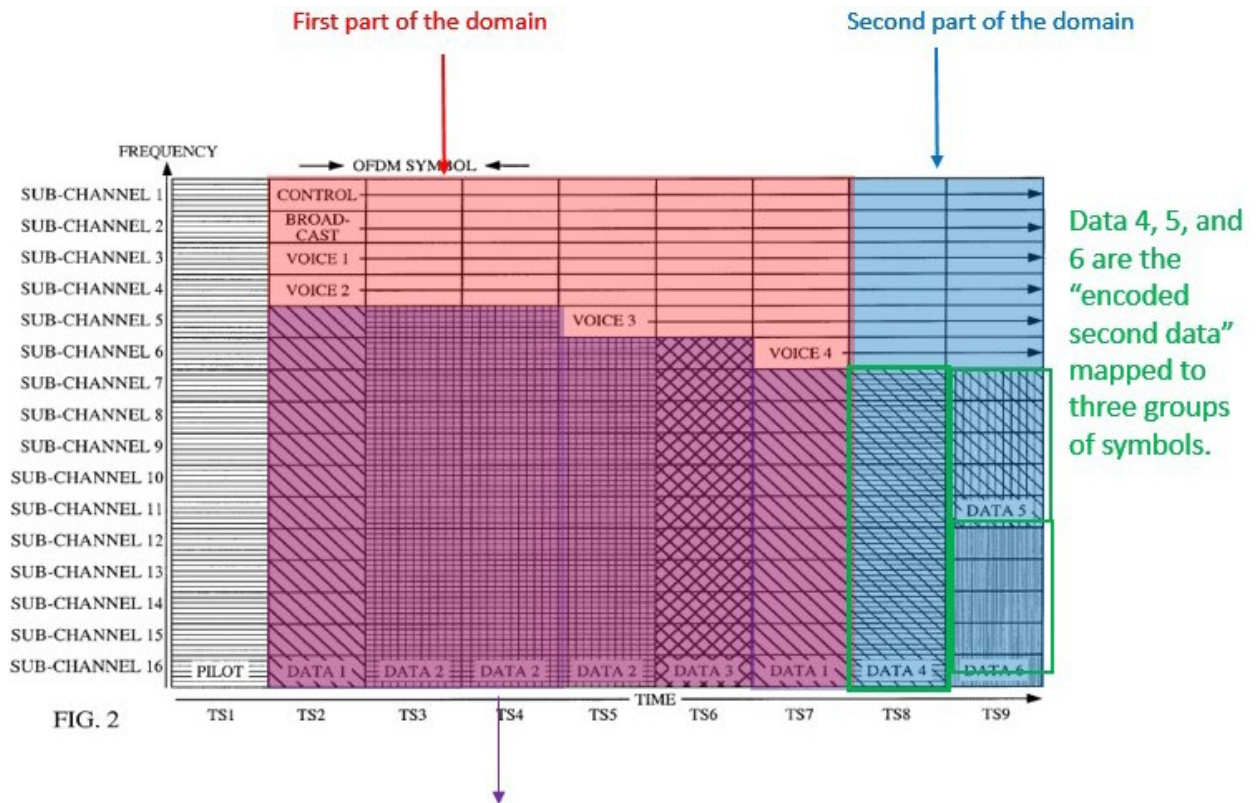
example, Petitioner cites a first version of Figure 2 of Wallace as annotated by Petitioner, which is reproduced below. Pet. 42–43 (“first annotated version” of Figure 2).



As explained above, Figure 2 of Wallace is a diagram illustrating a specific example of a data transmission, in which the horizontal axis is the time index covering 9 time slots, with time slot 1 at the far left and time slot 9 at the far right, and the vertical axis is the frequency index covering 16 sub-channels, with sub-channel 1 at the top and sub-channel 16 at the bottom. Ex. 1106, 3:12–14, 10:30–37. Each individual rectangle in Figure 2

represents one modulation symbol in the domain. *Id.* at 12:5–14. Petitioner contends a “first part of the domain” consists of timeslots 8–9 and sub-channels 1–16 and a “second part of the domain” consists of timeslots 2–7 and sub-channels 1–16. *Id.* at 42 (citing Ex. 1108 ¶¶ 71–77, 182). Petitioner also contends the “encoded first data” consists of DATA 4–6, which are “mapped to symbols” in timeslots 8–9, and “encoded second data” consists of DATA 1–3, which are mapped to six “groups of symbols,” respectively, in timeslots 2–7, with each group occupying a separate timeslot. *Id.* (citing Ex. 1106, 10:66–11:18; Ex. 1108 ¶¶ 71–77, 183).

As a second example, Petitioner contends that these limitations are disclosed in a second version of Figure 2 of Wallace, as annotated by Petitioner, which is reproduced below. *See id.* at 43 (“second annotated version” of Figure 2).



Data 1, 2, 3 is the “encoded first data” and is mapped to symbols in time slots 2-7.

In the second annotated version of Wallace’s Figure 2, Petitioner contends a “first part of the domain” consists of timeslots 2–7 and sub-channels 1–16, and a “second part of the domain” consists of timeslots 8–9 and sub-channels 1–16. *Id.* at 43–44 (citing Ex. 1108 ¶¶ 71–77, 184). Petitioner also contends that “encoded first data” consists of DATA 1–3, which are mapped to symbols in timeslots 2–7, and “encoded second data” consists of DATA 4–6, which are mapped to three “groups of symbols,” respectively in timeslots 8–9. *Id.* (citing Ex. 1106, 10:66–11:18; Ex. 1108 ¶¶ 71–77, 184).

In response, Patent Owner asserts two contentions. First, Patent Owner contends that Wallace does not disclose “mapping second data to

groups of symbols.” PO Resp. 31–40. Second, Patent Owner contends that Wallace does not disclose a “first part of a domain” and a “second part of a domain.” *Id.* at 40–44. We consider each of these contentions in turn.

(a) *“mapping second data to groups of symbols”*

Regarding Patent Owner’s first contention that Wallace does not disclose “mapping second data to groups of symbols,” Patent Owner argues Petitioner’s analysis is arbitrary because it reads Figure 2 of Wallace “in various ways.” PO Resp. 31. In particular, Patent Owner argues Petitioner asserts Figure 2 of Wallace discloses data mapped to groups of symbols “by drawing arbitrary boxes around symbols in Figure 2 and calling those symbols ‘groups,’” where “these divisions of Figure 2 find no support in Wallace.” *Id.* at 31–34. In that regard, Patent Owner also argues Petitioner “has only identified these collections of data as ‘groups’ *after* the data has been mapped” and has not identified anything in Wallace that discloses actually “mapping data to arrangements of symbols that are defined prior to mapping.” *Id.* at 34–35 (citing Ex. 2003 ¶ 80). According to Patent Owner, Petitioner “slices and dices Figure 2 of Wallace in ways that suit its positions with no support in Wallace.” *Id.* at 35. Patent Owner also asserts that Petitioner’s arbitrary analysis extends to other claims, such as dependent claims 6 and 7, with respect to which Petitioner changes its contentions as to what part of the domain is the first part and what is a part of the encoded second data. *Id.* at 35–36.

Patent Owner also argues that Wallace’s actual discussion of Figure 2 “shows that Figure 2 does not disclose data mapped to groups of symbols.” *Id.* at 36–38 (citing Ex. 2003 ¶¶ 84–86). Patent Owner further argues “[t]hat

Figure 2 does not disclose groups of symbols is confirmed by how Wallace actually schedules data for transmission.” *Id.* at 38 (citing Ex. 1106, 19:57–20:9; Ex. 2003 ¶ 87). According to Patent Owner, the cited passage of Wallace (Ex. 1106, 19:57–20:9) “simply discloses a scheduler that dynamically allocates data for transmission based on several factors, including channel conditions and the amount of data that needs to be transmitted.” *Id.* at 39. Thus, Patent Owner argues that Wallace “discloses the dynamic allocation of data from multiple users, of multiple types, and in various amounts to symbols to achieve system goals,” but “does not disclose mapping data to specific arrangements of data to solve the effects of the Doppler effect and multipath fading on SNR variation among symbols, as the ’569 patent does.” *Id.* at 39–40 (citing Ex. 2003 ¶ 88).

We are not persuaded by Patent Owner’s arguments for several reasons. First, Petitioner’s analysis showing that the disputed claim limitations can be read on Figure 2 of Wallace in multiple ways does not demonstrate that the analysis is “arbitrary” or deficient in any respect. Instead, as Petitioner argues, and we agree, “this is no different from the examples set forth in the Petition that demonstrate how Figures 4A–F of the ’569 patent ‘could support the [challenged] claims in multiple ways.’” Pet. Reply 10 (*see e.g.*, Pet. 15 (citing Ex. 1108 ¶¶ 64–82)). As Petitioner also argues, Patent Owner “does not dispute that Figures 4A–F can support the challenged claims in multiple ways, and likewise, *Wallace* can also render the challenged claims unpatentable in multiple ways, as set forth in the Petition.” *Id.* at 10–11. Moreover, we determine that Petitioner’s examples of how the disputed limitations of claim 1 can be read on alternative

characterizations of Figure 2 of Wallace demonstrate the breadth of these limitations, rather than an arbitrary or improper application of these limitations to Wallace.

Second, we disagree with Patent Owner's argument that Petitioner's "arbitrary" analysis extends to other claims, such as claims 6 and 7, because it reads different limitations of these claims on Wallace in different ways. PO Resp. 35–37. As Petitioner argues, and we agree, Patent Owner's argument ignores the differences among the challenged claims and presumes, without citation of any authority, that Petitioner is confined to utilizing the same reading and disclosure of Wallace for multiple challenged claims, such as claims 1, 6, and 7. Pet. Reply 11 (citing *Jones v. Hardy*, 727 F.2d 1524, 1528 (Fed. Cir. 1984) (“[E]ach claim must be considered as defining a separate invention.”)).

Third, we are not persuaded by Patent Owner's argument that Petitioner has not identified anything in Wallace that discloses “mapping data to arrangements of symbols that are defined prior to mapping.” PO Resp. 34–35. Claim 1 does not recite mapping data to groups or arrangements of symbols that are “defined prior to mapping,” nor have we construed “mapped to groups of symbols” to mean data that is mapped to “a particular arrangement of symbols that exists prior to mapping,” as Patent Owner proposed. Thus, Patent Owner's argument fails because it is not commensurate with the scope of claim 1. See *In re Self*, 671 F.2d 1344, 1348 (CCPA 1982) (“[A]ppellant's arguments fail from the outset because . . . they are not based on limitations appearing in the claims.”).

Similarly, we are not persuaded by Patent Owner's argument that Wallace "discloses the dynamic allocation of data from multiple users, of multiple types, and in various amounts to symbols to achieve system goals," but "does not disclose mapping data to specific arrangements of data to solve the effects of the Doppler effect and multipath fading on SNR variation among symbols, as the '569 patent does." PO Resp. 39–40. This argument is not persuasive because it also is not commensurate with the scope of claim 1, which does not recite mapping data "to specific arrangements of data to solve the effects of the Doppler effect and multipath fading on SNR variation among symbols." Moreover, this argument is not persuasive because, as Petitioner argues, and we agree, "neither the challenged claims nor the specification or prosecution history precludes data that is mapped to groups of symbols, from also being mapped to symbols." Pet. Reply 11 (citing *id.* at 7 (citing Ex. 1108 ¶¶ 71–82; Ex. 1120 ¶¶ 18–26)). In that regard, Petitioner further argues, and we agree, although Patent Owner contends there is a distinction between "mapped to symbols" and "mapped to groups of symbols" (*see* PO Resp. 21–28), Patent Owner "fails to cite to any specification disclosure that would support this alleged distinction." *Id.* at 11–12. We also agree with Petitioner that Patent Owner's argument is contradicted by the prosecution history because Figures 4A–4F and 5, which were relied on for written description support for the claims, do not disclose which part of the encoded data mapped on the domain is encoded first data or encoded second data and, therefore, a person of ordinary skill in the art would have understood that data that is mapped to

“groups of symbols” could also meet the “encoded first data” limitation or the “encoded second data” limitation.” *Id.* at 12 (citing Ex. 1120 ¶¶ 22–26).

