

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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ZTE CORPORATION, ZTE (USA), INC., and ZTE (TX), INC.,  
Petitioner,

v.

WSOU INVESTMENTS, LLC  
d/b/a BRAZOS LICENSING AND DEVELOPMENT,  
Patent Owner.

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IPR2021-00699  
Patent 7,742,534 B2

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Before BRIAN J. McNAMARA, ROBERT J. WEINSCHENK, and  
JOHN A. HUDALLA, *Administrative Patent Judges*.

HUDALLA, *Administrative Patent Judge*.

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

ZTE Corporation, ZTE (USA), Inc., and ZTE (TX), Inc. (collectively, “Petitioner”) filed a Petition (Paper 1, “Pet.”) requesting an *inter partes* review of claims 1–18 (“the challenged claims”) of U.S. Patent No. 7,742,534 B2 (Ex. 1001, “the ’534 patent”). Petitioner filed a Declaration of Stephen Gray (Ex. 1003) with its Petition. Patent Owner, WSOU

Investments, LLC d/b/a Brazos Licensing and Development (“Patent Owner”), filed a Preliminary Response. Taking into account the arguments presented by Patent Owner in the preliminary record, we determined that the information presented in the Petition established that there was a reasonable likelihood that Petitioner would prevail with respect to its unpatentability challenges. Pursuant to 35 U.S.C. § 314, we instituted this proceeding on October 18, 2021, as to all challenged claims and all grounds of unpatentability. Paper 11 (“Dec. on Inst.”).

During the course of trial, Patent Owner filed a Patent Owner Response (Paper 14, “PO Resp.”), and Petitioner filed a Reply to the Patent Owner Response (Paper 17, “Pet. Reply”). Patent Owner also filed a Sur-reply. Paper 19 (“PO Sur-reply”).

An oral hearing was held on July 19, 2022, and a transcript of the hearing is included in the record. Paper 32 (“Tr.”).

After the oral hearing, we authorized the parties to file parallel briefs related to certain claim construction issues. Paper 27. Petitioner filed opening (Paper 28, “Pet. CC Br.”) and responsive (Paper 30, “Pet. CC Resp.”) briefs. Patent Owner also filed opening (Paper 29, “PO CC Br.”) and responsive (Paper 31, “PO CC Resp.”) briefs.

We have jurisdiction under 35 U.S.C. § 6. This decision is a Final Written Decision under 35 U.S.C. § 318(a) as to the patentability of claims 1–18 of the ’534 patent. For the reasons discussed below, Petitioner has demonstrated by a preponderance of the evidence that claims 1–18 of the ’534 patent are unpatentable.

## I. BACKGROUND

### A. *Real Parties-in-Interest*

Petitioner identifies ZTE Corporation, ZTE (USA), Inc., and ZTE (TX), Inc., as the real parties-in-interest. Pet. 77. Patent Owner identifies WSOU Investments, LLC d/b/a Brazos Licensing and Development as the real party-in-interest. Paper 3, 1–2.

### B. *Related Proceedings*

The parties identify the following proceedings related to the '534 patent (Pet. 1 n.1, 78–79; Paper 3, 2; Paper 10, 1):

*WSOU Invs., LLC v. ZTE Corp.*, No. 6:20-cv-00496 (W.D. Tex. filed June 3, 2020) (“the underlying litigation”);

*WSOU Invs., LLC v. ZTE Corp.*, No. 6:20-cv-00254 (W.D. Tex. filed Mar. 31, 2020); and

*ZTE (USA) Inc. v. WSOU Invs., LLC*, No. 3:21-cv-02128 (N.D. Tex. filed Sept. 7, 2021).

We additionally note that Petitioner has challenged other patents owned by Patent Owner in IPR2021-00694, IPR2021-00695, IPR2021-00696, IPR2021-00697, and IPR2021-00698.

### C. *The '534 patent*

The '534 patent is directed to optimizing the use of the feedback forward channel in multi-carrier systems such as Orthogonal Frequency Division Multiplexing (OFDM) systems. Ex. 1001, 1:10–12. According to the '534 patent, “[t]he selection of the sub-carriers to be used between a base station and a UE [user equipment] should be coordinated between the transmitter and the receiver to avoid errors.” *Id.* at 1:54–56. The

'534 patent describes how, in a prior art method, “a message indicating the sub-carriers to be used is exchanged between the transmitter and the receiver in the feed forward carrier i.e. on the same carrier to be used for transmitting user data and prior to the transmission of the user data.” *Id.* at 1:56–60. But “[t]his kind of signaling information consumes a not negligible bandwidth and time so that the effective payload data rate is reduced accordingly.” *Id.* at 1:60–63. Thus, the invention of the '534 patent proposes “a more efficient way so that the amount of signaling information in the feed forward carrier is reduced but . . . sufficient for performing an efficient resource allocation in the multi carrier system.” *Id.* at 2:1–6.

Figure 1 of the '534 patent is reproduced below.

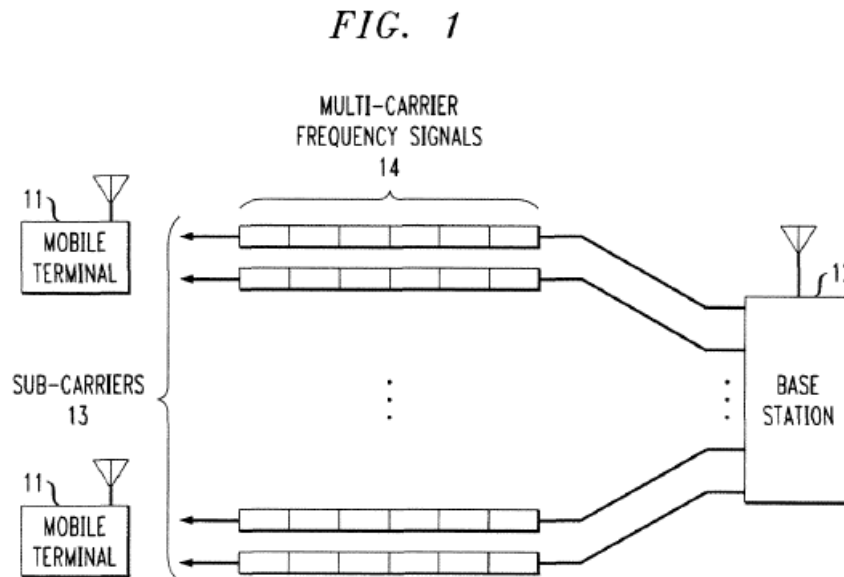


Figure 1 is an illustration of a network using multi-carrier transmission in a downlink. *Id.* at 2:43–44. Mobile terminals 11 receive multi-carrier frequency signals 14 in the downlink from base station 12 over sub-carriers 13. *Id.* at 2:44–46. Prior to transmission of user data to mobile terminals 11, base station 12 sends an indication of the particular sub-carriers 13 to be used for the transmission. *Id.* at 2:46–49. The indication

can be, for example, the number of the sub-carriers to select or a minimum quality threshold based on Signal to Interference Ratio (SIR) for sub-carriers to be selected. *Id.* at 4:11–18, 5:25–32.

Figure 2 of the '534 patent is reproduced below.

*FIG. 2*

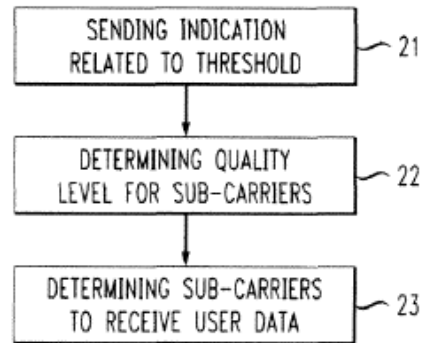


Figure 2 shows an implementation of the method for transmitting user data in a multi-carrier radio communication system. *Id.* at 2:29–32, 3:46–48. At step 21, base station 12 sends mobile terminals 11 an indication related to a threshold before transmission of user data. *Id.* at 3:50–52. At step 22, mobile terminal 11 determines a quality level, such as a SIR measurement, for the sub-carriers. *Id.* at 3:60–63. At step 23, mobile terminal 11 determines the sub-carriers through which it will receive user data as a function of the indication related to a threshold and of the quality level of the sub-carriers. *Id.* at 4:1–4.

Figure 3 of the '534 patent is reproduced below.

*FIG. 3*

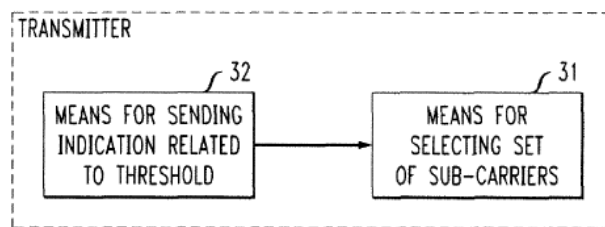


Figure 3 shows an implementation of a transmitter. *Id.* at 2:36–37, 5:10–11. The transmitter comprises means 31 for selecting a set of sub-carriers on which user data are to be transmitted to a receiver. *Id.* at 5:11–18. The transmitter also comprises means 32 for sending to the receiver, on a feed forward channel, an indication related to a threshold. *Id.* The indication allows the receiver to deduce the set of sub-carriers that will be used for transmission based on concordant information available at both the transmitter and the receiver. *Id.* The concordant information is quality information, such as SIR for various sub-carriers, which is measured at the receiver and sent to the transmitter on a feedback channel. *Id.* at 5:19–24.

Figure 4 of the '534 patent is reproduced below.

*FIG. 4*

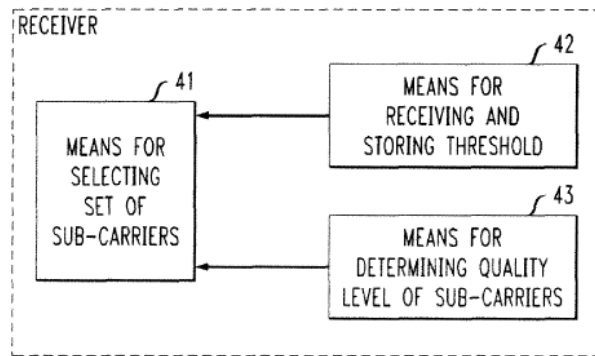


Figure 4 shows an implementation of a receiver. *Id.* at 2:38–39, 5:36–37. The receiver comprises means 41 for selecting a set of sub-carriers on which to receive user data from a transmitter. *Id.* at 5:38–42. The receiver also comprises means 42 for receiving and storing a threshold and means 43 for determining a quality level for sub-carriers. *Id.* Means 41 for selecting a set of sub-carriers selects the sub-carriers referred by means 43 as having a quality level higher than the threshold stored by means 42. *Id.* at 5:45–47. Alternatively, means 41 selects sub-carriers starting with the one having the

highest quality level referred by means 42 and continuing with sub-carriers with decreasing quality level until reaching the number of sub-carriers indicated by the threshold stored in means 42. *Id.* at 5:48–52.

The '534 patent issued from a U.S. application filed on July 11, 2006, and claims priority to a European patent application filed on August 1, 2005. *Id.* at codes (22), (30). As discussed below, Petitioner applies the August 1, 2005, filing date of the European application (i.e., the earliest effective filing date of the challenged claims) or the July 11, 2006, U.S. application filing date for qualifying the asserted references as prior art. *See* Pet. 5–7.

*D. Illustrative Claim*

Of the challenged claims of the '534 patent, claims 1, 6, and 16 are independent. Claims 2–5 depend from claim 1; claims 7–15 depend directly or indirectly from claim 6; and claims 17 and 18 depend from claim 16.

Claim 1 is illustrative of the challenged claims and recites:

1. Method for transmitting user data between a transmitter and a receiver in a multi-carrier radio communication system having a plurality of orthogonal frequency sub-carriers, said method comprising the steps of
  - at the receiver, determining quality levels for said sub-carriers;
  - sending said quality levels from said receiver to said transmitter;
  - selecting, based on said quality levels, a set of sub-carriers on which said user data is to be transmitted between said transmitter and said receiver,
  - from said transmitter, before transmission of said user data, sending an indication related to a threshold, said indication and said quality levels enabling said receiver to

deduce said set of sub-carriers on which said user data is to be transmitted; and

at said receiver, selecting said set of sub-carriers on which said user data is to be transmitted as a function of said indication and of said quality levels.

Ex. 1001, 5:57–6:8.

*E. Prior Art*

Petitioner relies on the following prior art:

WIPO International Patent Application Publication No. WO 2005/020489 A1, published Mar. 3, 2005 (Exs. 1005–1007, “Cheng”);<sup>1</sup>

U.S. Patent No. 7,697,449 B1, filed Nov. 12, 2004, issued Apr. 13, 2010 (Ex. 1008, “Shirali”);

U.S. Patent Application Publication No. 2006/0089102 A1, filed Nov. 20, 2003, published Apr. 27, 2006 (Ex. 1009, “Nishio”); and

U.S. Patent No. 7,075,906 B2, filed Sept. 30, 2003, issued July 11, 2006 (Ex. 1010, “Douglas”).

*F. The Instituted Grounds*

We instituted *inter partes* review of claims 1–18 of the ’534 patent on the following grounds (Dec. on Inst. 43), which are all the grounds presented in the Petition (Pet. 13):

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<sup>1</sup> Cheng is a Japanese-language publication that was filed with a translator’s affidavit (Ex. 1007), an English-language translation (Ex. 1006), and the original Japanese-language publication (Ex. 1005).

| Claim(s) Challenged             | 35 U.S.C. §         | Reference(s)/Basis |
|---------------------------------|---------------------|--------------------|
| 1–9, 12, 13, 15–18 <sup>2</sup> | 102(b) <sup>3</sup> | Cheng              |
| 1, 2, 6–10, 12–18 <sup>4</sup>  | 103(a) <sup>5</sup> | Cheng              |
| 3                               | 103(a)              | Cheng, Shirali     |
| 4, 5, 10, 14                    | 103(a)              | Cheng, Nishio      |
| 11                              | 103(a)              | Cheng, Douglas     |

## II. ANALYSIS

### A. *Legal Standards*

A claim is anticipated if a single prior art reference either expressly or inherently discloses every limitation of the claim. *Orion IP, LLC v. Hyundai Motor Am.*, 605 F.3d 967, 975 (Fed. Cir. 2010). Although the elements must be arranged or combined in the same way as in the claim, “the reference

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<sup>2</sup> Although claims 3–5 are not listed for the Cheng anticipation ground in Petitioner’s table of asserted grounds (*see* Pet. 13), Petitioner puts forth anticipation contentions for those claims in the body of the Petition (*see id.* at 59, 61, 65). We analyze those anticipation contentions below.

<sup>3</sup> The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112-29, 125 Stat. 284, 287–88 (2011), amended 35 U.S.C. §§ 102, 103, and 112. Because the ’534 patent was filed before March 16, 2013 (the effective date of the relevant amendments), the pre-AIA versions of §§ 102, 103, and 112 apply.

<sup>4</sup> Although claims 10 and 14 are not listed for the Cheng obviousness ground in Petitioner’s table of asserted grounds (*see* Pet. 13), Petitioner puts forth obviousness contentions for those claims based on Cheng in the body of the Petition (*see id.* at 66–69). We analyze those obviousness contentions in this Decision.

<sup>5</sup> Petitioner puts forth anticipation and obviousness grounds based on Cheng in the same section of the Petition. *See* Pet. 13. We treat these as two separate grounds.

need not satisfy an *ipsissimis verbis* test,” i.e., identity of terminology is not required. *In re Gleave*, 560 F.3d 1331, 1334 (Fed. Cir. 2009) (citing *In re Bond*, 910 F.2d 831, 832–33 (Fed. Cir. 1990)).

A claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *See 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) where in evidence, so-called secondary considerations.<sup>6</sup> *See Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). We also recognize that prior art references must be “considered together with the knowledge of one of ordinary skill in the pertinent art.” *In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994) (citing *In re Samour*, 571 F.2d 559, 562 (CCPA 1978)).

*B. Level of Ordinary Skill in the Art*

Citing testimony from Mr. Gray, Petitioner contends a person of ordinary skill in the art (or “POSITA”) “would have had a Bachelor of Science degree in Electrical Engineering or an equivalent field, with at least two years of academic or industry experience in the wireless communication

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<sup>6</sup> The trial record does not include any evidence of secondary considerations of nonobviousness.

industry or comparable industry experience.” Pet. 7 (citing Ex. 1003 ¶ 38). Patent Owner does not propose an alternative definition. *See* PO Resp. 5.

We adopt Petitioner’s definition of the level of ordinary skill in the art without the qualifier “at least,” which introduces ambiguity. We are satisfied that this definition comports with the level of skill necessary to understand and implement the teachings of the ’534 patent and the asserted prior art.

### *C. Claim Interpretation*

In an *inter partes* review, we construe each claim “in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.” 37 C.F.R. § 42.100(b). Accordingly, our claim construction standard is the same as that of a district court. *See id.* Under the standard applied by district courts, claim terms are generally given their plain and ordinary meaning as would have been understood by a person of ordinary skill in the art at the time of the invention and in the context of the entire patent disclosure. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313 (Fed. Cir. 2005) (en banc). “There are only two exceptions to this general rule: 1) when a patentee sets out a definition and acts as his own lexicographer, or 2) when the patentee disavows the full scope of a claim term either in the specification or during prosecution.” *Thorner v. Sony Comput. Entm’t Am. LLC*, 669 F.3d 1362, 1365 (Fed. Cir. 2012).

