

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

INTEL CORPORATION,
Petitioner,

v.

HERA WIRELESS S.A.,
Patent Owner.

IPR2018-01701
Patent 7,454,234 B2

Before THOMAS L. GIANNETTI, ROBERT L. KINDER, and
CHRISTOPHER L. OGDEN, *Administrative Patent Judges*.

KINDER, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining All Challenged Claims Unpatentable
Denying Patent Owner's Motion to Amend
35 U.S.C. § 318(a)

I. INTRODUCTION

A. Background

Intel Corporation (“Petitioner”) filed a Petition requesting *inter partes* review of claims 1–4 (the “challenged claims”) of U.S. Patent No. 7,454,234 B2 (Ex. 1001, the “’234 patent”). Paper 2 (“Pet.”). Hera Wireless S.A. (“Patent Owner”) filed a Preliminary Response. Paper 7 (“Prelim. Resp.”). Taking into account the arguments presented in Patent Owner’s Preliminary Response, 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 May 1, 2019, as to all challenged claims and all grounds of unpatentability. Paper 9 (“Dec.”).

During the course of trial, Patent Owner did not file a patent owner response.¹ Nonetheless, Patent Owner filed a contingent Motion to Amend (Paper 17, “Mot. Amend”) proposing to substitute claims 5, 6, 7, and 8 for claims 1, 2, 3, and 4 respectively, if we determined claims 1–4 to be unpatentable. Petitioner filed an Opposition to the Motion to Amend. Paper 18 (“Opp. Amend”). Patent Owner did not file a reply. An oral hearing was held on January 22, 2020, and a transcript of the hearing is included in the record. Paper 24 (“Tr.”).

Petitioner filed declarations of Stephen B. Wicker, Ph.D., with its Petition (Ex. 1002) and its Opposition to the Motion to Amend (Ex. 1021).

¹ Patent Owner waived those issues presented in its Preliminary Response by not filing a patent owner response. See Paper 10, 7 (“Patent Owner is cautioned that any arguments for patentability not raised in the response may be deemed waived.”).

Patent Owner did not file any testimonial evidence regarding Petitioner's unpatentability contentions or Patent Owner's Motion to Amend.

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 1–4 and proposed substitute claims 5–8 of the '234 patent. For the reasons discussed below, Petitioner has demonstrated by a preponderance of the evidence that claims 1–4 of the '234 patent are unpatentable. We also *deny* Patent Owner's Motion to Amend.

B. Related Proceedings

The parties identify the following as matters relating to the '234 patent: *Hera Wireless S.A. v. Amazon.com, Inc.*, 1:17-cv-00947 (D. Del.); *Hera Wireless S.A. v. ARRIS Group, Inc.*, 1:17-cv-00948 (D. Del.); *Hera Wireless S.A. v. Belkin Int'l, Inc.*, 1:17-cv-00949 (D. Del.); *Hera Wireless S.A. v. Buffalo Americas, Inc.*, 1:17-cv-00950 (D. Del.); *Hera Wireless S.A. v. Netgear, Inc.*, 1:17-cv-00951 (D. Del.); *Hera Wireless S.A. v. Roku, Inc.*, 1:17-cv-00952 (D. Del.); *Hera Wireless S.A. v. Lenovo Holding Co., Inc.*, 1:17-cv-01088 (D. Del.); and *Hera Wireless S.A. v. LG Electronics, Inc.*, 1:17-cv-01089 (D. Del.). Paper 6, 3–4; Paper 5, 1–2.

The '234 patent was also the subject of *Ruckus Wireless, Inc. v. Hera Wireless S.A.*, IPR2018-01736, Paper 1 (PTAB Sept. 14, 2018), *institution denied*, Paper 21 at 2 (PTAB Apr. 30, 2019).²

Petitioner has also filed petitions seeking *inter partes* review of several other of Hera's patents, including the following: IPR2018-01371

² Petitioners in that proceeding were Ruckus Wireless, Inc., Belkin International, Inc., Amazon.com, Inc., Netgear, Inc., and Roku, Inc. See IPR2018–01736, Paper 1.

(challenging U.S. Patent No. 7,962,103); IPR2018-01372 (challenging U.S. Patent No. 8,412,115); IPR2018-01373 (challenging U.S. Patent No. 8,934,851); IPR2018-01543 (challenging U.S. Patent No. 8,295,400); IPR2018-01657 (challenging U.S. Patent No. 9,270,024); IPR2018-01686 (challenging U.S. Patent No. 8,737,377); IPR2018-01687 (challenging U.S. Patent No. 8,737,377); IPR2018-01700 (challenging U.S. Patent No. 7,369,878); and IPR2018-01702 (challenging U.S. Patent No. 7,873,389).

C. Real Parties in Interest

The Petition named only Intel Corporation as the real party in interest. Pet. 1–2. Later, in Updated Mandatory Notices, Intel identified its customers Lenovo Holding Co., Inc. and Lenovo (United States), Inc. as real parties in interest “[o]ut of an abundance of caution, . . . without conceding that they would be determined to be real parties[]in[]interest under the governing legal standard.” Paper 6, 2. Intel also notes that “accused products sold by . . . LG Electronics, Inc. and LG Electronics USA, Inc. might have included integrated circuit products from Intel,” but Patent Owner settled with these entities before Intel filed the Petition. *Id.* Patent Owner does not contest the accuracy or timeliness of Intel’s identification of the real parties in interest.

In addition to itself, Hera identifies Sisvel UK Limited as a real party in interest, because it is the exclusive licensing agent for the ’234 patent. Paper 5, 1.

D. The '234 Patent

The '234 patent is titled “Radio Base Station Apparatus, Radio Terminal Apparatus, Mobile Communication System, and Reception Operation Control Program.” Ex. 1001, code (54).

The '234 patent is directed to an apparatus and method for a radio terminal device to optimize a reception operation. *Id.* at code (57). In response to a connection request from a terminal, a radio base station provides a signal to the terminal indicating a reception operation adapted to a transmission operation of the base station. *Id.* The indicating signal then allows the terminal to select and perform the optimum reception operation. *Id.* The terminal also provides its own reception operation information in advance to the base station. *Id.* The base station then transmits a reception operation indication to the terminal based on the reception operation information. *Id.*

The '234 patent explains that prior art mobile communication systems, such as the Personal Handyphone System (PHS), use Path Division Multiple Access (PDMA) schemes to allow radio terminals of a plurality of users to be connected to a radio base station in a spatial multiplexing manner, by spatially dividing an identical time slot of an identical frequency, for improving the frequency effectiveness of a radio wave. *Id.* at 1:35–43. In this PDMA scheme, a base station uses an adaptive array, and a receiving terminal may use selective diversity reception (“diversity reception”) using a plurality of antennas, single-antenna reception, or adaptive array reception, where a received signal is extracted with reception directivity through an adaptive array process. *Id.* at 1:44–50, 1:63–65, 15:54–16:3.

When a terminal device using diversity reception receives a transmission from a base station that uses an adaptive array transmission technique, it may receive signals not intended for it, thereby reducing its DU ratio (ratio of desired signal power to undesired signal power). *Id.* at 3:52–66, 4:3–12. The '234 patent aims to overcome this problem by causing the terminal to perform a reception operation that is adapted to the transmission operation of the base station. *Id.* at 4:22–34. Specifically, an indicating signal instructs the terminal to receive the frame in the manner prescribed to it by the base station. *Id.* at 15:3–16:3. When the terminal receives this signal, it adapts its reception operation to the transmission operation of the base station and proceeds to receive a frame in an optimal manner. *Id.* at 15:64–16:3.

In one embodiment, an adaptive array base station sends a signal to a terminal telling the terminal to stop diversity operation. *Id.* at 15:21–40. In response, the terminal stops diversity reception and instead selects the single antenna that transmitted the last uplink signal as the antenna that will receive the immediately following frame of the base station's downlink signal. *Id.*

This is illustrated by Figure 1 of the '234 patent, reproduced below:

F I G. 1

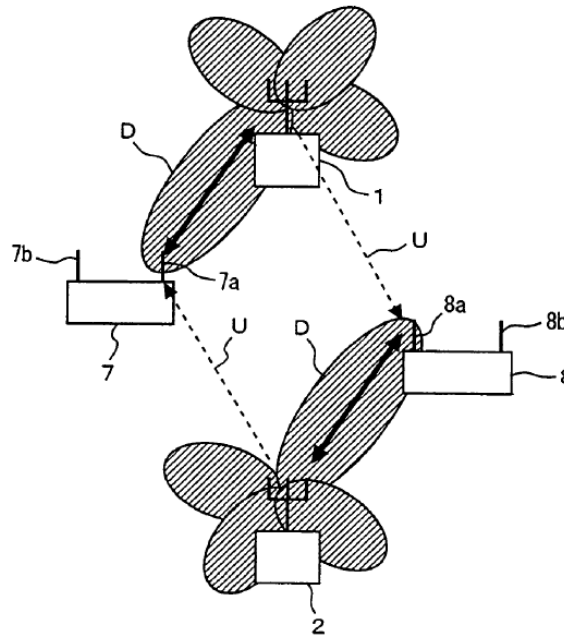


Figure 1 depicts adaptive array base stations 1 and 2, as well as terminals 7 (with antennas 7a and 7b) and 8 (with antennas 8a and 8b), which normally use their two antennas to perform diversity reception. Ex. 1001, 15:3–10. When base stations 1 and 2 each send a signal indicating that diversity reception should stop, terminals 7 and 8 cease performing diversity reception. *Id.* at 15:3–15. Then terminal 7 shifts from diversity reception using both antennas 7a and 7b to using only antenna 7a. *Id.* at 15:33–40. As a result, base station 1 directs the beam of its signal wave D to antenna 7a, as indicated in Figure 1 by a bold arrow. *Id.* at 15:41–42. This shift to a single antenna minimizes the effect of interference wave U from base station 2. *Id.* at 15:42–44. Terminal 8, likewise, selects antenna 8a to receive communications from base station 2. *See id.* at 15:51–53.

The '234 patent describes an alternative embodiment in which terminals 7 and 8 switch from diversity reception to using their two antennas for “adaptive array reception.” *Id.* at 15:54–58, 15:64–16:3. According to

the '234 patent, adaptive array reception was a “well known technique, and the terminal that selectively performs the diversity reception and the adaptive array reception can easily be realized with software using a plurality of antennas and a digital signal processor.” *Id.* at 15:60–63.

Figure 10 of the '234 patent, reproduced below, shows further detail with respect to the embodiment of switching from diversity reception to single-antenna reception:

FIG. 10

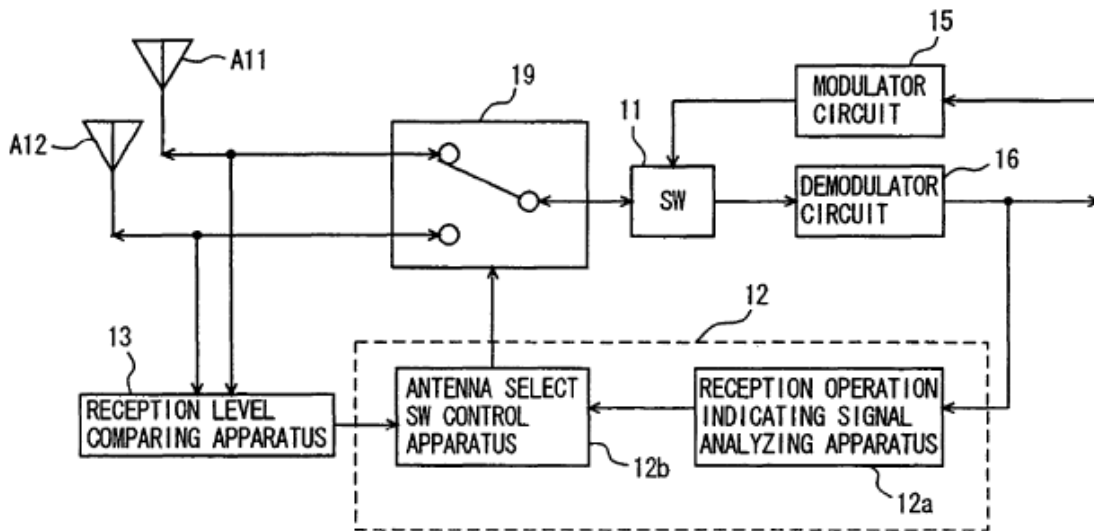


Figure 10 is a functional block diagram of a terminal that is performing diversity reception using two antennas A11 and A12. Ex. 1001, 18:65–67. Switch 19 connects the two antennas to signal-alternating circuit 11. *Id.* at 18:67–19:2. Level comparing apparatus 13 compares the outputs of antennas A11 and A12 and sends its output to switch controlling apparatus 12b, which controls switch 19. *Id.* at 19:6–7, 15–20, 31–36. After receiving a signal indicating that adaptive array processing is unavailable, the apparatus in Figure 10 can “perform[] the reception operation in which the

antenna that was used in the immediately preceding transmission is fixed as the reception antenna.” *Id.* at 21:44–47.

