

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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INTEL CORPORATION,  
Petitioner,

v.

HERA WIRELESS S.A.,  
Patent Owner.

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IPR2018-01657  
Patent 9,270,024 B2

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Before THOMAS L. GIANNETTI, ROBERT L. KINDER, and  
JOHN A. HUDALLA, *Administrative Patent Judges*.

KINDER, *Administrative Patent Judge*.

JUDGMENT

Final Written Decision

Granting Patent Owner's Motion to Amend to Cancel Claims 1, 5, 6, 12, 16,  
and 17

Denying Patent Owner's Motion to Amend to Substitute Claims 21 and 22  
*35 U.S.C. § 318(a)*

## I. INTRODUCTION

Petitioner, Intel Corporation, filed a Petition requesting an *inter partes* review of claims 1, 5, 6, 12, 16, and 17 of U.S. Patent No. 9,270,024 B2 (Ex. 1001, “the ’024 patent”). Paper 2 (“Pet.”). Patent Owner, Hera Wireless S.A., filed a Preliminary Response. *See* Paper 7. After considering 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 at least one challenged claim. Pursuant to 35 U.S.C. § 314, we instituted this *inter partes* review as to all of the challenged claims and all grounds raised in the Petition. Paper 12 (“Institution Dec.”).

Following institution, Patent Owner did not file a Patent Owner Response. Instead, Patent Owner filed a Motion to Amend. Paper 22 (“Motion”). The Motion requests the Board to cancel original claims 1, 5, 6, 12, 16, and 17 of the ’024 patent and substitute new claims 21 and 22. *Id.* at 1. Subsequently, Petitioner filed an Opposition to the Motion to Amend (Paper 24, “Opp.”), Patent Owner filed a Reply (Paper 27, “Reply”), and Petitioner filed a Sur-reply (Paper 35, “Sur-reply”).

A consolidated oral hearing with related case IPR2018-01732, also involving the ’024 patent, was held on December 13, 2019, and a transcript of the hearing is included in the record. Paper 39 (“Hearing Tr.”).

We have jurisdiction under 35 U.S.C. § 6. This decision is a Final Written Decision under 35 U.S.C. § 318(a). For the reasons we identify below, we *grant* Patent Owner’s Motion to Amend with respect to its request to cancel challenged claims 1, 5, 6, 12, 16, and 17 of the ’024 patent. We,

however, *deny* Patent Owner's Motion to Amend with respect to its request to substitute proposed claims 21 and 22.

*A. Related Matters*

The parties indicate that the '024 patent is the subject of numerous district court cases including: (1) *Hera Wireless S.A. v. Amazon.com, Inc.*, 1:17-cv-00947 (D. Del.); (2) *Hera Wireless S.A. v. ARRIS Group, Inc.*, 1:17-cv-00948 (D. Del.); (3) *Hera Wireless S.A. v. Belkin Int'l, Inc.*, 1:17-cv-00949 (D. Del.); (5) *Hera Wireless S.A. v. Netgear, Inc.*, 1:17-cv-00951 (D. Del.); (6) *Hera Wireless S.A. v. Roku, Inc.*, 1:17-cv-00952 (D. Del.); (7) *Hera Wireless S.A. v. Lenovo Holding Co., Inc.*, 1:17-cv-01088 (D. Del.); (8) *Hera Wireless S.A. and Sisvel UK Limited v. LG Electronics, Inc. and LG Electronics USA, Inc.*, 1:17-cv-01089; (9) *Hera Wireless S.A. v. Buffalo Americas, Inc.*, 1:17-cv-00950 (D. Del.). Pet. 2–3; Paper 3, 2.

The '024 patent is also the subject of a petition for *inter partes* review filed by Ruckus Wireless, Inc., Belkin International, Inc., Amazon.com, Inc., Netgear, Inc., and Roku, Inc: IPR2018-01732. The Board instituted *inter partes* review in IPR2018-01732, which also challenges claims 1, 5, 6, 12, 16, and 17 of the '024 patent. *Ruckus Wireless, Inc. v. Hera Wireless S.A.*, IPR2018-01732, Paper 18, 2 (PTAB Mar. 19, 2019) (institution decision). Concurrently with this Decision, the Board is entering a Final Written Decision in that proceeding.