Construing a claim term under 35 U.S.C. § 112 ¶ 6 involves two steps: identifying the claimed function and then determining what structure, if any, disclosed in the specification corresponds to the claimed function.

*Williamson v. Citrix Online, LLC*, 792 F.3d 1339, 1351 (Fed. Cir. 2015). To determine whether § 112 ¶ 6 applies to a claim limitation, the essential inquiry is “whether the words of the claim are understood by persons of ordinary skill in the art to have a sufficiently definite meaning as the name for structure.” *Id.* at 1348. If the limitation uses the word “means,” “there is a rebuttable presumption that § 112, para. 6 applies; if not, there is a rebuttable presumption that the provision does not apply.” *Diebold Nixdorf, Inc. v. Int’l Trade Comm’n*, 899 F.3d 1291, 1298 (Fed. Cir. 2018).

We now consider claim construction issues only to the extent necessary to dispose of the instant unpatentability grounds. *See, e.g., Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019) (“The Board is required to construe ‘only those terms . . . that are in controversy, and only to the extent necessary to resolve the controversy.’” (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

1. *Construction of Claim 1*

Claim 1 recites two different “selecting” limitations:

selecting, based on said quality levels, a set of sub-carriers on which said user data is to be transmitted between said transmitter and said receiver [“first ‘selecting’ limitation”],

. . .

at said receiver, selecting said set of sub-carriers on which said user data is to be transmitted as a function of said indication and of said quality levels [“second ‘selecting’ limitation”].

Ex. 1001, 5:65–6:8. Regarding the two “selecting” limitations, Patent Owner states the following: “When understood in its proper context, the first recited ‘selecting’ is performed at the transmitter, while the second

recited ‘selecting’ is expressly differentiated in that it is performed ‘at said receiver.’” PO Resp. 14 (citing Ex. 1001, 5:65–67, 6:6–8). According to Patent Owner, “selecting” is “performed at both the transmitter and the receiver, using ‘concordant information’ present at each location.” *Id.*; *see also id.* at 4 (citing Ex. 1001, 3:6–13, 5:10–18), 7–10 (similar argument for “means for selecting” limitations of claim 6). As such, Patent Owner argues that it would be redundant, superfluous, and nonsensical to interpret the first “selecting” step as being performed at the receiver when the second “selecting” step is expressly said to be performed “at said receiver.” *Id.* at 15.

Patent Owner also argues that the second “selecting” limitation derives antecedent basis from the first “selecting” limitation for the term “said set of sub-carriers.” PO Sur-reply 16 (citing, *inter alia*, Ex. 1001, 5:65–67, 6:6–8; *Hytera Commc ’ns Co. v. Motorola Sols., Inc.*, 841 F. App’x 210, 218 (Fed. Cir. 2021)). According to Patent Owner, the fact “[t]hat the second ‘selecting’ step refers to the same ‘set of sub-carriers’ selected in the ‘first’ selecting step supports interpreting these distinct steps as requiring separate performance in the order recited.” *Id.* Patent Owner also notes that such a construction “is consistent with the preferred embodiment” insofar as “the selection of the sub-carriers to be used between a base station and a UE should be coordinated between the transmitter and the receiver to avoid errors.” *Id.* at 17 (quoting Ex. 1001, 1:54–56).

Petitioner does not address the construction of the first “selecting” limitation in the Petition, but Petitioner does ascribe both the first and second “selecting” limitations to Cheng’s terminal apparatus 200 (i.e., the claimed “receiver”) in its unpatentability analysis for claim 1. *See* Pet. 21,

26–27. In its Reply, Petitioner notes that the Specification of the ’534 patent discusses the selection of sub-carriers in reference to both the transmitter and the receiver. Pet. Reply 7–8 (citing Ex. 1001, 5:38–39, Figs. 3, 4).

Petitioner also argues that “the second selecting limitation is a further refinement on the first selecting limitation, where the second selecting limitation recognizes that the receiver is selecting the set of sub-carriers ‘as a function of said indication and of said quality levels.’” *Id.* at 8. Petitioner additionally characterizes the second “selecting” limitation as a logical narrowing of the first “selecting” limitation. *See id.* at 8–9. Thus, Petitioner contends that “a plain reading of claim 1 provides no reason why . . . the ‘two’ selecting steps are indeed separate steps, that the ‘two’ steps are performed separately, and that the ‘two’ selecting steps are performed in separate devices.” *Id.* at 9.

In our Decision on Institution, we determined preliminarily that the first “selecting” limitation is not tied to any particular structure because, *inter alia*, other steps of claim 1 are expressly recited to be performed “at said receiver” or “from said transmitter,” whereas the first “selecting” step does not have such a structural recitation. Dec. on Inst. 12 (citing Ex. 1001, 5:61–6:8; *Schumer v. Lab. Comput. Sys., Inc.*, 308 F.3d 1304, 1312 (Fed. Cir. 2002)). Notwithstanding, we noted that the Specification of the ’534 patent indicates that the first “selecting” limitation can be performed at the transmitter. *Id.* (citing Ex. 1001, 5:10–18). We now reconsider our preliminary construction about the first “selecting” step not being tied to a particular structure in light of the entire trial record, and, specifically, the parties’ supplemental briefs on claim construction.

a. Whether Claim 1 Requires an Order of Steps

We start by considering the language of claim 1 itself and whether the language imposes an order of steps. Petitioner states that the steps of claim 1 have a particular order “because (1) the receiver determines quality levels and those quality levels are sent from the receiver to the transmitter, (2) the transmitter sends an indication related to a threshold to the receiver, and (3) the receiver determines a set of sub-carriers based on the quality levels and the threshold.” Pet. CC Br. 4 (citing Ex. 1001, 3:50–4:4, Fig. 2). Petitioner allegedly bases this position on the three steps depicted in Figure 2 and their corresponding description in the ’534 patent. *Id.*

Patent Owner highlights numerous limitations in claim 1 that derive antecedent basis from earlier recitations as indicating an order of steps. PO CC Br. 4–5. Patent Owner cites *Hytera* for the proposition that we may impose an order of steps “where a step recited a term that provided antecedent basis for the same term recited in a step that followed.” PO Sur-reply 16 (citing *Hytera*, 841 F. App’x at 218); *see also* PO CC Br. 4–5 & n.1 (similar argument).

When “determining if the steps of a method claim that do not otherwise recite an order, must nonetheless be performed in the order in which they are written,” we “look to the claim language to determine if, as a matter of logic or grammar, they must be performed in the order written.” *Altiris, Inc. v. Symantec Corp.*, 318 F.3d 1363, 1369 (Fed. Cir. 2003) (citing *Interactive Gift Exp., Inc. v. Compuserve Inc.*, 256 F.3d 1323, 1343 (Fed. Cir. 2001)). At the outset, we note that claim 1 appears to have a temporal recitation: “from said transmitter, *before transmission of said user data*, sending an indication related to a threshold.” Ex. 1001, 6:1–2 (emphasis

added). Yet no claim of the challenged patent recites a limitation requiring actual transmission of user data. Rather, all limitations in the patent regarding transmission of user data are merely prospective. Thus, we find that this limitation does not bear on whether claim 1 implies an order of steps.

Next, we consider antecedent relationships in claim 1. Specifically, the first “selecting” limitation recites “selecting a set of sub-carriers,” whereas the second “selecting” limitation recites “at the receiver, selecting said set of sub-carriers.” Ex. 1001, 5:65–67, 6:6–8 (emphases added). Patent Owner is correct (PO Sur-reply 16; PO CC Br. 4–5) that the reference to “said set of sub-carriers” in the second “selecting” limitation derives antecedent basis from the first “selecting” limitation. Yet we do not agree that this antecedent relationship alone imposes an order of steps. For example, in *Respironics, Inc. v. Invacare Corp.*, 303 F. App’x 865, 870 (Fed. Cir. 2008) (citing *Interactive Gift*, 256 F.3d at 1328, 1343), the Federal Circuit held that, “in a method claim, a step that recites ‘said’ or ‘the,’ referring to an earlier object, does not always have to be performed after the step that first introduces the object.” Thus, we must still consider the other evidence of record before deciding whether the claim imposes an order of steps.

Petitioner references the embodiment of Figure 2 for the proposition that “selection at the receiver, which is the only selecting step disclosed . . . , occurs after the transmitter sends an indication to the receiver because the receiver then has the information to select the only set of sub-carriers.” Pet. CC Br. 4. Although we do not agree with Petitioner’s characterization of Figure 2 or that the Specification does not describe the transmitter making a

selection, we agree with Petitioner that the Figure 2 has some bearing on whether the steps of claim 1 must be performed in order. The embodiment of Figure 2 includes only a single step of determining subcarriers at the receiver (*see* Ex. 1001, 4:1–4, Fig. 2 (step 23)), so it does not elucidate the interplay of two different “selecting” limitations, as are recited in claim 1. Nevertheless, the embodiment of Figure 2 does provide insight as to whether the first step recited in claim 1, i.e., “at the receiver, determining quality levels for said sub-carriers,” must be performed first in the method of claim 1. We conclude that it need not be performed first.

The method of Figure 2 includes just three steps: (1) the base station sending a threshold indication to the mobile terminals (step 21); (2) the mobile terminal determining quality levels for subcarriers (step 22); and (3) the mobile terminal selecting subcarriers (step 23). Ex. 1001, 3:46–4:10; Fig. 2. Step 21, where the transmitter sends a threshold indication, presupposes that the transmitter already has some information about subcarrier quality and has selected subcarriers. In particular, the Specification states that “additional and concordant information [is] present at the transmitter 12 and at the receiver 11” and this information is “quality information preferably in form of Signal to Interference Ratio (SIR) for the different sub carriers which are preferably measured at the receiver and send [sic] back to the transmitter on a feedback channel.” *Id.* at 5:19–24. At the transmitter, “several sub-carriers 13 are allocated to each mobile terminal 11 in order to match the high throughput received from base station 12 in the downlink.”<sup>7</sup> *Id.* at 2:52–54. The transmitter then sends the threshold

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<sup>7</sup> We understand the reference to high throughput to be a measure of quality. *See, e.g.*, Ex. 1003 ¶ 149 (Mr. Gray testifying that an ordinarily skilled

indication on a feed-forward carrier that allows the receiver to deduce the subcarriers on which transmission will be performed. *Id.* at 3:8–13. Thus, step 22 of Figure 2 must relate to a subsequent determination of quality levels at the receiver rather than a determination that precedes step 21.

In addition, the Specification states that the receiver “should advantageously” make quality measurements “at [a] regular time interval in order to track channel change as fast as possible and avoid incompatibility with channel quality available at base station 12 and at mobile terminals 11.” Ex. 1001, 3:63–67. The fact that the receiver can determine quality levels before or after subcarriers are selected at the transmitter—and at regular time intervals—cuts against requiring the step of “determining quality levels” to come first in the method of claim 1.<sup>8</sup> Although this does not directly address the interplay of the two “selecting” limitations in claim 1, we view it as an indication that the steps in claim 1 need not be performed in the recited order.

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artisan “would have understood that the request transmission rate is related to reception quality, and that the quality would degrade if the transmission rate is not met or exceeded.”); Ex. 1006, 16 (Cheng stating that “the base station device can assign packet data to the subcarriers with good reception quality, thereby, user diversity effects can be obtained, and at the same time, the throughput of the entire system can be improved.”); Ex. 1009 ¶ 86 (Nishio stating that “blocks [of sub-carriers] are selected from those having top-ranking [Carrier to Interference Ratios] because it is thereby possible to prevent assignment of blocks of low quality, realize highly efficient transmission and reduce interference with neighboring cells. This allows the throughput of the entire system to be improved.”).

<sup>8</sup> The same logic applies to the method of claim 16. *See infra* § II.C.7.

b. Whether the Two “Selecting” Steps Must Be Separate

Next, we consider whether the two “selecting” limitations must be separate steps. Petitioner argues that “[n]othing in the claim requires a second, distinct selecting step,” and, “[r]ather, the second selecting limitation can be a further definition of the first selecting limitation.” Pet. CC Br. 3. In support of this premise, Petitioner cites teachings in the ’534 patent of the receiver selecting sub-carriers. *Id.* (citing Ex. 1001, 3:9–13, 4:1–4, 5:14–18, 5:38–42). Petitioner also notes that the two steps select the same sub-carriers based on different criteria. Pet. CC Resp. 3. As such, Petitioner reasons that “[t]he two selecting limitations are the same step because two steps on two different criteria would not yield the same ‘set of sub-carriers.’” *Id.* Petitioner also argues that “[t]he specification does not disclose the transmitter selecting sub-carriers or how it would make a selection.” *Id.* at 4.

Patent Owner argues that the antecedent relationship between the two “selecting” limitations for the “set of sub-carriers” (as discussed above) indicates they are separate steps. PO CC Br. 3. Patent Owner also argues that conflating the two “selecting” limitations would thwart an objective of the invention to minimize information sent between transmitter and receiver for coordinating the selection of sub-carriers. *Id.* at 3–4; PO Resp. 17–18.

Although we again do not agree with Petitioner’s reasoning,<sup>9</sup> we agree with Petitioner that the two “selecting” steps need not be separate. For

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<sup>9</sup> As discussed above, we disagree with Petitioner (Pet. CC Br. 3–4) that the Specification does not describe how the transmitter selects subcarriers. We also disagree with Petitioner (*see id.*) that two distinct “selecting” limitations could not yield the same set of subcarriers. Such an argument conflicts with an object of the invention to reduce the signaling load in the feed forward

reasons similar to those discussed above, we find that the antecedent relationship between the “set of sub-carriers” does not necessarily imply that the two “selecting” steps must be ordered and, therefore, distinct.

Furthermore, two passages in the Specification suggest that the act of selecting can be refined across the two limitations in the manner suggested by Petitioner. Referring to step 23 of Figure 2, the Specification states that the mobile terminal determines “sub-carriers to be listened to receive user data destined to this mobile as a function of the indication related to a threshold and of the quality level of the sub carriers.” Ex. 1001, 4:1–4. The Specification then states that the function “consist[s] in arranging the sub carriers in quality level decreasing order and *to select* the sub carriers starting with the sub carrier having the highest quality level and *continuing to select* the sub carriers with decreasing quality level until the indication related to a threshold is reached.” *Id.* at 4:5–10 (emphasis added); *see also id.* at 5:48–52 (similar language). In this way, the Specification plausibly supports a reading where the receiver chooses the first subcarrier with the highest quality (i.e., the first “selecting” limitation), and then continues to select subcarriers based on quality levels until the threshold indication is reached (i.e., the second “selecting” limitation). All of the selected subcarriers would be part of the same “set of sub-carriers,” thus accounting for the antecedent relationship.

We also agree with Petitioner that, as written, claim 1 can convey that the second “selecting” limitation is a refinement of the first “selecting” limitation. Contrary to Patent Owner’s suggestion at oral argument

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channel such that the receiver can deduce the subcarriers on which the base station will be transmitting. *See* Ex. 1001, 2:1–6, 3:9–13.

(Tr. 46:19–25), we do not agree that any specific formulation, such as a “wherein” clause or a more express antecedent relationship for the “selecting” steps (e.g., “said selecting further comprising”), is required to convey such refinement. In fact, the prosecution history supports that one “selecting” limitation can be a refinement of the other. Claim 1 as originally filed included two different “selecting” limitations:

1/ Method for transmitting user data between a transmitter and a receiver in a multi-carrier radio communication system having a plurality of orthogonal frequency sub-carriers, said method comprising the steps of selecting a set of sub-carriers on which said user data are to be transmitted between said transmitter and said receiver, said method further comprising the steps of:

- Sending from said transmitter, before transmission of said user data, an indication related to a threshold;
- Determining at the receiver a quality level for each sub carriers;
- Selecting at said receiver sub carriers to received said user data as a function of said indication related to a threshold and of said quality levels.

Ex. 1002, 134. As can be seen, the first “selecting” limitation here arguably appears in the preamble of this original claim, and the recited method is said to “further compris[e]” the second “[s]electing at said receiver” limitation. In addition, this original claim includes no express antecedent relationship between the sub-carriers selected in the two limitations. These details in the prosecution history support a broader interpretation where the latter limitation can be a refinement of the former.<sup>10</sup>

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<sup>10</sup> Only later in prosecution was the first “selecting” limitation moved out of the preamble and into the body of the claim, the “further comprising” language removed, and the antecedent relationship regarding “said set of sub-carriers” expressly established. *See* Ex. 1002, 61.

For these reasons, we decline to construe the two “selecting” steps as requiring separate and distinct steps.

c. Whether the First “Selecting” Limitation Must be Performed at the Transmitter

In our Decision on Institution, we determined that the lack of specific language, such as “at the receiver” and “from said transmitter,” supports that the first “selecting” limitation is not limited to any particular structure. Dec. on Inst. 12. We again decline to require that the first “selecting” limitation must be performed at the transmitter for the same reasons.<sup>11</sup> This determination also is bolstered by our analysis above that claim 1 need not be performed in a specific order and that one “selecting” limitation may be a refinement of the other. We additionally note that, as discussed in the next section, “selecting” may be performed at either the transmitter or the receiver in accordance with the Specification and prosecution history of the ’534 patent. *See infra* § II.C.2.