In Petitioner’s Reply, Petitioner contends that, although the claims do not require “arrangements of symbols that are defined prior to mapping,” as Patent Owner proposes in its construction of “mapped to groups of symbols,” Wallace nevertheless “suggests this feature” and, therefore, the challenged claims remain unpatentable even under Patent Owner’s narrow construction. Pet. Reply 14–18. Petitioner contends that Wallace suggests this feature for four reasons. *Id.*

In Patent Owner’s Surreply, Patent Owner argues that “Petitioner is wrong on all fronts.” PO Surreply 9. For the reasons discussed below, we agree with Petitioner that Wallace suggests “arrangements of symbols that are defined prior to mapping” for the first, third, and fourth reasons argued by Petitioner.⁹

First and Fourth Reasons

Petitioner’s first and fourth reasons are related and will, therefore, be discussed together. For its first reason, Petitioner contends that Wallace teaches mapping data to groups of symbols in pre-configured parts of the domain in Figure 2, like Figures 4A–4F and 5 of the ’569 patent, which

⁹ As its second reason, Petitioner contends “Wallace teaches that the transmitter can ‘precondition’ signals based on channel state information provided by the receiver, which suggests that groups are defined based on channel conditions before mapping takes place.” Pet. Reply 16. However, we are not persuaded that the disclosure of preconditioning signals reasonably suggests that groups or arrangements of symbols are defined prior to mapping.

suggests that Wallace maps data to arrangements of symbols that are defined prior to mapping. Pet. Reply 14–16. In support of this reason, Petitioner argues Wallace teaches mapping data to groups of symbols in pre-configured parts of the domain in Figure 2, like Figures 4A–4F and 5 of the ’569 patent, which suggests that Wallace maps data to arrangements of symbols that are defined prior to mapping. *Id.* at 14–15 (citing Ex. 1120 ¶¶ 28–31). In particular, Petitioner argues, “to the extent Figures 4A–4F and 5 of the ’569 [p]atent suggest that arrangements of symbols are defined prior to mapping (as acknowledged by [Patent Owner’s] expert), Figure 2 of Wallace also suggests that arrangements of symbols are defined prior to mapping.” *Id.* at 14 (citing Ex. 1121, 67:11–68:13, 82:15–21 (“Dr. Womack admitting that the structures of code blocks in Figures 4A–4F and 5 of the ’569 [p]atent suggest pre-formed groups of symbols”)). In Patent Owner’s Surreply, this argument is not addressed or disputed. *See* PO Surreply 8–12.

Petitioner also argues that, as shown in Figure 2, (1) pilot data is mapped to symbols in time slot 1 (*see* Ex. 1106, 10:43–48), (2) control and broadcast data are reserved for designated sub-channels 1–2 (*see id.* at 10:59–61, 12:26–31), (3) voice data and traffic data are mapped differently based on their different characteristics (*see id.* at 5:5–23), (4) a voice call may be assigned to a particular sub-channel (*see id.* at 12:22–31, 60–63), and (5) the remaining sub-channels and time slots are used for traffic data (*see id.* at 11:6–18). Pet. Reply 15–16. Thus, Petitioner argues a person of ordinary skill in the art would understand that Wallace maps data to arrangements of symbols that are defined prior to mapping because (1) the transmitter would need to define each group before mapping it and (2)

Wallace's mapping to structured groups is similar to the structured code blocks in Figures 4A-4F and 5 of the '569 patent. *Id.* at 16.

In response, Patent Owner states "Petitioner is correct that Figure 2 discloses mapping pilot data, control data, broadcast data, voice data, and traffic data to different places in the time-frequency domain. But this does not mean that Wallace maps this data to pre-defined arrangements of symbols. Indeed, nothing in Wallace explains how the mapping in Figure 2 came to be." PO Surreply 9.

For its fourth reason, Petitioner contends that because data can be transmitted to one or more receiver units, a transmitter would need to determine which data transmission goes to which receiver and group the data to be transmitted to each receiver, before mapping takes place. Pet. Reply 17–18. Petitioner argues that, because data 1 to data 6 in Wallace's Figure 2 can represent transmissions to up to six different receivers, the transmitter would need to determine which data transmission goes to which receiver and group the data to be transmitted to each receiver, before mapping takes place. *Id.* (citing Ex. 1106, 11:16–18; Ex. 1120 ¶ 36). Patent Owner, on the other hand, argues that, although Petitioner is correct that data 1 through data 6 in Figure 2 of Wallace can be intended for different receivers, "nothing in Figure 2 says that the transmitter would need to group the symbols to which data is mapped before mapping. Indeed, Petitioner's expert, Dr. Wells, did not even state as much in his declaration." PO Surreply 10 (emphasis omitted) (citing Ex. 1120 ¶ 36).

We are persuaded by Petitioner's arguments. Regarding Petitioner's first reason, Patent Owner acknowledges that Wallace discloses mapping

pilot data, control data, broadcast data, voice data, and traffic data to different places in the time-frequency domain. We agree with Patent Owner that Wallace does not expressly describe how the mapping in Figure 2 came to be. However, we agree with Petitioner that Figure 2 would have suggested to a person of ordinary skill in the art that Wallace maps data to arrangements of symbols that are defined prior to mapping because, as Petitioner argues, “(1) the transmitter in Wallace would need to define each group before mapping it to a preconfigured, distinct part of the domain, and (2) Wallace’s mapping data to regular, structured groups of symbols in Figure 2 is similar to the ’569 patent’s mapping of data to regular, structured code blocks in Figures 4A–4F and 5.” Pet. Reply 16 (citing Ex. 1120 ¶¶ 28–31; Ex. 2009, 20:17–23:19, 23:20–24:17); see *Merck & Co. v. Biocraft Labs., Inc.*, 874 F.2d 804, 807–08 (Fed. Cir. 1989) (“[T]he question under 35 [U.S.C. §] 103 is not merely what the references expressly teach but what they would have suggested to one of ordinary skill in the art at the time the invention was made.” (citation omitted)).

With respect to Petitioner’s fourth reason, we agree with Patent Owner that Figure 2 of Wallace does not expressly say that the transmitter would need to group the symbols to which data is mapped before mapping. However, we agree with Petitioner that, for data being transmitted to more than one receiver, Figure 2 suggests the transmitter would need to determine which data transmission goes to which receiver and group the data to be transmitted to each receiver, before mapping takes place. See Pet. Reply 17–18. Although Patent Owner argues that Dr. Wells “did not even state as much in his declaration” (PO Surreply 10 (citing Ex. 1120 ¶ 36)), we

determine that Dr. Wells’s testimony supports Petitioner’s argument because he testified that “it would be natural and convenient to define a distinct group of symbols that will be transmitted to a particular receiver before mapping of the group takes place,” which we determine suggests mapping data to arrangements of symbols that are defined prior to mapping.

Third Reason

For its third reason, Petitioner contends that Wallace’s teaching on temporal diversity—transmitting the data over different time slots—“strongly suggests that data is mapped to groups of symbols that are defined prior to mapping.” Pet. Reply 17. In this regard, Petitioner argues Wallace teaches “a user can be assigned one sub-channel for each time slot or, equivalently, four sub-channels every fourth time slot” or that data can be “aggregated and transmitted at designated time slot(s) for improved efficiency.” *Id.* (citing Ex. 1106, 12:41–48). Petitioner also argues “[t]his suggests that groups are defined prior to mapping based on designated time slots and sub-channels assigned to a particular user.” *Id.* (citing Ex. 1120 ¶¶ 33–34). Petitioner further argues Wallace teaches “data 1 transmission at time slot 7 is a portion (e.g., new or repeated) of the data 1 transmission at time slot 2.” *Id.* (citing Ex. 1106, 11:55–57). According to Petitioner, this “suggests that the two groups of DATA 1 symbols (shown in Figure 2) are defined prior to the mapping of DATA 1, because the transmitter would need to deliberately determine whether to repeat the DATA 1 transmission in time slot 2, and in which time slot to repeat it. Such a determination needs to be made before mapping takes place.” *Id.* (citing Ex. 1120 ¶ 35; Ex. 2009, 25:6–26:19).

In Patent Owner's Surreply, Patent Owner acknowledges that Wallace teaches temporal diversity, as asserted by Petitioner, including by transmitting data over multiple time slots. PO Surreply 11–12 (citing Ex. 1106, 6:10–12, 11:54–57, 12:41–46). Patent Owner argues, however, that although Wallace's disclosure of temporal diversity relates to assigning time slots or sub-channels to particular users or data, "it does not disclose arranging code blocks or groups of symbols in time-frequency domain before data is mapped." *Id.* at 12. Patent Owner further argues that "despite Dr. Well's conclusory say-so, there is no apparent reason that achieving temporal diversity would require defining groups of symbols before mapping data." *Id.*

We are persuaded by Petitioner's arguments with respect to the third reason. In particular, in regard to Wallace's disclosure of obtaining temporal diversity by transmitting data over multiple time slots, Wallace states that as shown in Figure 2, "data 1 transmission at time slot 7 is a portion (e.g., new or repeated) of the data 1 transmission at time slot 2." Ex. 1106, 11:55–57. Dr. Wells testifies that to perform this teaching, "Wallace has to determine in advance whether to repeat a particular transmission (e.g., data 1 transmission in time slot 2), and where to repeat it (e.g., data 1 transmission in time slot 7). In other words, the two groups of data 1 symbols need to be defined before mapping takes place." Ex. 1120 ¶ 35. Thus, we determine that, at least in this particular instance of temporal diversity, contrary to Patent Owner's argument, Petitioner has shown that there is a valid reason for defining two groups of data 1 symbols before mapping data. Accordingly, we also determine that Wallace's teaching of transmitting data

1 over different time slots suggests to a person of ordinary skill in that art that data would have been mapped to groups of symbols that are defined prior to mapping as Patent Owner's proposed construction of "mapped to groups of symbols" would require.

(b) *"first part" and "second part" of a domain*

Patent Owner also contends that Wallace does not disclose a "first part of a domain" and "a second part of a domain," as required by independent claims 1, 21, and 41. PO Resp. 40. In particular, Patent Owner argues that Petitioner again purports to find these features in Figure 2 of Wallace by drawing "arbitrary" boxes around symbols in Figure 2, but these divisions are "Petitioner's after-the-fact creations with no support in Wallace's disclosure." *Id.*

According to Patent Owner, each independent claim requires a first part of a domain and a second part of a domain, and "data is mapped in different ways depending on the part of the domain it is mapped to." *Id.* Patent Owner argues that, for claim 1, Petitioner describes two ways in which Figure 2 of Wallace discloses a first part of a domain and a second part of a domain, as shown in Petitioner's first and second annotated versions of Figure 2. *Id.* at 41–42. Patent Owner also argues that, for claim 41,¹⁰ "Petitioner finds yet another way in which Wallace discloses a first part of a domain and a second part of a domain." *Id.* at 42–43 (citing Pet. 82; Ex. 2003 ¶¶ 93–94). Patent Owner further argues that Petitioner "cites

¹⁰ We believe Patent Owner mistakenly refers to claim 43, instead of claim 41. See PO Resp. 42.

nothing in Wallace showing that the disclosed time-frequency domain is separated into different parts.” *Id.* at 43. Instead, according to Patent Owner, Wallace discloses exactly what unannotated Figure 2 shows—“a single time-frequency domain that is not divided into first and second parts.” *Id.* Moreover, Patent Owner argues that Petitioner’s “slicing-and-dicing of Figure 2 is arbitrary and finds no support in Wallace.” *Id.* at 43–44.