Petitioner has also filed petitions seeking *inter partes* review of patents related to the '024 patent, including: IPR2018-01371 (challenging U.S. Patent No. 7,962,103 B2); IPR2018-01372 (challenging U.S. Patent No. 8,412,115 B2); and, IPR2018-01373 (challenging U.S. Patent No. 8,934,851 B2). Pet. 3.

*B. The '024 Patent*

The '024 patent is titled “Radio Apparatus, and Method and Program for Controlling Spatial Path.” Ex. 1001, code (54). The '024 patent generally relates to a radio apparatus capable of establishing multiplex communication between a radio terminal and a radio base station via a plurality of paths formed by space division, as well as to a method and a program for controlling a spatial path. *Id.* at 1:21–27. The patent describes use of a plurality of antennas constituting an array antenna that are divided into a plurality of subarrays corresponding to the plurality of spatial paths. *Id.* at code (57). An adaptive array processing unit can perform an adaptive array processing for each of the plurality of subarrays. *Id.*

The '024 patent describes a modification to a known wireless communication system known as the “PHS (Personal Handy phone System)” standard which used a Time Division Multiple Access (TDMA) scheme for transmission and reception. *Id.* at 1:31–46. The patent discusses use in PHS of PDMA (Path Division Multiple Access) to improve efficiency. *Id.* at 2:23–29. In PDMA, in order to achieve efficiency in using a given frequency of a radio wave, mobile radio terminal units of a plurality of users establish spatial multiple connections to a radio base station through a plurality of paths formed by spatially dividing an identical time slot of an identical frequency. *Id.* at 2:25–39.

According to the '024 patent, one alleged problem with prior art multi-path communications systems was that, once established, the paths could not be modified, even if a failure occurred in one of the designated paths. *Id.* at 4:16–19. The '024 patent, therefore, proposes a solution by providing:

a radio apparatus capable of adaptive modification in connection of a plurality of paths between a terminal and a base station in accordance with a communication condition in a mobile communication system where communication is established with a multiple-paths-for-one-user scheme such as the MIMO scheme, as well as a method and a program for controlling a spatial path.

*Id.* at 4:25–32.

The '024 patent proposes a MIMO (“Multi Input-Multi Output”) scheme in which multiplex communication is established between one terminal having a plurality of antennas and a PDMA base station via a plurality of spatial paths of an identical frequency and an identical time slot. Ex. 1001, 3:27–31.

Figure 2 of the '024 patent is reproduced below.

FIG.2

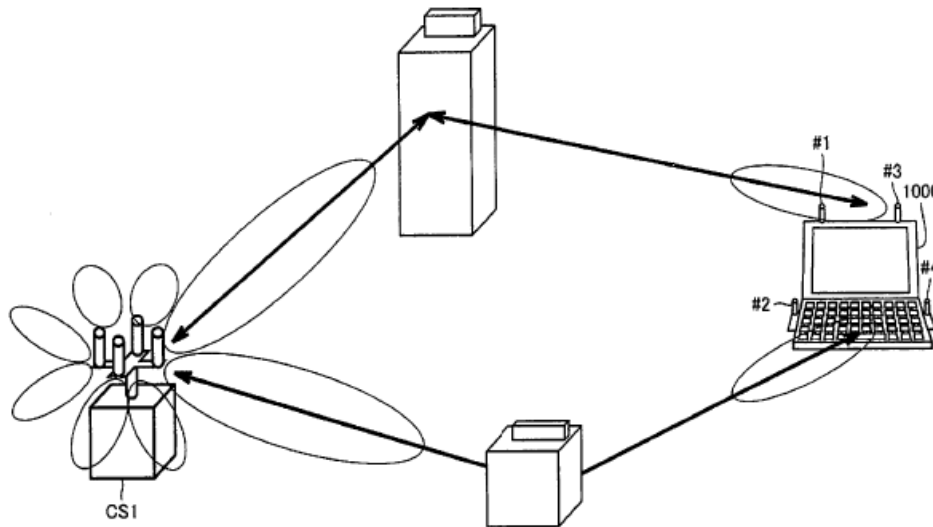


Figure 2 illustrates communication between PDMA terminal 1000 and an array antenna of base station CS1 using multiple spatial paths, where terminal antennas 1 and 3 are used for a first path and terminal antennas 2 and 4 are used for a second path. Ex. 1001, 7:27–30, 9:26–34.