E. Illustrative Claims

The ’234 patent has four claims. All are challenged in the Petition. Claims 1 and 4 are independent claims. Claims 1 and 2 are representative of the challenged claims and each recites:

1. A radio base station apparatus for transmitting a multiple-field frame to a radio terminal apparatus, the radio base station apparatus comprising:

a receiver for receiving a connection request from the radio terminal apparatus; and

a transmitter for transmitting the multiple-field frame to the radio terminal apparatus which has sent the connection request wherein control information and first data are respectively contained in mutually different fields in the multiple-field frame, and the control information contains (1) single bit indicating a reception operation adapted to a transmission operation of the radio base station apparatus and (2) second data for communication control.

2. A radio base station apparatus according to claim 1, wherein the single bit has a first value specifying a first reception operation or a second value specifying a second reception operation, the single bit instructing the radio terminal apparatus to accept the multiple-field frame only in a prescribed manner determined by the first or second value and adapted to a corresponding transmission operation of the radio base station apparatus.

Ex. 1001, 26:13–34. Claim 3 likewise depends from claim 1 and further recites limitations related to a plurality of antennas. *Id.* at 26:35–40. Claim 4 is similar in scope to the combination of claims 1 and 2 above. *Id.* at 26:35–62.

F. References and Other Evidence

The Petition relies on the following references:

1. International Pub. No. WO 99/59263, published November 18, 1999 (Ex. 1003, “Park”)
2. U.S. Patent No. 7,158,493 B1, issued January 2, 2007 (Ex. 1004, “Uhlik”)
3. U.S. Patent App. Pub. No. 2001/0014588 A1, published August 16, 2001 (Ex. 1005, “Ishida”)
4. Personal Handy Phone System Version 2 (Ex. 1007, “PHSv2”).

Petitioner relies on the Declaration of Dr. Stephen B. Wicker (Ex. 1002), and the Supplemental Declaration of Dr. Wicker (Ex. 1021).

G. Instituted Grounds of Unpatentability

We instituted *inter partes* review of claims 1–4 of the ’234 patent on the following grounds (Dec. 5, 27) presented in the Petition (Pet. 4):

Claims Challenged	35 U.S.C. §	Reference(s)/Basis
1–4	102 ³	Park
1–4	103	Park
1–4	102	Ishida
1–4	102	Uhlik
1–4	103	Uhlik
1–4	103	PHSv2, Uhlik

³ The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112-29, 125 Stat. 284, 285–88 (2011), amended 35 U.S.C. §§ 102, 103. Because the effective filing date of the ’234 patent is before March 16, 2013 (the effective date of the relevant amendments), the pre-AIA version of §§ 102, 103 apply.

II. PRELIMINARY MATTERS

A. Level of Ordinary Skill

To assess the level of ordinary skill, we construct a hypothetical “person of ordinary skill in the art,” from whose vantage point we assess obviousness and claim interpretation. *See In re Rouffet*, 149 F.3d 1350, 1357 (Fed. Cir. 1998). This legal construct “presumes that all prior art references in the field of the invention are available to this hypothetical skilled artisan.” *Id.* (citing *In re Carlson*, 983 F.2d 1032, 1038 (Fed. Cir. 1993)).

Petitioner contends that “[a]s of 2001, a person of ordinary skill in the ’234 patent’s field (‘skilled person’) would have a Master’s degree in Electrical Engineering and at least 2-4 years of industry or research experience in the area of wireless communications [systems].” Pet. 13 (citing Ex. 1002 ¶ 54).

Not having submitted a Response, Patent Owner does not contest this formulation on the trial record.⁴

From our review of the final record, including the prior art references cited, we conclude that a person of ordinary skill in wireless communications would be required to have a “working knowledge” of advanced antenna techniques. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (prior art itself may reflect an appropriate level of skill). For the purpose of our decision, we adopt Petitioner’s proposal with the modification that a person of ordinary skill in wireless communications

⁴ During the pre-institution stage of this *inter partes* review, the Board considered the arguments about the level of ordinary skill that Patent Owner made in its Preliminary Response. *See* Dec. 6–7. The panel stated that it “regard[s] any differences in the parties’ formulations as immaterial,” and adopted Petitioner’s proposed level of ordinary skill. *Id.*

would be required to have a working knowledge of advanced antenna techniques. However, we would reach the same result with regard to this decision under either formulation.

B. Claim Construction

In this *inter partes* review, the Board interprets claim terms according to the broadest reasonable construction in light of the specification of the patent in which they appear. 37 C.F.R. § 42.100(b) (2018); *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2142 (2016).⁵ Under that standard, and absent any special definitions, we give claim terms their ordinary and customary meaning, as would be understood by one of ordinary skill in the art at the time of the invention. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). Additionally, any special definitions for claim terms must be set forth with reasonable clarity, deliberateness, and precision. *In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994).

Petitioner does not request any of its own constructions. Pet. 13–14. Instead, Petitioner offers construction of a term that Petitioner indicates Patent Owner “may argue,” namely, the phrase “accept[ing] the multiple-field frame only in a prescribed manner,” appearing in claims 2 and 4. *Id.* Petitioner would construe this limitation as not limited to the base station’s response to a connection request from a terminal. *Id.* at 14–15; *see id.* at 15

⁵ A recent amendment to this rule changing the claim construction standard does not apply here because the Petition was filed before the November 13, 2018, effective date. *See* Changes to the Claim Construction Standard for Interpreting Claims in Trial Proceedings Before the Patent Trial and Appeal Board, 83 Fed. Reg. 51,340 (Oct. 11, 2018).

(“includes the frame transmitted after the base station’s response to a connection request”).

We understand Petitioner’s proposal on claim construction to be conditioned on Patent Owner’s particular proposal for a specific term. Based on the final record before us, Patent Owner has not offered such a construction for this term. Accordingly, we need not address Petitioner’s conditionally proposed construction.

In the Institution Decision, the Board did not construe any claim terms, because neither party identified any terms needing an explicit construction. *See* Dec. 7–9 (citing Pet. 12–14). Neither party raised the issue of claim construction at trial, either. Therefore, we need not construe claim terms explicitly for the purpose of this decision. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (“[W]e need only construe 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))).

C. Description of the Prior Art References

1. Park

Park is titled “Time-Switched Transmission Diversity (TSTD)[⁶] Device and Controlling Method Thereof in Mobile Communication System.” Ex. 1003, code (54). Park describes a “transmission diversity control method in a mobile communication system including a base station which transmits forward common and dedicated channel data through at

⁶ TSTD stands for “time-switched transmission diversity.” Ex. 1003, 1:9–10, 2:20–21.

least two antennas with transmission diversity.” *Id.* at code (57). “The base station sends a message indicating a TSTD[or] non TSTD transmission mode through an antenna to a plurality of mobile stations in the coverage area of the base station.” *Id.* “Then, each mobile station analyses the message received from the base station and sets its reception mode to a TSTD/non-TSTD mode according to the transmission mode.” *Id.* As the alternative to diversity mode, Park discloses selecting a single antenna for continuous reception; the selection of which antenna to use is based on a channel type. *See id.* at 13:12–15, 22–25.

Petitioner relies on Figure 8C of Park. Park’s Figure 8C, reproduced below, illustrates an example of such a diversity- or non-diversity-indicating message from the base station:

CCCH MESSAGE FORMAT			
MESSAGE TYPE	TSTD MODE CHANGE (OPTIONAL)	TSTD PATTERN (OPTIONAL)	OTHER INFORMATION ELEMENTS

FIG. 8C

Figure 8C is an example of a message format used by Park, and Figure 8C “illustrates the format of a common control channel (CCCH) message sent to an MS by a BS.” *Id.* at 5:24–25. The message frame contains fields, from left to right, for (1) message type, (2) TSTD (diversity) mode change information, (3) TSTD (diversity) pattern information, and (4) other information elements. The second field indicates that “the [diversity] mode is changed to a non-[diversity] mode when the [base station] does not want to use the [diversity] mode.” *Id.* at 17:4–6. The third field “provides a

[diversity] pattern in which data is switchedly transmitted through the antennas . . . by the [base station].” *Id.* at 17:6–7.

2. *Ishida*

Ishida discloses a radio base station that sends a diversity reception stop instruction to the mobile station as a response to a traffic channel assignment request. Ex. 1005, code(57). The mobile station’s message to the base station is called a link channel (Lch) establishment request, while the base station’s responding message to the mobile station is called a link channel assignment request. *Id.* ¶¶ 43, 44.

In a preferred embodiment, the radio base station is a PHS base station that “performs a radio communication with a PHS telephone according to a TDMA/TDD (Time Division Multiple Access/Time Division Duplex) method conforming to a PHS standard.” *Id.* ¶ 36. Figure 5 illustrates an example of a “link channel assignment message” according to that embodiment. *Id.* ¶¶ 31, 68. Petitioner provides an annotated version of that figure, which follows:

FIG.5

LINK CHANNEL ASSIGNMENT MESSAGE

OCTET \ BIT	8	7	6	5	4	3	2	1
1	RESERVED	0	0	0	0	0	0	1
MESSAGE TYPE								
2	LCH TYPE			RESERVED		EXTENDED LCH PROTOCOL TYPE		
3	CC PROTOCOL		D	RELATIVE SLOT NO.				
4	CARRIER NO.							
5							ABSOLUTE SLOT NO.	

D = 1;DIVERSITY RECEPTION STOP INSTRUCTION
D = 0;DIVERSITY RECEPTION AVAILABLE

Petitioner's annotated Figure 5 shows a Link Channel Assignment Message including a D Flag field. Pet. 19; Ex. 1005 ¶ 68. Figure 5 shows the format of a five-octet-long link channel (Lch) assignment message, which a base station sends to a terminal. Ex. 1005 ¶ 68. Ishida states that "bit '6' of the octet '3' (hereinafter referred to as a D flag)," "indicates a diversity reception stop instruction against the mobile station," when it is "1," "and when being '0', the D flag indicates that a diversity reception is possible, namely, that either a diversity reception or a reception using one antenna is possible." Ex. 1005 ¶ 68.