In Patent Owner’s Surreply, Patent Owner argues Petitioner incorrectly argues that the ’569 patent “does not require that the time-frequency domain be divided or separated into different parts.” PO Surreply 12 (citing Pet. Reply 18–20). According to Patent Owner, claims 1, 21, and 41 “clearly require that the time-frequency domain be separated into two different parts based on how data is mapped in those parts.” *Id.* at 12–13. In regard to Wallace, Patent Owner argues it discloses “a single, undivided time-frequency domain” and “[n]othing in Wallace discloses that data is mapped differently in different parts of the domain.” *Id.* at 13. In response to Petitioner’s argument that its analysis is not arbitrary because Wallace discloses two parts of the domain in multiple ways, Patent Owner argues the problem is Petitioner’s ability to slice and dice Wallace in any way it chooses, including arguing that “the exact same portion of the time-frequency domain can be both the first part of the domain and the second part of the domain.” *Id.* (citing PO Resp. 41–42).

We are not persuaded by Patent Owner’s arguments that Wallace does not disclose a “first part of a domain” and “a second part of a domain,” for several reasons. First, contrary to Patent Owner’s arguments, we agree with Petitioner that the claimed “time-frequency domain” is not required to be

“separated into different parts” or “divided” into two parts. Pet. Reply 18. Instead, claims 1 and 21 simply require “symbols in a first part of a domain” and “groups of symbols in a second part of the domain.” Ex. 1101, 12:41, 43, 46, 49–50; 14:18–21, 23, 26–27. As Petitioner argues, and we agree, “[t]his is precisely what Wallace discloses, as set forth in the Petition.” Pet. Reply 18 (emphasis omitted) (citing Pet. 38–40; Ex. 1120 ¶¶ 38–46). As the parties’ acknowledge, claim 41, on the other hand, does not require “groups of symbols,” but instead requires that “at least a part of the encoded first data and at least a part of the encoded second data are mapped to symbols along the frequency indices of the first part of the domain and the second part of the domain, respectively.” Ex. 1101, 16:11–14. Thus, like claims 1 and 21, the domain in claim 41 is not required to be separated or divided into different parts, but is simply required to have “symbols in a first part” and “symbols in a second part.” See *id.* at 16:5–6.

Second, in response to Patent Owner’s argument that Wallace discloses “a single time-frequency domain that is not divided into first and second parts” (see PO Resp. 43), Petitioner argues, and we agree, that this confirms the applicability and relevance of Wallace to the challenged claims “because the challenged claims require . . . ‘a domain comprising a time index and a frequency index.’” Pet. Reply 19 (citing Ex. 1101, claim 1). Petitioner further argues, and we agree, “none of the challenged claims preclude ‘a single time-frequency domain that is not divided into first and second parts.’” *Id.*

Third, we are not persuaded by Patent Owner’s arguments that claims 1, 21, and 41 “clearly require that the time-frequency domain be separated

into two different parts based on *how data is mapped* in those parts.” PO Surreply 12–13 (emphasis added); *see also* PO Resp. 41. Petitioner argues that the only feature that distinguishes a first part of a domain from a second part of a domain in claims 1 and 21 is “the respective mapping of data to symbols (first part) and groups of symbols (second part).” Pet. Reply 19. As discussed *supra*, the claims do not specify the manner in which or “how” data are mapped. Instead, as Petitioner argues, and we agree, the distinguishing feature, as set forth in the claims, is “where” data are mapped to, rather than how data are mapped. As discussed, claims 1 and 21 require that “at least a part of the encoded first data is mapped to at least a part of the *symbols* in the first part of the domain in an increasing order according to the frequency index” and that “at least a part of the encoded second data is mapped to at least a part of the *groups of symbols* in the second part of the domain.” *Id.* (citing Ex. 1101, claim 1 and 21) (emphasis added). As discussed, claim 41 does not require mapping data to groups of symbols, but requires that “part of the encoded first data” and “part of the encoded second data” are mapped to the first part of the domain and the second part of the domain, respectively, in an increasing order according to the frequency index, based on a predetermined number of symbols; claim 41 also requires that “the predetermined number of symbols for the encoded first data and the encoded second data is different.” *Id.* at 20 (citing Ex. 1101, claim 41). Thus, claim 41 also does not require that the time-frequency domain be separated into two different parts based on how data is mapped in those parts, as Patent Owner argues, because claim 41 specifies

that data are mapped to “symbols” in both the first part and second part of the domain, which differ in the predetermined number of symbols. *Id.*

Fourth, we do not agree that Petitioner’s contentions regarding the two parts of the domain in claims 1, 21, and 41 are “arbitrary,” as Patent Owner asserts. *See* PO Resp. 43–44; PO Surreply 13. Petitioner argues, and we agree, that Patent Owner “does not dispute that Figures 4A–F can support the challenged claims in multiple ways, and accordingly it cannot dispute that Wallace can also render the challenged claims unpatentable in multiple ways, as set forth in the Petition.” Pet. Reply 19. As discussed *supra*, we determine that Petitioner’s examples of how the limitations “first part of the domain” and “second part of the domain” of claims 1, 21, and 41 can be read on alternative characterizations of Figure 2 of Wallace demonstrate the breadth of these limitations.

Finally, Petitioner argues, and we agree, the applicant of the ’569 patent cited Figures 4A–4F and Figure 5 as support for the claims and those figures do not depict a time-frequency domain that is “divided” or “separated” into two parts, “nor do they otherwise designate a certain part of a domain as the first or second part.” Pet. Reply 20 (citing PO Resp. 43; Ex. 1121, 32:16–33:16 (“Dr. Womack conceding that none of the patent figures explicitly point out a first part or a second part of the domain.”)). Petitioner further argues, and we agree, that Patent Owner’s “arguments fail because they do not provide any specification support for a ‘divided’ or ‘separated’ domain, or any analysis as to why such alleged disclosure must be read into the claims.” *Id.*

Thus, for these reasons, including our determinations above that Wallace discloses “mapping second data to groups of symbols,” and a “first part” and “second part” of a time-frequency domain, and for the reasons set forth in the Petition, we determine Petitioner has shown by a preponderance of the evidence that Figure 2 of Wallace teaches or suggests the disputed features of limitation 1(b)—mapping the encoded first data to symbols in “a first part of a domain . . . and encoded second data to groups of symbols in a second part of the domain.”¹¹ See Pet. 40–44. In that regard, Petitioner has shown by a preponderance of the evidence that the first annotated version of Figure 2 of Wallace teaches or suggests encoded second data which are mapped to “groups of symbols” or “more than one arrangement of symbols” because encoded second data, DATA 1–3, are mapped to six “groups” or “arrangements” of symbols that are in timeslots 2–7, with each group occupying a separate timeslot. Pet. 42 (citing Ex. 1106, 10:66–11:18; Ex. 1108 ¶¶ 71–77, 183). Petitioner has also demonstrated by a preponderance of the evidence that this first annotated version of Figure 2 teaches or suggests a “first part of the domain,” consisting of the symbols in timeslots 8–9 and sub-channels 1–16, and a “second part of the domain” consisting of the six groups of symbols in timeslots 2–7 and sub-channels 1–16. *Id.* (citing Ex. 1108 ¶¶ 70–71, 182).

¹¹ Although the analysis in this section relates specifically to limitation 1(b), the analysis showing that Figure 2 of Wallace teaches or suggests “a first part of a domain” and “a second part of the domain” also applies to the corresponding limitations of claims 21 and 41.

Petitioner has also shown by a preponderance of the evidence that the second annotated version of Figure 2 of Wallace teaches or suggests encoded second data which is mapped to “groups of symbols” or “more than one arrangement of symbols” because encoded second data, DATA 4–6, are mapped to three “groups” or “arrangements” of symbols that are in timeslots 8–9. Pet. at 43 (citing Ex. 1106, 1066–11:18; Ex. 1108 ¶¶ 71–77, 184).

Petitioner has also shown by a preponderance of the evidence that this second annotated version of Figure 2 teaches or suggests “a first part” of the domain, consisting of timeslots 2–7 and sub-channels 1–16, and “a second part” of the domain, consisting of timeslots 8–9 and sub-channels 1–16. *Id.* (citing Ex. 1108 ¶¶ 71–77, 184).

(4) *Limitation 1(c)*

Petitioner contends that the combination of Wallace and Ishikawa discloses limitation 1(c), which recites “at least a part of the encoded first data is mapped to at least a part of the symbols in the first part of the domain in an increasing order according to the frequency index.” See Pet. 44–48. Petitioner argues that, as one example, the first annotated version of Figure 2 of Wallace discloses that the encoded first data consist of DATA 4–6, which is mapped to symbols in timeslots 8 and 9 (TS8 and TS9) in the first part of the domain, and DATA 4, which is “at least a part of the encoded first data,” is mapped to symbols in timeslot 8 (TS8), which is “at least part of the symbols” in the first part of the domain. *Id.* at 44 (citing Ex. 1108 ¶¶ 71–75, 186). Petitioner also asserts that Ishikawa discloses that “information data is written into memories [first] along the frequency direction (row direction) in a sequential order” and then along the time direction (column direction) in a

sequential order.” *Id.* at 46–48 (citing Ex. 1107, Figs. 5–7; 8:53–58; 8:64–9:11; Ex. 1108 ¶¶ 188–189).

Further in regard to Ishikawa, Petitioner contends a person of ordinary skill in the art would have been motivated to combine Ishikawa with Wallace for several reasons. Pet. 48–51. For example, Petitioner asserts Wallace suggests mapping data to symbols along the frequency index and time index to achieve frequency and temporal diversity, thereby improving error correction (*see id.* at 49 (citing Ex. 1106, 7:34–38; Ex. 1108 ¶ 192)), and Ishikawa explicitly teaches multiple ways of mapping data to symbols “along the frequency direction (row direction) in a sequential [increasing] order” (*id.* at 50 (citing Ex. 1107, Figs. 5–7; 8:53–9:11) (brackets in original)). According to Petitioner, a person of ordinary skill would have recognized certain advantages and benefits of this combination of Wallace and Ishikawa. *Id.* (citing Ex. 1108 ¶ 192). In particular, Petitioner asserts that mapping data to symbols in an increasing order according to the frequency index, as taught in Ishikawa, “would have provided a more robust manner of transmitting and receiving.” *Id.* at 51 (citing Ex. 1108 ¶ 193).

According to Petitioner, the combination of Wallace and Ishikawa would have been within the capabilities of a person of ordinary skill who would have had a reasonable expectation of success in applying a known technique (disclosed in Ishikawa) to a known device (disclosed in Wallace) ready for improvement to yield predictable results. *Id.* (citing *KSR*, 550 U.S. at 401; Ex. 1108 ¶ 194).

Patent Owner does not specifically address Petitioner’s contentions regarding the combined teachings of Wallace and Ishikawa in regard to

limitation 1(c). *See generally* PO Resp. Based on Petitioner’s arguments and evidence in the Petition, with which we agree, we determine Petitioner has shown by a preponderance of the evidence that the combination of Wallace and Ishikawa teaches limitation 1(c). We also agree with Petitioner’s arguments and evidence supporting its proposed motivation to combine, summarized above, and determine that Petitioner has shown by a preponderance of the evidence that a person of ordinary skill in the art would have been motivated to combine Wallace and Ishikawa in the manner set forth in limitation 1(c) and would have had a reasonable expectation of success in doing so.