In the embodiment of Figures 2 and 3 (identified as “First Embodiment”), a memory within terminal 1000 stores “antenna number information.” *Id.* at 9:46–47. Terminal 1000 transmits the antenna number information to base station CS1 at a prescribed timing. “Base station CS1 issues an instruction for the number of paths to be set to base station 1000 based on the antenna number information from terminal 1000.” *Id.* at 9:49–52. “Terminal 1000 sets the number of paths to be formed in accordance with the instruction from base station CS1.” *Id.* at 9:52–53.

Regarding Figure 3, the ’024 patent further explains that antenna number information is transmitted to the base station from terminal 1000 as control information in requesting establishment of a link channel (LCH allocation request). *Id.* at 9:62–65. Base station CS1 gives an instruction for the number of paths stating that “the number of paths to be set should be equal to or smaller than the number of antennas, as the control information for link channel allocation instruction, for example, based on the antenna number information from the terminal.” *Id.* at 9:66–10:4.

## II. MOTION TO AMEND

### *A. Background*

We instituted *inter partes* review of the ’024 patent on various grounds, including grounds based on Wallace<sup>1</sup> and others based on Paulraj.<sup>2</sup> Institution Dec. 42. As discussed *infra*, Patent Owner now requests

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<sup>1</sup> U.S. Patent Application Pub. No. 2002/0193146 A1, Dec. 19, 2002. Ex. 1003.

<sup>2</sup> U.S. Patent No. 6,351,499 B1, Feb. 26, 2002. Ex. 1005.

cancellation of original claims 1, 5, 6, 12, 16, and 17 and substitution of new claims 21 and 22 for the cancelled claims. Motion 1–2. The Motion to Amend is not contingent on our determination as to whether a preponderance of the evidence establishes that challenged claims 1, 5, 6, 12, 16, and 17 of the '024 patent are unpatentable. We, therefore, *grant* Patent Owner's request to cancel those claims. *Id.* Thus, the only remaining issue before us is whether to grant the Motion to Amend as to proposed substitute claims 21 and 22.

In addition to its Motion and Reply, Patent Owner relies on two declarations from Jacob Sharony, Ph.D., to support its proposed amendment. A first declaration of Dr. Sharony was filed with the Motion to Amend. Ex. 2018. The second was filed with Patent Owner's Reply. Ex. 2026.

With its Opposition to the Motion to Amend, Petitioner submitted a second declaration by Stephen B. Wicker, Ph.D. Ex. 1036. Petitioner also relies on an earlier declaration by Dr. Wicker that was submitted with the Petition. Ex. 1002.

### *B. Proposed Substitute Claims*

As noted, Patent Owner moves to substitute independent claims 21 and 22 for cancelled independent claims 1 and 12, respectively. Motion 1, Claims App. Claim 21 recites the following (with underlining indicating language added to and brackets indicating language removed from independent claim 1):

21. A radio apparatus for communication by forming a plurality of spatial signals to another radio apparatus, comprising:

a plurality of transmission units connectable to a plurality of antennas;

at least a signal processing unit capable of processing spatial signals to be transmitted through the plurality of transmission units and the plurality of antennas;

storage means for storing prior to any request to establish a link channel being sent to the another radio apparatus [in advance] information on the maximum number of spatial signals that can be processed by the signal processing unit for multiplex communication[, wherein the number of spatial signals is smaller than or equal to the total number of the plurality of antennas]; and

control means for controlling a process of transmitting the information on the maximum number of spatial signals,

wherein the information on the maximum number of spatial signals is transmitted in a request to establish a link channel.