3. *Uhlik*

Uhlik discloses a "wireless network using spatial division multiple access (SDMA) technology in combination with multiple access systems." Ex. 1004, 2:54–58. Uhlik discloses a multi-antenna base station that receives a "request burst from a user terminal" and transmits "a message burst from the base station to the user terminal from which the request was received." *Id.* at code (57), Fig. 1. The message burst includes, among other things, "a description of the channels available on the radio communications system." *Id.*

Uhlik describes the base station's response as a "Configuration Message," which follows a frame format with several fields specifying various configuration parameters for a receiver. *Id.* at 9:58–63, 15:4–18, Fig. 7. Figure 7 of Uhlik follows:

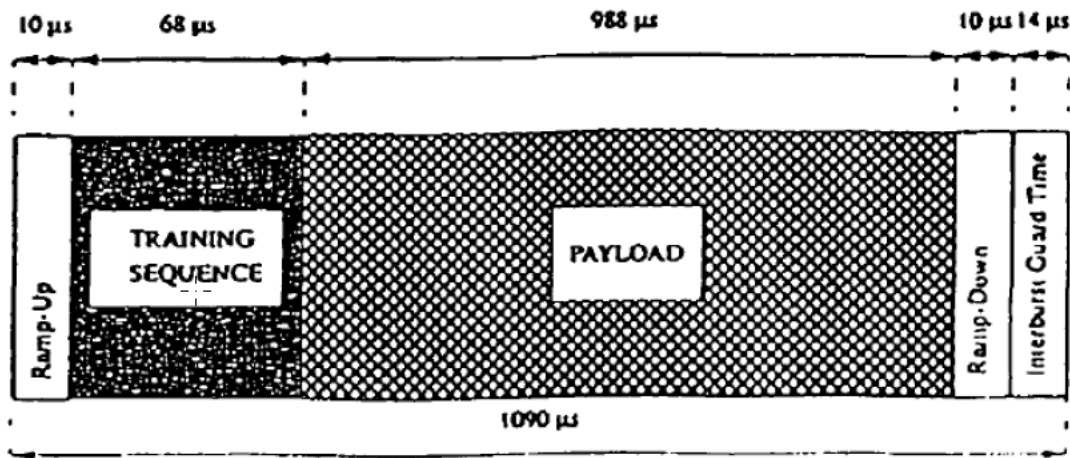


Figure 7 shows the timing and content of an example Configuration Message burst. *Id.* at 2:35–37. Boxes represent bits for ramp-up, training, the payload, ramp-down and then an inter-burst guard time. *Id.* at 14:42–50. One field of the Configuration Message is a single-bit instruction to the terminal regarding whether to use frequency hopping. *Id.* at 15:4–18.

4. PHSv2

PHSv2 discloses a system for communication between personal stations (i.e., terminals) and cell stations (i.e., base stations). Ex. 1007, 17, 20. PHSv2 describes in detail the frame formats and functions of data 10 communicated between personal and cell stations. *Id.* at 56, 85. The frame formats include signals that instruct terminals how to communicate with base stations.

III. ANALYSIS OF THE CHALLENGED CLAIMS

The Petition challenges claims 1–4 of the '234 patent. Petitioner asserts grounds of unpatentability based on anticipation and obviousness.

A. Anticipation

“A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference.” *Verdegaal Bros., Inc. v. Union Oil Co. of Cal.*, 814 F.2d 628, 631 (Fed. Cir. 1987). To establish anticipation, “all of the elements and limitations of the claim must be shown in a single prior reference, arranged as in the claim.” *Karsten Mfg. Corp. v. Cleveland Golf Co.*, 242 F.3d 1376, 1383 (Fed. Cir. 2001).

When evaluating a single prior art reference in the context of anticipation, the reference 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)). “[T]he dispositive question regarding anticipation[, therefore, i]s whether *one skilled in the art* would reasonably understand or infer from the [prior art reference’s] teaching’ that every claim element was disclosed in that single reference.” *Dayco Prods., Inc. v. Total Containment, Inc.*, 329 F.3d 1358, 1368 (Fed. Cir. 2003) (alterations in original) (quoting *In re Baxter Travenol Labs.*, 952 F.2d 388, 390 (Fed. Cir. 1991)).

B. Obviousness

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. *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,” including: commercial success, long-felt but unsolved needs, failure of others, and unexpected results.⁷ *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966) (“the *Graham* factors”).

C. Park Challenges

Petitioner contends claims 1–4 are “anticipated or rendered obvious” by Park. Pet. 29. As noted above, claims 1 and 4 are independent. Claims 2 and 3 depend from claim 1. *See infra*. We first address claim 1. Patent Owner has not directly responded to Petitioner’s contentions. We agree with Petitioner that Park qualifies as prior art under 35 U.S.C. § 102(b). *See* Pet. 16; Ex. 1003, code(43). For the reasons below, we find the evidence on the final record persuasive, and we determine that claims 1–4 are unpatentable on these anticipation and obviousness grounds.

1. Claim 1

Petitioner’s analysis of claim 1 in relation to Park appears at pages 29–39 of the Petition. Petitioner supports its analysis with testimony from its expert, Dr. Wicker. Ex. 1002 ¶¶ 153–164.

⁷ Because neither party has presented evidence of objective indicia of obviousness or non-obviousness, we do not address that consideration in our decision.

Petitioner asserts that each element of claim 1 is disclosed by Park. The claim 1 preamble calls for a “radio base station apparatus for transmitting a multiple-field frame to a radio terminal apparatus.” Petitioner contends this element is found in Park’s base station 10, which sends a message to a plurality of base stations. Pet. 29 (citing Ex. 1003, Fig. 2, 5:5–7, 9:21–10:3). “Park taught that ‘upon receiving a TCH assignment request,’ base station 10 transmits ‘[t]he message of FIG. 8C’ below to mobile station 12,” and “the message of Figure 8C included multiple fields.” Pet. 30 (quoting Ex. 1003, 16:24–17:8). Petitioner contends that a person of ordinary skill in the art “would recognize that [Code Division Multiple Access (CDMA)] mobile communication systems communicate using frames, and that the data structure shown in Park’s Figure 8C above constitutes part of a multiple-field frame.” *Id.* As for the claim requirement of “a receiver for receiving a connection request from the radio terminal apparatus,” Petitioner relies on “[t]he base station ‘BS’ disclosed in Park” as having a receiver for receiving a connection request. *Id.* at 31.

Claim 1 further calls for

a transmitter for transmitting the multiple-field frame to the radio terminal apparatus which has sent the connection request wherein control information and first data are respectively contained in mutually different fields in the multiple-field frame, and the control information contains (1) single bit indicating a reception operation adapted to a transmission operation of the radio base station apparatus and (2) second data for communication control.

Ex. 1001, 26:18–26. Petitioner relies on the base station’s transmitter (*see* Ex. 1003, Fig. 2 (BS Transmitter 14)), which transmits “the frame of Figure 8C (a message assigning a TCH) to the radio terminal apparatus which has

sent the connection request.” Pet. 33–34. Further addressing this limitation, Petitioner cites the TSTD mode change bit illustrated in Park’s Figure 8C, *supra* § II.C.1, noting that “if the base station will transmit in the TSTD (time-switched transmit) mode,” the base station ““notifies the MS 12 of a TSTD pattern by sending the MS 12 the message of FIG. 8C on the CCCH.”” *Id.* at 34 (quoting Ex. 1003, 16:24–17:8). As argued by Petitioner, “[i]n TSTD mode, the base station switches between antennas according to a TSTD pattern,” and “[s]ending the TSTD pattern to the mobile station allows it to use a reception pattern that matches the base station’s pattern, thereby improving its performance.” *Id.* at 34–35 (citing Ex. 1003, 6:13–17, 12:4–23, 7:20–24; Ex. 1002 ¶ 165).

Petitioner alleges that the claimed “control information” and “‘first data’ are contained in mutually different fields in the frame disclosed in Park’s Figure 8C” and that Park discloses that the frame in annotated Figure 8C includes “other information elements,” corresponding to the claimed “first data.” *Id.* at 35–36 (citing Ex. 1003, 15:13–18). “[T]he claimed ‘control information,’ . . . includes (1) a single bit indicating a reception operation adapted to a transmission operation of the radio base station apparatus and (2) second data for communication control,” and Petitioner equates Park’s TSTD mode change field, depicted in Figure 8C, as a “single bit indicating a reception operation adapted to a transmission operation of the radio base station apparatus.” *Id.* at 36. Petitioner relies also on Park’s showing that the value of the bit is used by the mobile station to change from a TSTD mode to a non-TSTD mode. *Id.* (“TSTD mode change has only two values: one indicating that TSTD is on, and the other indicating TSTD is off.”). Thus, according to Petitioner, a person of ordinary skill would

“immediately recognize that the TSTD mode change is therefore represented by a single bit.” *Id.* at 36–37. “Finally,” Petitioner identifies “the TSTD pattern field” as corresponding “to the claimed ‘second data for communication control’” required by claim 1. *Id.* at 38. Petitioner’s arguments as to the unpatentability of claim 1 based on Park are un rebutted.

Based on the final record before us, we find Petitioner’s contentions as to claim 1 persuasive. By a preponderance of the evidence, we find that Park discloses each limitation identically as recited in claim 1. In particular, Dr. Wicker’s uncontested testimony persuades us that the diversity-mode-change field contains only a single bit of information: whether diversity mode is on or off. Ex. 1002 ¶¶ 163–164. Thus, a skilled artisan would have understood that the field consists of a single bit. *Id.*

In addition, we agree with Petitioner’s alternative argument that the “single bit” element of claim 1 would have been obvious based on Park. Pet. 38. In particular, we find persuasive Dr. Wicker’s alternative testimony that a person of ordinary skill in the art would have had reason to store the mode-change information as a single bit, because it is “the most efficient storage and transmission design choice.” *Id.* We find that because the mode-change field only conveys one bit of information—on or off—it would have been within the skill in the art to select a frame size of one bit to convey the single bit of diversity-mode-change information, and a person of ordinary would have had a reason to use a one bit frame size in order to increase the efficiency of the transmission. *See KSR*, 550 U.S. at 417 (“If a person of ordinary skill can implement a predictable variation, § 103 likely bars its patentability.”).

Thus, we find that Park anticipates claim 1. We also determine that a person of ordinary skill in the art would have found claim 1 to have been obvious because Park teaches each element of the claimed radio base station apparatus for transmitting a multiple-field frame to a radio terminal apparatus.

2. Claims 2–4

As noted above, claim 2 adds the requirement that “the single bit has a first value specifying a first reception operation or a second value specifying a second reception operation” and “only in a prescribed manner determined by the first or second value and adapted to a corresponding transmission operation.” Ex. 1001, 26:28–34. Petitioner contends that “Park disclosed that the TSTD mode change signal is a bit with two possible values, each specifying a different reception operation and instructing the terminal to accept the frame only in a prescribed manner.” Pet. 39. Petitioner’s analysis of independent claim 4 incorporates its analysis of claims 1 and 2. *Id.* at 42–43. Claim 3 adds limitations requiring a plurality of antennas. *Id.* at 41.

We are persuaded that Petitioner has demonstrated by a preponderance of the evidence that Park discloses each element of claims 2–4. As we discuss above, Petitioner has persuasively shown, and we therefore find, that Park’s diversity-mode-change signal is a single bit, or alternatively that the use of a single bit was a predictable variation of Park’s disclosure at the time of invention. With particular regard to the TSTD mode change field, as Petitioner explains, “TSTD mode change has only two values: one indicating that TSTD is on, and the other indicating TSTD is off.” Pet. 36 (citing Ex. 1003, 14:3–6; Ex. 1002 ¶¶ 163–164). Thus, in view of the final record before us, Petitioner has established that an ordinarily skilled artisan

would have recognized “that the TSTD mode change is therefore represented by a single bit.” *Id.* at 36–37 (citing Ex. 1002 ¶ 164).

Furthermore, even if Park may suggest that TSTD Mode Change may comprise more than a single bit, Petitioner has persuasively established that an ordinarily skilled artisan would have modified Park to employ “a one-bit signal to instruct the mobile terminal whether to use TSTD mode or a non-diversity reception operation” because a single bit is the “most efficient way to instruct a terminal” to “differentiate between two operating modes.” Pet. 38 (citing Ex. 1002 ¶ 164; Ex. 1013, 187, 198). Petitioner cites Dr. Wicker’s testimony that Park prescribes a manner in which the diversity-mode-change signal specifies two different reception operations: diversity-mode operation and a non-diversity-mode operation. *Id.* (citing Ex. 1002 ¶ 164). We note that in particular, Park discloses single-antenna reception as a non-diversity-mode operation. *See* Ex. 1003, 13:12–15, 22–25.