(5) *Limitation 1(d)*

Limitation 1(d) recites “at least a part of the encoded second data is mapped to at least a part of the groups of symbols in the second part of the domain and each group of the at least a part of the groups of symbols is aligned in an increasing order according to the time index.” Ex. 1101, 12:48–52. Petitioner contends that Wallace discloses limitation 1(d) in multiple ways. Pet. 51. As one example, shown in the first annotated version of Figure 2 of Wallace (*see* Pet. 52), Petitioner asserts “a first part” of the domain occupies timeslots 8–9 and sub-channels 1–16, and “a second part” of the domain occupies timeslots 2–7 and sub-channels 1–16. *Id.* at 51–52. Petitioner also asserts that at least a part of the encoded second data, which includes DATA 1, is mapped to two groups of symbols in the second part of the domain: a first group of symbols is in timeslot 2 and sub-channels 5–16, and a second group of symbols is in timeslot 7 and sub-channels 7–16. *Id.* at 52 (citing Ex. 1106, 10:66-11:18; Ex. 1108 ¶¶ 71–77,

197). Petitioner further asserts that the two groups of DATA 1 symbols are “aligned in an increasing order according to the time index” because the first group of DATA 1 symbols is in timeslot 2, and the second group of DATA 1 symbols is in timeslot 7. *Id.* According to Petitioner, “[t]he order of the timeslot 7 for the second group of DATA 1 symbols thus increases numerically and chronologically relative to timeslot 2 for the first group of DATA 1 symbols.” *Id.* at 52–53 (citing Ex. 1108 ¶¶ 71–77, 197–198). Patent Owner does not specifically address limitation 1(d). *See generally* PO Resp. In view of our determinations above that Wallace discloses “mapping second data to groups of symbols,” and a “first part” and “second part” of a time-frequency domain, and Petitioner’s persuasive arguments and evidence set forth in the Petition, we determine Petitioner has shown by a preponderance of the evidence that Wallace teaches limitation 1(d).

(6) *Limitation 1(e)*

Petitioner contends Wallace discloses, in multiple ways, “each symbol within each of the groups of symbols is aligned along the frequency index,” as recited in limitation 1(e). Pet. 54–56. For example, Petitioner asserts that the annotated version of Figure 2 at page 55 of the Petition discloses that the encoded second data consist of DATA 1–3, which are mapped to the six groups of symbols in timeslots 2–7. *Id.* at 54. According to Petitioner, each symbol in each of these six groups of symbols is aligned along the frequency index “because i) each symbol in each of the two groups in timeslot 2–4 is arranged in twelve positions (sub-channel 5 to sub-channel 16), along the frequency index, ii) each symbol in each of the two groups in timeslots 5–6 is arranged in 11 positions (sub-channel 6 to sub-channel 16), along the

frequency index, and iii) each symbol in the group of symbols in timeslot 7 is arranged in 10 positions (sub-channel 7 to sub-channel 16), along the frequency index.” *Id.* at 54–55 (citing Ex. 1108 ¶¶ 78–79, 201–202, 204). Patent Owner does not specifically address limitation 1(e). *See generally* PO Resp. Having considered Petitioner’s arguments and evidence, we agree with Petitioner’s showing, summarized above, and determine that Petitioner has shown by a preponderance of the evidence that Wallace teaches limitation 1(e).

Thus, for the reasons given above, we determine that Petitioner has shown by a preponderance of the evidence that the combination of Wallace and Ishikawa teaches or suggests limitations 1(a)–(e) and that a person of ordinary skill in the art would have been motivated to combine these references to achieve the claimed invention and would have had a reasonable expectation of success in doing so. Accordingly, we determine that Petitioner has demonstrated by a preponderance of the evidence that claim 1 would have been obvious in view of Wallace and Ishikawa.

b. Claim 21

Petitioner contends that the combination of Wallace and Ishikawa discloses all of the limitations of claim 21 for the same reasons set forth with respect to the limitations of claim 1. Pet. 77–78. Patent Owner’s Response does not contain arguments expressly directed to claim 21, except as discussed *supra*, Patent Owner’s arguments regarding claim 1 that Wallace does not disclose “mapping second data to groups of symbols,” and a “first part” and “second part” of a time-frequency domain also apply to claim 21. *See* PO Resp. 31–44. We note that the limitations of claim 21 are

substantially similar to those of claim 1. *See* Ex. 1101, 14:16–31. Thus, for the reasons discussed above with respect to the limitations of claim 1, including our determinations that Wallace teaches or suggests “mapping second data to groups of symbols,” and a “first part” and “second part” of a time-frequency domain, we determine Petitioner has shown by a preponderance of the evidence that the combination of Wallace and Ishikawa teaches or suggests limitations 21(a)–(e) and that a person of ordinary skill in the art would have been motivated to combine these references to achieve the claimed invention and would have had a reasonable expectation of success in doing so. Accordingly, we determine Petitioner has demonstrated by a preponderance of the evidence that claim 21 would have been obvious in view of Wallace and Ishikawa.

c. Claim 41

Petitioner contends that the combination of Wallace and Ishikawa discloses all of the limitations of claim 41 and that a person of ordinary skill would have had multiple reasons to combine Wallace and Ishikawa to reach the apparatus recited in claim 41. Pet. 81–90. Patent Owner’s Response does not contain arguments expressly directed to claim 41, except, as discussed *supra*, Patent Owner’s arguments regarding whether Wallace teaches a “first part” and “second part” of a time-frequency domain with respect to claims 1 and 21 also apply to claim 41. *See* PO Resp. 40–44. Because the preamble¹² of claim 41 and limitation 41(a) are the same as the preamble of claim 1 and limitation 1(a), respectively, we determine that

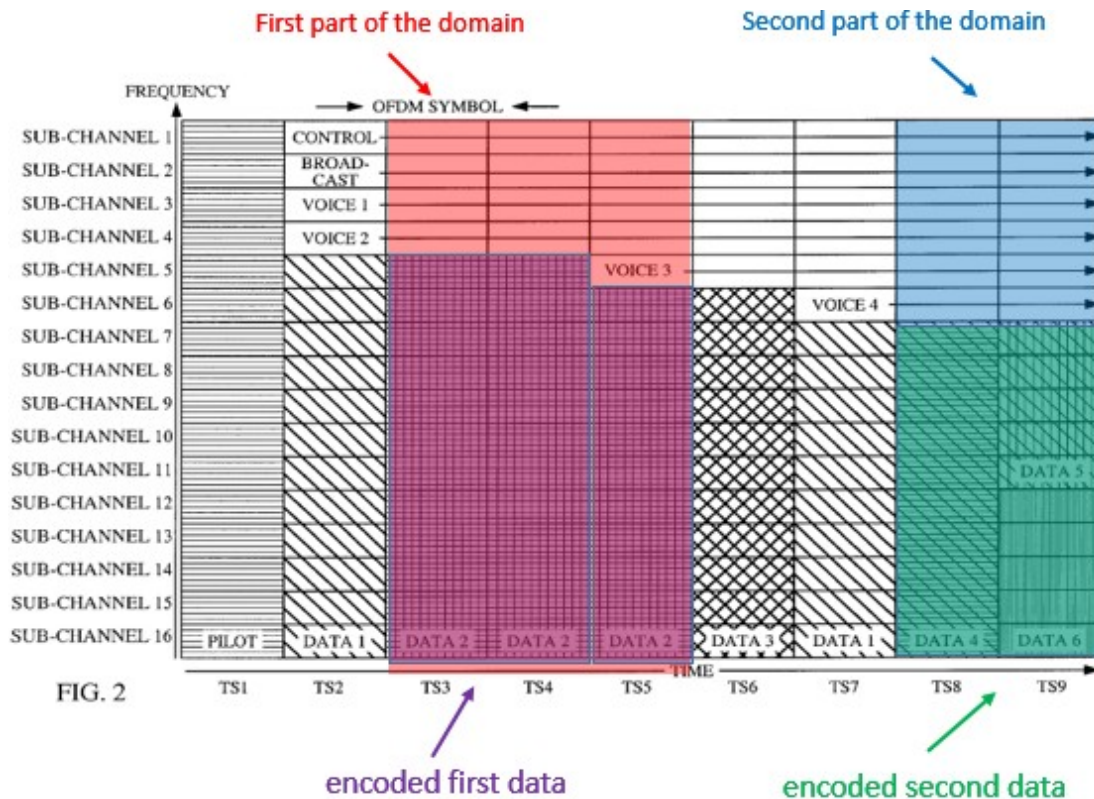
¹² For purposes of this Decision, we assume, without deciding, that the preamble of claim 41 is limiting.

Wallace teaches the preamble of claim 41 and limitation 41(a) for the same reasons discussed *supra* regarding the preamble of claim 1 and limitation 1(a), respectively. Because the other limitations of claim 41 are different in certain respects from the other limitations of claim 1, we consider the remaining limitations of claim 41 below.

(1) *Limitation 41(b)*

Limitation 41(b) recites “a mapping section configured to map the encoded first data symbols in a first part of a domain and encoded second data to symbols in a second part of the domain.” Ex. 1101, 16:4–6.

Petitioner contends that Wallace discloses a “mapping section” configured to map data to symbols. Pet. 82 (citing Ex. 1106, 20:50–58, Fig. 6); *see also* Section II.B.3.a(3) *supra*. Petitioner also contends that the annotated version of Figure 2 of Wallace, which is reproduced below (“the third annotated version” of Figure 2), shows a specific example of a transmission from a transmitter. *Id.* at 80 (citing Ex. 1106, 10:30–31, Fig. 2).



As discussed above, Figure 2 of Wallace is a diagram illustrating a specific example of a data transmission, in which the horizontal axis is the time index covering 9 time slots, with time slot 1 at the far left and time slot 9 at the far right, and the vertical axis is the frequency index covering 16 sub-channels, with sub-channel 1 at the top and sub-channel 16 at the bottom. Ex. 1106, 3:12–14, 10:30–37. Petitioner contends this third annotated version of Figure 2 discloses a domain that includes two parts: the “first part of the domain” consists of three timeslots (TS3 – TS5) and 16 sub-channels; the “second part of the domain” consists of two timeslots (TS8 – TS9) and 16 sub-channels. Petitioner also contends the encoded first data is DATA 2, which is mapped to symbols of the first part of a domain, and the encoded second data is DATA 4–6, which are mapped to symbols in the

second part of the domain. *Id.* at 83 (citing Ex. 1106, 10:66–11:18; Ex. 1108 ¶¶ 134–140, 266). For the reasons discussed *supra* regarding our determination that Wallace discloses a “first part” and “second” part of a time-frequency domain (*see* § II.B.3.a(2)(b)) and based on Petitioner’s persuasive arguments and evidence in the Petition, we agree that Wallace discloses limitation 41(b).

(2) *Limitation 41(c)*

Limitation 41(c) recites “the first part of the domain and the second part of the domain each comprise a time index and a frequency index.” Ex. 1101, 16:8–10. Petitioner contends the third annotated version of Figure 2 of Wallace discloses a time index and a frequency index, and a person of ordinary skill in the art would understand that if a domain includes a time index and a frequency index, then any part of that domain also includes a time index and a frequency index. Pet. 83 (citing Ex. 1108 ¶ 267). Thus, Petitioner contends both the first part and second part of the domain shown above in the third annotated version of Figure 2 include a time index and a frequency index. *Id.* at 84 (citing Ex. 1108 ¶¶ 139–140, 268). In particular, Petitioner contends the first part of the domain includes a time index covering three timeslots (TS3 –TS5) and a frequency index covering 16 sub-channels, and the second part of the domain includes a time index covering 2 timeslots (TS8 – TS9) and a frequency index covering 16 sub-channels. *Id.* (citing Ex. 1108 ¶ 268). Having considered Petitioner’s arguments and evidence, we agree with Petitioner’s showing and find that Wallace discloses limitation 41(c).