Motion, Claims App. Claim 22 recites the following (with underlining indicating language added to and brackets indicating language removed from independent claim 12):

22. A radio apparatus for communication by forming a plurality of spatial signals to another radio apparatus, comprising:

a plurality of transmission units connectable to a plurality of antennas;

a signal processing unit capable of processing spatial signals to be transmitted through the plurality of transmission units and the plurality of antennas;

a storage unit that stores prior to any request to establish a link channel being sent to the another radio apparatus [in advance] information on the maximum number of spatial signals that can be processed by the signal processing unit for multiplex communication[, wherein the number of spatial signals is smaller than or equal to the total number of the plurality of antennas]; and

a control unit that controls a process of transmitting the information on the maximum number of spatial signals,

wherein the information on the maximum number of spatial signals is transmitted in a request to establish a link channel.

*Id.*

### *C. Statutory and Regulatory Requirements*

In this proceeding, we determine whether the motion to amend meets the statutory and regulatory requirements set forth in 35 U.S.C. § 316(d) and 37 C.F.R. § 42.121. *See Lectrosonics, Inc. v. Zaxcom, Inc.*, IPR2018-01129, Paper 15 and IPR2018-01130, Paper 14 (PTAB Feb. 25, 2019) (precedential) (“*Lectrosonics*”). We then consider the patentability of proposed substitute claims.

#### *1. A Reasonable Number of Substitute Claims*

A motion to amend may, “[f]or each challenged claim, propose a reasonable number of substitute claims.” 35 U.S.C. § 316(d)(1)(B) (2012). “The presumption is that only one substitute claim would be needed to replace each challenged claim, and it may be rebutted by a demonstration of need.” 37 C.F.R. § 42.121(a)(3) (2018).

Patent Owner cancels six claims and proposes two replacements—claims 21 and 22. We determine that the number of proposed substitute

claims is reasonable under 35 U.S.C. § 316(d)(1)(B) and 37 C.F.R. §§ 42.121(a)(3).

*2. Responding to a Ground of Unpatentability*

“A motion to amend may be denied where . . . [t]he amendment does not respond to a ground of unpatentability involved in the trial.” 37 C.F.R. § 42.121(a)(2)(i). In its proposed substitute claim, Patent Owner adds limitations to cancelled independent claims 1 and 12 and explains how the proposed substitute claims are patentable over various grounds relying on Paulraj and Wallace. These two references served as the basis of the grounds of unpatentability involved in the trial. Institution Dec. 7, 42; Motion 12–22. Specifically, Patent Owner has added two categories of allegedly narrowing limitations not present in original claims 1 and 12:

(1) the term “in advance” is replaced by the more-specific clause “prior to any request to establish a link channel being sent to the another radio apparatus” and the narrowing clause “wherein the information. . . is transmitted in a request to establish a link channel”; and (2) the clause “wherein the number of spatial signals is smaller than or equal to the total number of the plurality of antennas” is deleted in favor of inserting the specific, narrower descriptor “maximum” to describe the number of spatial signals and to those signals are qualified as “for multiplex communication.”

Motion 12–13 (emphasis omitted). Patent Owner contends “[n]one of Petitioner’s references teaches or suggests systems having this new combination of limitations.” *Id.* at 13. We determine that the amended language in the proposed substitute claims, which will be discussed in more detail *infra*, is responsive to the grounds of unpatentability involved in this trial under 37 C.F.R. § 42.121(a)(2)(i).

### 3. *Scope of the Proposed Substitute Claims*

A motion to amend “may not enlarge the scope of the claims of the patent.” 35 U.S.C. § 316(d)(3); *see* 37 C.F.R. § 42.121(a)(2)(ii). Patent Owner contends that the substitute claims are “narrower than the original, now-cancelled claims and introduce no new matter.” Motion 3. We have reviewed the limitations added in the proposed substitute claims (*see supra*) and determine that they do not enlarge the scope of the original cancelled claims.

### 4. *New Matter/Written Description*

A motion to amend “may not . . . introduce new matter.” 35 U.S.C. § 316(d)(3); *see* 37 C.F.R. § 42.121(a)(2)(ii). “New matter is any addition to the claims without support in the original disclosure.” *Lectrosonics*, Paper 15 at 7 (citing *TurboCare Div. of Demag Delaval Turbomachinery Corp. v. General Elec. Co.*, 264 F.3d 1111, 1118 (Fed. Cir. 2001)).