2. *“means for selecting a set of sub-carriers from the plurality of sub-carriers on which user data is to be communicated from a transmitter to a receiver, said selecting based at least in part on at least one of sub-carrier quality levels and a threshold indication associated with sub-carriers” (“first ‘means for selecting’ limitation”)* (claim 6)

In our Decision on Institution, we determined preliminarily that the first “means for selecting” limitation should be construed under 35 U.S.C. § 112 ¶ 6 because the use of the words “means for” creates a rebuttable

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<sup>11</sup> We still maintain that the first “selecting” limitation could be performed by the transmitter, however. *See, e.g.,* Ex. 1001, 2:52–54, 5:11–13.

presumption that § 112 ¶ 6 applies. Dec. on Inst. 10–11 (citing *Diebold*, 899 F.3d at 1298). After institution, Petitioner did not address this preliminary determination, and Patent Owner signaled agreement with it. *See* PO Sur-reply 3. We maintain our determination that § 112 ¶ 6 applies to this limitation.

We did not identify the claimed function and determine the corresponding structure the first “means for selecting” limitation in our Decision on Institution. Instead, we found that Petitioner had contravened 37 C.F.R. § 42.104(b)(3) because Petitioner had misstated Patent Owner’s proposed corresponding structure and had not supported its contention that a receiver is corresponding structure. Dec. on Inst. 11. In light of the parties’ post-institution briefing regarding the construction of this term, we find that it is necessary to fully construe the instant term. Thus, we now consider the proper interpretation of the first “means for selecting” limitation under 35 U.S.C. § 112 ¶ 6.

In the Petition, Petitioner identified the claimed function of the first “means for selecting” limitation as “selecting a set of sub-carriers from the plurality of sub-carriers on which user data is to be communicated from a transmitter to a receiver.” Pet. 9. Patent Owner agreed in its Response. PO Resp. 6. We also note that the district court in the underlying litigation identified this same function. Ex. 2007, 3. After the oral hearing in this case, we asked the parties to brief the issue of whether we should further include the following language in the identified function: “said selecting based at least in part on at least one of sub-carrier quality levels and a threshold indication associated with sub-carriers.” Paper 27, 3 (emphasis omitted). Petitioner states that the identified function should include this

additional language. Pet. CC Br. 6; Pet. CC Resp. 4–5. Patent Owner does not take a clear position on this issue, though Patent Owner recapitulates its argument from the Response and its briefing in the underlying litigation that this additional language “meaningfully and structurally limits how the [*first* ‘means for selecting’] is performed.” PO CC Br. 6 (quoting PO Resp. 6 n.2) (alteration by Patent Owner); *see also* Ex. 2007, 3 (same argument in underlying litigation).<sup>12</sup>

The recitation “said selecting based at least in part on at least one of sub-carrier quality levels and a threshold indication associated with sub-carriers” directly refers to and further defines the recited “selecting” function. Accordingly, we determine it is an integral part of the recited “selecting” function in claim 6. Thus, we identify the claimed function as “selecting a set of sub-carriers from the plurality of sub-carriers on which user data is to be communicated from a transmitter to a receiver, said

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<sup>12</sup> We note that Patent Owner makes the argument about meaningfully and structurally limiting how “selecting” is performed with respect to a larger swath of claim language:

said selecting based at least in part on at least one of sub-carrier quality levels and a threshold indication associated with sub-carriers, said quality levels communicated from the receiver to the transmitter and said threshold indication communicated from the transmitter to the receiver, said threshold indication and said quality levels enabling said receiver to deduce said set of sub-carriers on which said user data is to be communicated.

PO Resp. 6 n.2 (citing Ex. 2003, 7). Nevertheless, we do not view the further recitations about the “quality levels” and “threshold indication” being communicated—and what they enable—to define the recited “selecting” function.

selecting based at least in part on at least one of sub-carrier quality levels and a threshold indication associated with sub-carriers.”

We note that, within the identified function, the recitation “based at least in part on at least one of sub-carrier quality levels and a threshold indication associated with sub-carriers” appears to be in Markush form, which means the claim “lists alternative species or elements that can be selected as part of the claimed invention.” *Multilayer Stretch Cling Film Holdings, Inc. v. Berry Plastics Corp.*, 831 F.3d 1350, 1357 (Fed. Cir. 2016). If an element is written in Markush form, “the entire element is disclosed by the prior art if one alternative in the Markush group is in the prior art.” *Fresenius USA, Inc. v. Baxter Int’l, Inc.*, 582 F.3d 1288, 1298 (Fed. Cir. 2009).

Next, we consider the corresponding structure in the Specification of the ’534 patent. We acknowledge that the Petition was filed in the midst of various claim construction exchanges between the parties in the underlying litigation, which led to some confusion about the parties’ positions at various times. Rather than attempting to chronicle the exchanges, we turn directly to the parties’ substantive arguments.<sup>13</sup>

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<sup>13</sup> In our Decision on Institution, we found preliminarily that the Petition was deficient under 37 C.F.R. § 42.104(b)(3) based on Petitioner’s misstatement that Patent Owner’s proposed corresponding structure for the first “means for selecting” limitation of claim 6 is a receiver, rather than a transmitter as Patent Owner actually proposed. Dec. on Inst. 10–11. Petitioner maintains its contention that a receiver is the corresponding structure in the Reply and provides some additional support for its contention. Pet. Reply 5. Given that we now find the corresponding structure to be a transmitter or a receiver, as discussed below, we no longer find the Petition to be deficient in the same way.

Petitioner contends that the receiver is the corresponding structure. Pet. Reply 5; Pet. CC Br. 7–8. Petitioner argues that “the only structure identified in the specification as performing the selecting step based on any criteria is the receiver.” Pet. CC Br. 7 (citing Ex. 1001, Abstr., 3:9–13, 4:1–4, 5:10–18, 5:38–42). Although Petitioner acknowledges that column 5 of the ’534 patent references “means for selecting” at the transmitter, Petitioner contends that “the specification does not disclose whether or how the transmitter performs any selection of sub-carriers.” *Id.* (citing Ex. 1001, 5:11–14). Thus, according to Petitioner, “the receiver is only structure described in the specification as selecting sub-carriers based on quality levels or a threshold indication.” *Id.* Petitioner also argues that the second “means for selecting” limitation of claim 6 “is a refinement of the first, occurring at the receiver.” Pet. CC Resp. 5.

Patent Owner argues that the transmitter as disclosed in Figure 3 of the ’534 patent is the corresponding structure. PO CC Br. 7; PO Resp. 7–10; PO Sur-reply 9. Patent Owner notes how the patent examiner stated that “the idea behind” the claim that issued as claim 6 “is that the *transmitter* selects the sub[-]carriers for transmission.” PO CC Br. 1, 7–8 (quoting Ex. 1002, 49) (emphasis and alteration by Patent Owner). Patent Owner also argues that

the recitation of *two* distinct “means for selecting” limitations in claim 6 reflects the disclosed and thematic objective of minimizing the exchange of signaling information between a transmitter and a receiver, while nevertheless enabling the transmitter *and* the receiver to *both* separately select the same set of sub-carriers to be used.

*Id.* at 8. Patent Owner further argues that “claim 13 accurately reflects the written description of Figure 3, which identifies the transmitter 12 as

performing its own sub-carrier selection for transmitting user data, using its internal selecting means 32,” which is consistent with claim 6. *Id.* (citing Ex. 1001, 5:10–35). Patent Owner additionally argues that the concept of claim differentiation with respect to claim 13 does not make this limitation open-ended. *Id.* (citing *Laitram Corp. v. Rexnord, Inc.*, 939 F.2d 1533, 1558 (Fed. Cir. 1991)).

The district court determined the corresponding structure to be a “transmitter as described in Fig. 3 and corresponding text, and equivalents.” Ex. 2007, 3; *see also* PO Resp. 1–2. The court did not support its construction with any analysis, however.<sup>14</sup>

In determining the corresponding structure, we start with the function identified above and note that the selecting of sub-carriers is “based at least in part on at least one of sub-carrier quality levels and a threshold indication associated with sub-carriers.” The Markush form of the limitation indicates that selection can be based on quality levels or a threshold indication or both. We agree with Petitioner that the Specification identifies the receiver of Figure 4 as selecting sub-carriers based on both quality levels and a threshold indication, which meets the identified function. Ex. 1001, 5:38–52, Fig. 4. This is an indicator that the receiver is corresponding structure.

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<sup>14</sup> We note that the court’s determination of corresponding structure was based on the identified function being “selecting a set of sub-carriers from the plurality of sub-carriers on which user data is to be communicated from a transmitter to a receiver.” Ex. 2007, 3. As discussed directly above, we find that the identified function further includes the language “said selecting based at least in part on at least one of sub-carrier quality levels and a threshold indication associated with sub-carriers.” This additional language influences our view about the corresponding structure.

Yet we disagree with Petitioner (Pet. CC Br. 7) that the Specification does not say how the transmitter selects sub-carriers. On the contrary, the Specification states that “several sub-carriers 13 are allocated to each mobile terminal 11 in order to match the high throughput received from base station 12 in the downlink.” Ex. 1001, 2:52–54. High throughput is a measure of quality. *See supra* note 7. And, as noted by Patent Owner (PO Resp. 9–10), the Specification describes a transmitter in Figure 3 with “means 31 for selecting a set of sub carriers on which the user data are to be transmitted to a receiver.” Ex. 1001, 5:10–13. Taken together, these disclosures indicate that the transmitter may also be corresponding structure because it selects sub-carriers based on quality levels, thus satisfying the Markush limitation.

Furthermore, as noted by both parties (Pet. CC Br. 7–8; Pet. CC Resp. 5; PO CC Br. 8; PO CC Resp. 4–5), we must interpret the first “means for selecting” limitation such that it is consistent with two other limitations: (1) a subsequent limitation in claim 6 that recites “said receiver comprising: means for selecting said set of sub-carriers on which said user data is to be received from said transmitter; and (2) a subsequent limitation in claim 13, which depends from claim 6, that recites “said transmitter comprising: means for selecting said set of sub-carriers on which said user data is to be transmitted to said receiver.” Ex. 1001, 6:39–42, 7:14–16. Each party contends that its proposed structure is consistent with these subsequent limitations, but, in our view, both parties’ positions on this issue create inconsistencies with one of these subsequent limitations. Nevertheless, by choosing a transmitter or a receiver as alternative corresponding structures, we can maintain consistency with both subsequent limitations. In this way,

the subsequent limitations further define the invention as to one of the alternative corresponding structures, i.e., as a receiver for the second “means for selecting” of claim 6, and as a transmitter for the “means for selecting” of claim 13.

The prosecution history supports the notion that a transmitter or a receiver are alternative corresponding structures for the first “means for selecting” limitation. *See Medtronic, Inc. v. Advanced Cardiovascular*, 248 F.3d 1303, 1311 (Fed. Cir. 2001) (determining that the language of the specification or the prosecution history must clearly link the structures to a particular recited function). Prosecution claim 8, which corresponds to issued claim 6, initially recited only the first “means for selecting” limitation. Ex. 1002, 62. The subsequent receiver and transmitter “means for selecting” limitations appeared in separate claims, each of which depended from prosecution claim 8. *See id.* at 63 (prosecution claim 12), 64 (prosecution claim 16). This indicates that the first “means for selecting” limitation of prosecution claim 8 initially was not tied to either the receiver or the transmitter. Only in a later amendment did the patentees combine the limitations of prosecution claim 8 with prosecution claim 12, thus yielding issued claim 6. *Id.* at 34–35. Prosecution claim 16, now issued claim 13, remained separate. *Id.* at 36. We find that this prosecution history supports a broader notion of the corresponding structure for the first “means for selecting” limitation such that it can be either a transmitter or a receiver.

For these reasons, we determine that the corresponding structure for the first “means for selecting” limitation is a transmitter or a receiver.

3. *Construction of Additional Means-Plus-Function Limitations in Claim 6*

Claim 6 includes four additional means-plus-function limitations, which are nested within the “wherein” clause reproduced below:

wherein said receiver is adapted to receive user data from said transmitter via the radio link, said receiver comprising:

means for selecting said set of sub-carriers on which said user data is to be received from said transmitter;

means for determining quality levels for sub-carriers;

means for sending said quality levels to said transmitter;

and

means for receiving and storing said threshold indication from said transmitter, said threshold indication and said quality levels enabling said receiver to deduce said set of sub-carriers on which said user data is to be received[.]

Ex. 1001, 6:37–50. Petitioner states that it adopts Patent Owner’s constructions under 35 U.S.C. § 112 ¶ 6 for these limitations, which identify the functions as underlined above and identify the corresponding structure of a receiver. Pet. 9–11. Patent Owner does not respond other than to note that the court in the underlying litigation determined that the corresponding structure for the recited “means for determining quality levels for sub-carriers” is a “receiver as described in Fig. 4 and corresponding text, and equivalents.” PO Sur-reply 1–2 (quoting Ex. 2007, 3). Thus, we apply § 112 ¶ 6 and determine that (1) the recited functions are identified by the underlining above; and (2) the corresponding structure for each of these means-plus-function limitations is a receiver.

4. *“means for selecting sub-carriers or sub-carrier groups with the highest quality level and decreasing quality levels until the threshold indication is reached” (claim 9)*

Claim 9 recites “means for selecting sub-carriers or sub-carrier groups with the highest quality level and decreasing quality levels until the threshold indication is reached.” Ex. 1001, 6:65–67. Petitioner states that it adopts Patent Owner’s construction under 35 U.S.C. § 112 ¶ 6 for this limitation, which identifies the function as underlined above and identifies the corresponding structure of a receiver. Pet. 9, 11. Patent Owner does not address the construction of this limitation. Thus, we apply § 112 ¶ 6 and determine that (1) the recited function is identified by the underlining above; and (2) the corresponding structure for this limitation is a receiver.

5. *“means for reading the threshold indication on at least one sub-carrier of the selected set of sub-carriers after detecting a specific identifier associated with the receiver on said at least one sub-carrier” (claim 11)*

Claim 11 recites “means for reading the threshold indication on at least one sub-carrier of the selected set of sub-carriers after detecting a specific identifier associated with the receiver on said at least one sub-carrier.” Ex. 1001, 7:4–9 (emphasis added). Petitioner states that it adopts Patent Owner’s construction under 35 U.S.C. § 112 ¶ 6 for this limitation, which identifies the function as underlined above and identifies the corresponding structure of a receiver. Pet. 9, 11. Patent Owner does not address the construction of this limitation. Thus, we apply § 112 ¶ 6 and determine that (1) the recited function is identified by the underlining above; and (2) the corresponding structure for this limitation is a receiver.

6. *Construction of Means-Plus-Function Limitations in Claim 13*

Claim 13 includes three means-plus-function limitations, which are nested within the clause reproduced below:

said transmitter adapted to transmit user data to said receiver via the radio link, said transmitter comprising:

means for selecting said set of sub-carriers on which said user data is to be transmitted to said receiver;

means for receiving said quality levels from said receiver; and

means for sending said threshold indication to said receiver, said threshold indication and said quality levels enabling said receiver to deduce the set of sub-carriers on which said user data is to be transmitted.

Ex. 1001, 7:12–22. Petitioner states that it adopts Patent Owner’s constructions under 35 U.S.C. § 112 ¶ 6 for these limitations, which identify the functions as underlined above and identify the corresponding structure of a transmitter.<sup>15</sup> Pet. 9, 11–12. Patent Owner does not address the construction of this limitation in any arguments pertaining to claim 13. Thus, we apply § 112 ¶ 6 and determine that (1) the recited functions are identified by the underlining above; and (2) the corresponding structure for each of these means-plus-function limitations is a transmitter.

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<sup>15</sup> Petitioner’s claim construction chart includes an apparent typographical error in the function of the “means for selecting” limitation of claim 13. Pet. 11. In particular, the correct function should be “selecting said set of sub-carriers on which *said user data is to be transmitted to said receiver*.” Ex. 1001, 7:15–16 (emphasis added). We view this as harmless error.

7. *Construction of Claim 16*

Claim 16 recites two different “selecting” limitations:

selecting a set of sub-carriers from the plurality of sub-carriers on which user data is to be communicated from a transmitter to a receiver, said selecting based at least in part on at least one of sub-carrier quality levels and a threshold indication associated with sub-carriers, said quality levels communicated from the receiver to the transmitter and said threshold indication communicated from the transmitter to the receiver, said threshold indication and said quality levels enabling said receiver to deduce said set of sub-carriers on which said user data is to be transmitted [“first ‘selecting’ limitation”];

selecting said set of sub-carriers on which said user data is to be received from said transmitter at said receiver [“second ‘selecting’ limitation”][.]

Ex. 1001, 5:65–6:8. Both parties argue that claim 16 should be construed in the same manner as claim 1. Pet. CC Br. 5; PO CC Br. 5. We agree insofar as claim 16 (1) does not imply an order of steps; (2) does not require distinct and separate acts of “selecting”; and (3) does not require the first “selecting” limitation to occur at the transmitter.