(3) *Limitation 41(d)*

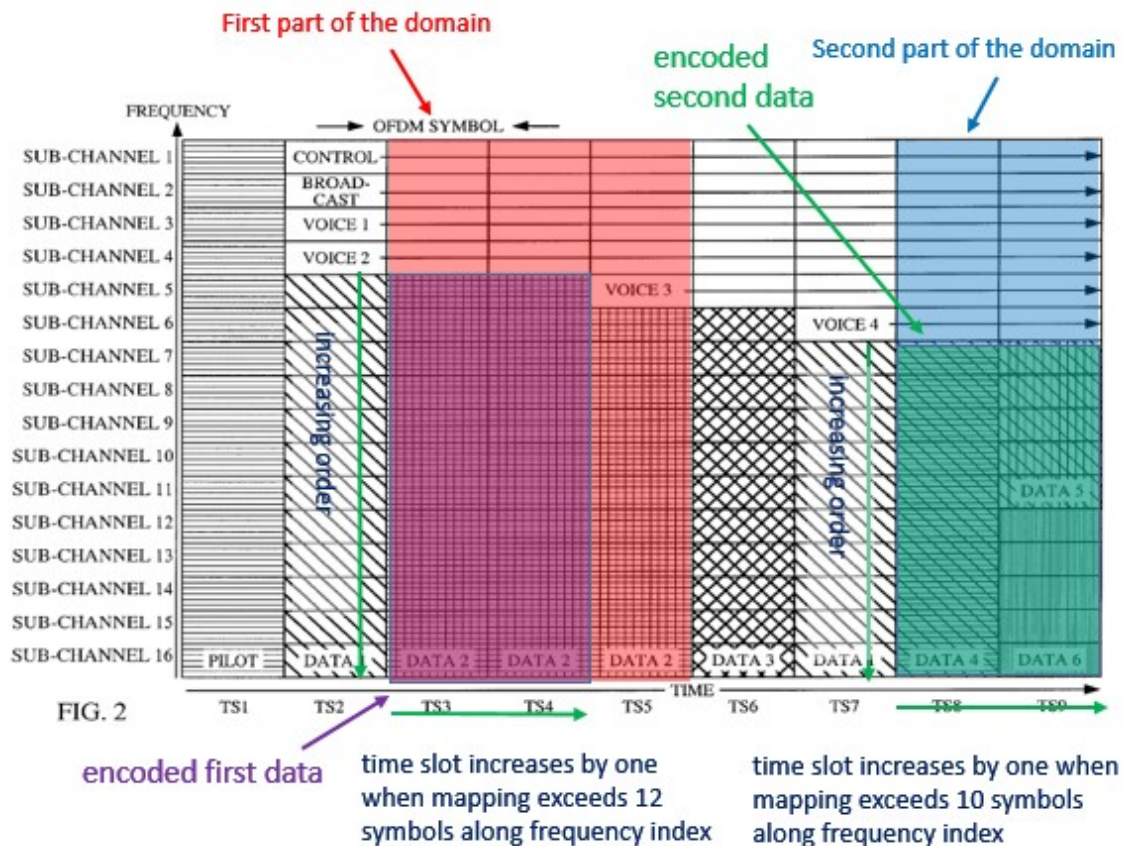
Limitation 41(d) recites the following:

at least a part of the encoded first data and at least a part of the encoded second data are mapped to symbols along the frequency indices of the first part of the domain and the second part of the domain, respectively, in an increasing order, and when the mapping exceeds a predetermined number of symbols along the frequency indices, a next part of the encoded first data and a next part of the encoded second data are then mapped along the frequency indices of the first part of the domain and the second part of the domain, respectively, in an increasing order, to symbols where the time indices are increased by one compared to the previous mapping.

Ex. 1101, 16:11–22.

Petitioner contends that Wallace and Ishikawa collectively disclose this limitation. Pet. 85–90. First, Petitioner contends Wallace teaches or suggests a transmitter unit would first map control and broadcast data to reserved sub-channels, subsequently map voice data to predetermined sub-channels and timeslots, and then map traffic data to the remaining sub-channels and timeslots. *Id.* at 85–86 (citing Ex. 1106, 10:43–11:18, 12:22–31, 12:60–63, 26:61–27:5; Ex. 1108 ¶¶ 270–271). Petitioner also contends that a person of ordinary skill in the art would understand from these teachings “that a transmitter would then map traffic data to the remaining sub-channels and timeslots.” *Id.* at 86 (citing Ex. 1108 ¶ 272). Thus, Petitioner contends the “number of symbols along the frequency index for mapping of traffic data will be ‘predetermined’ by the particular mapping of control, broadcast, and voice data that has been completed.” *Id.* (citing Ex. 1108 ¶¶ 141–142, 272).

Second, Petitioner contends the combination of Wallace and Ishikawa discloses “a part of the encoded first data and . . . encoded second data are mapped to symbols along the frequency indices . . . in an increasing order, and when the mapping exceeds a predetermined number of symbols along the frequency indices, a next part of the encoded first data and . . . encoded second data are then mapped along the frequency indices . . . in an increasing order, to symbols where the time indices are increased by one compared to the previous mapping.” *Id.* at 86–90. In particular, Petitioner contends that mapping of the “encoded first data” and “encoded second data” is shown in the annotated version of Figure 2 of Wallace below (“the fourth annotated version” of Figure 2). *Id.* at 86.



As previously discussed, Figure 2 of Wallace is a diagram illustrating a specific example of a data transmission, in which the horizontal axis is the time index covering 9 time slots and the vertical axis is the frequency index covering 16 sub-channels. Ex. 1106, 3:12–14, 10:30–37. Petitioner contends that, as shown in this fourth annotated version of Figure 2 of Wallace, CONTROL and BROADCAST data are respectively mapped to sub-channels 1 and 2, and VOICE 1 and 2 are respectively mapped to sub-channels 3 and 4. *Id.* at 86–87. Thus, according to Petitioner, the predetermined number of symbols for the “encoded first data” (DATA 2) in timeslot 3–4 is 12 because the mapping of DATA 2 spans 12 sub-channels (sub-channels 5–16). *Id.* at 87 (citing Ex. 1108 ¶¶ 138–142, 273). Similarly, Petitioner contends, for the “encoded second data” (DATA 4–6) in timeslots 8–9, CONTROL and BROADCAST data are mapped to sub-channels 1–2, and VOICE 1–4 are mapped to sub-channels 3–6, respectively. *Id.* Thus, according to Petitioner, the predetermined number of symbols for the “encoded second data” (DATA 4–6) in timeslots 8–9 is 10 because the mapping of DATA 4–6 spans 10 sub-channels (sub-channels 7–16). *Id.* (citing Ex. 1108 ¶¶ 138–142, 274).

Petitioner also contends that, for the reasons set forth in the Petition regarding limitation 1(c) (*see* Pet. 44–48), Ishikawa discloses mapping data to symbols first in an increasing order according to the frequency index, and then in an increasing order according to the time index. *Id.* at 88. Petitioner further contends that, for the reasons set forth in the Petition regarding limitation 1(c) (*see id.* at 48–51), a person of ordinary skill in the art would have had multiple reasons to combine Wallace and Ishikawa and map data to

symbols (e.g., DATA 2 and DATA 4–6 in the fourth annotated version of Figure 2 of Wallace) first in an increasing order according to the frequency index, and then in an increasing order according to the time index. *Id.* at 88–89 (citing Ex. 1108 ¶¶ 275–277). Based on Petitioner’s arguments and evidence in the Petition, with which we agree, we determine Petitioner has shown by a preponderance of the evidence that the combination of Wallace and Ishikawa teaches limitation 41(d). We also agree with Petitioner’s arguments and evidence supporting its proposed motivation to combine, summarized above, and determine that Petitioner has shown by a preponderance of the evidence that a person of ordinary skill in the art would have been motivated to combine Wallace and Ishikawa in the manner set forth in limitation 41(d) and would have had a reasonable expectation of success in doing so.

(4) *Limitation 41(e)*

Limitation 41(e) recites “the predetermined number of symbols for the encoded first data and the encoded second data is different.” Ex. 1101, 16:23–24. Petitioner contends that, as discussed above regarding limitation 41(d), “the predetermined number of symbols for the encoded first and second data is 12 and 10, respectively,” and “[t]he two numbers are different.” *Id.* at 90 (citing Ex. 1108 ¶ 278). Having considered Petitioner’s arguments and evidence, we agree with Petitioner’s showing, outlined above, and determine that Wallace teaches limitation 41(e).

Thus, for the reasons given above, we determine that Petitioner has shown by a preponderance of the evidence that the combination of Wallace and Ishikawa teaches or suggests limitations 41(a)–(e) and that a person of

ordinary skill in the art would have been motivated to combine these references to achieve the claimed invention. Accordingly, we determine that Petitioner has demonstrated by a preponderance of the evidence that claim 41 would have been obvious in view of Wallace and Ishikawa.

4. *Dependent Claims 7 and 27*

a. *The Parties' Arguments*

In the Petition, Petitioner contends that Figure 2 of Wallace discloses claim 7, which recites “[t]he transmission apparatus according to claim 1, wherein at least a part of the encoded second data is not continuously mapped to each symbol within each of the groups of symbols aligned along the frequency index.” Pet. 69–70. In particular, Petitioner argues that the first annotated version of Figure 2 of Wallace teaches claim 7 because DATA 1, “which is ‘at least a part of the encoded second data,’ is mapped to two groups of symbols in the second part of the domain, respectively in timeslots 2 and 7.” *Id.* at 69 (citing Ex. 1106, Fig. 2, 10:66–11:18). Petitioner also argues “DATA 1 is not continuously mapped to ‘each symbol within each of the groups of symbols aligned along the frequency index’ because the mapping of DATA 1 symbols in timeslot 2 is interrupted by the mapping of the DATA 2 symbols in timeslots 3, 4, and 5, and the DATA 3 symbols in time slot 6, before the mapping of DATA 1 symbols resumes in timeslot 7.” *Id.* at 69–70 (citing Ex. 1108 ¶¶ 117–127, 233–235).

The language of claim 27 is exactly the same as claim 7, except for the introductory clause, which recites “[t]he transmission method according to claim 21,” instead of “[t]he transmission apparatus according to claim 1,” as in claim 7. Thus, in the Petition, Petitioner also contends that Wallace

discloses claim 27 for the same reasons that Wallace discloses claim 7. *Id.* at 80 (citing Ex. 1108 ¶ 258).

Patent Owner contends that, even if Wallace discloses “groups of symbols” and a first and second part of a domain, Wallace does not disclose “at least a part of the encoded second data is not continuously mapped to each symbol within each of the groups of symbols aligned along the frequency index,” as recited in claims 7 and 27. PO Resp. 44–54. Patent Owner argues Petitioner appears to interpret claims 7 and 27 as simply requiring that “groups of data not be continuous with one another,” whereas the claims require that a part of the encoded second data “is not continuously mapped to each symbol *within* each of the groups of symbols.” *Id.* at 44–46. According to Patent Owner, the focus of the claims is “on continuity of the symbols within each group, not on continuity among the groups,” and Petitioner’s analysis never addresses “whether the symbols *within* any groups are continuous with one another.” *Id.* at 46–47 (citing Ex. 2003 ¶¶ 97–98).