In order to show that an amendment does not introduce new subject matter, a motion to amend must set forth “[t]he support in the original disclosure of the patent for each claim that is added or amended” and “[t]he support in an earlier-filed disclosure for each claim for which benefit of the filing date of the earlier filed disclosure is sought.” 37 C.F.R. § 42.121(b)(1) and (2).

Patent Owner provides citations for each respective limitation of the claim, showing that proposed substitute claims 21 and 22 are supported by U.S. Patent Application No. 14/532,095 (Ex. 2019, “the ’095 application”), which issued as the ’024 patent. Motion 5–9. Patent Owner also provides citations for each respective limitation of the claims, showing that proposed substitute claims 21 and 22 are supported by earlier filed disclosures for

which benefit of the filing date is sought—namely, U.S. Patent Application No. 10/508,655 (Ex. 2020, “the ’655 application”), filed on March 11, 2003, and the English translation of Japanese Patent Application No. JP-2002-081375 (Ex. 2022, “the ’375 application”; Ex. 2021 (English Translation)), filed on March 22, 2002. Motion 5–7.

For reasons that will be discussed *infra*, of particular relevance to this discussion is whether the original disclosure of the ’095 application, and the earlier filed disclosures of the ’655 application and the ’375 application, provide sufficient written description support for the added claim limitation “value indicating the maximum number of spatial paths formable” “in a request to establish a link channel,” as recited in each of proposed substitute claims 21 and 22. *See* discussion of claims 21 and 22 *supra*. Specifically, in responding to Petitioner’s prior art challenge to claims 21 and 22, Patent Owner argues that the “information on the maximum number of spatial signals that can be processed” is not met by sending the number of antennas.

As discussed *supra*, in describing the First Embodiment of Figures 2 and 3 of the ’024 patent, the ’095 application explains: “First, the antenna number information is transmitted to the base station from terminal 1000 as control information in requesting establishment of a link channel (LCH allocation request).” Ex. 2019,<sup>3</sup> 16:10–12. Patent Owner relies on this disclosure of transmitting antenna number information, and quotes this discussion in support of its proposed amendment. Motion 7, 10 (quoting Ex. 2019, 16:10–12). In the very next sentence, the ’095 application

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<sup>3</sup> Citations to the ’095 application of Exhibit 2019 are to the original specification page numbering at the bottom center.

explains further that in this embodiment, “[b]ase station CS1 gives an instruction for the number of paths stating that *the number of paths to be set should be equal to or smaller than the number of antennas*, as the control information for link channel allocation instruction, for example, based on the antenna number information from the terminal.” Ex. 2019, 16:13–16 (emphasis added). Thus, the antenna number information is described as an upper limit for the number of paths formed. Patent Owner cites this and similar discussions from the ’655 application and the ’375 application. Motion 7 (citing Exs. 2019 & 2020, 16:10–12; Ex. 2022 ¶¶ 22, 35 (“the potential multiplicity information is information on a total number of the plurality of antennas”)).

Patent Owner also relies on Figure 7 of the ’095 application as written description support for this limitation. Motion 7 (citing “Figs. 7(S100) and 8 (S200)”). That figure (designated “Second Embodiment”) is a flowchart that shows “flow in adaptive control of the number of paths set” in that embodiment. Ex. 2019, 20:7–8. The first step in the process, designated S100, has two variations. *See* discussion *infra*. In the first variation, the terminal notifies the base station of “the number of antenna elements in the terminal.” *Id.* at 20:15–16.

Petitioner contends that, to the extent proposed substitute claims 21 and 22 are broad enough in scope such that the claimed “information” encompasses more than using the antenna number information to determine “information on the maximum number of spatial signals that can be processed,” these claims lack sufficient written description support. Opp. 25–29.

Based on the disclosures in the '095 application, the '655 application, and the '375 application, we find that there is at least one embodiment where a terminal transmits antenna number information in a link channel request. Specifically, in the First Embodiment discussed *supra* in relation to Figure 3, the antenna number information is transmitted to the base station from terminal 1000 as control information in requesting establishment of a link channel (LCH allocation request). Ex. 1001, 9:59–64. We further find that this amounts to transmitting “information on the maximum number of spatial signals that can be processed” in “a request to establish a link channel,” as recited in proposed substitute claims 21 and 22. So, too, does the description of the first variation of the Figure 7 Second Embodiment described *supra*. This showing discharges Patent Owner’s burden on this issue.