In particular, the recitations in claim 16 do not imply any particular order for the same reasons as in claim 1. *See supra* § II.C.1.a. We also note that, as with the first “means for selecting” limitation in claim 6, the first “selecting” limitation in claim 16 is broad enough to cover an act of selecting at either a transmitter or a receiver. *See supra* § II.C.2. Claim 16 also recites that the second “selecting” limitation occurs “at said receiver,” and a subsequent limitation in claim 17 recites a “selecting” limitation “at said transmitter.” Just as with claim 6, this supports an interpretation where the first “selecting” limitation could occur in a transmitter or a receiver. *See id.*

Furthermore, the prosecution history supports a similar interpretation of claim 16. Prosecution claim 19, which corresponds to issued claim 16, initially recited only the first “selecting” limitation. Ex. 1002, 64. The second “selecting” limitation, which occurs “at said receiver,” appeared separately in prosecution claim 20. *Id.* at 64–65. Still another “selecting” limitation “at said transmitter,” which is recited in issued claim 17, appears separately in prosecution claim 21. *Id.* at 65. This indicates that the first “selecting” limitation of prosecution claim 19 (now issued claim 16) initially was not tied to either the receiver or the transmitter. We find that this prosecution history supports a broader notion of the first “selecting” limitation of claim 16 such that it need not be performed in any particular structure.

Thus, for these reasons and for similar reasons to those mentioned above with respect to claims 1 and 6, we decline to (1) impose an order of steps for claim 16; (2) require distinct and separate acts of selecting for the two “selecting” limitations in claim 16; or (3) require that the first “selecting” limitation of claim 16 must occur at the transmitter. *See supra* §§ II.C.1, II.C.2.

8. *“means for sending the threshold indication from said transmitter to said receiver” (claim 17)*

Claim 17 recites “means for sending the threshold indication from said transmitter to said receiver.” Ex. 1001, 6:65–67 (emphasis added). Petitioner states that it adopts Patent Owner’s construction under 35 U.S.C. § 112 ¶ 6 for this limitation, which identifies the function as underlined above and identifies the corresponding structure of a transmitter. Pet. 9, 12. Patent Owner does not address the construction of this limitation. Thus, we

apply § 112 ¶ 6 and determine that (1) the recited function is identified by the underlining above; and (2) the corresponding structure for this limitation is a transmitter.<sup>16</sup>

#### 9. *Other Terms*

We note that the district court’s claim construction order states that the following terms are construed as having their plain and ordinary meaning: “maximal number of subcarriers” (claim 4); “maximum number of sub-carriers” (claim 7); “quality levels” (claims 1, 2, 3, 5–9, 13, and 16–18); and “as a function of” (claims 1, 6, and 16). Ex. 2007, 2, 4. We apply the same construction for these terms herein. We also determine that no other terms require explicit construction. *See Realtime Data*, 912 F.3d at 1375.

#### D. *Anticipation Ground Based on Cheng*

Petitioner contends claims 1–9, 12, 13, and 15–18 are anticipated by Cheng. Pet. 13–59, 61, 65; Pet. Reply 6–15. Patent Owner disputes Petitioner’s contentions. PO Resp. 11–22; PO Sur-reply 9–18.

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<sup>16</sup> Claim 17 appears to reference two statutory classes of invention: an apparatus (via the “means for sending” limitation of claim 17) and a method (all other limitations). As such, it appears to be indefinite under 35 U.S.C. § 112 ¶ 2. *See IPXL Holdings, L.L.C. v. Amazon.com, Inc.*, 430 F.3d 1377, 1384 (Fed. Cir. 2005). Notwithstanding, we follow the counsel of our reviewing court and proceed to “analyze the patentability of [the] claim even if that claim is indefinite under the reasoning of *IPXL*.” *Samsung Elecs. Am., Inc. v. Prisua Eng’g Corp.*, 948 F.3d 1342, 1355 (Fed. Cir. 2020).

1. *Cheng*

Cheng is an international patent application publication directed to “a radio communication apparatus and subcarrier assignment method combining adaptive modulation and frequency scheduling.” Ex. 1006, 1.<sup>17</sup> Figure 3 of Cheng is reproduced below.

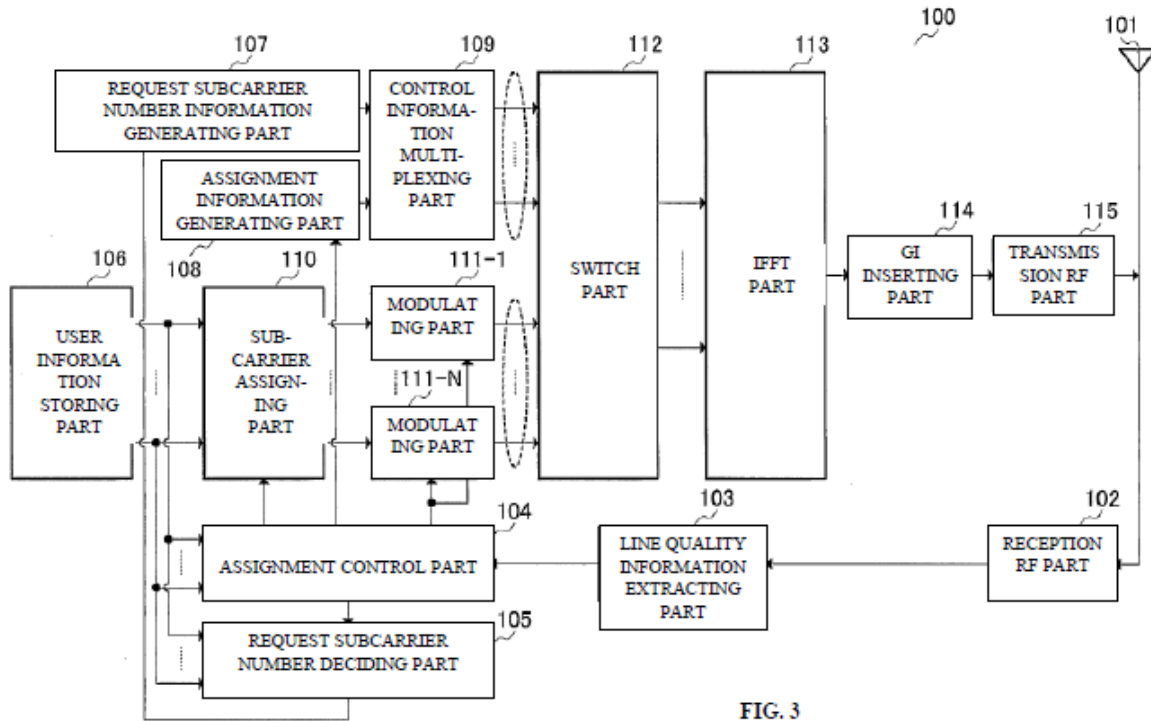


FIG. 3

Figure 3 is a block diagram of radio communication apparatus 100 (i.e., a base station) having reception radio frequency (RF) part 102, transmission RF part 115, and antenna 101. *Id.* at 4, 7. Line quality information extracting part 103 extracts line quality information, such as a channel quality indicator (CQI), from signals received via reception RF part 102. *Id.* at 4. Assignment control part 104 assigns a subcarrier and selects a modulation scheme for each communication terminal apparatus based on the

<sup>17</sup> Unless otherwise specified, we follow Petitioner’s convention of citing Specification page numbers at the top of each page in the English-language translation of Cheng.

CQI and a requested transmission rate. *Id.* at Abstr. Request subcarrier number deciding part 105 “decides, based on the request transmission rate information of the communication terminal apparatus of each user, the number of subcarriers to be assigned.” *Id.* Request subcarrier number information generating part 107 generates control information on the number of subcarriers. *Id.* at 6. Transmission RF part 115 transmits control information and packet data via antenna 101. *Id.* at 7.

Figure 4 of Cheng is reproduced below.

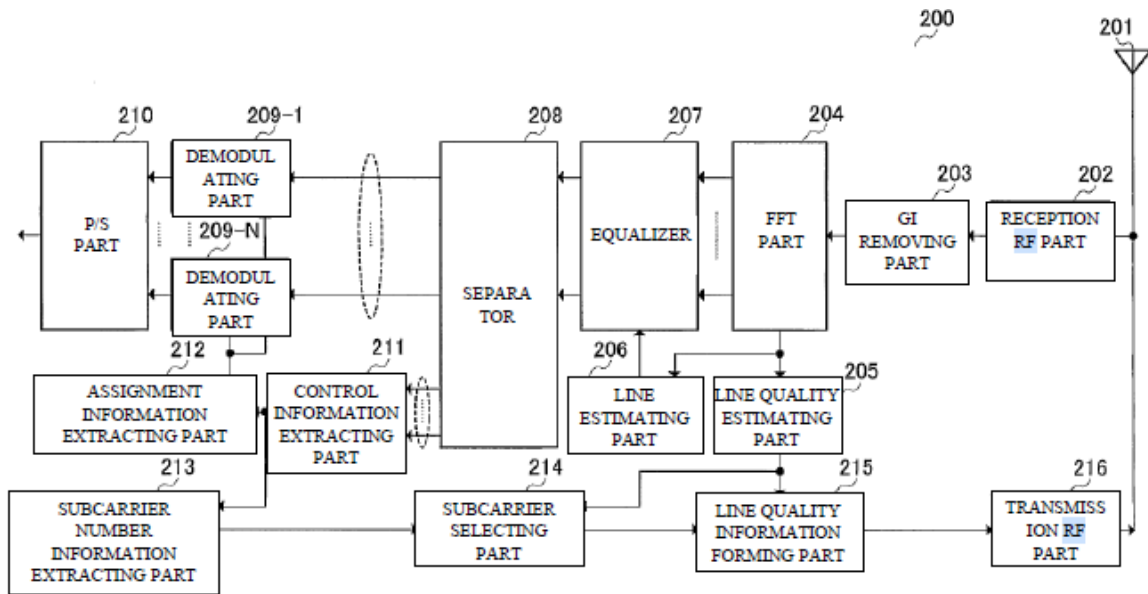


FIG. 4

Figure 4 is a block diagram of communication terminal apparatus 200 having reception RF part 202, transmission RF part 216, and antenna 201. *Id.* at 4, 7, 9. Line quality estimating part 205 estimates line quality using, for example, Signal to Interferer Ratio (SIR) or Carrier to Interferer Ratio (CIR) as an estimation result. *Id.* at 8. In accordance with the number of subcarriers instructed from the base station device, subcarrier selecting part 214 selects subcarriers based on the SIR measurement result in the order of line quality. *Id.* at 9. Also based on SIR, line quality information forming

part 215 outputs CQI for each selected subcarrier for transmission via transmission RF part 216 and antenna 201. *Id.*

Figure 5 of Cheng is reproduced below.

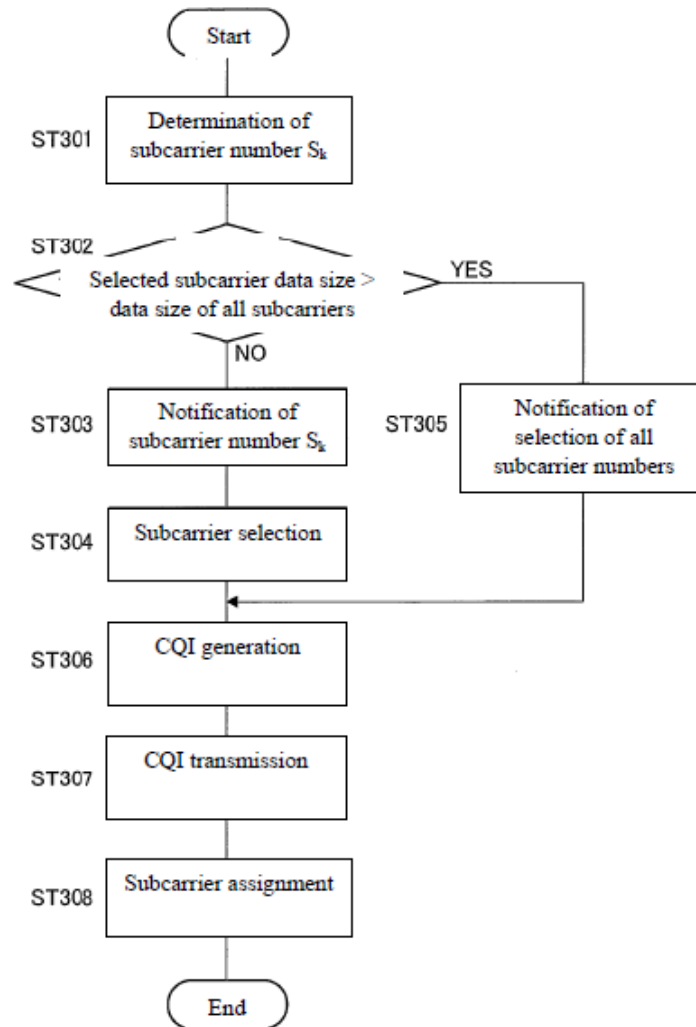


FIG. 5

Figure 5 is a flowchart showing a method of assigning subcarriers. *Id.* at 4, 9. In step 301, request subcarrier number deciding part 105 determines the number of subcarriers to be assigned to each communication terminal apparatus 200. *Id.* at 9. Subcarrier number information is transmitted and notified to communication terminal apparatus 200 in step 303. *Id.* at 11. In step 304, subcarrier number information extracting part 213 extracts the

subcarrier number information from a received signal, and the line quality information forming part 215 selects subcarriers in the order from the most favorable reception quality. *Id.* In step 306, line quality information forming part 215 generates CQI of each selected subcarrier or all subcarriers. *Id.* at 12. Communication terminal apparatus 200 then transmits CQI and subcarrier information to radio communication apparatus 100 in step 307. *Id.* In step 308, line quality information extracting part 103 extracts CQI from the received signal, and assignment control part 104 assigns the subcarriers to communication terminal apparatus 200. *Id.*

Petitioner contends that Cheng qualifies as prior art under, *inter alia*, 35 U.S.C. § 102(b) based on its publication date. Pet. 5. Patent Owner does not contest the prior art status of Cheng. We determine that Cheng qualifies as prior art under 35 U.S.C. § 102(b) because Cheng's publication date of March 3, 2005, is more than one year before the U.S. filing date of the challenged claims, which is July 11, 2006. Ex. 1001, code (22); Ex. 1006, code (43).

## 2. *Claim 1*

The preamble of claim 1 recites a “[m]ethod for transmitting user data between a transmitter and a receiver in a multi-carrier radio communication system having a plurality of orthogonal frequency sub-carriers.” Ex. 1001, 5:57–60. For the recited “transmitter” and “receiver,” Petitioner cites Cheng's radio communication apparatus 100 and communication terminal apparatus 200, respectively. Pet. 14–15 (citing Ex. 1006, 2–3, 7, Figs. 3, 4). Petitioner notes that radio communication apparatus 100 includes RF

transmission section 115, which outputs “control information or packet data” to antenna 101 for transmission. *Id.* at 14 (citing Ex. 1006, 7, Fig. 3).

Petitioner further notes that communication terminal apparatus 200 includes reception RF part 202 to down-convert received radio signals from antenna 201. *Id.* at 15 (citing Ex. 1006, 7, Fig. 4).

For “transmitting user data,” Petitioner cites Cheng’s disclosure of allocating subcarriers for transmitting packet data to communication partners. *Id.* (citing Ex. 1006, 2, 3). Regarding the “multi-carrier radio communication system having a plurality of orthogonal frequency sub-carriers,” Petitioner contends an ordinarily skilled artisan “would have understood that *Cheng* discloses an OFDM system based on the related background art and *Cheng*’s disclosure of assigning multiple subcarriers to transmit packet data using frequencies.” *Id.* at 16 (citing Ex. 1003 ¶ 61; Ex. 1006, 1–2). Neither party addresses whether the preamble is limiting. Patent Owner does not dispute that Cheng discloses the preamble.

We are persuaded that Cheng’s radio communication apparatus 100 and communication terminal apparatus 200 describe the recited “transmitter” and “receiver,” respectively. *See, e.g.*, Ex. 1006, 2–3, 7, Figs. 3, 4. We also are persuaded that Cheng’s disclosure of OFDM describes the recited “multi-carrier radio communication system having a plurality of orthogonal frequency sub-carriers” because the sub-carriers in OFDM systems are orthogonal to one another. *See, e.g.*, Ex. 1003 ¶ 61; Ex. 1006, 1–3. Because Petitioner has shown that Cheng discloses the preamble, we need not determine whether the preamble is limiting. *See Realtime Data*, 912 F.3d at 1375 (Fed. Cir. 2019).

Claim 1 further recites “at the receiver, determining quality levels for said sub-carriers.” Ex. 1001, 5:63–64. Petitioner cites Cheng’s disclosure of line quality estimating part 205 in terminal apparatus 200, which estimates “a Signal to Interferer Ratio (SIR)” or a “Carrier Interference Ratio (CIR)”<sup>18</sup> from a received signal. Pet. 16–17 (citing Ex. 1006, 8, Fig. 4). Petitioner further cites Cheng’s disclosure of selecting subcarriers based on the SIR measurement. *Id.* at 18 (citing Ex. 1006, 9). Patent Owner does not dispute that Cheng discloses this limitation. We are persuaded that Cheng’s line quality estimating part 205, which estimates SIR or CIR, discloses the “determining” limitation. *See, e.g.*, Ex. 1006, 8.

Claim 1 further recites “sending said quality levels from said receiver to said transmitter” (“first ‘sending’ limitation”). Ex. 1001, 5:63–64. Petitioner cites Cheng’s disclosure of line quality information forming part 215 in terminal apparatus 200, which outputs Channel Quality Indicators (CQIs) associated with SIR measurements from line quality estimating part 205. Pet. 18, 20 (citing Ex. 1006, 9). According to Petitioner, the CQIs (i.e., the recited “quality levels”) are transmitted via transmission RF part 216 and antenna 201 to radio communication apparatus 100. *Id.* at 18–21 (citing Ex. 1003 ¶ 70; Ex. 1006, 4, 9, 12, 15, Figs. 4, 5). Patent Owner does not dispute that Cheng discloses this limitation. We are persuaded that Cheng’s disclosure of line quality information forming part 215 outputting line quality indicators for transmission to radio communication apparatus 100 describes the first “sending” limitation. *See, e.g.*, Ex. 1006, 4, 9, 12, 15, Figs. 4, 5.