Patent Owner also argues that for Petitioner to show Wallace discloses claims 7 and 27, Petitioner would have to show Wallace discloses “a group of symbols in which at least one of the sub-channels is skipped during mapping,” but Wallace does not contain any such disclosure, nor does Petitioner contend it does. *Id.* at 47–48. Instead, Patent Owner asserts Petitioner relies on DATA 1 in Wallace, but “admits that DATA 1 appears in two separate ‘groups’ of symbols—one group in timeslot 2 and one group in timeslot 7.” *Id.* at 48 (citing Pet. 69 (“DATA 1, which is ‘at least a part of the encoded second data,’ is mapped to two groups of symbols in the second

part of the domain, respectively in time slots 2 and 7.”)). Patent Owner further argues “[i]t does not matter that the ‘groups’ of symbols to which DATA 1 is mapped do not appear in sequential timeslots—that is not what the claim requires.” *Id.* at 49 (citing Ex. 2003 ¶ 101). Moreover, Patent Owner argues that “Petitioner’s expert, Dr. Wells, agrees that the symbols to which DATA 1 is mapped in timeslot 2 and 7 are continuous.” *Id.* at 49–51 (citing Ex. 2002, 41:25–43:6; Ex. 2003 ¶ 102).

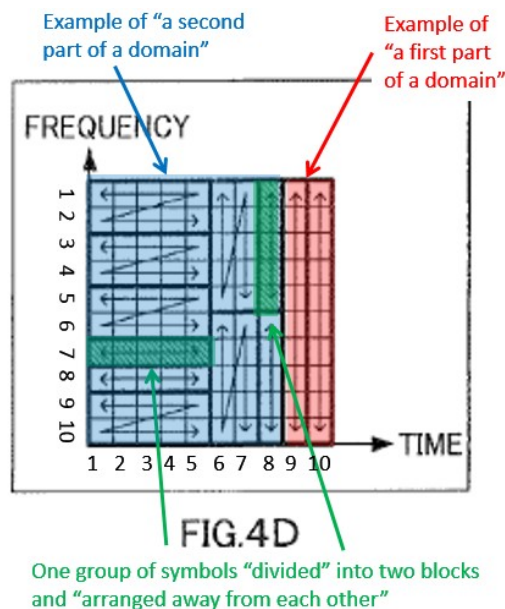
Next, Patent Owner argues that, even if Petitioner’s view is correct that claims 7 and 27 require only that the groups themselves are not continuously mapped, all of the groups of encoded second data in Figure 2 of Wallace are continuous with one another. *Id.* at 50–54. In particular, Patent Owner argues that Petitioner cannot ignore DATA 2–4 because claims 7 and 27 “only require at least a *part* of the second data not be continuously mapped, and DATA 1 is part of the second data.” *Id.* at 51. According to Patent Owner, Petitioner has admitted it considers DATA 2–4 to be encoded second data (*id.* (citing Pet. 69)) and the “‘groups’ in which all of this data appears (assuming that they are groups) are continuous with each other.” *Id.* Patent Owner also argues that, “yet again,” Dr. Wells’s testimony at his deposition supports Patent Owner.¹³ *Id.* at 52–54 (citing Ex. 2002, 45:10–46:20, 47:7–13; Ex. 2003 ¶¶ 105–106).

In response, Petitioner notes that Patent Owner asserts “[t]he focus [of claims 7 and 27] is clearly on continuity of the symbols within each group, not on continuity between different groups.” Pet. Reply 21 (citing PO Resp.

¹³ We believe Patent Owner mistakenly referred here to “Petitioner.” PO Resp. 52.

29). Although Petitioner argues that Patent Owner’s “construction is incorrect because it is unduly narrow,” Petitioner asserts “the prior art renders claims 7 and 27 unpatentable even under [Patent Owner’s] narrow construction” of the additional limitation of these dependent claims. *Id.*

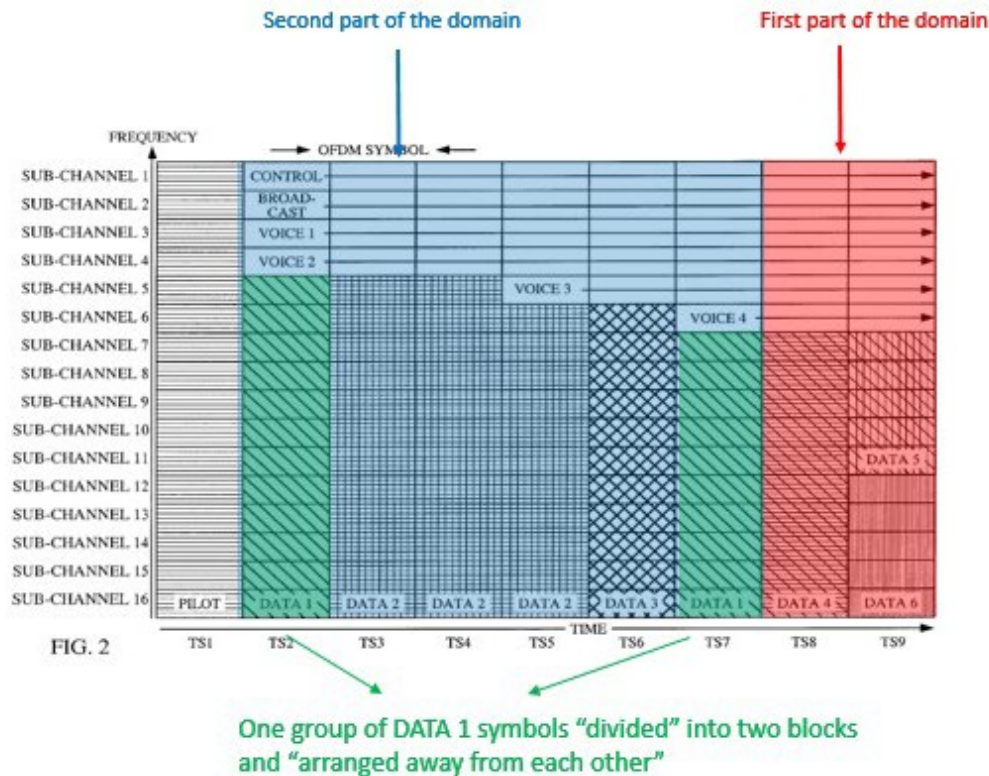
With respect to Patent Owner’s construction, Petitioner asserts that a person of ordinary skill in the art would understand that its annotated version of Figure 4D of the ’569 patent, which is shown below, “supports claims 7 and 27 under [Patent Owner’s] construction.” *Id.* at 21–22.



As explained *supra*, Figure 4D illustrates an example of one frame of an OFDM signal consisting of a total of 100 symbols in which code blocks vary in number and orientation in the time axis (horizontal) direction and in the frequency axis (vertical) direction. Regarding this annotated version of Figure 4D, Petitioner argues that the two hatched blocks (shown in green) represent “one group of symbols that is ‘divided’ into two blocks and ‘arranged away from each other,’ thereby creating a discontinuity within the

group.” *Id.* at 22 (citing Ex. 1101, 5:35–39; Ex. 1120 ¶ 57; Ex. 1121, 68:19–69:8, 70:21–71:16).

Second, Petitioner contends that, as in Figure 4D, “Figure 2 of Wallace also discloses claims 7 and 27 under [Patent Owner’s] construction.” *Id.* (emphasis omitted). In that regard, Petitioner relies on an additional annotated version of Figure 2 of Wallace (“additional annotated version” of Figure 2), which is reproduced below, showing “that DATA 1 is mapped to symbols in time slot 2 and time slot 7.” *Id.* (citing Ex. 1106, 11:7–10, Fig. 2).



As explained above, Figure 2 of Wallace is a diagram illustrating a specific example of a data transmission, in which the horizontal axis is the time index covering 9 time slots and the vertical axis is the frequency index covering 16 sub-channels. Ex. 1106, 3:12–14, 10:30–37. With respect to

this additional annotated version of Figure 2 of Wallace, Petitioner argues that a person of ordinary skill in the art would understand that “DATA 1 is mapped to one group of symbols that is ‘divided’ into two blocks and ‘arranged away from each other’ in time slot 2 and time slot 7, because the DATA 1 symbols in time slot 7 can be a repeat transmission of the DATA 1 symbols in time slot 2, and the two blocks of DATA 1 symbols are ‘arranged away from each other’ to achieve temporal diversity.” *Id.* at 22–23 (citing Ex. 1101, 5:35–39; Ex. 1106, 11:55–57 (“[D]ata 1 transmission at time slot 7 is a portion (e.g., new or repeated) of the data 1 transmission at time slot 2.”); Ex. 1120 ¶¶ 58–59). Thus, Petitioner argues that “even under [Patent Owner’s] narrow construction, the mapping of data 1 in Figure 2 meets the additional limitation of claims 7 and 27, because there is a discontinuity within the group of symbols to which data 1 is mapped.” *Id.* at 23.

In its Surreply, Patent Owner first argues that Figure 4D does not support claims 7 and 27 under Patent Owner’s construction because the ’569 patent “does not disclose the two hatched blocks as a single group.” PO Surreply 20 (citing Ex. 1101, 5:35–39). According to Patent Owner, the “hatched blocks thus form *two* code blocks (or groups of symbols), not one.” *Id.* Second, Patent Owner argues that Figure 2 of Wallace does not disclose claims 7 and 27 under the proper understanding of the claims. *Id.* at 21–22. Specifically, Patent Owner argues that, although Petitioner contends a person of ordinary skill would understand “DATA 1 is mapped to one group of symbols that is ‘divided’ into two blocks and ‘arranged away from each other’ in time slot 2 and time slot 7, because the DATA 1 symbols in time slot 7 can be a repeat transmission of the DATA 1 symbols in time slot 2,”

“Petitioner cites to nothing in Figure 2 that supports treating DATA 1 in time slot 2 and DATA 1 in time slot 7 as a single group.” *Id.* at 21. Patent Owner also argues that “Petitioner has always argued that DATA 1 in time slot 2 and time slot 7 are *different* groups.” *Id.* (citing Pet. 42, 52, 69–70). And, Patent Owner further argues that “by Dr. Wells’s admission, if DATA 1 in time slot 2 and DATA 1 in time slot 7 are different groups, as Dr. Wells and Petitioner have always maintained, then Wallace does not disclose claims 7 and 27 under Patent Owner’s understanding.” *Id.* (citing Ex. 2012, 83:12–20).

Third, Patent Owner contends that, “even if DATA 1 in time slot 2 and DATA 1 in time slot 7 were parts of the same group, however, Figure 2 of Wallace still would not disclose claims 7 and 27.” *Id.* Patent Owner asserts those claims require that data “is not continuously mapped to each symbol within each of the groups of symbols.” *Id.* at 21–22. Patent Owner further argues “[b]ut data is mapped to every single symbol in the ‘group’ formed by DATA 1 in time slot 2 and DATA 1 in time slot 7. Not a single symbol is skipped during mapping.” *Id.* at 22. Thus, according to Patent Owner, “[b]ecause data is mapped to every symbol, the data in Figure 2 is continuously mapped” and, therefore, does not disclose claims 7 and 27. *Id.*

b. Analysis

Initially, we are not persuaded by Petitioner’s argument that, under Petitioner’s first or broader construction, Wallace teaches at least a part of the encoded second data “is not continuously mapped to each symbol within each of the groups of symbols” because there is a discontinuity in at least the time or frequency indices “*between* two or more groups of symbols.” See

Pet. 69–70. Instead, we agree with Patent Owner that this construction is not consistent with the plain and ordinary meaning of the limitation of claims 7 and 27 because the claim language that “data is not continuously mapped to each symbol within each of the groups of symbols” focuses “on continuity of the symbols within each group, not on continuity among the groups.” See PO Resp. 46–47. We also agree with Patent Owner, as argued in its Response, that, because all of the groups of encoded second data in Figure 2 of Wallace are continuous with one another, Wallace does not disclose claims 7 and 27 “under Petitioner’s [broader] understanding of the claims,” and Petitioner did not address this argument in its Reply. See PO Surreply 20 n.1 (citing PO Resp. 51–54).