However, because we also conclude, *infra*, that Wallace anticipates and renders obvious proposed substitute claims proposed claims 21 and 22, we do not find it necessary to further address Petitioner’s specific written description arguments.

*D. Patentability of Proposed Substitute Claims 21 and 22*

*1. Introduction*

Petitioner contends that proposed substitute claims 21 and 22 are unpatentable based on the following grounds set forth in the table below. Opp. 3–23.

| <b>Claims</b> | <b>35 U.S.C. §</b> | <b>Reference(s)/Basis</b>                      |
|---------------|--------------------|------------------------------------------------|
| 21, 22        | 102                | Wallace                                        |
| 21, 22        | 103                | Wallace                                        |
| 21, 22        | 103                | Wallace, Mayrand <sup>4</sup>                  |
| 21, 22        | 102                | Paulraj                                        |
| 21, 22        | 103                | Paulraj                                        |
| 21, 22        | 103                | Paulraj, Mukerjee, <sup>5</sup> and/or Mayrand |

To support its positions, Petitioner relies on the original Declaration of Dr. Wicker that accompanied the Petition, as well as the Supplemental Declaration of Dr. Wicker filed with its Opposition to the Motion to Amend. Exs. 1002, 1036.

We begin our analysis with the principles of law that generally apply to anticipation and obviousness grounds, followed by a brief overview of Wallace, and then we address the parties’ contentions directed to whether Wallace anticipates and renders obvious proposed substitute claims 21 and 22.

Patent Owner “does not bear the burden of persuasion to demonstrate the patentability of [the proposed] substitute claims.” *Lectrosonics*, Paper 15 at 4 (citing *Aqua Prods., Inc. v. Matal*, 872 F.3d 1290 (Fed. Cir.

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<sup>4</sup> U.S. Patent No. 5,504,939, Apr. 2, 1996. Ex. 1044.

<sup>5</sup> U.S. Patent No. 5,479,484, Dec. 26, 1995. Ex. 1028.

2017); *Bosch Auto. Serv. Sols. LLC v. Iancu*, 878 F.3d 1027 (Fed. Cir. 2017)). “Rather, as a result of the current state of the law and [Office] rules and guidance, the burden of persuasion will ordinarily lie with the petitioner to show that any proposed substitute claims are unpatentable by a preponderance of the evidence.” *Id.*

## 2. Principles of Law

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) (quoting *In re Samour*, 571 F.2d 559, 562 (CCPA 1978)). “[T]he dispositive question regarding anticipation [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 omitted) (quoting *In re Baxter Travenol Labs.*, 952 F.2d 388, 390 (Fed. Cir. 1991)).

A claim is unpatentable as obvious 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) when in evidence, objective indicia of non-obviousness (i.e., secondary considerations).<sup>6</sup> *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). We analyze Petitioner’s unpatentability arguments based on obviousness with the principles identified above in mind.

### *3. Person of Ordinary Skill*

Relying on the testimony of Dr. Sharony, Patent Owner contends that a person of ordinary skill in the art at the time of the invention of the ’024 patent would have possessed

a working knowledge of multi-input multi-output (MIMO) wireless communications. The person would have gained this knowledge through a Bachelor of Science degree in Electrical Engineering or an equivalent degree, and three to five years of experience working in the field of wireless communications. Additional education or experience may serve as a substitute for these requirements.

Motion 4 (citing Ex. 2018 ¶ 28).

In its Opposition, Petitioner does not dispute Dr. Sharony’s assessment of the level of skill in the art. *See generally* Opp. In its Petition, however, we note that Petitioner, relying on the testimony of its declarant, Stephen B. Wicker, Ph.D., contends that a person of ordinary skill in the art at the time of the ’024 patent would have possessed a “Master’s degree in Electrical Engineering and at least 2–4 years of academic or industry

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<sup>6</sup> Patent Owner did not present arguments or evidence regarding secondary considerations for the substitute claims during the course of trial.

experience designing and implementing digital wireless communication systems.” Pet. 13 (citing Ex. 1002 ¶ 54).