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<sup>18</sup> The cited portion of Cheng actually uses the term “Carrier to Interferer Ratio (CIR).” Ex. 1006, 8.

Claim 1 further recites “selecting, based on said quality levels, a set of subcarriers on which said user data is to be transmitted between said transmitter and said receiver” (“first ‘selecting’ limitation”). Ex. 1001, 5:65–67. Petitioner cites Cheng’s subcarrier selecting section 214 in terminal apparatus 200, which selects subcarriers based on SIR measurement results, i.e., line quality. Pet. 21 (citing Ex. 1006, 9). Petitioner notes that subcarriers are selected based on the number of subcarriers designated by the base station. *Id.* Petitioner further contends that, in Cheng, some or all subcarriers may be assigned to meet a “request transmission rate,” so an ordinarily skilled artisan have understood that Cheng discloses the selection of a “set of sub-carriers.” *Id.* at 21–22 (citing Ex. 1003 ¶ 73; Ex. 1006, 11–12). Petitioner also cites Cheng’s disclosure of allocating subcarriers for transmitting packet data between communication partners. *Id.* at 22 (citing Ex. 1006, 2–3).

Patent Owner disputes Petitioner’s analysis to the extent that it maps the first “selecting” step to Cheng’s subcarrier selecting section 214 in terminal apparatus 200 (i.e., the claimed “receiver”) rather than to radio communication apparatus 100 (i.e., the claimed “transmitter”). PO Resp. 14–16. According to Patent Owner, “Petitioner errs . . . in advancing a theory that interprets both ‘selecting’ steps of claim 1 to be redundantly performed (twice) at the claimed ‘receiver.’” *Id.* at 15 (citing Pet. 21–22). Patent Owner also argues that Petitioner’s mapping “render[s] superfluous and nonsensical the explicit differentiation of the second ‘selecting’ as being performed ‘at said receiver.’” *Id.* (citing Ex. 1001, 6:6–8). Nevertheless, as discussed above (*see supra* § II.C.1), we do not interpret the first “selecting” step such that it must be performed at the transmitter. Thus, we do not agree

with Patent Owner’s argument and are persuaded that Cheng’s disclosure of subcarrier selecting section 214 in terminal apparatus 200 selecting subcarriers based on SIR measurement results describes the first “selecting” step.<sup>19</sup> *See, e.g.*, Ex. 1006, 2–3, 9.

Claim 1 further recites “from said transmitter, before transmission of said user data, sending an indication related to a threshold, said indication and said quality levels enabling said receiver to deduce said set of subcarriers on which said user data is to be transmitted” (“second ‘sending’ limitation”). Ex. 1001, 6:1–5. For “sending an indication related to a threshold,” Petitioner cites Cheng’s disclosure of “sending a number of subcarriers, based on a requested transmission rate, assigned and sent from its base station (the claimed transmitter) to its terminal apparatuses.” Pet. 23 (citing Ex. 1006, Abstr.). In particular, Petitioner cites request subcarrier number deciding part 105 in the base station, which “decides, based on the request transmission rate information for the communication terminal apparatus of each user, the number of subcarriers to be assigned.” *Id.* (quoting Ex. 1006, Abstr.). Petitioner also cites request subcarrier number information generating part 107, which “generates information of the

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<sup>19</sup> In its Reply, Petitioner puts forth a new theory whereby Cheng’s terminal apparatus 200, which Petitioner cites as the recited “receiver,” “is both a receiver and a transmitter.” Pet. Reply 10. Petitioner contends “*Cheng’s* ‘terminal apparatus’ is capable of transmission because, ‘[t]ransmission RF part 216 *transmits* the CQI through antenna 201.’” *Id.* at 12 (quoting Ex. 1006, 9) (citing Pet. 18–19) (emphasis and alteration by Petitioner); *see also id.* at 12–13 (citing Ex. 1006, 2, 12, Fig. 4) (similar argument). Patent Owner argues that Petitioner has improperly raised a new theory in its Reply. PO Sur-reply 12–15. We do not consider this new theory and instead base our disposition only on Petitioner’s unpatentability contentions that are rooted in the Petition.

number of the subcarriers assigned to the communication terminal apparatuses” for output via transmission RF part 115 and antenna 101. *Id.* (quoting Ex. 1006, Abstr.) (citing Ex. 1006, 6–7). Then, turning to the disclosed terminal apparatus in Cheng, Petitioner notes that subcarrier number information extracting part 213 “extracts the subcarrier number information from the control information.” *Id.* at 23–24 (citing Ex. 1006, 9). Petitioner contends an ordinarily skilled artisan “would have understood that the terminal apparatuses would receive the number of subcarriers assigned by the base station from the base station because it receives the control information.” *Id.* at 24 (citing Ex. 1003 ¶ 76).

Regarding the requirement that “sending an indication” occurs “before transmission of said user data,” Petitioner cites the order of steps in Cheng’s Figure 5 and contends that subcarriers are selected in step 304 before being allocated to transfer packet data in step 308. *Id.* at 24 (citing Ex. 1006, 9, 12–13, Fig. 5). For “said quality levels enabling said receiver to deduce said set of sub-carriers,” Petitioner cites Cheng’s disclosure of “terminal apparatus 200 (the claimed ‘receiver’) select[ing] subcarriers based on the number of subcarriers instructed (the claimed ‘indication related to a threshold’) in order of line quality (the claimed ‘quality levels’).” *Id.* at 25–26 (citing Ex. 1003 ¶ 79; Ex. 1006, 9).

Patent Owner does not contest Petitioner’s analysis of the second “sending” limitation. We are persuaded that Cheng discloses subcarrier number deciding part 105 in radio communication apparatus 100 (i.e., the claimed “transmitter”), which decides the number of subcarriers assigned. *See, e.g.*, Ex. 1006, Abstr. Request subcarrier number information generating part 107 generates information regarding subcarrier assignments

for transmission to communication terminal apparatus 200 (i.e., the claimed “receiver”). *See, e.g., id.* at Abstr., 6–7. And, as discussed in more detail immediately below, terminal apparatus 200 uses this information along with line quality information to deduce a set of subcarriers. *See, e.g., id.* at 9. Thus, we are persuaded that Cheng discloses the second “sending” limitation.

Claim 1 further recites “at said receiver, selecting said set of subcarriers on which said user data is to be transmitted as a function of said indication and of said quality levels” (“second ‘selecting’ limitation”). Ex. 1001, 6:6–8. Petitioner cites Cheng’s disclosure of selecting part 214 in terminal apparatus 200 receiving the subcarrier number and “select[ing] the subcarriers for the number of subcarriers instructed from the base station device from the SIR measurement result received as an input from the line quality estimating part 205 in the order of line quality.” Pet. 26–27 (quoting Ex. 1006, 9). Petitioner also cites Cheng’s description of Figure 5, which states that subcarriers are selected “in the order from the most favorable reception quality” in step 304. *Id.* at 27–28 (quoting Ex. 1006, 11).

Patent Owner disputes Petitioner’s analysis to the extent that Petitioner maps both “selecting” limitations to actions occurring in Cheng’s terminal apparatus 200 (i.e., the recited “receiver”). PO Resp. 14–16. As discussed directly above, we do not agree with Patent Owner’s argument. Otherwise, Patent Owner does not dispute that Cheng discloses the second “selecting” limitation. Based on the present record, we are persuaded that Cheng discloses the second “selecting” limitation because subcarrier selecting part 214 selects subcarriers based on instructions received from

radio communication apparatus 100 and based on line quality information from line quality estimating part 205. *See, e.g.*, Ex. 1006, 9, 11.

Based on the entire trial record, we are persuaded that Cheng describes each limitation of claim 1, combined in the same way as in claim 1. Thus, we determine that Petitioner has shown, by a preponderance of the evidence, that claim 1 is anticipated by Cheng.

3. *Claim 2*

Claim 2 depends from claim 1 and further recites “said function comprises the step of selecting said sub-carriers to receive said user data starting with the sub-carriers having the highest quality level and continuing with selecting the sub carrier with decreasing quality level until said threshold is reached.” Ex. 1001, 6:9–13. Petitioner cites Cheng’s disclosure that “the communication terminal apparatus selects the number of subcarriers instructed by the base station device based on the subcarrier number information *in order from the better channel quality* and notifies the base station device.” Pet. 29–30 (quoting Ex. 1006, 13) (emphasis by Petitioner). Petitioner further cites Cheng’s disclosure that subcarrier selecting part 214 “selects the subcarriers *for the number of subcarriers instructed from the base station device . . . in the order of line quality.*” *Id.* at 50 (quoting Ex. 1006, 9) (emphasis and alteration by Petitioner). Patent Owner does not dispute that Cheng discloses the limitation of claim 2.

We are persuaded that Cheng discloses the terminal apparatus selecting sub-carriers in order starting with better channel quality until the instructed number of sub-carriers (i.e., the recited “threshold”) is reached. *See, e.g.*, Ex. 1003 ¶ 84; Ex. 1006, 9, 13. On the entire trial record, we

determine that Petitioner has shown, by a preponderance of the evidence, that claim 2 is anticipated by Cheng.

4. *Claim 3*

Claim 3 depends from claim 1 and further recites “said threshold is related to a quality level threshold.” Ex. 1001, 6:14–15. For the recited “threshold . . . related to a quality level threshold,” Petitioner maps the threshold to Cheng’s request transmission rate and cites Cheng’s disclosure that the number of subcarriers are selected “to reach or exceed the request transmission rate of each communication partner.” Pet. 59 (quoting Ex. 1006, 3). Petitioner also cites Cheng’s disclosure that the request transmission rate is determined with a margin “in preparation for degradation of reception quality due to fading variation.” *Id.* (quoting Ex. 1006, 5). In light of these disclosures, Petitioner contends that an ordinarily skilled artisan “would have understood that the request transmission rate is related to reception quality, and that the quality would degrade if the transmission rate is not met or exceeded.” *Id.* (citing Ex. 1003 ¶ 149<sup>20</sup>). Patent Owner does not dispute that Cheng discloses the limitation of claim 3.

We are persuaded that Cheng’s request transmission rate is a “threshold . . . related to a quality level threshold.” *See, e.g.*, Ex. 1003 ¶ 149; Ex. 1006, 3, 5. On the entire trial record, we determine that Petitioner has shown, by a preponderance of the evidence, that claim 3 is anticipated by Cheng.

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<sup>20</sup> Petitioner mistakenly cites to paragraph 150, but the context makes clear that Petitioner intended to cite paragraph 149.

5. *Claim 4*

Claim 4 depends from claim 1 and further recites “said threshold is related to a maximal number of sub-carriers to be used.” Ex. 1001, 6:16–17. For the recited “maximal number of sub-carriers,” Petitioner cites step ST305 of Cheng’s Figure 5 for teaching that “all subcarriers may be assigned, for example, to meet a request transmission rate.” Pet. 61–62 (citing Ex. 1003 ¶ 154; Ex. 1006, 11–12, Fig. 5). Patent Owner does not dispute that Cheng discloses the limitation of claim 4.

We are persuaded that Cheng discloses assignment of all subcarriers, which discloses the “maximal number” limitation. *See, e.g.*, Ex. 1003 ¶ 154; Ex. 1006, 11–12, Fig. 5. On the entire trial record, we determine that Petitioner has shown, by a preponderance of the evidence, that claim 4 is anticipated by Cheng.

6. *Claim 5*

Claim 5 depends from claim 1 and further recites that “quality levels are calculated at said receiver for groups of sub carriers.” Ex. 1001, 6:18–19. Petitioner cites Cheng’s disclosure that “subcarrier selecting part 214 selects the subcarriers for the number of subcarriers instructed from the base station device from the SIR measurement result received as an input from the line quality estimating part 205 in the order of line quality.” Pet. 65 (citing Ex. 1006, 9). Petitioner contends that an ordinarily skilled artisan “would have understood that a number of subcarriers assigned from the base

station is a group of subcarriers.” *Id.* (citing Ex. 1003 ¶ 159<sup>21</sup>). Patent Owner does not dispute that Cheng discloses the limitation of claim 5.

We are persuaded that Cheng discloses that subcarrier selecting part 214 in terminal apparatus 200 (i.e., the recited “receiver”) uses SIR quality measurements from line quality estimating part 205 while selecting the assigned number of subcarriers, which is a group of subcarriers. *See, e.g.*, Ex. 1003 ¶ 159; Ex. 1006, 9. On the entire trial record, we determine that Petitioner has shown, by a preponderance of the evidence, that claim 5 is anticipated by Cheng.

7. *Claim 6*<sup>22</sup>

The preamble of claim 6 recites “[a]n apparatus to facilitate communication of user data in a multi-carrier radio communication system having a plurality of orthogonal frequency sub-carriers.” Ex. 1001, 6:20–22. Petitioner cites Cheng’s disclosure of “a radio communication apparatus, or a base station, that communicates with a communication terminal apparatus.” Pet. 31 (citing Ex. 1006, 2–3). According to Petitioner, “*Cheng* discloses multiple subcarriers within [an] orthogonal frequency division multiplexing (OFDM) system, where the subcarriers are orthogonal to each other.” *Id.* (citing Ex. 1006, 2). Neither party addresses whether the

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<sup>21</sup> Petitioner mistakenly cites to paragraph 160, but the context makes clear that Petitioner intended to cite paragraph 159.

<sup>22</sup> We are not persuaded by Petitioner’s anticipation contentions for claim 6, but we nonetheless discuss all of Petitioner’s anticipation contentions to set up our discussion below of Petitioner’s obviousness case based on Cheng. *See infra* § II.E.3.

preamble is limiting. Patent Owner does not dispute that Cheng discloses the preamble of claim 6.

We are persuaded that Cheng discloses a base station communicating with a terminal apparatus using multiple orthogonal frequency sub-carriers. *See, e.g.*, Ex. 1006, 2–3. Because Petitioner has shown that Cheng discloses the preamble, we need not determine whether the preamble is limiting. *See Realtime Data*, 912 F.3d at 1375 (Fed. Cir. 2019).

Claim 6 further recites “means for selecting a set of sub-carriers from the plurality of sub-carriers on which user data is to be communicated from a transmitter to a receiver, said selecting based at least in part on at least one of sub-carrier quality levels and a threshold indication associated with sub-carriers.” Ex. 1001, 6:24–28. For the corresponding structure, Petitioner cites Cheng’s terminal apparatus, i.e., a receiver. Pet. 33 (citing Ex. 1006, 9). Regarding the recited function, Petitioner relies on the same mapping from claim 1 of the recited “transmitter” to Cheng’s radio communication apparatus 100 and the recited “receiver” to Cheng’s communication terminal apparatus 200. *Id.* at 32; *see also id.* at 14–15 (citing Ex. 1006, 2–3, 7, Figs. 3, 4). For “selecting a set of sub-carriers . . . on which user data is to be communicated from a transmitter to a receiver,” Petitioner relies on an analysis similar to the first “selecting” limitation, as discussed above. *Id.* at 33 (citing Ex. 1006, 9, 11–12); *see also id.* at 21–22; *supra* § II.D.2.

Regarding the recited “sub-carrier quality levels,” Petitioner cites Cheng’s SIR and CIR measurements by line quality estimating part 205 as analyzed in the “determining” step of claim 1. *Id.* at 32; *see also id.* at 16–18; *supra* § II.D.2. Regarding the “threshold indication associated with sub-carriers,” Petitioner cites Cheng’s base station assigning a number of

subcarriers as analyzed in the second “sending” limitation of claim 1. Pet. 32; *see also id.* at 24–26; *supra* § II.D.2. Petitioner additionally contends that Cheng’s subcarrier selecting part 214 in terminal apparatus 200 receives the assigned number of subcarriers from base station 100 and “selects the subcarriers for the number of subcarriers instructed from the base station device from the SIR measurement result received as an input from the line quality estimating part 205 in the order of line quality.” Pet. 34 (quoting Ex. 1006, 9). According to Petitioner, this discloses selecting based on quality levels and a threshold indication. *Id.*

Patent Owner’s arguments are premised on the notion that the corresponding structure must be a transmitter, as discussed above. *See* PO Resp. 12–14; *supra* § II.C.2. Because the corresponding structure may be a transmitter or a receiver (*see supra* § II.C.2), we are persuaded that Cheng’s terminal apparatus 200 discloses the corresponding structure of a receiver. *See, e.g.,* Ex. 1006, 9. Regarding the recited function, we are persuaded that subcarrier selecting section 214 in Cheng’s terminal apparatus 200 selects subcarriers for the number of subcarriers instructed by the base station (i.e., the recited “threshold indication”) based on SIR measurement results (i.e., the recited “quality levels”). *See, e.g., id.* at 2–3, 9.