For the reasons given, we are persuaded that Petitioner demonstrates by a preponderance of the evidence that Park anticipates claim 2. We also determine that a person of ordinary skill in the art would have found claim 2 obvious based on Park.

Claim 3 depends from claim 1 and adds that receiving and transmitting are each performed by a “plurality of antennas.” Ex. 1001, 26:35–40. Petitioner points to Park’s Figure 3, reproduced below:

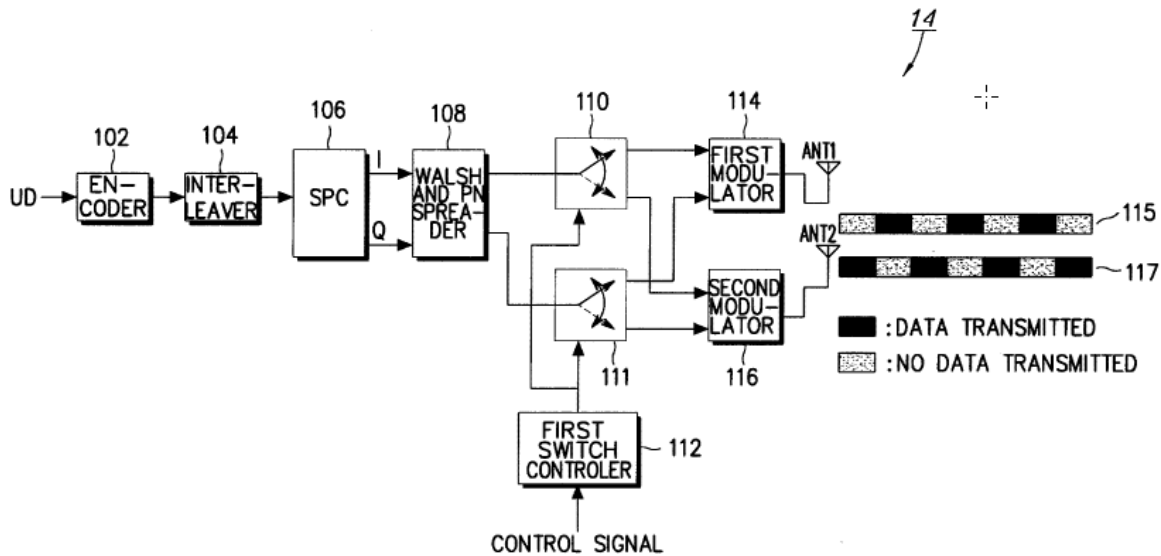


FIG. 3

Pet. 41. Figure 3 is a block diagram showing a diversity transmitter as part of a base station transmitter “for sending a signal through two antennas.” Ex. 1003, 12:4–5. The transmitter includes switches 110 and 111, which produce a pattern through antennas ANT1 and ANT2 according to a “time switching pattern control signal.” *Id.* at 12:25–13:3. According to Park, “[t]he switching pattern control signal is generated based on a control signal received from the [base station] controller,” and “[t]he control signal is determined by the [base station] transmission mode information indicating whether the [base station] supports a [diversity] mode or not.” *Id.* at 13:5–8. In addition to transmitting via a plurality of antennas, Park discloses using “a plurality of reception antennas in a BS so that the BS can receive a signal from an MS on a reverse link with good reception performance.” *Id.* at 2:1–4; Ex. 1002 ¶ 169.

Based on this description in Park, we find that Park discloses the additional limitations of claim 3. For this reason as well as the reasons

discussed above with regard to claim 1, we find that Park anticipates claim 3 and, alternatively, that claim 3 would have been obvious in light of Park's disclosure.

As noted above, claim 4 (Ex. 1001, 26:41–62) combines limitations from claims 1 and 2, and Petitioner relies on the same arguments set forth for those claims. *See* Pet. 42–43. For the reasons discussed above, we are persuaded that Petitioner demonstrates by a preponderance of the evidence that Park anticipates claim 4. We also determine that a person of ordinary skill in the art would have found claim 4 obvious based on Park.

In view of all the above considerations, we conclude that Petitioner has shown by a preponderance of the evidence that claims 1–4 are unpatentable under the first ground of the Petition based on Park.

D. Ishida Challenge

Petitioner contends claims 1–4 are anticipated by Ishida, relying on supporting testimony by Dr. Wicker. Pet. 43–56; Ex. 1002 ¶¶ 174–195. For the reasons provided below, we find Petitioner's evidence persuasive, and we find that claims 1–4 are unpatentable on this ground.

We agree with Petitioner that Ishida qualifies as prior art under 35 U.S.C. § 102(e). *See* Pet. 17 (citing Ex. 1008, 90 (applicant conceding during prosecution that Ishida is § 102(e) prior art)). Patent Owner presents no evidence to antedate Ishida's U.S. filing date of February 13, 2001. *See* Ex. 1005, code(22).

1. Claim 1

Petitioner's analysis of claim 1 in relation to Ishida appears at pages 43–53 of the Petition. Petitioner supports its analysis with testimony from Dr. Wicker. Ex. 1002 ¶¶ 174–195.

Petitioner asserts that each element of claim 1 is disclosed by Ishida. The claim 1 preamble calling for a “radio base station apparatus for transmitting a multiple-field frame to a radio terminal apparatus” is found in Ishida’s radio base station (Fig. 1) which is a PHS base station communication with a PHS telephone. Pet. 44–45 (citing Ex. 1005, Fig. 1, ¶¶ 27, 36). Petitioner contends that the claimed “receiver for receiving a connection request from the radio terminal apparatus” is disclosed by Ishida’s radio communication units that include a reception unit that “receives a connection request, specifically, a ‘Lch establishment request,’ from the radio terminal apparatus.” Pet. 45–46.

As for the claim limitations related to “a transmitter for transmitting the multiple-field frame to the radio terminal apparatus . . . wherein control information and first data are respectively contained in mutually different fields in the multiple-field frame,” Petitioner relies on Ishida’s base station that includes a transmitter (a transmission unit) “for transmitting a multiple-field frame to the radio terminal apparatus which has sent the connection request.” *Id.* at 47. Petitioner further notes “that Ishida’s base station transmits an LCH Assignment frame . . . to the radio terminal apparatus that sent the connection request.” *Id.* at 48.

According to Petitioner, “Ishida’s LCH Assignment frame included multiple fields with control information and ‘first data’ in mutually different fields.” *Id.* at 48 (citing Ex. 1002 ¶¶ 184–188). The claimed “first data” is disclosed by “Ishida’s LCH Assignment frame [that] included ‘fields R (Ramp bits), SS (Start Symbol), PR (Preamble), and UW (Unique Word),’ which are ‘defined in the PHS standard,’ any of which include data according to Petitioner. *Id.* (quoting Ex. 1002 ¶ 54); *id.* at 50. Petitioner

also relies on Ishida's Figure 5, which depicts "'an Lch assignment message,' which 'conform[s] to the PHS standard' except for 'bit "6" of the octet "3",'" which Petitioner refers to as "a D flag." *Id.* at 50 (quoting Ex. 1005 ¶ 68). Petitioner contends that "Ishida's link channel assignment message (the 'control information') included (1) a single bit indicating a reception operation adapted to a transmission operation of the radio base station apparatus and (2) second data for communication control." *Id.* at 51 (citing Ex. 1002 ¶¶ 184–186). Relying on Dr. Wicker's testimony, Petitioner argues that the D flag "is a single bit indicating a reception operation adapted to a transmission operation of the base station." *Id.* (citing Ex. 1002 ¶¶ 184–185). "When the D flag is 1, it 'indicates a diversity reception stop instruction.' Ex. 1005 ¶ 68. When the D flag is 0, it 'indicates that a diversity reception is possible.'" *Id.*

Petitioner has persuasively shown on the final record, and we therefore find, that each limitation of claim 1 is found in a single embodiment in Ishida. Therefore, we agree with Petitioner's showing. In particular, we agree that Ishida's D flag is a "single bit indicating a reception operation adapted to a transmission operation of the radio base station apparatus" (Ex. 1001, 26:23–24). The bit indicates a reception operation: for example, reception with one antenna, rather than diversity reception. *See* Ex. 1005 ¶¶ 69, 80. Thus, we find that Ishida anticipates claim 1.

2. Claims 2–4

Claim 2 adds the requirements that "the single bit has a first value specifying a first reception operation or a second value specifying a second reception operation" and "only in a prescribed manner determined by the first or second value and adapted to a corresponding transmission

operation.” Ex. 1001, 26:28–34. Petitioner argues persuasively that Ishida’s D flag satisfies the requirement of claim 2 for a single bit specifying two reception operations that instructs the terminal to accept the multiple-field frame in a prescribed manner that is determined by a first or second value of the bit, and that is adapted to a transmission operation of the base station. Pet. 53–54 (citing Ex. 1002 ¶¶ 189–190 (Dr. Wicker’s supporting testimony)).

Petitioner’s argument is persuasive, and we therefore find that Ishida anticipates claim 2. In particular, when D=0, Ishida’s D flag initially specifies diversity reception. By sending a message frame with D=1, the base station instructs the terminal to stop diversity reception and shift to a second reception operation (e.g., single-antenna reception). See Ex. 1005 ¶ 68. We therefore find that the D flag instructs the apparatus to accept the multiple-field frame only in a prescribed manner, based on the D flag value (e.g., using single-antenna reception when D=1, or allowing diversity reception when D=0). See *id.*; Ex. 1002 ¶¶ 189–190.

Claim 3 depends from claim 1 and adds that receiving and transmitting are each performed by a “plurality of antennas.” Ex. 1001, 26:35–40. Petitioner relies persuasively on Ishida’s Figure 1 and Ishida’s disclosure that the base station communicates with mobile stations “using a plurality of antennas.” Pet. 55 (quoting Ex. 1005 ¶ 36). Petitioner’s argument is persuasive, and we therefore find that Ishida anticipates claim 3.

Claim 4 combines limitations from claims 1 and 2, and Petitioner relies on the same arguments set forth above for those claims. See Pet. 55–56. For the reasons discussed above, we are persuaded that Petitioner

demonstrates by a preponderance of the evidence that Ishida anticipates claim 4.

In view of all the above considerations, we conclude that Petitioner has shown by a preponderance of the evidence that claims 1–4 are unpatentable under this ground of the Petition based on Ishida.

E. Uhlik Challenges

Petitioner contends claims 1–4 are “anticipated or rendered obvious” by Uhlik, relying on supporting testimony by Dr. Wicker. Pet. 56–68; Ex. 1002 ¶¶ 196–215. For the reasons provided below, we find Petitioner’s evidence persuasive, and we find that claims 1–4 are unpatentable on these grounds.

We agree with Petitioner that Uhlik qualifies as prior art under 35 U.S.C. § 102(e). *See* Pet. 19 (noting that Uhlik’s filing date is before Ishida, which is conceded § 102(e) prior art). Patent Owner presents no evidence to antedate Uhlik’s U.S. filing date of September 29, 2000. *See* Ex. 1004, code(22).

1. Claim 1

Petitioner’s analysis of claim 1 in relation to Uhlik appears at pages 56–65 of the Petition. Petitioner supports its analysis with testimony from Dr. Wicker. Ex. 1002 ¶¶ 196–215.

Petitioner asserts that each element of claim 1 is disclosed or suggested by Uhlik. Petitioner first argues that the claim 1 preamble, calling for a “radio base station apparatus for transmitting a multiple-field frame to a radio terminal apparatus,” is found in Uhlik’s base station (Fig. 1) communicating with remote user terminals. Pet. 57 (citing Ex. 1004, 2:47–54, Fig. 1).