Apart from the difference between a bachelor’s degree and a master’s degree in electrical engineering, we do not discern a material difference between the assessments advanced by the declarants. We regard these differences in the two formulations as insignificant. For the purpose of this Final Written Decision, we adopt Patent Owner’s proposal as consistent with the prior art before us. However, we would reach the same result with regard to this decision under either formulation.

#### 4. Claim Construction

In this *inter partes* review proceeding, which was filed before November 13, 2018, we interpret claim terms according to the broadest reasonable construction in light of the specification of the patent in which they appear. *See* 37 C.F.R. § 42.100(b) (2018).<sup>7</sup> Under that standard, and absent any special definitions, claim terms generally are given their ordinary and customary meaning, as would have been 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).

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<sup>7</sup> A recent amendment to this rule does not apply here because the Petition was filed before November 13, 2018. *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) (amending 37 C.F.R. § 42.100(b) effective November 13, 2018) (codified at 37 C.F.R. § 42.100(b) (2019)) (“This rule is effective on November 13, 2018 and applies to all . . . petitions filed *on or after the effective date.*” (emphasis added)).

Referring to proposed constructions from terms found in the original claims, Patent Owner asserts it “does not rely on those or any other specific claim constructions to demonstrate patentability of the proposed substitute claim over the prior art. Rather, Patent Owner demonstrates patentability based on the new limitations of the proposed substitute claims.” Motion 11. Thus, Patent Owner contends that “[t]he meanings of any new limitations (e.g., ‘maximum number of spatial paths’ or ‘request to establish a link channel’)—taken as a whole—are discernible from their context and would be readily understood by those of ordinary skill in the art.” *Id.*

Petitioner does not advance any explicit constructions with respect to its unpatentability contentions for claims 21 and 22.

In its Petition, however, Petitioner proposed constructions for two terms of claim 1 that are written in means-plus-function format. Pet. 14–17 (“storage means” and “control means”). Amended claim 21 also requires a “storage means” and “control means.” In the Institution Decision, we construed “storage means” and “control means” of claim 1 pursuant to 35 U.S.C. § 112 ¶ 6. Institution Dec. 14–15. We also noted that similar claim terms “storage unit” and “control unit” found in claim 12 presumptively were not in means-plus-function format, and we declined to construe “storage unit” and “control unit” pursuant to § 112 ¶ 6. *See id.* Amended claim 22 also recites “storage unit” and “control unit” limitations.

Although these terms are not at issue between the parties, we offer an interpretation in this Decision for clarity. We note that the identified functions have slightly changed due to the amendments for claim 21.

Claim 21 first requires a “storage means for storing prior to any request to establish a link channel being sent to the another radio apparatus

information on the maximum number of spatial signals that can be processed by the signal processing unit for multiplex communication.” Motion, Claims App. We construe this claim language pursuant to 35 U.S.C. § 112 ¶ 6. The stated function of “storing prior to any request to establish a link channel being sent to the another radio apparatus information on the maximum number of spatial signals that can be processed by the signal processing unit for multiplex communication,” is carried out by a memory. *See* Institution Dec. 14.

Claim 21 next requires “control means for controlling a process of transmitting the information on the maximum number of spatial signals.” We construe this language pursuant to 35 U.S.C. § 112 ¶ 6. The stated function of “controlling a process of transmitting the information on the maximum number of spatial signals,” is carried out by a controller or processor. *See* Institution Dec. 14–15. The ’024 patent discloses this function being performed by a “control circuit” or “a digital signal processor executing a software algorithm.” *Id.* (citing Ex. 1001, 7:61–62, 8:44–48, 8:51–55, 8:64–9:4, 17:21–38, 19:36–41). Further, “[a] control circuit is simply another name for a controller or processor.” *Id.* (citing Ex. 1002 ¶¶ 165, 175).

Claim 22 requires “a storage unit” and “a control unit.” We determine that these terms should not be construed pursuant to § 112 ¶ 6, and also that their scope is clear from the context of the Specification. Patent Owner made a deliberate choice to employ the word “unit” instead of “means.” *See* Institution Dec. 14. Thus, based on the final record, we determine that Patent Owner intended to invoke § 112 ¶ 6 for the “means” terms (claim 21) but did not so intend for the “unit” terms (claim 22) in the ’024 patent.