Claim 6 further recites “said quality levels communicated from the receiver to the transmitter and said threshold indication communicated from the transmitter to the receiver.” Ex. 1001, 6:29–31. Petitioner relies on the same teachings discussed above with respect to claim 1 insofar as “*Cheng* discloses CQIs reflecting channel/line quality (i.e., claimed quality levels) transmitted to the base station (i.e., claimed transmitter) and the assigned subcarrier number (i.e., claimed threshold indication) sent to the terminal

apparatus (i.e., claimed receiver).” Pet. 34–35 (citing Ex. 1003 ¶ 92). In particular, Petitioner relies on its analysis from claim 1 for the first “sending” limitation to support that Cheng discloses sending quality levels from the receiver to the transmitter. *Id.* Petitioner relies on its analysis of the second “sending” limitation of claim 1 to support that Cheng discloses communicating the threshold indication from the transmitter to the receiver. *Id.* at 35. Patent Owner does not dispute that Cheng discloses this limitation. We are persuaded that Cheng’s terminal apparatus transmits CQIs (which are associated with SIR measurements) (i.e., the recited “quality levels”) to the base station. *See, e.g.*, Ex. 1006, 9. We also are persuaded that Chang’s base station communicates the number of subcarriers assigned (i.e., the recited “threshold indication”) to the terminal apparatus. *See, e.g., id.* at Abstr., 6–7.

Claim 6 further recites “said threshold indication and said quality levels enabling said receiver to deduce said set of sub-carriers on which said user data is to be communicated.” Ex. 1001, 6:29–34. Petitioner relies on the same teachings discussed above with respect to claim 1 insofar as “*Cheng* discloses its terminal apparatus (i.e., claimed receiver) selecting subcarriers based on the assigned subcarrier number (i.e., claimed threshold indication) in the order of line quality (i.e., claimed quality levels) for which the packet data is assigned.” Pet. 35 (citing Ex. 1003 ¶¶ 94–95). In particular, Petitioner relies on its analysis of the second “sending” limitation of claim 1 to support that Cheng discloses the “enabling said receiver to deduce” aspect of this limitation. *Id.* Patent Owner does not dispute that Cheng discloses this limitation. We are persuaded that Cheng’s terminal apparatus 200 selects subcarriers based on the number of subcarriers

assigned (the recited “threshold indication”) in order of line quality (the recited “quality levels”). *See, e.g.*, Ex. 1006, 9.

Claim 6 further recites “a radio link for communicating user data via the selected set of sub-carriers.” Ex. 1001, 6:35–36. Petitioner cites Cheng’s disclosure of radio communication apparatus 100 (i.e., the recited “transmitter”) having RF transmission part 115 to transmit “control information or packet data” via antenna 101. Pet. 35–36 (quoting Ex. 1006, 7) (citing Ex. 1006, Fig. 3). Petitioner also cites Cheng’s disclosure of communication terminal apparatus 200 (i.e., the recited “receiver”) having Reception RF part 202 that down-converts received radio signals from antenna 201. *Id.* at 36–37 (citing Ex. 1003 ¶ 97; Ex. 1006, 7, Fig. 4). Petitioner contends that an ordinarily skilled artisan “would have understood that *Cheng*’s subcarriers, accessed through the antenna of its base station and terminal apparatuses, would be used to transmit packet data because it the subcarriers are selected and assigned to meet the request transmission date.” *Id.* at 37 (citing Ex. 1003 ¶ 98; Ex. 1006, 3). Patent Owner does not dispute that Cheng discloses this limitation. We are persuaded that Cheng discloses communicating control information and packet data between the base station and the terminal apparatus using selected subcarriers. *See, e.g.*, Ex. 1003 ¶ 98; Ex. 1006, 3, 7, Figs. 3, 4).

Claim 6 further recites “said receiver is adapted to receive user data from said transmitter via the radio link.” Ex. 1001, 6:37–38. Petitioner cites its analysis from the previous limitation and contends that Cheng’s terminal apparatus (i.e., the recited “receiver”) includes a radio antenna that allows for “a radio link where packet data is assigned for each communication partner.” Pet. 38 (citing Ex. 1003 ¶ 99; Ex. 1006, 3). Patent Owner does not

dispute that Cheng discloses this limitation. We are persuaded that Cheng's terminal apparatus includes antenna 201 to receive data from the base station via a radio link. *See, e.g.*, Ex. 1006, 7, Fig. 4.

Claim 6 further recites "said receiver comprising: means for selecting said set of sub-carriers on which said user data is to be received from said transmitter." Ex. 1001, 6:38–41. We have construed this limitation above. *See supra* § II.C.3. Petitioner cites Cheng's terminal apparatus (i.e., the recited "receiver") as disclosing the corresponding structure. Pet. 38–39. Regarding the recited function, Petitioner contends that Cheng's

terminal apparatus 200 includes subcarrier selecting part 214 [that] receives the subcarrier number and "selects the subcarriers for the number of subcarriers instructed from the base station device from the SIR measurement result received as an input from the line quality estimating part 205 in the order of line quality."

*Id.* at 38 (quoting Ex. 1006, 9). Patent Owner does not dispute that Cheng discloses this limitation. We are persuaded that Cheng's terminal apparatus 200 discloses the corresponding structure of a receiver. *See, e.g.*, Ex. 1006, 9. Regarding the recited function, we are persuaded that subcarrier selecting section 214 in Cheng's terminal apparatus 200 selects subcarriers for receiving data from base station 100. *See, e.g., id.* at 2–3, 9.

Claim 6 further recites "said receiver comprising: . . . means for determining quality levels for sub-carriers." Ex. 1001, 6:38–43. We have construed this limitation above. *See supra* § II.C.3. Petitioner cites Cheng's terminal apparatus (i.e., the recited "receiver") as disclosing the corresponding structure. Pet. 39–40. Regarding the recited function, Petitioner cites Cheng's disclosure "that subcarriers are selected 'from the SIR measurement result received as an input from the line quality estimating

part 205 in the order of line quality.” *Id.* at 39 (quoting Ex. 1006, 9). According to Petitioner, “[t]he line quality measurement is performed for a number of subcarriers that may be assigned.” *Id.* (citing Ex. 1003 ¶ 103). Patent Owner does not dispute that Cheng discloses this limitation. We are persuaded that Cheng’s terminal apparatus 200 discloses the corresponding structure of a receiver. *See, e.g.*, Ex. 1006, 9. Regarding the recited function, we are persuaded that line quality estimating part 205 in terminal apparatus 200 estimates line quality for subcarriers using, for example, SIR measurements. *See, e.g., id.* at 8–9.

Claim 6 further recites “said receiver comprising: . . . means for sending said quality levels to said transmitter.” Ex. 1001, 6:38–44. We have construed this limitation above. *See supra* § II.C.3. Petitioner cites Cheng’s terminal apparatus (i.e., the recited “receiver”) as disclosing the corresponding structure. Pet. 40–42. Regarding the recited function, Petitioner relies on the same teachings discussed above with respect to the first “sending” limitation of claim 1. *Id.* at 40. Petitioner further cites Cheng’s Figure 5, which includes “step 306 for CQI generation and step 307 for CQI transmission from terminal apparatus 200 to radio communication apparatus 100 (i.e., base station).” *Id.* at 40–41 (citing Ex. 1006, 12, Fig. 5). Patent Owner does not dispute that Cheng discloses this limitation. We are persuaded that Cheng’s terminal apparatus 200 discloses the corresponding structure of a receiver. *See, e.g.*, Ex. 1006, 9. Regarding the recited function, we are persuaded that CQIs (i.e., the recited “quality levels”) are transmitted via transmission RF part 216 and antenna 201 to radio communication apparatus 100 (i.e., the recited “transmitter”). *See, e.g.*, Ex. 1006, 4, 9, 12, 15, Figs. 4, 5.

Claim 6 further recites “said receiver comprising: . . . means for receiving and storing said threshold indication from said transmitter, said threshold indication and said quality levels enabling said receiver to deduce said set of sub-carriers on which said user data is to be received.” Ex. 1001, 6:38–50. We have construed this limitation above. *See supra* § II.C.3. Petitioner cites Cheng’s terminal apparatus (i.e., the recited “receiver”) as disclosing the corresponding structure. Pet. 42–45. Regarding the recited function, Petitioner cites Cheng’s disclosure that Cheng’s “terminal apparatus includes a corresponding subcarrier number information extracting part 213 that extracts the subcarrier number information from the control information” that is sent from the transmitter. *Id.* at 42 (citing Ex. 1006, 6–7, 9) (internal quotation omitted). Petitioner also cites Cheng’s line quality information forming part 215, which “holds a reference table that stores the line quality selection information with which the CQI have been associated.” *Id.* at 43 (citing Ex. 1006, 9). According to Petitioner, an ordinarily skilled artisan “would have understood the number of subcarriers assigned could be stored in a table.” *Id.* (quoting Ex. 1003 ¶ 108). Regarding the limitation “said threshold indication and said quality levels enabling said receiver to deduce said set of sub-carriers on which said user data is to be received,” Petitioner cites Cheng’s disclosure of selecting subcarriers based on the assigned subcarrier number in the order of line quality. *Id.* at 44–45 (citing Ex. 1006, 9, 11, Fig. 5). Patent Owner does not dispute that Cheng discloses this limitation.

We are persuaded that Cheng’s terminal apparatus 200 discloses the corresponding structure of a receiver. *See, e.g.*, Ex. 1006, 9. Regarding the recited function, we are persuaded that subcarrier number information

extracting part 213 in terminal apparatus 200 receives and extracts subcarrier number information (i.e., the recited “threshold indication”) from the transmitter. *See, e.g., id.* at 6–7, 9. We also are persuaded that Cheng’s terminal apparatus 200 selects subcarriers based on the number of subcarriers assigned (the recited “threshold indication”) in order of line quality (the recited “quality levels”). *See, e.g., id.* at 9. Nevertheless, Petitioner has not established that Cheng discloses the recited “storing” function. Although Cheng discloses that line quality information forming part 215a has a reference table that stores the line quality selection information (*see id.* at 9), Cheng does not state that its system stores the number of subcarriers assigned in the table. Petitioner’s contention about how an ordinarily skilled artisan could store such information in the table represents a modification of Cheng that is more properly addressed as a matter of obviousness, not anticipation.<sup>23</sup> Thus, we are not persuaded that Cheng discloses the “means for receiving and storing” limitation of claim 6.

Claim 6 further recites “said set of sub-carriers on which said user data is to be received are deduced as a function of said threshold indication and said quality levels.” Ex. 1001, 6:51–53. Petitioner again cites Cheng’s disclosure that the terminal apparatus “selects the subcarriers for the number of subcarriers instructed from the base station device from the SIR measurement result received as an input from the line quality estimating

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<sup>23</sup> We are persuaded by Petitioner’s obviousness case for this limitation. *See infra* § II.E.3.

part 205 in the order of line quality.” Pet. 45–46 (quoting Ex. 1006, 9).<sup>24</sup> Patent Owner does not dispute that Cheng discloses this limitation. We again are persuaded that Cheng’s terminal apparatus 200 selects subcarriers based on the number of subcarriers assigned (the recited “threshold indication”) in order of line quality (the recited “quality levels”). *See, e.g.*, Ex. 1006, 9.

Petitioner has established that Cheng discloses all limitations of claim 6 except for the “means for receiving and storing” limitation. As such, Petitioner has not shown that Cheng describes each limitation of claim 6, combined in the same way as in claim 6. Thus, we determine that Petitioner has not shown, by a preponderance of the evidence, that claim 6 is anticipated by Cheng.

8. *Claims 7–9, 12, 13, and 15*

Each of claims 7–9, 12, 13, and 15 depends directly or indirectly from claim 6. Ex. 1001, 5:54–67, 7:10–22, 7:26–27. Petitioner’s analysis for these claims does not cure the deficiencies discussed above with respect to the “means for receiving and storing” limitation of claim 6. Thus, we determine that Petitioner has not shown, by a preponderance of the evidence, that claims 7–9, 12, 13, and 15 are anticipated by Cheng.

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<sup>24</sup> The citation in the Petition appears to be incorrect, but the context makes clear where the quotation appeared. The same quotation also appears with the correct citation at page 26 of the Petition.

9. *Claims 16–18*

Although Petitioner lists claims 16–18 in a chart as being part of an anticipation ground based on Cheng (*see* Pet. 13), Petitioner does not appear to have put forth any anticipation contentions for claims 16–18. *See id.* at 57–58 (stating that “*Cheng* renders obvious” each of claims 16–18). In the absence of any anticipation showing, we determine Petitioner has not shown, by a preponderance of the evidence, that claims 16–18 are anticipated by Cheng.

E. *Obviousness Ground Based on Cheng*

Petitioner contends the subject matter of claims 1, 2, 6–10, and 12–18 would have been obvious over Cheng. Pet. 13–58, 66–69; Pet. Reply 6–15. Patent Owner disputes Petitioner’s contentions. PO Resp. 11–22; PO Sur-reply 9–18.

1. *Claim 1*

For this ground, Petitioner’s obviousness contentions based on Cheng are interspersed with and build upon its anticipation contentions based on Cheng. The only additional contention for claim 1 relates to the first “sending” limitation, where Petitioner cites testimony from Mr. Gray “[t]o the extent Patent Owner argues that *Cheng*’s sending CQIs does not anticipate sending quality levels.” Pet. 21. In particular, Petitioner contends that an ordinarily skilled artisan “would have found it obvious to send the SIR measurement results rather than the CQIs because the SIR measurement results are a predictable and obvious version of the line quality information

that *Cheng*'s terminal apparatus sends to its base station.” *Id.* (citing Ex. 1003 ¶ 70).

Based on the reasons discussed above in the *Cheng* anticipation ground, and in light of this additional contention, we are persuaded that an ordinarily skilled artisan considering *Cheng* would have known to send a different measure of quality, such as SIR measurements, rather than CQIs. *See, e.g.*, Ex. 1003 ¶ 70; Ex. 1006, 9; *supra* § II.D.1. On the entire trial record, we determine that Petitioner has shown, by a preponderance of the evidence, that the subject matter of claim 1 would have been obvious over *Cheng*.

2. *Claim 2*

Claim 2 depends from claim 1. Ex. 1001, 6:9–13. Petitioner's obviousness analysis based on *Cheng* for claim 2 incorporates its obviousness analysis for claim 1 discussed above and its analysis for claim 2 in the *Cheng* anticipation ground. *See supra* §§ II.D.3, II.E.1. We are persuaded by Petitioner's analysis for the same reasons mentioned above. On the entire trial record, we determine that Petitioner has shown, by a preponderance of the evidence, that the subject matter of claim 2 would have been obvious over *Cheng*.

3. *Claim 6*

Petitioner's obviousness analysis based on *Cheng* for claims 6 builds upon its analysis for claim 6 in the *Cheng* anticipation ground. *See supra* § II.D.7. As discussed above, we are persuaded that *Cheng* discloses all limitations of claim 6 except for the “storing” aspect of the “means for

receiving and storing” limitation. Regarding the recited “storing,” Petitioner cites Cheng’s line quality information forming part 215, which “holds a reference table that stores the line quality selection information with which the CQI have been associated.” Pet. 43 (citing Ex. 1006, 9). Petitioner contends that an ordinarily skilled artisan would have understood from Cheng that storing the assigned subcarrier was obvious “because the assigned subcarrier number is used in the functional blocks of *Cheng*, for example, to select subcarriers . . . , and other information like SIR measurements are stored for use by the integrated circuits.” *Id.* (citing Ex. 1003 ¶ 108; Ex. 1006, 9). Patent Owner does not dispute that Cheng teaches the “storing” aspect of the “means for receiving and storing” limitation.

In light of this additional contention, and based on Mr. Gray’s uncontested testimony, we are persuaded that an ordinarily skilled artisan considering Cheng would have known that the assigned subcarrier number is stored. *See, e.g.*, Ex. 1003 ¶ 108; Ex. 1006, 9; *supra* § II.D.7. For this reason, and based on the anticipation analysis for claim 6 above, we determine that Petitioner has shown, by a preponderance of the evidence, that the subject matter of claim 6 would have been obvious over Cheng.

#### 4. *Claim 7*

Claim 7 depends from claim 6 and further recites “said threshold indication is one of a maximum number of sub-carriers in the set of sub-carriers and a minimum sub-carrier quality level for the set of sub-carriers.” Ex. 1001, 6:54–57. This limitation is written in Markush form, so “the entire element is disclosed by the prior art if one alternative in the Markush

group is in the prior art.” *Fresenius*, 582 F.3d at 1298. Although Petitioner analyzes both alternatives, we focus on the “maximum number of sub-carriers.” Petitioner cites step ST305 of Cheng’s Figure 5 for teaching that “all subcarriers may be assigned, for example, to meet a request transmission rate.” Pet. 46–47 (citing Ex. 1003 ¶ 112; Ex. 1006, 11–12, Fig. 5) (internal quotation omitted). Patent Owner does not dispute that Cheng teaches the limitation of claim 7.

We are persuaded that Cheng teaches assignment of all subcarriers, which discloses the “maximum number” limitation. *See, e.g.*, Ex. 1003 ¶ 112; Ex. 1006, 11–12, Fig. 5. On the entire trial record, we determine that Petitioner has shown, by a preponderance of the evidence, that claim 7 would have been obvious over Cheng.

#### 5. *Claim 8*

Claim 8 depends from claim 6 and further recites “each sub-carrier quality level identifies at least one of a signal-to-interference ratio, a bit error rate, and a modulation scheme for a corresponding sub-carrier or a corresponding sub-carrier group.” Ex. 1001, 6:58–62. This limitation is written in Markush form, so “the entire element is disclosed by the prior art if one alternative in the Markush group is in the prior art.” *Fresenius*, 582 F.3d at 1298. Petitioner contends that Cheng teaches the “signal-to-interference ratio” alternative because “subcarrier selecting part 214 receives the subcarrier number and ‘selects the subcarriers for the number of subcarriers instructed from the base station device from the SIR measurement result received as an input from the line quality estimating part 205 in the order of line quality.’” Pet. 48 (quoting Ex. 1006, 8–9).