Regarding the recitation in claim 1 of “a receiver for receiving a connection request from the radio terminal apparatus,” Petitioner asserts that Uhlik’s disclosure that the base station receives a “Configuration Request” from a remote terminal satisfies this claim limitation. Pet. 58–59 (citing Ex. 1004, 1:61–65, 2:38–40, 9:58–63, 10:44–47, Fig. 8; Ex. 1002 ¶ 201). We agree.

Regarding claim 1’s recitation of

a transmitter for transmitting the multiple-field frame to the radio terminal apparatus which has sent the connection request wherein control information and first data are respectively contained in mutually different fields in the multiple-field frame, and the control information contains (1) a single bit indicating a reception operation adapted to a transmission operation of the radio base station apparatus and (2) second data for communication control,

Petitioner contends that these limitations correspond to Uhlik’s Configuration Message, which the base station sends in response to the Configuration Request. Pet. 60–63 (citing Ex. 1004, 2:38–40, 9:58–63, 10:50–53, Fig. 8; Ex. 1002 ¶ 203). For example, claim 1 calls for a “single bit indicating a reception operation adapted to a transmission operation of the radio base station apparatus.” Petitioner notes that “[t]he Configuration Message frame included ‘first data’ and ‘control information’ in mutually different fields.” Pet. 63–64. Petitioner then relies on the “hopping” bit described in Uhlik as part of the configuration message. *Id.* at 64; *see also* Ex. 1007, Fig. 7 (reproduced *supra* § II.C.3). As explained by Dr. Wicker,

Uhlik disclosed that if the hopping bit was “equal to 1, the relationship between physical and logical carriers hops each frame.” (Uhlik at 15:39–40 (Ex. 1004)). That is, setting the hopping bit to one signaled to the terminal that the forthcoming communications would be subject to frequency hopping. Uhlik

taught that the terminal initially did not know the “parameters of the frequency hopping scheme,” so the base station used the Configuration Message and hopping bit to instruct the terminal on how to tune to the correct frequencies to properly receive hopping transmissions from the base station. (Uhlik at 11:58-63 (Ex. 1004)).

Ex. 1002 ¶ 205. Petitioner argues persuasively that when the hopping bit is set, the base station also transmits the “parameters of the frequency hopping scheme” to the receiving terminal as part of the Configuration Message burst. Pet. 64 (quoting Ex. 1004, 11:58–63). The receiving terminal needs those parameters so that it can “be tuned to the correct carrier frequency to properly receive transmissions from the base station transmitter.” *Id.* (citing Ex. 1002 ¶ 206).

We find persuasive Dr. Wicker’s un rebutted testimony that in Uhlik “setting the hopping bit to one signaled to the terminal that the forthcoming communications would be subject to frequency hopping.” Ex. 1002 ¶ 205. Thus, we find that the evidence of record shows that the hopping bit “indicat[es] a reception operation adapted to a transmission operation of a radio base station” (Ex. 1001, 26:23–25), which in this case is the reception of a hopping transmission.

Accordingly, we find that Uhlik anticipates claim 1. We also conclude that claim 1 would have been obvious in view of Uhlik. *See* Pet. 64–65 (“Even if Uhlik did not disclose data and control information in mutually different fields, it would have been obvious to divide the frame into separate fields that included data and control information,” because “[i]t was known in the prior art to divide frames into fields, and the point of sending frames was to transmit data.” (citing Ex. 1002 ¶ 209)).

2. Claims 2–4

Petitioner’s analysis of claims 2–4 is set forth at pages 65–68 of the Petition. Petitioner supports its analysis with testimony from Dr. Wicker. Ex. 1002 ¶¶ 196–215.

Petitioner argues that Uhlik’s hopping bit satisfies the requirement found in claims 2 and 4 for a single bit specifying two reception operations. *See* Pet. 65–66 (citing Ex. 1002 ¶ 210 (Dr. Wicker’s supporting testimony)). Likewise, Petitioner contends that Uhlik teaches instructing the terminal to accept the multiple-field frame in a prescribed manner that is determined by a first or second value of the bit, and that is adapted to a transmission operation of the base station. *Id.* For limitations found in claims 2 or 4, we credit Dr. Wicker’s testimony that “[t]o receive each frame properly, [Uhlik’s] terminal had to follow the frequency hopping instruction specified by the base station and adapt its operation to the frequency hopping approach used by the base station.” Ex. 1002 ¶ 210. We agree with Dr. Wicker that the hopping bit defines two operations: “frequency hopping or no frequency hopping.” *Id.* We also find persuasive Petitioner’s argument that Uhlik’s “terminal must only accept each frame in the manner prescribed by the ‘hopping’ bit.” Pet. 66 (citing Ex. 1002 ¶ 210).

Based on Petitioner’s evidence and argument, we are persuaded that this meets the claim limitation requiring the terminal to “to accept the multiple-field frame only in a prescribed manner determined by the first or second value and adapted to a corresponding transmission operation of the radio base station apparatus,” as required by claims 2 and 4. Ex. 1001, 26:31–34. We find that Uhlik anticipates claims 2 and 4. We also determine that claims 2 and 4 would have been obvious in view of Uhlik.

As for claim 3's requirements, discussed above, Figure 1 of Uhlik depicts a base station having multiple antennas. *See* Ex. 1004, 3:2–7, 3:26–31, Fig. 1. Petitioner argues that this satisfies the requirement in claim 3 that the receiving and transmitting be performed using a plurality of antennas. Pet. 66–67. We find this argument persuasive. Thus, we find that Uhlik anticipates claim 3. We also determine that claim 3 would have been obvious in view of Uhlik.

In view of all the above considerations, we determine that Petitioner has shown, by a preponderance of the evidence, that claims 1–4 are unpatentable under this ground of the Petition.

F. PHSv2 and Uhlik Challenge

Petitioner contends claims 1–4 are rendered obvious by PHSv2 and Uhlik relying on supporting testimony by Dr. Wicker. Pet. 69–84; Ex. 1002 ¶¶ 71, 139–146, 206, 217–231. Patent Owner has not responded to Petitioner's arguments.

We agree with Petitioner that PHSv2 qualifies as prior art under 35 U.S.C. § 102(b). *See* Pet. 21, 69. For the reasons provided below, we find the evidence persuasive, and we therefore conclude that claims 1–4 are unpatentable on this ground.

1. Claim 1

Petitioner asserts that each element of claim 1 “save one” is disclosed or suggested by PHSv2. Pet. 69. Specifically, Petitioner acknowledges that PHSv2 does not disclose or suggest the limitation that requires the single bit indicating a reception operation adapted to a transmission operation of the base station. *Id.* Petitioner argues that Uhlik teaches this limitation, and that it would have been obvious to use one of PHSv2's reserved bits for that

purpose, according to Uhlik’s teachings. *Id.* at 69–80. Petitioner explains that “PHSv2 disclosed reserved bits in its frame format for downlink response (the ‘link channel assignment’ frame) to a terminal’s connection request—any one of which a skilled person would know were available for use as a control signal to guide reception operations by the terminal.” *Id.* at 69.

Petitioner relies on Uhlik’s disclosure of a “hopping” bit (*see supra*) to provide the specific use for the reserved bit. *Id.* at 70–72. Petitioner presents a number of reasons a person of ordinary skill would have looked to Uhlik for this teaching. For example, Petitioner contends that “it was already known in the art to perform frequency hopping operations in PHS.” *Id.* at 70 (citing Ex. 1002 ¶ 143). Also, according to Petitioner, a skilled person would have been motivated to add frequency hopping to a PHSv2 system to further reduce or avoid channel interference. *Id.* at 71.

We find that for the reasons Petitioner has presented, a person of ordinary skill in the art would have known to perform frequency hopping in PHS systems, and that adding Uhlik’s frequency hopping to PHSv2 would have helped reduce interference among users. Pet. 70–71 (citing Ex. 1002 ¶¶ 71, 142–145; Ex. 1007, 2, 31, 35; Ex. 1014 (U.S. Patent No. 6,442,146 B1); Ex. 1015 (Int’l Patent Appl. Pub. No. WO 01/56204 A1)). According to Petitioner, “[u]sing frequency hopping to avoid interference in PHSv2 systems was merely the application of a known technique to a known objective or issue, with predictable results.” *Id.* at 71 (citing *KSR*, 550 U.S. at 416). Petitioner further asserts that an ordinarily skilled artisan would have used Uhlik’s single-bit frequency-hopping instruction so that it could maintain backward compatibility with legacy PHS terminals lacking the

frequency-hopping functionality, and that such an artisan would have used one of the reserved bits in PHSv2's link channel assignment message for this purpose. *Id.* at 72 (citing Ex. 1004, 15:5–40, Fig. 8; Ex. 1007, 85; Ex. 1002 ¶¶ 144–145). We find this evidence to be persuasive.

As for the “receiver for receiving” limitation of claim 1, Petitioner relies on PHSv2's base station, which includes a receiver that receives a link channel assignment request (i.e., connection request) from the radio terminal apparatus. Pet. 75 (citing Ex. 1007, 20; Ex. 1002 ¶ 219).

Relying on Figure 2.4 of PHSv2, Petitioner contends that the “transmitter for transmitting the multiple-field frame to the radio terminal apparatus” limitations are disclosed by PHSv2's transmitter that transmits the multiple field “Link channel assignment” frame to the radio terminal apparatus, which has sent the connection request. Pet. 75–76 (citing Ex. 1007, 20; Ex. 1002 ¶ 220). Petitioner notes that “[t]he link channel assignment message includes data and control information in mutually different fields” and “the link channel assignment message included data separate from control information.” *Id.* at 76. Further, “[a] link channel assignment message is transmitted as part of an SCCH frame.” *Id.* PHSv2 discloses that in response to a connection request, the cell station transmits a link channel assignment message as part of an SCCH multiple field frame to a personal station. *Id.* at 77–78 (citing Ex. 1007, 20, 56, 85; Ex. 1002 ¶¶ 223–224).

Petitioner reiterates that “[t]he link channel assignment message included control information used to provide instructions to the terminal about how to communicate with the base station.” Pet. 78 (citing Ex. 1002 ¶ 224). Petitioner explains “[t]hat control information included second data

for communication control,” and “[t]he link channel assignment message specifies the link channel type (LCH type), extension LCH protocol type, and control channel protocol type (CC protocol type).” *Id.* (citing Ex. 1007, 85). Petitioner contends that “[t]hose data are used to control communication by, for example, assigning carriers and slots,” such that “a skilled person would have found it obvious to use the link channel assignment message to instruct the terminal about an appropriate ‘reception operation.’” *Id.* (citing Ex. 1002 ¶ 224). As discussed above, Petitioner has shown persuasively that “a skilled person would have been motivated to include such an instruction (as a single bit indicating a reception operation adapted to a transmission operation of the radio base station apparatus) based on the teachings of Uhlik.” *Id.* at 78–79.

Patent Owner does not challenge the motivation to combine these references. We are persuaded based on the final record that Petitioner has demonstrated a sufficient motivation to combine PHSv2 and Uhlik. By a preponderance of the evidence of record, including Dr. Wicker’s testimony, we determine that a person of ordinary skill in the art would have had reason to combine Uhlik’s teachings with PHSv2’s disclosure and that the resulting combination meets all the limitations of claim 1.

2. Claims 2–4

Petitioner contends that Uhlik’s hopping bit, used as one of PHSv2’s reserve bits, satisfies the claim 2 and claim 4 requirement for a single bit that instructs the terminal to accept the multiple-field frame in a prescribed manner that is determined by a first or second value of the bit, and that is adapted to a transmission operation of the base station. Pet. 81 (citing Ex. 1002 ¶¶ 206, 228).