In regard to Petitioner’s second or narrower construction, we agree with Patent Owner that the parties appear to agree that claims 7 and 27 cover “discontinuous mapping of data *within* a single group of symbols.” PO Surreply 13–14 (citing PO Reply 9; Ex. 1120 ¶ 52; Ex. 2012, 69:5–17). Giving the claim language the plain and ordinary meaning, claims 7 and 27 are directed to “data that has a discontinuity in at least one of the time or frequency indices within a single group of symbols.”

We also determine, as Petitioner argues, that Wallace renders claims 7 and 27 unpatentable under this construction. See Pet. Reply 22. Petitioner argues, and we agree, a person of ordinary skill in the art would understand that, as shown in the additional annotated version of Wallace’s Figure 2, “DATA 1 is mapped to one group of symbols that is ‘divided’ into two blocks and ‘arranged away from each other’ in time slot 2 and time slot 7, because the DATA 1 symbols in time slot 7 can be a repeat transmission of

the DATA 1 symbols in time slot 2, and the two blocks of DATA 1 symbols are ‘arranged away from each other’ to achieve temporal diversity.” *Id.* at 22–23 (citing Ex. 1101, 5:35–39; Ex. 1106, 11:55–57 (“[D]ata 1 transmission at time slot 7 is a portion (e.g., new or repeated) of the data 1 transmission at time slot 2.”; Ex. 1120 ¶¶ 58–59). Petitioner also argues, and we agree, that “the mapping of data 1 in Figure 2 meets the additional limitation of claims 7 and 27, because there is a discontinuity within the group of symbols to which data 1 is mapped.” *Id.* at 23.

We further determine Patent Owner’s arguments that the evidence is insufficient to disclose claims 7 and 27 under this construction are not persuasive. *See* PO Surreply 21–22. Although Patent Owner argues that “Petitioner cites to nothing in Figure 2 that supports treating DATA 1 in time slot 2 and time slot 7 as a single group” (*see id.* at 21), Petitioner cites to, and quotes from, the disclosure of Wallace pertaining to Figure 2 stating, “[D]ata 1 transmission at time slot 7 is a portion (e.g., new or repeated) of the data 1 transmission at time slot 2.” Pet. Reply 23 (quoting Ex. 1106, 11:55–57). The introductory clause to this disclosure specifically states, “As shown in FIG. 2.” Ex. 1106, 11:55–56. We find this disclosure of Wallace teaches or suggests that “DATA 1 is mapped to one group of symbols that is ‘divided’ into two blocks and ‘arranged away from each other’ in time slot 2 and time slot 7,” as Petitioner contends. *See id.* at 22–23.

We are also not persuaded by Patent Owner’s argument that “Petitioner has always argued that DATA 1 in time slot 2 and time slot 7 are *different* groups.” *See* PO Surreply 21 (citing Pet. 42, 52, 69–70). In the Petition, Petitioner argued that DATA 1 is mapped to “two groups of

symbols” in time slots 2 and 7 in support of its contention that Wallace taught the limitation of claims 7 and 27 under its original construction of “data is not continuously mapped” as meaning “data that has a discontinuity in at least one of the time or frequency indices between two or more groups of symbols.” *See, e.g.*, Pet. 69–70 (citing Ex. 1108 ¶¶ 117–127, 233–235). However, as Patent Owner notes, Petitioner argued, for the first time in its Reply, that “a part of the encoded second data is not continuously mapped” can be interpreted to mean “(1) data that has a discontinuity in at least one of the time or frequency indices *between* two or more groups of symbols . . . , or (2) data that has a discontinuity in at least one of the time or frequency indices *within* a single group of symbols.” PO Surreply 13–14 (citing Pet. Reply 9). In other words, in the Reply, Petitioner argued that the limitation of claims 7 and 27 could be interpreted in two ways; the first is the broader construction argued by Petitioner in the Petition, and the second is the narrower construction argued by Patent Owner in its Response. As previously stated, Petitioner also argued in the Reply that Wallace renders claims 7 and 27 unpatentable “even under [Patent Owner’s] narrow construction.” Pet. Reply 21–23. In support of this argument, as also previously stated, Petitioner specifically argued that “DATA 1 is mapped to one group of symbols that is ‘divided’ into two blocks and ‘arranged away from each other’ in time slot 2 and time slot 7,” instead of arguing as in the Petition that DATA 1 is mapped to two groups in time slot 2 and time slot 7. *See id.* at 22–23 (emphasis added). Thus, Patent Owner’s arguments concerning what Petitioner has “always argued” about data 1 are irrelevant

and unpersuasive with respect to Petitioner's new arguments asserted in its Reply.¹⁴

Although Patent Owner argued in its Surreply that Petitioner's understanding regarding the construction of "data is not continuously mapped" is "overbroad," Patent Owner did not assert that Petitioner's revised claim construction argument or its argument that claims 7 and 27 are unpatentable under the second or narrower construction is untimely or improper. See PO Surreply 13–14. Nor do we find that these arguments of Petitioner are untimely or improper as being asserted for the first time in Petitioner's Reply because we determine these arguments were properly asserted in response to Patent Owner's arguments concerning the construction and patentability of claims 7 and 27 in Patent Owner's Response. See PO Resp. 29–30, 44–54.

Lastly, we are not persuaded by Patent Owner's argument that, even if data 1 in time slots 2 and 7 are part of the same group, Figure 2 of Wallace does not disclose claims 7 and 27 because these claims require that data "is not continuously mapped to each symbol within each of the groups of symbols," "[b]ut data is mapped to every single symbol in the 'group' formed by DATA 1 in time slot 2 and DATA 1 in time slot 7. Not a single

¹⁴ For these same reasons, we are not persuaded by Patent Owner's argument that Wallace does not disclose claims 7 and 27 under Patent Owner's understanding "if DATA 1 in time slot 2 and DATA 1 in time slot 7 are different groups, as Dr. Wells and Petitioner have always maintained" because, as discussed above, Petitioner contends "DATA 1 is mapped to one group of symbols that is 'divided' into two blocks and 'arranged away from each other' in time slot 2 and time slot 7," with respect to Patent Owner's understanding of these claims. See PO Surreply 21 (emphasis added).

symbol is skipped during mapping.” PO Surreply 21–22. To begin with, we note that the specification of the ’569 patent does not mention the term “not continuously mapped” or “continuously mapped.” Patent Owner’s interpretation of “not continuously mapped” in claims 7 and 27 is limited in that it focuses on the symbols that form a group in each time slot and asks whether any of the symbols in that time slot are skipped. However, we also note that Dr. Wells testified in regard to an annotated version of Figure 4D of the ’569 patent that “part of the encoded second data is ‘not continuously mapped to each symbol within each of the groups of symbols along the frequency index’ because the mapping skips frequency channel 6 and timeslots 6 and 7.” Ex. 1108 ¶ 125. In other words, depending on how a group of symbols is arranged, for example, data 1 in multiple time slots 2 and 7 of Figure 2 of Wallace, the symbols would not be continuously mapped because the intervening time slots 3–6 are skipped, even though none of the symbols along the frequency axis in time slots 2 and 7 is skipped. Thus, Patent Owner’s argument is not persuasive because it is not based on the broadest reasonable construction of “not continuously mapped” in the context of claims 7 and 27. Moreover, we determine, as Petitioner argues, that “the mapping of data 1 in Figure 2 meets the additional limitation of claims 7 and 27, because there is a discontinuity within the group of symbols to which data 1 is mapped.” Pet. Reply 23.

In sum, based on our review of Petitioner’s and Patent Owner’s arguments and evidence, we determine that Petitioner has shown by a preponderance of the evidence that claims 7 and 27 would have been obvious over Wallace and Ishikawa.

5. *Dependent Claims 2–6, 8–10, 22–26, and 28–30*

Patent Owner’s Response does not contain arguments expressly directed to dependent claims 2–6, 8–10, 22–26, and 28–30 apart from those directed to independent claims 1 and 21, from one of which each of these claims depend. *See generally* PO Resp. 31–44. As discussed below, based on Petitioner’s contentions and supporting evidence as to claims 2–6, 8–10, 22–26, and 28–30 (*see* Pet. 56–81), we determine Petitioner has shown by a preponderance of the evidence that claims 2–6, 8–10, 22–26, and 28–30 would have been obvious in view of Wallace and Ishikawa.

Petitioner contends that Figure 2 of Wallace discloses claim 2, which recites “[t]he transmission apparatus according to claim 1, wherein a number of symbols along the frequency index for the first part of the domain and for the groups of symbols in the second part of the domain is different.” Pet. 56–58. In particular, Petitioner contends the first annotated version of Figure 2 shows that the “number of symbols along the frequency index for the first part of the domain is 16 because the first part of the domain spans across sub-channels 1-16 and has 16 symbols along the frequency index.” *Id.* at 56. Petitioner also contends that “the number of symbols along the frequency index for the six groups of symbols for DATA 1–3 in the second part of the domain is 12, because the six groups span across sub-channels 5 through 16, and have 12 symbols along the frequency index.” *Id.* at 57 (citing Ex. 1106, 10:66–11:18, Fig. 2). Thus, according to Petitioner, the first annotated version of Figure 2 of Wallace discloses the limitations of claim 2 because the 16 symbols for the first part of the domain are different

than the 12 symbols for the second part of the domain. *Id.* (citing Ex. 1108 ¶¶ 88–91, 208–211).

Petitioner contends that Figure 2 of Wallace discloses claim 3, which recites “[t]he transmission apparatus according to claim 1, wherein a number of symbols in the first part of the domain is greater than a number of symbols within each of the groups of symbols.” *Id.* at 58–60. In particular, Petitioner contends that the first annotated version of Figure 2 of Wallace discloses (1) a number of symbols in the first part of the domain, consisting of timeslots 8 and 9 spanning across sub-channels 1 through 16, is 32 (*see id.* at 58 (citing Ex. 1108 ¶¶ 93, 95, 214), and (2) “each of the first three groups of symbols in timeslots 2-4 has 12 symbols, each of the fourth and fifth groups of symbols in timeslots 5-6 has 11 symbols, and the sixth group of symbols in timeslot 7 has 10 symbols” (*id.* at 59 (citing Ex. 1106, 10:66–11:18, Fig. 2; Ex. 1108 ¶¶ 95–96, 215–218)). Thus, according to Petitioner, the first annotated version of Figure 2 teaches the limitations of claim 3 because “a number of symbols in the first part of the domain (32 symbols) is greater than a number of symbols within each of the groups of symbols (10, 11 or 12 symbols).” *Id.* at 59.