Petitioner further contends that “*Cheng*’s terminal apparatus 200 (the claimed ‘receiver’) and base station 100 (the claimed ‘transmitter’) both select subcarriers based on the number of subcarriers instructed using the CQI based on SIR measurement (the claimed ‘quality levels’).” *Id.* at 48–49 (citing Ex. 1003 ¶ 115<sup>25</sup>). Patent Owner does not dispute that Cheng teaches the limitation of claim 8.

We are persuaded that Cheng teaches a sub-carrier quality level based on SIR measurements. *See, e.g.*, Ex. 1003 ¶ 115; Ex. 1006, 8–9. On the entire trial record, we determine that Petitioner has shown, by a preponderance of the evidence, that claim 8 would have been obvious over Cheng.

6. *Claim 9*

Claim 9 depends from claim 6 and further recites “the means for selecting said set of sub-carriers comprising: means for selecting sub-carriers or sub-carrier groups with the highest quality level and decreasing quality levels until the threshold indication is reached.” Ex. 1001, 6:63–67. We have construed this limitation above. *See supra* § II.C.4. Petitioner cites Cheng’s terminal apparatus (i.e., the recited “receiver”) as teaching the corresponding structure. Pet. 49–50 (citing, *inter alia*, Ex. 1006, 9). Regarding the recited function, Petitioner cites Cheng’s disclosure that “the communication terminal apparatus selects the number of subcarriers instructed by the base station device based on the subcarrier number information *in order from the better channel quality* and notifies the base

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<sup>25</sup> Petitioner mistakenly cites to paragraph 116, but the context makes clear that Petitioner intended to cite paragraph 115.

station device.” *Id.* at 49–50 (quoting Ex. 1006, 13) (emphasis by Petitioner). Petitioner further cites Cheng’s disclosure that subcarrier selecting part 214 “selects the subcarriers *for the number of subcarriers instructed from the base station device . . . in the order of line quality.*” *Id.* at 50 (quoting Ex. 1006, 9) (emphasis by Petitioner). Patent Owner does not dispute that Cheng discloses the limitation of claim 9.

We are persuaded that Cheng’s terminal apparatus teaches the corresponding structure of a receiver. *See, e.g.*, Ex. 1006, 9. Regarding the recited function, we are persuaded that Cheng teaches the terminal apparatus selecting sub-carriers in order starting with better channel quality until the instructed number of sub-carriers (i.e., the recited “threshold indication”) is reached. *See, e.g.*, Ex. 1003 ¶ 118; Ex. 1006, 9, 13. On the entire trial record, we determine that Petitioner has shown, by a preponderance of the evidence, that claim 9 would have been obvious over Cheng.

#### 7. *Claim 10*

Claim 10 depends from claim 6 and further recites “said threshold indication is received via at least one sub-carrier of the selected set of sub-carriers.” Ex. 1001, 7:1–3. Petitioner contends that, in Cheng’s OFDM system, radio communication apparatus/base station 100 (i.e., the recited “transmitter”) prepares and outputs control information, including the number of subcarriers, to transmission RF part 115 for transmission via antenna 101. Pet. 66 (citing Ex. 1006, 1, 6–7). Petitioner further cites Cheng’s teaching that subcarrier number information extracting part 213 in terminal apparatus 200 (i.e., the recited “receiver”) “extracts the subcarrier number information from the control information.” *Id.* at 66–67 (quoting

Ex. 1006, 9). According to Petitioner, an ordinarily skilled artisan “would have understood that the assigned subcarrier number (i.e., the claimed threshold indication) is sent via an antenna using subcarriers and would be received via an antenna using subcarriers.” *Id.* at 67 (citing Ex. 1003 ¶ 162<sup>26</sup>). Patent Owner does not dispute that Cheng teaches the limitation of claim 10.

We are persuaded that Cheng’s OFDM system sends control information in the form of the assigned subcarrier number from base station 100 to terminal apparatus 200, where it is received and extracted. *See, e.g.*, Ex. 1006, 1, 6–7, 9. Furthermore, based on Mr. Gray’s uncontested testimony, we are persuaded that an ordinarily skilled artisan would have known this communication to occur using a selected subcarrier in Cheng’s OFDM system. *See, e.g.*, Ex. 1003 ¶ 162. On the entire trial record, we determine that Petitioner has shown, by a preponderance of the evidence, that the subject matter of claim 10 would have been obvious over Cheng.

#### 8. *Claim 12*

Claim 12 depends from claim 6 and further recites “said receiver comprising a mobile terminal.” Ex. 1001, 6:63–67. According to Petitioner, Cheng teaches that its terminal apparatus (i.e., the recited “receiver”) is a mobile station communicating with a base station in the OFDM system of Cheng. Pet. 51; Ex. 1003 ¶¶ 120–121; Ex. 1006, 1–2. Petitioner further contends that, “[t]o the extent Patent Owner argues *Cheng*’s terminal

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<sup>26</sup> Petitioner mistakenly cites to paragraph 163, but the context makes clear that Petitioner intended to cite paragraph 162.

apparatus does not disclose a mobile station, *Cheng* renders it obvious because *Cheng* discloses conventional OFDM systems use mobile stations, and it would have been obvious to include a mobile station as one of *Cheng*'s terminal apparatuses." Pet. 51 (citing Ex. 1003 ¶ 121<sup>27</sup>). Patent Owner does not dispute that *Cheng* teaches this limitation.

We are persuaded that an ordinarily skilled artisan considering *Cheng* would have known to implement its terminal apparatus (i.e., the recited "receiver") as a mobile station. *See, e.g.*, Ex. 1003 ¶ 121; Ex. 1006, 1–2. On the entire trial record, we determine that Petitioner has shown, by a preponderance of the evidence, that the subject matter of claim 12 would have been obvious over *Cheng*.

#### 9. *Claim 13*

Claim 13 depends from claim 6 and further recites "said transmitter adapted to transmit user data to said receiver via the radio link." Ex. 1001, 7:12–14. *Cheng* discloses that radio communication apparatus/base station 100 (i.e., the recited "transmitter") includes RF transmission section 115, which outputs "control information or packet data" to antenna 101 for transmission to terminal apparatus 200 (i.e., the recited "receiver"). Pet. 52; Ex. 1003 ¶ 123; Ex. 1006, 7, Fig. 3. Patent Owner does not dispute that *Cheng* teaches this limitation of claim 13. We are persuaded that *Cheng*'s base station 100 transmits to terminal apparatus 200 via a radio link, as evidenced by RF transmission section 115 and antenna 101. *See, e.g.*, Ex. 1006, 7, Fig. 3.

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<sup>27</sup> Petitioner mistakenly cites to paragraph 122, but the context makes clear that Petitioner intended to cite paragraph 121.

Claim 13 further recites “said transmitter comprising: means for selecting said set of sub-carriers on which said user data is to be transmitted to said receiver.” Ex. 1001, 7:14–16. We have construed this limitation above. *See supra* § II.C.6. Petitioner cites Cheng’s base station (i.e., the recited “transmitter”) as teaching the corresponding structure.<sup>28</sup> Pet. 53. Regarding the recited function, Petitioner cites Cheng’s teaching of “a first transmission means for transmitting the information on the number of subcarriers decided by the subcarrier number deciding means to each communication partner, and an assignment control means for selecting a subcarrier to which packet data is assigned.” *Id.* (quoting Ex. 1006, 3). Patent Owner does not dispute that Cheng teaches this limitation of claim 13. We are persuaded that Cheng’s base station (i.e., the recited “transmitter”) selects sub-carriers that are used for transmissions to the terminal apparatus. *See, e.g.*, Ex. 1006, 3.

Claim 13 further recites “said transmitter comprising: . . . means for receiving said quality levels from said receiver.” Ex. 1001, 7:14–18. We have construed this limitation above. *See supra* § II.C.6. Petitioner cites Cheng’s base station (i.e., the recited “transmitter”) as teaching the corresponding structure. Pet. 54. Regarding the recited function, Petitioner cites Cheng’s teaching of the base station receiving CQIs, which are associated with SIR measurements, from the terminal apparatus and extracting the CQIs. *Id.* (citing Ex. 1006, 4, 9, 12, 15). Patent Owner does

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<sup>28</sup> One sentence in Petitioner’s analysis appears to have a typographical error in identifying Cheng’s base station as disclosing the corresponding structure of a “transmitter.” Pet. 53. We view this as harmless error and interpret Petitioner’s contentions based on the entirety of Petitioner’s analysis, the remainder of which is keyed to Cheng’s base station.

not dispute that Cheng discloses this limitation of claim 13. We are persuaded that Cheng's base station (i.e., the recited "transmitter") receives and extracts CQIs (e.g., with line quality information extracting part 103) sent from the terminal apparatus. *See, e.g.*, Ex. 1006, 4, 9, 12, 15.

Claim 13 further recites "said transmitter comprising: . . . means for sending said threshold indication to said receiver, said threshold indication and said quality levels enabling said receiver to deduce the set of sub-carriers on which said user data is to be transmitted." Ex. 1001, 7:14–22. We have construed this limitation above. *See supra* § II.C.6. Petitioner cites Cheng's base station (i.e., the recited "transmitter") as teaching the corresponding structure. Pet. 55–56. For the recited function "sending said threshold indication to said receiver," Petitioner contends "*Cheng* discloses that its base station includes an antenna that is used to transmit control information to its terminal apparatuses." *Id.* at 55; *see also id.* at 35–36 (citing Ex. 1006, 7) (claim 6 analysis stating that "[r]adio communication apparatus 100 includes RF transmission section 115 to output 'control information or packet data' to antenna 101 to be transmitted"). Petitioner further notes that, correspondingly, Cheng's mobile terminal includes subcarrier number information extracting part 213 that "extracts the subcarrier number information from the control information." *Id.* at 55 (quoting Ex. 1006, 9). Regarding "said threshold indication and said quality levels enabling said receiver to deduce the set of sub-carriers on which said user data is to be transmitted," Petitioner cites subcarrier selecting part 214 in the terminal apparatus that "receives the subcarrier number and 'selects the subcarriers for the number of subcarriers instructed from the base station device from the SIR measurement result received as an input from the line

quality estimating part 205 in the order of line quality.” *Id.* at 55–56 (quoting Ex. 1006, 9). Patent Owner does not dispute that Cheng teaches this limitation of claim 13. We are persuaded that Cheng’s base station (i.e., the recited “transmitter”) includes a transmitter that sends the assigned subcarrier number (i.e., recited “threshold indication”) to the terminal apparatus (i.e., the recited “receiver”). *See, e.g.*, Ex. 1006, 7. We also are persuaded that the threshold indication and SIR measurement data allow the terminal apparatus to select subcarriers in order of line quality. *See, e.g., id.* at 9.

Petitioner has persuasively shown that Cheng teaches the additional limitations of claim 13. On the entire trial record, we determine that Petitioner has shown, by a preponderance of the evidence, that the subject matter of claim 13 would have been obvious over Cheng.

#### 10. Claim 14

Claim 14 depends from claim 13 and further recites “said threshold indication is sent via at least one sub-carrier of the selected set of sub-carriers.” Ex. 1001, 7:23–25. Petitioner relies on the same analysis discussed above with respect to claim 10. Pet. 68 (citing Ex. 1003 ¶ 166<sup>29</sup>; Ex. 1006, 1, 6–7, 9); *see supra* § II.E.7. Patent Owner does not dispute that Cheng teaches the limitation of claim 14.

We are persuaded by Petitioner’s showing for the same reasons discussed above. *See, e.g.*, Ex. 1003 ¶ 166; Ex. 1006, 1, 6–7, 9; *supra* § II.E.7. On the entire trial record, we determine that Petitioner has shown,

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<sup>29</sup> Petitioner mistakenly cites to paragraph 167, but the context makes clear that Petitioner intended to cite paragraph 166.

by a preponderance of the evidence, that the subject matter of claim 14 would have been obvious over Cheng.

*11. Claim 15*

Claim 15 depends from claim 13 and further recites “said transmitter comprising a base station.” Ex. 1001, 7:26–27. According to Petitioner, Cheng teaches that its radio communication apparatus (i.e., the recited “transmitter”) is a base station in the OFDM system of Cheng. Pet. 56–57; Ex. 1003 ¶¶ 132–133; Ex. 1006, 3. Patent Owner does not dispute that Cheng teaches the limitation of claim 15. We are persuaded by Petitioner’s showing. On the entire trial record, we determine that Petitioner has shown, by a preponderance of the evidence, that the subject matter of claim 15 would have been obvious over Cheng.

*12. Claim 16*

Claim 16 is a method claim. Ex. 1001, 7:28–8:19. The first recitation of claim 16 is the same as that of claim 6 except without the recited “means.” Petitioner relies on the analysis from claim 6 for this recitation. Pet. 57–58 (citing Ex. 1003 ¶ 139<sup>30</sup> (comparing claims)). The preamble and all other limitations of claim 16 are similar to limitations in claim 1, so Petitioner relies on its analysis from claim 1. *Id.* at 57 (citing Ex. 1003 ¶ 137<sup>31</sup> (comparing claims)).

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<sup>30</sup> Petitioner mistakenly cites to paragraph 140, but the context makes clear that Petitioner intended to cite paragraph 139.

<sup>31</sup> Petitioner mistakenly cites to paragraph 138, but the context makes clear that Petitioner intended to cite paragraph 137.

Patent Owner's arguments are premised on the notion that the first limitation of claim 16—"selecting a set of sub-carriers from the plurality of sub-carriers on which user data is to be communicated from a transmitter to a receiver, said selecting based at least in part on at least one of sub-carrier quality levels and a threshold indication associated with sub-carriers" (Ex. 1001, 7:31–35)—must be performed by the transmitter, as discussed above. *See* PO Resp. 19–22; *supra* §§ II.C.2, II.C.7. As discussed above, we do not agree that this "selecting" limitation must be performed at the transmitter. *See supra* §§ II.C.2, II.C.7. Based on Petitioner's analysis for claims 1 and 6 above, we are persuaded that, in view of the knowledge of a person of ordinary skill in the art, Cheng teaches all limitations of claim 16. *See id.* On the entire trial record, we determine that Petitioner has shown, by a preponderance of the evidence, that the subject matter of claim 16 would have been obvious over Cheng.

### 13. *Claim 17*

Claim 17 depends from claim 16. Ex. 1001, 8:20–28. Claim 17 is similar in scope to claim 13, so Petitioner relies on the same analysis from claim 13. Pet. 58 (citing Ex. 1003 ¶ 144<sup>32</sup> (comparing claims)). Patent Owner relies on the same arguments discussed above for claim 16. Based on Petitioner's analysis for claim 13 above, we are persuaded that, in view of the knowledge of a person of ordinary skill in the art, Cheng teaches all limitations of claim 17. *See supra* § II.E.9. On the entire trial record, we

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<sup>32</sup> Petitioner mistakenly cites to paragraph 144, but the context makes clear that Petitioner intended to cite paragraph 143.

determine that Petitioner has shown, by a preponderance of the evidence, that the subject matter of claim 17 would have been obvious over Cheng.<sup>33</sup>

*14. Claim 18*

Claim 18 depends from claim 16. Ex. 1001, 8:29–33. Claim 18 is similar in scope to claim 9, so Petitioner relies on the same analysis from claim 9. Pet. 58 (citing Ex. 1003 ¶ 147<sup>34</sup> (comparing claims)). Patent Owner relies on the same arguments discussed above for claim 16. Based on Petitioner’s analysis for claim 9 above, we are persuaded that, in view of the knowledge of a person of ordinary skill in the art, Cheng teaches all limitations of claim 18. *See supra* § II.E.6. On the entire trial record, we determine that Petitioner has shown, by a preponderance of the evidence, that the subject matter of claim 18 would have been obvious over Cheng.

*F. Obviousness Ground Based on Cheng and Shirali*

Petitioner contends the subject matter of claim 3 would have been obvious over the combination of Cheng and Shirali. Pet. 58–61; Pet. Reply 6–9. Patent Owner did not put forth any arguments regarding this ground after institution. As such, Patent Owner relies on the same arguments put forth for the Cheng anticipation and obviousness grounds discussed above.

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<sup>33</sup> In making this determination for claim 17, we apply the construction of “means for sending the threshold indication from said transmitter to said receiver” discussed above. *See supra* § II.C.8; *see also supra* note 16.

<sup>34</sup> Petitioner mistakenly cites to paragraph 148, but the context makes clear that Petitioner intended to cite paragraph 147.

1. *Shirali*

Shirali is a U.S. patent directed to “deriving a channel quality measure from an orthogonal frequency division multiplexed (OFDM) signal to aid in adaptively determining a data rate of packetized information transmission over a wireless channel.” Ex. 1008, 1:32–37. Shirali teaches that “a data rate of packetized information transmission over a wireless channel is adaptively determined based on both a signal quality measure of a received signal and a channel quality measure derived from the received signal.” *Id.* at 2:19–25. The adjustment of data rate based on the channel quality measure can “go in both directions (e.g., decrease an original rate when the channel quality measure falls below a threshold and increase an original rate when the channel quality measure falls above a threshold).” *Id.* at 6:44–50.