Petitioner's argument is persuasive. We therefore find that a person of ordinary skill in the art would have had reason to use the combination of PHSv2 and Uhlik as discussed above with respect to claim 1. In addition, as discussed above, we determine that when the hopping bit is set, "the relationship between physical and logical carriers hops each frame," whereas if the bit is not set, "the relationship between physical and logical carriers remains static." *Id.* (quoting Ex. 1004, 15:39–40). Therefore, we find that the hopping bit instructs the terminal to accept the frame in a prescribed manner that is determined by a first or second value of the bit.

Petitioner identifies Uhlik's disclosure of a base station with multiple antennas as satisfying claim 3's requirement that the base station perform both the receiving and transmitting using a plurality of antennas. Pet. 81–83. Petitioner further argues that "[b]y August 2001, . . . it was well-known in the art that a base station conforming to PHSv2 could communicate with terminals using a plurality of antennas in a multi-antenna array." *Id.* at 82 (citing Ex. 1002 ¶ 229).

Petitioner's argument is persuasive. We also credit Dr. Wicker's testimony that in combining PHSv2 and Uhlik, the use of multiple antennas would have "allowed for spatial multiplexing, which was known in the prior art to increase transmission rates by allowing the transmission of parallel data streams using the same frequency." Ex. 1002 ¶ 231 (citing Ex. 1004, 3:2–7, 3:26–31; Ex. 1005 ¶ 5). We therefore find that the combination of Uhlik and PHSv2 meets the limitations of claim 3, and we conclude that the combination would have been obvious to a person of ordinary skill in the art.

For the reasons explained above, Petitioner has shown, by a preponderance of the evidence, that claims 2–4 are unpatentable under this ground of the Petition.

G. Conclusion

In summary, Petitioner has articulated specific and persuasive reasoning, based on the final record, to support a finding of anticipation and the legal conclusion of obviousness. We determine that a preponderance of the evidence shows that Park, Ishida, and Uhlik anticipate claims 1–4. We also determine that a preponderance of the evidence shows that a person of ordinary skill in the art in the relevant timeframe would have had reason to apply the teachings in (1) Park alone, (2) Uhlik alone, and (3) a combination of PHSv2 and Uhlik, with a reasonable expectation of success, such that claims 1–4 would have been obvious based on each of these grounds. Therefore, we determine that claims 1–4 of the '234 patent are unpatentable.

IV. PATENT OWNER’S MOTION TO AMEND

Because we determine that all of the challenged claims are unpatentable, we consider Patent Owner’s Motion to Amend. *See* Mot. Amend 1 (asserting that the Motion is “contingent upon a finding of unpatentability with respect to the original challenged claims”). Patent Owner’s Motion proposes claim 5 as a substitute for challenged claim 1, claim 6 as a substitute for challenged claim 2, claim 7 as a substitute for challenged claim 3, and claim 8 as a substitute for challenged claim 4. *See id.*

A. Legal Standards

In an *inter partes* review, amended claims are not added to a patent as of right, but rather must be proposed as a part of a motion to amend. 35 U.S.C. § 316(d) (2012). The Board must assess the patentability of proposed substitute claims “without placing the burden of persuasion on the patent owner.” *Aqua Prods., Inc. v. Matal*, 872 F.3d 1290, 1328 (Fed. Cir. 2017) (en banc); *see Lectrosonics, Inc. v. Zaxcom, Inc.*, IPR2018-01129, Paper 15 at 3–4 (PTAB Feb. 25, 2019) (precedential). Subsequent to the issuance of *Aqua Products*, the Federal Circuit issued a decision in *Bosch Automotive Service Solutions, LLC v. Matal*, 878 F.3d 1027 (Fed. Cir. 2017), as well as a follow-up order amending that decision on rehearing. *See Bosch Auto. Serv. Sols., LLC v. Iancu*, No. 2015-1928 (Fed. Cir. Mar. 15, 2018) (Order on Petition for Panel Rehearing).

In accordance with *Aqua Products*, *Bosch*, and *Lectrosonics*, patent owner does not bear the burden of persuasion to demonstrate the patentability of the substitute claims presented in the motion to amend. Rather, ordinarily, “the petitioner bears the burden of proving that

the proposed amended claims are unpatentable by a preponderance of the evidence.” *Bosch*, 878 F.3d at 1040 (as amended on rehearing); *Lectrosonics*, Paper 15 at 3–4. In determining whether a petitioner has proven unpatentability of the substitute claims, the Board focuses on “arguments and theories raised by the petitioner in its petition or opposition to the motion to amend.” *Nike, Inc. v. Adidas AG*, 955 F.3d 45, 51 (Fed. Cir. 2020). The Board itself also may justify any finding of unpatentability by reference to evidence of record in the proceeding. *Lectrosonics*, Paper 15 at 4 (citing *Aqua Products*, 872 F.3d at 1311 (O’Malley, J.)).

Notwithstanding the foregoing, Patent Owner’s proposed substitute claims must meet the statutory requirements of 35 U.S.C. § 316(d) and the procedural requirements of 37 C.F.R. § 42.121. *Lectrosonics*, Paper 15 at 4–8. Accordingly, Patent Owner must demonstrate: (1) the amendment proposes a reasonable number of substitute claims; (2) the proposed claims are supported in the original disclosure (and any earlier filed disclosure for which the benefit of filing date is sought); (3) the amendment responds to a ground of unpatentability involved in the trial; and (4) the amendment does not seek to enlarge the scope of the claims of the patent or introduce new subject matter. *See* 35 U.S.C. § 316(d); 37 C.F.R. § 42.121.

B. Proposed Substitute Claims

Patent Owner’s proposed substitute claims 5–8 are reproduced below with bracketed labels to identify claim limitations and underlining indicating text added to the claims that Patent Owner proposes to replace.

[5.P] A radio base station apparatus for transmitting a multiple-field frame to a radio terminal apparatus, the radio base station apparatus comprising:

[5.1] a receiver for receiving a connection request from the radio terminal apparatus; and

[5.2] a transmitter for transmitting the multiple-field frame to the radio terminal apparatus which has sent the connection request

[5.3] wherein control information and first data are respectively contained in mutually different fields in the multiple-field frame, and the control information contains (1) single bit indicating a reception operation adapted to a transmission operation of the radio base station apparatus and (2) second data for communication control,

[5.4] wherein the transmission operation is a transmission to the radio terminal apparatus with directivity.

Mot. Amend 9 (Claims Appendix).

[6.P] A radio base station apparatus according to claim 1,

[6.1] wherein the single bit has a first value specifying a first reception operation or a second value specifying a second reception operation, the single bit instructing the radio terminal apparatus to accept the multiple-field frame only in a prescribed manner determined by the first or second value and adapted to a corresponding transmission operation of the radio base station apparatus,

[6.2] wherein the transmission operation includes transmitting a signal indicating an adaptive array reception operation to the radio terminal apparatus.

Id. at 10.

[7.P] A [a] radio base station apparatus according to claim 1,

[7.1] further comprising a plurality of antennas,

[7.2] wherein said receiver is configured for receiving the connection request by the plurality of antennas, and said transmitter is configured for transmitting the multiple-field frame by the plurality of antennas,

[7.3] wherein the radio terminal apparatus is caused to perform the adaptive array reception operation to improve the reception of the radio terminal apparatus.

Id.

[8.P] A radio base station apparatus for transmitting a multiple-field frame to a radio terminal apparatus, the radio base station apparatus comprising:

[8.1] a receiver for receiving a connection request from the radio terminal apparatus; and

[8.2] a transmitter for transmitting the multiple-field frame to the radio terminal apparatus which has sent the connection request

[8.3] wherein control information and first data are respectively contained in mutually different fields in the multiple-field frame, and the control information contains (1) a signal indicating a reception operation adapted to a transmission operation of the radio base station apparatus and (2) second data for communication control; and

[8.4] wherein the signal is a bit having first and second bit values which specify first and second reception operations, respectively, one of the first and second bit values instructing the radio terminal apparatus to accept the multiplefield frame only in a prescribed manner determined by the one bit value and adapted to a corresponding transmission operation of the radio base station apparatus,

[8.5] wherein the transmission operation is a transmission to the radio terminal apparatus with directivity,

[8.6] wherein the transmission operation includes transmitting a signal indicating an adaptive array reception operation to the radio terminal apparatus,

[8.7] wherein the radio terminal apparatus is caused to perform the adaptive array reception operation to improve the reception of the radio terminal apparatus.

Id. at 11–12. In our analysis below, we adopt the bracketed labels to more efficiently identify limitations.

C. Statutory and Procedural Requirements

A motion to amend may not present substitute claims that introduce new subject matter. 35 U.S.C. § 316(d)(3); 37 C.F.R. § 42.121(a)(2)(ii). New matter is any addition to the claims that lacks sufficient support in the subject patent’s original disclosure. *See TurboCare Div. of Demag Delaval Turbomach. Corp. v. Gen. Elec. Co.*, 264 F.3d 1111, 1118 (Fed. Cir. 2001) (“When [an] applicant adds a claim . . . , the new claim[] . . . must find support in the original specification.”). The Board requires that a motion to amend set forth written-description support in the originally filed disclosure of the subject patent for each proposed substitute claim and also set forth support in an earlier-filed disclosure for each claim for which the patent owner seeks the benefit of the earlier-filed disclosure’s filing date. *See* 37 C.F.R. § 42.121(b)(1)–(b)(2).

In its Motion to Amend, Patent Owner identifies citations in the original disclosure of the ’234 patent that it asserts provide support for the proposed amendment of each claim. Mot. Amend 4–5. Patent Owner also claims that each element finds supports in the Japanese application to which the ’234 patent application claims priority. *Id.* at 3–4 (citing Ex. 1008, 361 (declaration and power of attorney claiming priority to JP 2001-237798 (filed Aug. 6, 2001))). However, Patent Owner does not provide a translation of the Japanese priority document or provide citations showing support for the proposed amended claims. *See* 37 C.F.R. §§ 42.63(b), 42.121(a)(b)(2).

Petitioner argues that because Patent Owner omitted a limitation-by-limitation explanation of support in the Japanese application, this alone justifies denying the motion. Opp. Amend 2. Petitioner also argues that the

original and foreign priority applications “do not provide written description support for claims 6 and 8 because they do not demonstrate that the named inventor actually possessed the full scope of the claimed subject matter when the applications were filed.” *Id.* at 4 (citing *Ariad Pharm., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1353–54 (Fed. Cir. 2010) (en banc); *Lockwood v. Am. Airlines, Inc.*, 107 F.3d 1565, 1572 (Fed. Cir. 1997)).

As examined in detail below, because we determine that the proposed substitute claims are unpatentable based on the prior art, we need not address these arguments or the other statutory and procedural requirements.

D. Analysis of the Substitute Claims

We summarize Petitioner’s grounds challenging the patentability of the proposed substitute claims based on prior art in its Opposition to Patent Owner’s Motion to Amend in the following table:

Claims Challenged	35 U.S.C. §	Reference(s)/Basis
5	102	Ishida
5	102	Uhlik
5	103	Uhlik
6–8	103	Uhlik, Sebastian ⁸

Opp. Amend 13–25. Relying on Dr. Wicker’s second declaration (Ex. 1021),⁹ Petitioner contends that proposed substitute claim 5 is unpatentable because Ishida anticipates the claim under 35 U.S.C. § 102, that claim 5 is also unpatentable under §§ 102 and 103 for anticipation or

⁸ Sebastian et al., US Patent No. 6,757,265 B1, issued June 29, 2004 (Ex. 1022, “Sebastian”).

⁹ Patent Owner did not reply to Intel’s Opposition to the Motion to Amend, and did not submit declaratory testimony to rebut Dr. Wicker’s testimony.

obviousness over Uhlik, and that proposed substitute claims 6–8 are unpatentable under § 103 as obvious over Uhlik in view of Sebastian. Opp. Amend 10–23. We address each of these grounds in turn.