Petitioner contends that Wallace discloses claim 4, which recites “[t]he transmission apparatus according to claim 1, wherein a number of symbols for the encoded second data is configured to be changed at a predetermined interval.” *Id.* at 60–65. Specifically, Petitioner contends the ’569 patent does not discuss or explain the terms “predetermined interval” or “a number of symbols for the encoded second data is configured to be changed at a predetermined interval.” *Id.* at 60. Petitioner asserts that a

person of ordinary skill in the art would understand a “predetermined interval” to have its “plain and ordinary meaning, for example, a ‘frame rate.’” *Id.* at 60–61 (citing Ex. 1108 ¶¶ 98–99, 220). Petitioner argues that “*Wallace* teaches that a transmitter may dynamically allocate data to resources based on feedback of channel state information (CSI) provided by a receiver” (*id.* at 63 (citing Ex. 1106, 5:36–53, 12:5–14, 26:60–27:5)) and that a person of ordinary skill would understand that “the illustration of a transmission in Figure 2 of *Wallace* (Ex. 1106, 3:11–13) changes from one transmission to another, at a predetermined interval, based on CSI feedback” (*id.* (citing Ex. 1108 ¶¶ 221–222)). According to Petitioner, one example is the first annotated version of Figure 2, which shows the encoded second data are mapped to a total of 68 symbols. *Id.* at 63–64 (citing Ex. 1108 ¶ 223). Petitioner asserts that in this example, “if VOICE 3 and VOICE 4 were to cover the entire sub-channel 5 and 6 respectively in the subsequent transmission, the encoded second data would be mapped to 60 symbols.” *Id.* at 64 (citing Ex. 1106, 12:24–26, 12:60–64). Thus, Petitioner argues this example of Figure 2 teaches claim 4 because “a number of symbols for the encoded second data is configured to be changed [from 68 symbols to 60 symbols] at a predetermined interval (*e.g.*, frame rate).” *Id.* at 64–65 (citing Ex. 1108 ¶ 224).

Petitioner contends that *Wallace* discloses claim 5, which recites:

[t]he transmission apparatus according to claim 1, wherein the first part of the domain to which the encoded first data is mapped and the second part of the domain to which the encoded second data is mapped are allocated continuously according to the time index.

Pet. 65–67. In particular, Petitioner contends the first annotated version of Figure 2 of Wallace discloses claim 5 because the first part of the domain occupies timeslots 8 and 9, the second part of the domain occupies timeslots 2 through 7, and timeslots 2–9 are allocated continuously as “there is no discontinuity or break between any of timeslots 2–9.” *Id.* at 65–66 (citing Ex. 1106, 10:66–11:18; Ex. 1108 ¶¶ 108, 227).

Petitioner contends that the second annotated version of Figure 2 of Wallace discloses claim 6, which recites “[t]he transmission apparatus according to claim 1, wherein at least a part of the encoded first data is not continuously mapped to the symbols in the first part of the domain.” *Id.* at 67–68. In particular, Petitioner asserts this version of Figure 2 teaches claim 6 because the encoded first data, DATA 1–3, which are mapped to the first part of the domain, are not continuously mapped to the symbols in the first part, as the mapping of DATA 1 symbols is interrupted by the mapping of other symbols, namely VOICE 3 and 4 are mapped to sub-channels 5–6 in timeslot 7, and DATA 2 and 3 are mapped to timeslots 3–6. *Id.* (citing Ex. 1108 ¶¶ 110–115, 229–231).

Petitioner contends Wallace discloses claim 8, which recites “[t]he transmission apparatus according to claim 1, wherein said coding section carries out turbo coding or convolutional coding for each of the first data and the second data.” *Id.* at 70–71. Specifically, as discussed *supra* regarding limitation 1(a), Petitioner asserts Wallace discloses that the coding section (encoder 312 in transmitter unit 110) encodes the first and second data. *Id.* at 70 (citing Ex. 1106, 19:23–33, Fig. 3). Petitioner also asserts Wallace discloses the use of error correction coding to increase reliability and that

such encoding may include turbo coding or convolutional coding. *Id.* at 70–71 (citing Ex. 1106, 19:33–46). Thus, according to Petitioner, “encoder 312 encodes each of the first data and the second data as described in Figure 2 with turbo coding or convolutional coding.” *Id.* at 71 (citing Ex. 1108 ¶¶ 129, 236–237).

Petitioner contends that Wallace discloses claim 9, which recites:

[t]he transmission apparatus according to claim 1, wherein said coding section carries out error correcting coding for first data and the second data, and said mapping section maps each of the encoded first data and the encoded second data depending on characteristics of the error correcting coding.

Pet. 71–73. In particular, Petitioner asserts that Wallace discloses encoding first data and second data with error correcting coding (*id.* at 71 (citing Ex. 1106, 19:33–46)) and that each traffic data transmission may use a different error correcting coding scheme (*id.* (citing Ex. 1106, 19:28–33)). According to Petitioner, a person of ordinary skill in the art would understand that “error correcting coding adds redundancy to the data that is encoded” (*id.* at 71–72 (citing Ex. 1108 ¶¶ 33–38, 131, 238)) and “[d]ifferent error correcting coding schemes, even when applied to data of the same size, may generate different number of coded bits” (*id.* at 72 (citing Ex. 1108 ¶ 238)). Thus, Petitioner asserts that, because the mapping of data to symbols depends on the size of the encoded data, the mapping will depend on the “characteristics” of the error correcting encoding used. *Id.* at 72 (citing Ex. 1108 ¶ 238).

Petitioner contends that Wallace and Ishikawa collectively disclose claim 10, which recites “[t]he reception apparatus according to claim 1, wherein the mapping of the at least a part of the second data to at least a part of the groups of symbols in the second part of the domain is performed in increasing order according to the time index.” *Id.* at 73–77. Specifically, Petitioner contends a person of ordinary skill would understand that claim 10 requires the mapping of the at least a part of the encoded second data to the groups of symbols be “performed” in increasing order according to the time index, whereas claim 1 requires that the groups of symbols (*i.e.*, the result of mapping) are “aligned” in an increasing order according to the time index. *Id.* at 74 (citing Ex. 1108 ¶¶ 133–134, 242). Petitioner asserts that the second annotated version of Figure 2 of Wallace suggests mapping DATA 1 to two groups of symbols in an increasing order according to the time index. *Id.* (citing Ex. 1106, 11:8–10 “(‘data 1 transmission uses sub-channels 5 through 16 at time slot 2 and sub-channels 7 through 16 at time slot 7’)”). According to Petitioner, a person of ordinary skill may map DATA 1 first to the group in timeslot 2 and then to the group in timeslot 7 or in the reverse order, but would not perform the mapping without any particular order as that would make encoding and decoding more difficult and expensive. *Id.* at 75 (citing Ex. 1108 ¶ 243–244). Petitioner also asserts that Ishikawa discloses performing mapping of data to symbols first in “sequential” (increasing) order according to the frequency index, and then in increasing order according to the time index (*id.* at 76 (citing Ex. 1107, 8:53–58, Fig. 5; Ex. 1108 ¶¶ 161, 245)) and, therefore, a person of ordinary skill would understand “that the disclosure suggests mapping data to two groups of

symbols in an increasing order according to the time index” (*id.* (citing Ex. 1108 ¶ 245)). Petitioner further asserts that, for the same reasons argued in regard to limitation 1(c), a person of ordinary skill in the art “would have had multiple reasons to combine Wallace and Ishikawa and map data to at least a part of the groups of symbols in the second part of the domain (e.g., DATA 1 in Figure 2 of Wallace), in an increasing order according to the time index.” *Id.* at 76–77 (Ex. 1108 ¶ 246).

We agree with Petitioner’s arguments and evidence set forth in the Petition for claims 2–6 and 8–10, outlined above. Accordingly, we determine Petitioner has shown by a preponderance of the evidence that the combination of Wallace and Ishikawa teaches the limitations of claims 2–6 and 8–10 and that a person of ordinary skill in the art would have been motivated to combine these references, as Petitioner contends, with a reasonable expectation of success in doing so. Thus, we determine Petitioner has shown by a preponderance of the evidence that claims 2–6 and 8–10 would have been obvious in view of Wallace and Ishikawa.

Regarding claims 22–26 and 28–30, Petitioner contends that the combination of Wallace and Ishikawa discloses the limitations of these claims for the same reasons set forth with respect to claims 2–6 and 8–10. Pet. 79–81. Thus, for the reasons discussed above with respect to claims 2–6 and 8–10, we determine Petitioner has shown by a preponderance of the evidence that the combination of Wallace and Ishikawa teaches the limitations of claims 22–26 and 28–30 and that a person of ordinary skill in the art would have been motivated to combine these references, as Petitioner contends, with a reasonable expectation of success in doing so. Thus, we

determine Petitioner has shown by a preponderance of the evidence that claims 22–26 and 28–30 would have been obvious in view of Wallace and Ishikawa.

6. *Dependent Claim 42*

Patent Owner’s Response does not contain arguments expressly directed to claim 42, other than those directed to claim 41 from which claim 42 depends. *See generally* PO Resp. 31–44. Petitioner contends that Wallace discloses claim 42, which recites “[t]he transition apparatus according to claim 41, wherein the predetermined number of symbols is predetermined according to third data.” Pet. 90–93.

Specifically, Petitioner contends Wallace teaches “arranging data based on the reception state of a signal that is provided as *feedback* from a receiver” and also teaches “dynamic allocation of resources (i.e., the mapping of data to symbols) based on feedback of channel state information (CSI) provided by a receiver.” *Id.* at 90–91 (citing Ex. 1106, Fig. 1B; 14:66–15:2 (a receiver unit sends CSI feedback to a transmitter to “precondition further transmissions”); claim 24). As discussed *supra* regarding limitation 41(d), Petitioner also contends the “predetermined number of symbols” depends on the particular mapping of control, broadcast, and voice data, which, in turn, depends on the CSI feedback information. *Id.* at 91. Thus, Petitioner further contends a person of ordinary skill in the art “would understand that Wallace’s CSI feedback information discloses “third data.”” *Id.* (emphasis omitted) (citing Ex. 1108 ¶¶ 144–146, 280).

We agree with the arguments and evidence in the Petition, discussed above, and determine Petitioner has shown by a preponderance of the evidence that Wallace teaches or suggests the limitations of claim 42. Thus, we also determine Petitioner has demonstrated by a preponderance of the evidence that claim 42 would have been obvious in view of Wallace and Ishikawa.

C. Reconsideration of the Decision on Institution

On September 10, 2018, we instituted trial in this proceeding. Paper 11. Patent Owner contends that we should not have instituted trial in this proceeding “in light of a jury verdict [in the related district court action] finding claims 11 and 17 valid over the very same prior art and the very same invalidity theories presented here.” *See* PO Resp. 54–60.

On September 24, 2018, Patent Owner filed a Request for Rehearing Regarding Institution Decision under 37 C.F.R. § 42.71(d). Paper 14 (“Request for Rehearing”). Patent Owner’s arguments in its Response as to why we should not have instituted trial here are substantially the same as those made by Patent Owner in the Request for Rehearing. At the time Patent Owner filed its Response, the Request for Rehearing was pending, as Patent Owner states. *See* PO Resp. 58. However, on March 13, 2019, we entered the Decision Denying Patent Owner’s Request for Rehearing. Paper 27.

For the same reasons set forth in the Decision Denying Patent Owner’s Request for Rehearing, which we adopt and incorporate herein, we are not persuaded by Patent Owner’s arguments in its Response that we should not have instituted trial in this proceeding. *See id.* at 4–15.

III. CONCLUSION

Petitioner has demonstrated by a preponderance of the evidence that claims 1–10, 21–30, 41, and 42 of the '569 patent are unpatentable under 35 U.S.C. § 103 over the combination of Wallace and Ishikawa.

IV. ORDER

Accordingly, it is

ORDERED that claims 1–10, 21–30, 41, and 42 of the '569 patent have been shown to be unpatentable; 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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