Petitioner contends that Shirali qualifies as prior art under 35 U.S.C. § 102(e) based on its filing date. Pet. 6. Patent Owner does not contest the prior art status of Shirali. We have no evidence of an invention date other than the earliest possible effective filing date of the challenged claims. Thus, we determine that Shirali qualifies as prior art under 35 U.S.C. § 102(e) because Shirali’s filing date of November 12, 2004, is before the earliest effective filing date of the challenged claims, which is August 1, 2005. Ex. 1001, code (30); Ex. 1008, code (22).

2. *Claim 3*

Claim 3 depends from claim 1 and recites “said threshold is related to a quality level threshold.” Ex. 1001, 6:14–15. Petitioner’s obviousness contentions for claim 3 build upon its contentions for claim 3 in the Cheng anticipation ground. Petitioner additionally cites Shirali for teaching the

adjustment of the transmission data rate based on whether the signal quality measure meets a signal quality threshold, or based on whether the channel quality measure meets a channel quality threshold. Pet. 60 (citing Ex. 1008, 6:41–57). Petitioner contends that both the signal quality threshold and the channel quality threshold teach the recited threshold of claim 3. *Id.*

Petitioner notes Cheng’s teaching of avoiding signal degradation caused by fading variation. *Id.* (citing Ex. 1006, 5). Citing testimony from Mr. Gray, Petitioner contends an ordinarily skilled artisan “would have been motivated to combine *Shirali*’s signal and channel quality measures used to adaptively select a transmission data rate with *Cheng*’s disclosure of reaching or exceeding a requested transmission rate in order to avoid signal degrading effects such as fading.” *Id.* (citing Ex. 1003 ¶ 151<sup>35</sup>). Petitioner further contends that an ordinarily skilled artisan would have expected success in making the combination “because *Shirali* is compliant with IEEE 802 wireless standards that were in use world-wide.” *Id.* at 60–61 (citing Ex. 1008, 3:50–61).

Patent Owner relies on the same arguments it makes for claim 1, which we have discussed above. We are persuaded that *Shirali*’s channel quality threshold teaches the recited “quality level threshold.” *See, e.g.*, Ex. 1008, 6:44–50. We also are persuaded that, in light of Cheng’s recognition of degraded reception due to fading variation, an ordinarily skilled artisan would have implemented *Shirali*’s adaptive determination of a data rate based on quality measures in Cheng’s system with a reasonable expectation of success. *See, e.g.*, Ex. 1003 ¶ 151; Ex. 1006, 5; Ex. 1008,

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<sup>35</sup> Petitioner mistakenly cites to paragraph 152, but the context makes clear that Petitioner intended to cite paragraph 151.

3:50–61. On the entire trial record, we determine that Petitioner has shown, by a preponderance of the evidence, that the subject matter of claim 3 would have been obvious over the combination of Cheng and Shirali.

*G. Obviousness Ground Based on Cheng and Nishio*

Petitioner contends the subject matter of claims 4, 5, 10, and 14 would have been obvious over the combination of Cheng and Nishio. Pet. 61–69. Patent Owner did not put forth any arguments regarding this ground after institution.

*1. Nishio*

Nishio is a U.S. patent application publication directed to a radio communication apparatus and radio communication method in a multicarrier transmission that is suitable for use in an OFDM communication terminal apparatus. Ex. 1009 ¶ 1. Nishio describes a problem with prior art communication terminals where Channel Quality Indicators (CQIs) for all subcarriers are generated separately and reported a base station, which increases the number of transmission bits for reports and may outweigh the uplink. *Id.* ¶ 18. To address this problem, Nishio describes a subcarrier block selection section in a terminal apparatus that selects usable blocks equal to or greater than a Carrier to Interference Ratio (CIR) threshold and outputs CIRs of the selected blocks to a CIR averaging section. *Id.* ¶ 59. The CIR averaging section averages CIRs of the usable blocks and outputs the averaged value. *Id.* ¶ 60. A CQI generation section generates a CQI corresponding to the averaged CIR, which is transmitted to the base station apparatus together with the block numbers output from the block selection

section. *Id.* ¶ 66. According to Nishio, “[t]his eliminates the necessity for reporting CQIs of all blocks equal to or greater than the threshold to the base station apparatus and can thereby reduce amount of data transmitted over the uplink.” *Id.*

2. *Claim 4*

Claim 4 depends from claim 1 and recites “said threshold is related to a maximal number of sub-carriers to be used.” Ex. 1001, 6:16–17. Petitioner’s obviousness contentions for claim 4 build upon its contentions for claim 4 in the Cheng anticipation ground. Regarding the “maximal number of sub-carriers,” Petitioner cites Nishio’s statement that its disclosed embodiments assume that “the number of subcarriers used is 512 and one block consists of 32 subcarriers, but the present invention is not limited to this and the number of subcarriers may also be set arbitrarily.” Pet. 63 (quoting Ex. 1009 ¶ 106) (citing Ex. 1009 ¶ 49). Petitioner contends an ordinarily skilled artisan “would have found it obvious to arbitrarily set the number of carriers to the total possible, whether it was 512 subcarriers or some other number.” *Id.* (citing Ex. 1003 ¶ 155<sup>36</sup>).

Petitioner contends that an ordinarily skilled artisan would have modified Cheng to set the number of subcarriers arbitrarily “to achieve less reporting from each subcarrier that would overwhelm the uplink.” Pet. 63 (citing Ex. 1003 ¶ 156<sup>37</sup>). According to Petitioner, an ordinarily skilled

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<sup>36</sup> Petitioner cites to paragraph 156 of Mr. Gray’s declaration, but the context makes clear that Petitioner intended to cite to paragraph 155.

<sup>37</sup> Petitioner cites to paragraph 157 of Mr. Gray’s declaration, but the context makes clear that Petitioner intended to cite to paragraph 156.

artisan “would have understood that arbitrarily setting a number of subcarriers, as taught by *Nishio*, would have been important to efficiently selecting the assigned number of subcarriers of *Cheng*’s system.” *Id.* at 63–64 (citing Ex. 1003 ¶ 156).

In our Decision on Institution, we determined preliminarily that Petitioner’s rationale for combining *Nishio* with *Cheng* is faulty because it misstates *Nishio*’s teachings. Dec. on Inst. 40–41. We found that “*Nishio* does not teach that setting an arbitrary number of subcarriers avoids reporting for each subcarrier,” and, rather, that “*Nishio* achieves this efficiency by averaging CIRs of the usable blocks and transmitting to the base station only a CQI corresponding to the averaged CIR together with the block numbers.” *Id.* (citing Ex. 1009 ¶¶ 60, 66). Accordingly, we determined that Petitioner had not established a reasonable likelihood that the subject matter of claim 4 would have been obvious over the combination of *Cheng* and *Nishio*. *Id.* at 41.

After institution, neither party put forth arguments regarding our preliminary determination, and the record for this ground remains the same as it did at the time of institution. Thus, in the absence of a persuasive rationale for combining *Nishio* with *Cheng*, we determine that Petitioner has not shown, by a preponderance of the evidence, that the subject matter of claim 4 would have been obvious over the combination of *Cheng* and *Nishio*.

### 3. *Claims 5, 10, and 14*

Petitioner’s obviousness analysis for claims 5, 10, and 14 incorporates the same faulty rationale for combining *Nishio* with *Cheng* discussed above

for claim 4. *See* Pet. 64–69; *supra* § II.G.2. Thus, we determine that Petitioner has not shown, by a preponderance of the evidence, that the subject matter of claims 5, 10, and 14 would have been obvious over the combination of Cheng and Nishio.

*H. Obviousness Ground Based on Cheng and Douglas*

Petitioner contends the subject matter of claim 11 would have been obvious over the combination of Cheng and Douglas. Pet. 69–72; Pet. Reply 9. Patent Owner relies on the same arguments put forth for the Cheng anticipation and obviousness grounds discussed above.

*1. Douglas*

Douglas is a U.S. patent directed to “ascertaining . . . whether or not a packet received at a station of a cell of a wireless network is from another station of the cell.” Ex. 1010, 1:58–61. Douglas describes encoding certain symbols in the preamble of an OFDM packet “such that each co-channel cell is given a different sequence,” i.e., a unique identifier. *Id.* at 2:1–4, 2:38–40. Based on the unique identifier, “the physical layer of the receiver can determine whether the packet is from an intra-cell or inter-cell transmitter.” *Id.* at 2:5–7; 4:61–66. “If the packet is from an inter-cell transmitter, the receiver can terminate processing at the very beginning of the packet,” which “minimizes or at least reduces the amount of time that the medium would be otherwise occupied.” *Id.* at 2:7–10; 4:66–5:2. Douglas states that the unique identifier may be “communicated to intra-cell clients . . . during initial hand-shaking between an access point and a client station.” *Id.* at 2:40–43.

Petitioner contends Douglas qualifies as prior art under 35 U.S.C. § 102(e) based on its filing date. Pet. 7. Patent Owner does not contest the prior art status of Douglas. We have no evidence of an invention date other than the filing date of the application that led to the challenged claims. Thus, we determine that Douglas qualifies as prior art under 35 U.S.C. § 102(e) because Douglas's filing date of September 30, 2003, is before the earliest effective filing date of the challenged claims, which is August 1, 2005. Ex. 1001, code (30); Ex. 1010, code (22).

2. *Claim 11*

Claim 11 depends from claim 6 and further recites “the means for receiving and storing said threshold indication comprising: means for reading the threshold indication on at least one sub-carrier of the selected set of sub-carriers after detecting a specific identifier associated with the receiver on said at least one sub-carrier.” Ex. 1001, 7:4–9. We have construed this limitation above. *See supra* § II.C.5. Petitioner cites Cheng's terminal apparatus (i.e., the recited “receiver”) as disclosing the corresponding structure. Pet. 71. For “reading the threshold indication on at least one sub-carrier of the selected set of sub-carriers,” Petitioner cites Cheng's teaching that subcarrier number information extracting part 213 in terminal apparatus 200 (i.e., the recited “receiver”) “extracts the subcarrier number information from the control information.” *Id.* at 77 (quoting Ex. 1006, 9). According to Petitioner, an ordinarily skilled artisan “would have understood that the assigned subcarrier number (i.e., the claimed threshold indication) is sent via an antenna using subcarriers and would be

received via an antenna using subcarriers.” *Id.* at 67 (citing Ex. 1003 ¶ 171<sup>38</sup>).

For the limitation “after detecting a specific identifier associated with the receiver on said at least one sub-carrier,” Petitioner cites Douglas’s teachings of a “unique identifier . . . provided for each co-channel cell in the network” that is “communicated to intra-cell clients via the MAC protocol during initial hand-shaking between an access point and a client station.” *Id.* at 71 (quoting Ex. 1010, 2:38–43<sup>39</sup>). Petitioner states that its proposed combination includes this initial hand-shaking procedure “because *Cheng* already discloses using communication partners that use a subcarrier by ‘selecting a subcarrier to which packet data is assigned for each communication partner based on the line quality information for the number of subcarriers of each communication partner.’” *Id.* at 72 (quoting Ex. 1003, 3). According to Petitioner, an ordinarily skilled artisan “would have understood that Cheng would have used an identifier to know which communication partner has good line quality.” *Id.* (citing Ex. 1003 ¶ 174<sup>40</sup>).

Petitioner cites Douglas’s teaching that hand-shaking “may be conveyed in a coded form to provide for error detection and/or correction” and contends that an ordinarily skilled artisan would have modified Cheng based on Douglas “to achieve the error detection and correction.” *Id.* (citing Ex. 1010, 2:44–46). Petitioner further contends that Douglas’s initial hand-

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<sup>38</sup> Petitioner mistakenly cites to paragraph 172, but the context makes clear that Petitioner intended to cite paragraph 171.

<sup>39</sup> Petitioner’s citation appears to be wrong. We have updated it based on where the language quoted by Petitioner appears in Douglas.

<sup>40</sup> Petitioner mistakenly cites to paragraph 175, but the context makes clear that Petitioner intended to cite paragraph 174.

shaking procedure would achieve efficiency in the combined system by “knowing which communication partners existed for transmission of packet data of *Cheng*’s system.” *Id.* (citing Ex. 1003 ¶ 175<sup>41</sup>; Ex. 1010, 2:38–43). Petitioner additionally contends an ordinarily skilled artisan would have expected success in combining Douglas with Cheng because both references “are directed towards OFDM systems and techniques.” *Id.* at 73 (citing Ex. 1003 ¶ 176<sup>42</sup>; Ex. 1010, 2:1–10).

Patent Owner does not dispute that Cheng teaches the limitation of claim 11. Otherwise, Patent Owner relies on the same arguments put forth with respect to claim 6. Patent Owner also does not dispute Petitioner’s reasons for combining Douglas with Cheng.

We are persuaded that Cheng’s terminal apparatus teaches the corresponding structure of a receiver. *See, e.g.*, Ex. 1006, 9. Regarding the recited function, we are persuaded that Cheng teaches subcarrier number information extracting part 213 within terminal apparatus 200 (i.e., the recited “receiver”) reading the assigned subcarrier number (i.e., the recited “threshold indication”) from control information sent on a subcarrier. *See, e.g.*, Ex. 1003 ¶ 171; Ex. 1006, 9. We also are persuaded that Douglas teaches a hand-shaking procedure in which the receiver reads a unique identifier contained in the preamble of a packet in order to ascertain whether to further process the packet. *See, e.g.*, Ex. 1010, 2:1–10, 2:38–43, 4:61–5:2. In addition, we are persuaded by one of Petitioner’s reasons for the

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<sup>41</sup> Petitioner mistakenly cites to paragraph 176, but the context makes clear that Petitioner intended to cite paragraph 175.

<sup>42</sup> Petitioner mistakenly cites to paragraph 177, but the context makes clear that Petitioner intended to cite paragraph 176.

combination: that an ordinarily skilled artisan would have sought to incorporate Douglas’s hand-shaking procedure in Cheng’s system to achieve efficiency. *See, e.g.*, Pet. 72–73; Ex. 1003 ¶¶ 175–176. The efficiency arises from “convey[ing] cell-ID information earlier in the packet” so that “the physical layer of the receiver can ascertain whether or not the received packet is from an intra-cell or inter-cell transmitter.” Ex. 1010, 4:51–53; 4:61–66; *see also id.* at 2:5–9. In this way, “the receiver can terminate processing at the very beginning of the packet” if the packet is from an inter-cell transmitter. *Id.* at 2:5–9; 4:66–5:1. Although Mr. Gray’s testimony about efficiency is cursory (*see* Ex. 1003 ¶¶ 175–176), it is nevertheless uncontested and supported by the teachings of Douglas. Mr. Gray’s testimony also indicates that an ordinarily skilled artisan would have had a reasonable expectation of success in making the combination. *See id.* ¶ 176.

On the entire trial record, we determine that Petitioner has shown, by a preponderance of the evidence, that the subject matter of claim 11 would have been obvious over the combination of Cheng and Douglas.

### III. OBJECTIONS TO DEMONSTRATIVES

Prior to the oral argument, Patent Owner filed objections to certain of Petitioner’s demonstratives as presenting new argument. Paper 26. We have considered these objections. Nevertheless, demonstratives are not evidence, and we have relied solely on the arguments properly presented in the parties’ briefs and the evidence of record. *See* Paper 22, 3 (“Demonstratives also are not evidence, and will not be relied upon as evidence.”). Because we have not relied on the demonstratives in rendering this Final Written Decision, we *dismiss as moot* Patent Owner’s objections.

#### IV. CONCLUSION<sup>43</sup>

Petitioner has shown, by a preponderance of the evidence, that:

- (1) claims 1–5 are anticipated by Cheng;
- (2) claims 1, 2, 6–10, and 12–18 would have been obvious over Cheng; and
- (3) claim 3 would have been obvious over the combination of Cheng and Shirali; and
- (4) claim 11 would have been obvious over the combination of Cheng and Douglas.

Petitioner has not shown, by a preponderance of the evidence, that:

- (5) claims 6–9, 12, 13, and 15–18 are anticipated by Cheng; and
- (6) claims 4, 5, 10, and 14 would have been obvious over the combination of Cheng and Nishio.

#### V. ORDER

Accordingly, it is

ORDERED that claims 1–18 of the '534 patent are unpatentable; and

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<sup>43</sup> Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner's attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. See 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. See 37 C.F.R. § 42.8(a)(3), (b)(2).

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

In summary:

| <b>Claims</b>              | <b>35<br/>U.S.C. §</b> | <b>Reference(s)/Basis</b> | <b>Claims<br/>Shown<br/>Unpatentable</b> | <b>Claims<br/>Not shown<br/>Unpatentable</b> |
|----------------------------|------------------------|---------------------------|------------------------------------------|----------------------------------------------|
| 1–9, 12,<br>13, 15–<br>18  | 102(b)                 | Cheng                     | 1–5                                      | 6–9, 12, 13,<br>15–18                        |
| 1, 2, 6–<br>10, 12–<br>18  | 103(a)                 | Cheng                     | 1, 2, 6–10,<br>12–18                     |                                              |
| 3                          | 103(a)                 | Cheng, Shirali            | 3                                        |                                              |
| 4, 5, 10,<br>14            | 103(a)                 | Cheng, Nishio             |                                          | 4, 5, 10, 14                                 |
| 11                         | 103(a)                 | Cheng, Douglas            | 11                                       |                                              |
| <b>Overall<br/>Outcome</b> |                        |                           | 1–18                                     |                                              |

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