1. Ishida Under § 102 (Proposed Claim 5)

Petitioner argues that Ishida anticipates proposed substitute claim 5. *See* Opp. Amend 13–15. Because proposed claim 5 is identical to claim 1 except for an additional limitation, Petitioner relies partly on its analysis challenging claim 1 based on anticipation by Ishida. *See id.* at 13; Ex. 1021 ¶¶ 34–37. Because we address Petitioner’s anticipation arguments for the overlapping limitations of claim 1 above, we do not discuss them further in the context of the Motion to Amend. *See supra* § III.D.1 (finding Petitioner’s argument persuasive that Ishida anticipates claim 1).

Claim 5’s additional limitation is “wherein the transmission operation is a transmission to the radio terminal apparatus with directivity.” Mot. Amend 9. Petitioner argues that Ishida teaches “a base station that transmits using an adaptive array technique to form a ‘directional’ transmission to a terminal.” Opp. Amend. 14 (citing Ex. 1005 ¶¶ 6–7, 13, 36, 41). Relying on the testimony of Dr. Wicker, Petitioner argues that this “is a transmission ‘with directivity,’” as claim 5 requires. *Id.* (citing Ex. 1021 ¶¶ 38–41).

We find Petitioner’s argument persuasive. In particular, we credit Dr. Wicker’s unrebutted testimony and find that both Ishida and the ’234 patent disclose a similar PDMA scheme, using an antenna array to form transmissions with a directional pattern, and that in both cases, this directional pattern is a transmission “with directivity” as claim 5 recites. *See* Ex. 1021 ¶¶ 39–40 (citing Ex. 1001, 1:35–50; Ex. 1005 ¶¶ 6–7, 41). Thus,

we find that Petitioner has shown by a preponderance of the evidence that all limitations of claim 5 are present identically in Ishida, and that Ishida anticipates proposed substitute claim 5.

2. Uhlik Under §§ 102, 103 (Proposed Claim 5)

Petitioner argues that Uhlik either anticipates or renders obvious proposed substitute claim 5. *See* Opp. Amend 15–17. Because proposed claim 5 is identical to claim 1 except for an additional limitation, Petitioner relies partly on its analysis with respect to claim 1 in its Petition. *See id.* at 15; Ex. 1021 ¶¶ 42–45. We address Petitioner’s arguments for the overlapping limitations of claim 1 above. *See supra* § III.E.1 (finding Petitioner’s argument persuasive that Uhlik anticipates and renders obvious claim 1).

Regarding claim 5’s additional limitation, “wherein the transmission operation is a transmission to the radio terminal apparatus with directivity” (Mot. Amend 9), Petitioner argues that Uhlik discloses “a base station that transmits using a ‘spatial division multiple access’ (SDMA) technique by sending ‘spatially directed beam[s]’ to different terminals.” Opp. Amend 16 (alteration in original) (quoting Ex. 1004, 3:16–25, Fig. 2). Petitioner notes that “[t]raffic signals are ‘spatially directed to a particular user’” and “[t]his approach is known as beamforming.” *Id.* (quoting Ex. 1004, 11:41–55, 12:2–7, 14:56–58 (the configuration message that includes the hopping bit is also sent “in a spatially directed signal”); Ex. 1022, 30:23–31; Ex. 1021 ¶ 46).

Below is a reproduction of Figure 2 of Uhlik:

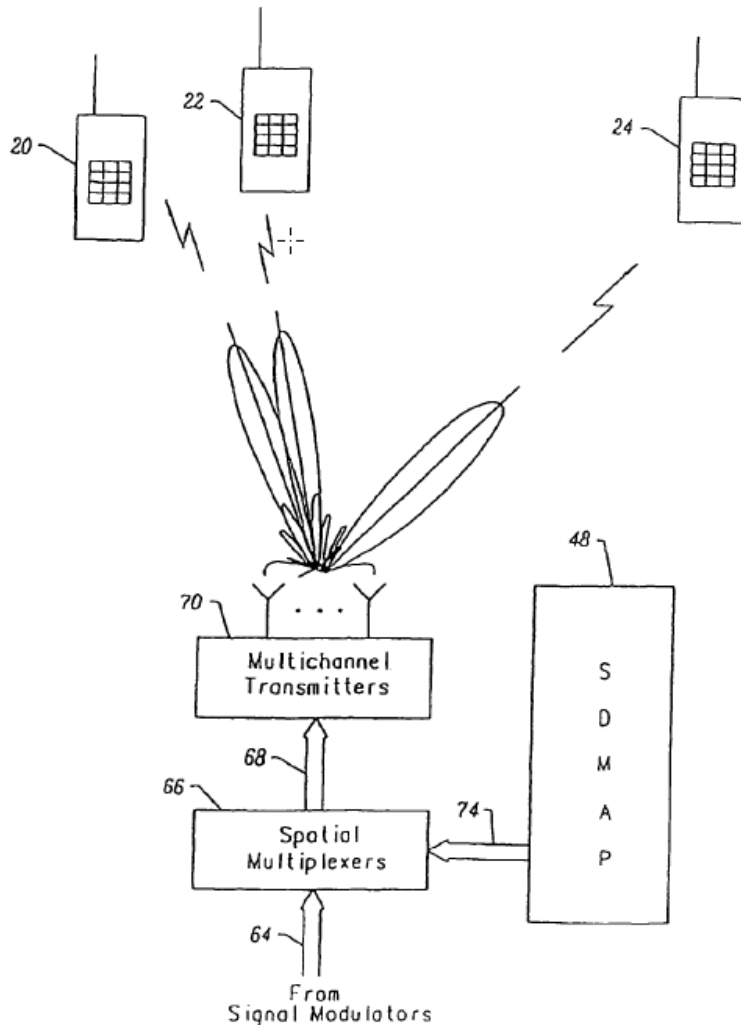


FIG. 2

Uhlik's Figure 2 "illustrat[es] transmission patterns of a multi-channel spatial diversity transmitter." Ex. 1004, 2:21–22. Multichannel transmitters 70 use an antenna array that forms beams directed at user terminal handsets 20, 22, and 24. *See id.* at 2:47–3:25. Uhlik notes that the prior art describes "[s]uitable technologies for achieving such a *spatially directed beam*." *Id.* at 3:21–23 (emphasis added) (citing Ottersten et al., U.S. Patent No. 5,828,658, issued Oct. 27, 1998; Roy, III et al., U.S. Patent No. 5,642,353, issued June 24, 1997).

Relying on the testimony of Dr. Wicker, Petitioner argues that these spatially directed beams constitute a transmission operation “with directivity,” according to claim 5, and that this “beamforming” technique is used in conjunction with frequency hopping. Opp. Amend 16–17 (citing Ex. 1021 ¶¶ 46–47). We agree. As Dr. Wicker persuasively explains, “[w]hile sending signals using beamforming (i.e., SDMA¹⁰), Uhlik disclosed that the base station transmits using either frequency hopping or a fixed frequency.” Ex. 1021 ¶ 47. Thus, in Uhlik, during either reception operation by the terminal (frequency hopping or fixed frequency), the base station’s transmission to the terminal is “with directivity.”

Thus, we find that Petitioner has shown by a preponderance of the evidence that Uhlik anticipates proposed substitute claim 5, and we further determine that claim 5 would have been obvious to a person of ordinary skill in the art.

3. Uhlik and Sebastian Under § 103 (Proposed Claims 6–8)

a. Overview of Sebastian

We agree with Petitioner that Sebastian is prior art to the ’234 patent under 35 U.S.C. § 102(e). Opp. Amend 18. Sebastian claims priority to a U.S. application filed on April 7, 2000,¹¹ which is before August 6, 2001, the filing date of the Japanese application to which the ’234 patent claims earliest priority. *Compare* Ex. 1022, code (60), *with* Ex. 1001, code (30). Sebastian issued on June 29, 2004, after the filing date of the ’234 patent.

¹⁰ According to Dr. Wicker, SDMA and PDMA (described in the ’234 patent) are equivalent terms for a type of beamforming technology.

¹¹ Sebastian also claims priority, as a continuation-in-part, to an earlier U.S. application filed July 30, 1999. *See* Ex. 1022, code (60).

Ex. 1022, code (45). Patent Owner has not submitted evidence to antedate Sebastian's April 7, 2000 priority claim.

Sebastian describes a system for “implementing spatial multiplexing in conjunction with one or more multiple access protocols during the broadcast of information in a wireless network.” Ex. 1022, code (57). These multiple access protocols include SDMA. *See id.* at 2:33–37, 4:39–46. Sebastian's spatial multiplexing technology “exploits multiple antennas at both the base station(s) and at the subscriber units to increase the bit rate in a wireless radio link.” *Id.* at 4:29–32.

The base station splits a stream of symbols into independent substreams, which it sends over its antenna array using a protocol such as SDMA. *See id.* at 4:37–46. The terminal apparatus likewise includes “an array of receive antennas,” which captures the multiple radio signals and then uses “a signal processing technique . . . to separate the signals, recover the original substreams and finally merge the symbols back together.” *Id.* at 4:50–52, 56–59.

Sebastian's Figure 6 illustrates this process:

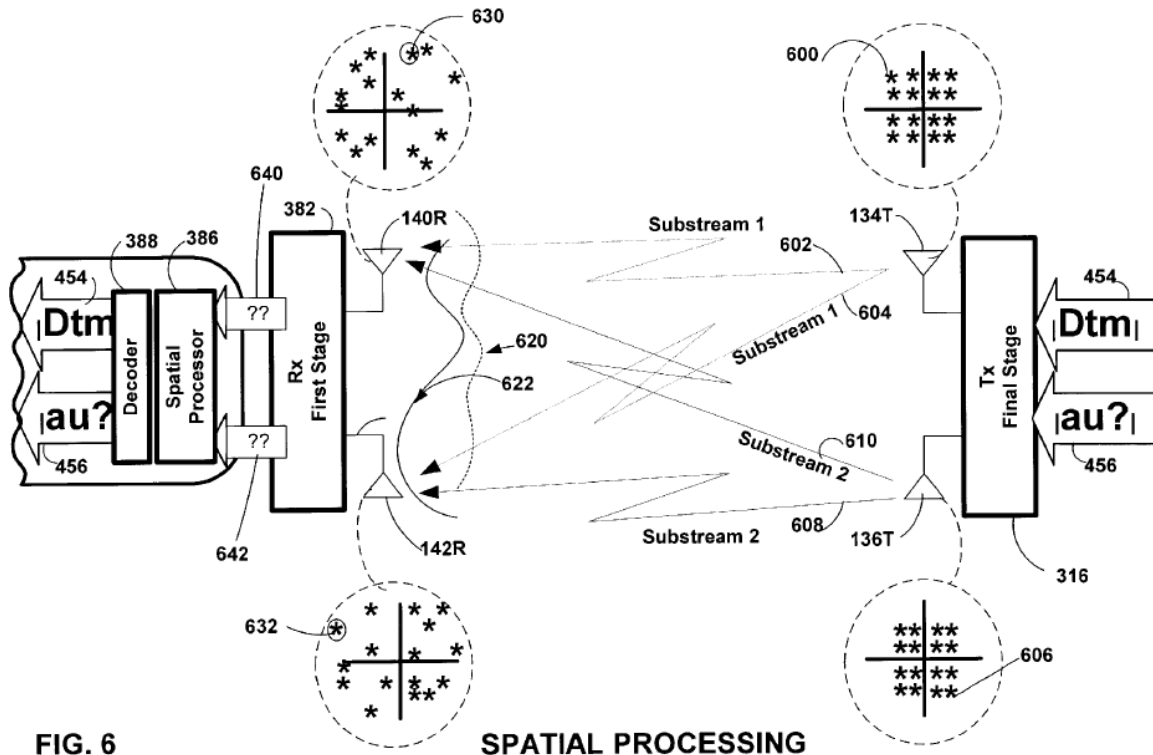


FIG. 6 **SPATIAL PROCESSING**

Figure 6 depicts a base station (right) and subscriber unit receiver (left). Ex. 1022, 21:43–45. The base station's transmitter has two antennas 134T and 136T, and the terminal's receiver has two antennas 140R and 142R. *Id.* at 21:43–47. The base station transmits two data substreams 454 ("Dtm" or "Substream 1") and 456 ("au?" or "Substream 2") over four different signals: Substream 1 includes signals 602 and 604, while Substream 2 includes signals 608 and 610. *Id.* at 22:3–13. Other signals could be present as a result of scattering off of buildings and other objects. *Id.* at 22:6–8.

Sebastian also describes a control system in which the base station can send a signal to the terminal, switching the terminal's spatial multiplexing on or off, so that the terminal may operate in either a spatial multiplexing mode or a "traditional" mode that does not use spatial multiplexing. *See id.* at 2:6–12, 12:27–35, 33:35–39.

b. Proposed Claim 6

Proposed substitute claim 6 is identical to claim 2 (including its dependency from claim 1), except that it adds a limitation “wherein the transmission operation includes transmitting a signal indicating an adaptive array reception operation to the radio terminal apparatus.” Mot. Amend 10. Petitioner argues that claim 6 would have been obvious over a combination of Uhlik’s method with Sebastian’s adaptive array reception operation. Opp. Amend 18–23. Petitioner relies partly on its analysis with respect to claim 2. *See id.* at 17. We address Petitioner’s arguments regarding the overlapping limitations of claim 2 above and do not repeat that discussion here. *See supra* § III.E.2 (finding persuasive Petitioner’s argument that Uhlik anticipates and renders obvious claim 2).

First, as a matter of claim construction, Petitioner argues that claim 6’s additional limitations “are broad enough to cover a base station that transmits a second signal to a terminal to indicate the terminal should perform an adaptive array reception operation.” Opp. Amend 19–20. We agree that the broadest reasonable interpretation of claim 6 encompasses two distinct signals. Claim 1, from which proposed claim 6 depends, includes (1) a “multiple-field frame,” which includes the single-bit signal, and (2) a “transmission operation” which is adapted to the single-bit signal in the multiple-frame field. *See* Ex. 1001, 26:30–34. According to the plain language of the proposed claim, the “signal indicating an adaptive array reception operation” is part of the transmission operation, and it may be transmitted separately from the multiple-field frame.

Next, Petitioner argues that Sebastian discloses an adaptive array reception operation within the scope of proposed claim 6. Opp. Amend 20.

According to Petitioner, Sebastian discloses a system with base stations that operate in two different modes: (1) “traditional,” in which there is one spatial stream between the base station and terminal, and (2) “spatially enabled,” in which each terminal receives multiple spatial streams. *Id.* (citing Ex. 1022, 5:67–6:5). This “spatially enabled” mode, which uses multiple antennas at both the base station and the terminal, is depicted in Sebastian’s Figure 6 (reproduced and discussed above § IV.D.3.a).

Petitioner argues that, according to Sebastian, the “spatially enabled” mode increases communication speed because it allows the base station to “transmit[] multiple substreams ‘in parallel’ rather than just a single data stream.” Opp. Amend 22 (citing Ex. 1022 5:6–8; Ex. 1021 ¶ 57). Moreover, Petitioner argues that Sebastian taught using this “spatially enabled” operation in conjunction with SDMA. *See id.* at 22–23 (citing Ex. 1022, 4:34–46, 30:23–29). SDMA is the multiple-access technique that Uhlik already uses for its base station’s adaptive antenna array. *See id.* (citing Ex. 1004, 2:54–60; Ex. 1022, 4:39–46, 6:32–41, 30:23–31; Ex. 1021 ¶¶ 49–52). According to Petitioner, using Sebastian’s “spatially enabled” mode (including multiple antennas at the terminal) in Uhlik’s system would have provided the benefit of improving communication speed. *See id.* at 22–23.

Petitioner also argues that, “[a]s part of the combination, a skilled person would have implemented Sebastian’s ‘control signal’ in Uhlik’s system.” Opp. Amend 23; Ex. 1021 ¶ 59. According to Petitioner, Sebastian’s base station sends a “control signal” to the terminal to indicate whether the terminal should use its “traditional” or “spatially enabled” mode. *Id.* at 21–22 (citing Ex. 1022, 2:6–12, 12:27–35, 26:49–53, 34:1–5); *see also id.* at 25 (citing Ex. 1022, Fig. 13B, 4:30–65, 31:26–57; Ex. 1021

¶¶ 55–56). This control signal “indicat[es] the mode of the transmitted signal, e.g. traditional/spatial, and in the latter case, the number of substreams to be generated from the composite signals received.” *Id.* (alteration in original) (quoting Ex. 1022, 33:35–39).

According to Petitioner, Sebastian teaches that there are reasons to switch between “traditional” and “spatially enabled” modes, based on factors including “QoS [quality of service], bit rate requirement[s], feasibility, etc.” *Id.* at 23 (quoting Ex. 1022, 13:4–10) (citing Ex. 1021 ¶ 56). Petitioner also cites Dr. Wicker as stating that “Sebastian’s control signal allows the base station to indicate use of spatial multiplexing to a terminal when conditions, such as data rate requirements and channel conditions, favor doing so.” *Id.* (citing Ex. 1021 ¶ 59). Thus, Petitioner argues that “[a] skilled person would have augmented Uhlik’s teachings by using a transmission operation such as frequency hopping to send a control signal indicating an adaptive array reception operation, as disclosed in Sebastian.” *Id.* at 22.

We find Petitioner’s arguments, and supporting testimony of Dr. Wicker, to be persuasive, and Patent Owner has submitted no responding arguments or testimony. In particular, we find, for the reasons that Petitioner has argued, that adding Sebastian’s spatial multiplexing to Uhlik’s system, including the single-bit frequency-hopping signal, predictably would have resulted in increased speed, without adversely increasing power or overhead. *See* Ex. 1021 ¶¶ 57–59. We also find that Petitioner has shown, by a preponderance of the evidence, that combining Sebastian’s teachings with those of Uhlik would have been within the ordinary level of skill in the art at the time of the claimed invention. *Id.* Therefore, we conclude that proposed

substitute claim 6 is unpatentable because it would have been obvious over the combination of Uhlik and Sebastian.

c. Proposed Claim 7

Proposed substitute claim 7 is identical to claim 3 (including its dependency from claim 1), except that it adds a limitation “wherein the radio terminal apparatus is caused to perform the adaptive array reception operation to improve the reception of the radio terminal apparatus.”

Mot. Amend 10. Petitioner argues that claim 7 would have been obvious over a combination of Uhlik’s method with Sebastian’s adaptive array reception operation. Opp. Amend 23–25. Petitioner relies partly on its analysis with respect to claim 3. *See id.* at 17. We address Petitioner’s arguments regarding the overlapping limitations of claim 3 above. *See supra* § III.E.2 (finding persuasive Petitioner’s argument that Uhlik anticipates and renders obvious claim 3).

Like claim 6, proposed substitute claim 7 recites an “adaptive array reception operation.” Mot. Amend. 10. New limitation 7.3 requires that a terminal perform an “adaptive array reception operation to improve” the terminal’s reception. As we discuss in the previous section, Petitioner has persuaded us that Sebastian discloses such an operation and that it would have been within the ordinary skill in the art to incorporate that operation into Uhlik’s SDMA method. *See supra* § IV.D.3.b; *see also* Opp. Amend 19–23 (citing Ex. 1022, Fig. 13B, 4:30–65, 31:26–57; Ex. 1021 ¶ 70) (reiterating the same arguments with respect to proposed claim 6).

In addition, Petitioner argues, and we agree, that Sebastian teaches “that the terminal’s use of spatial multiplexing adaptive array reception improves the reception of the terminal, as required by new limitations 7.3

and 8.7,” by improving link speed. Opp. Amend 25 (citing Ex. 1022, 4:66–5:22; Ex. 1021 ¶ 72). We agree with Petitioner that “a skilled person would have combined Sebastian and Uhlik [by] design[ing] the terminal to perform spatial multiplexing reception when that operation was indicated by a base station.” *Id.* (citing Ex. 1021 ¶ 73). Petitioner argues that “Uhlik’s system would not have realized the benefit of increased communication speed that results from spatial multiplexing unless the terminal actually implemented that technique when instructed.” *Id.* (citing Ex. 1021 ¶ 73).

We find Petitioner’s arguments persuasive by a preponderance of the evidence. For these reasons, and the reasons discussed above with respect to proposed substitute claim 6, we conclude that proposed substitute claim 7 is unpatentable because it would have been obvious over the combination of Uhlik and Sebastian.

d. Proposed Claim 8

Proposed independent claim 8 includes the limitations of original claim 4, as well as each of the new limitations added to the other proposed amended claims (8.5, 8.6, and 8.7, which mirror 5.4, 6.2, and 7.3). *See* Mot. Amend 11–12. Accordingly, each of the limitations of claim 8 have been addressed above with respect to original claim 4, and proposed claims 5, 6, and 7. *See id.* (limitations 8.5, 8.6, and 8.7 are identical to new limitations 5.4, 6.2, and 7.3).

As determined above, Uhlik teaches a one-bit signal (the hopping bit) having values that specify first and second reception operations (frequency hopping and single frequency reception), with each value instructing the terminal to accept a frame in a prescribed manner determined by the bit. Ex. 1004, 14:37–15:40, Fig. 8; Ex. 1002 ¶¶ 205–206, 210. Petitioner has

established persuasively that Uhlik discloses a transmission operation for sending communication traffic with directivity, as required by limitation 8.5. *See* Opp. Amend 16–17. Petitioner has also shown persuasively how the combination of Sebastian and Uhlik teaches “the transmission operation includes transmitting a signal indicating an adaptive array reception operation to the radio terminal apparatus” (Opp. Amend 19–23) and that “the radio terminal apparatus is caused to perform the adaptive array reception operation to improve the reception of the radio terminal apparatus” (*id.* at 24–25). Each of these limitations were addressed above. Petitioner, relying on the testimony of Dr. Wicker, has also explained how the combination of Sebastian and Uhlik teaches claim 8 as a whole and why a person of ordinary skill in the art would have decided to combine the limitations in the manner claimed. *See* Ex. 1021 ¶¶ 74–83. Patent Owner has not replied to Petitioner’s contentions or the testimony of Dr. Wicker.

We find Petitioner’s arguments persuasive by a preponderance of the evidence. For these reasons, and the reasons discussed above with respect to proposed substitute claims 5, 6 and 7, we conclude that proposed substitute claim 8 is unpatentable because it would have been obvious over the combination of Uhlik and Sebastian.

E. Conclusion

Because Petitioner establishes by a preponderance of the evidence that all proposed substitute claims are unpatentable for either anticipation or obviousness over the cited prior art, we deny Patent Owner’s Motion to Amend the claims.

V. ORDER

Upon consideration of the record before us, it is:

ORDERED that Petitioner has shown that claims 1–4 of the '234 patent are unpatentable;

FURTHER ORDERED that Patent Owner's Motion to Amend is denied; and

FURTHER ORDERED that 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.

The table below summarizes our conclusions as to the challenged claims:

Claims	35 U.S.C. §	Reference(s)/Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1–4	102	Park	1–4	
1–4	103	Park	1–4	
1–4	102	Ishida	1–4	
1–4	102	Uhlik	1–4	
1–4	103	Uhlik	1–4	
1–4	103	PHSv2, Uhlik	1–4	
Overall Outcome			1–4	

The table below summarizes our conclusions as to Patent Owner's Contingent Motion to Amend the claims:¹²

Motion to Amend Outcome	Claims
Original Claims Canceled by Amendment	
Substitute Claims Proposed in the Amendment	5–8
Substitute Claims: Motion to Amend Granted	
Substitute Claims: Motion to Amend Denied	5–8
Substitute Claims: Not Reached	

¹² 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*. 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 Hera 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).

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