We also note that our analysis would be the same if the “unit” terms found in claim 22 were also interpreted pursuant to § 112 ¶ 6. The parties agree that the analysis of the prior art does not depend on whether any term should, or should not be, interpreted pursuant to § 112 ¶ 6. *See* Motion 11 (Patent Owner does not rely on “any other specific claim constructions to demonstrate patentability.”). When asked at oral hearing whether there was any dispute among the parties whether any term should be construed pursuant to § 112 ¶ 6, counsel for Petitioner replied,

We don’t believe that the outcome would be different because the means that are disclosed in the specification are a memory in the case of the storage element. In the case of the control unit it’s a processor or a controller and so each of the claims, there’s one has means limitations and there’s one that has unit as a reference that’s used both of *those would end up having the same scope*.

Tr. 7:24–8:19 (emphasis added).

### 5. Wallace Overview

Wallace is titled “Method and Apparatus for Antenna Diversity in a Wireless Communication System.” Ex. 1003, code (54). Wallace discloses a “[m]ethod and apparatus for negotiating a transmission scenario in a mixed mode spectrum wireless communication system.” *Id.* at code (57); *see also id.* ¶ 74 (disclosing a “mixed mode operation of one embodiment” where “the base station negotiates with user terminals to determine antenna diversity status of the terminal”).

Wallace discloses the use of wireless MIMO technology, as well as receiving signals and performing adaptive array processing. *Id.* ¶ 31 (“Using Multiple Input-Multiple Output, MIMO, the transmitter can send

multiple independent data streams on the same carrier frequency to a user.”), ¶ 95 (“[T]he receiver performs a complementary processing (e.g., spatial matched filter) of the linear transmit processing based on the channel characterization to compute the NC spatial matched filter coefficients needed for each transmission channel (i.e., each eigenmode).”).

Figure 12 of Wallace is reproduced below.

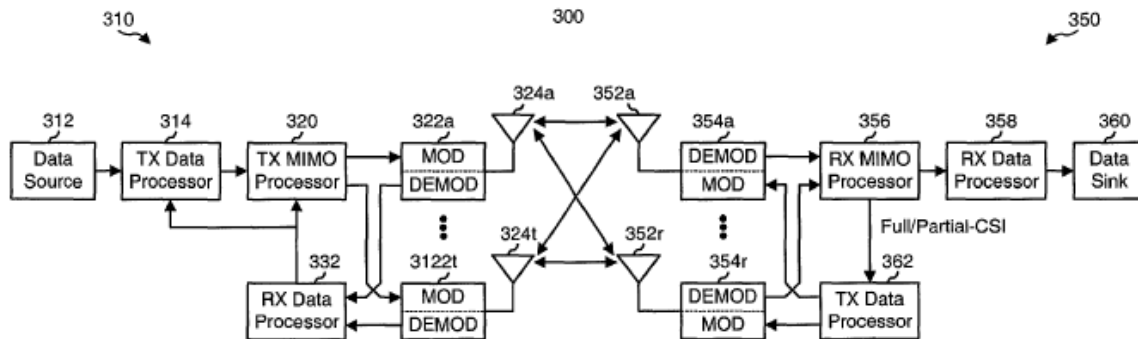


**FIG. 12**

Figure 12 of Wallace depicts a “wireless communication system capable of MIMO and diversity transmissions.” Ex. 1003 ¶ 22. Wallace explains that “system 300 may be operated to transmit data via a number of transmission channels.” *Id.* ¶ 93. Wallace relates the number of transmission channels (NC) to the number of transmit (NT) and receive (NR) antennas: “A MIMO channel may be decomposed into NC independent channels, with  $NC \leq \min \{NT, NR\}$ .” *Id.* Wallace explains further that “[e]ach of the NC independent channels is also referred to as a spatial subchannel of the MIMO channel. For a MIMO system, there may be only one frequency subchannel and each spatial subchannel may be referred to as a ‘transmission channel.’” *Id.*

Wallace also explains that a MIMO system, such as that shown in Figure 12, “can provide improved performance if the additional dimensionalities created by the multiple transmit and receive antennas are utilized.” *Id.* ¶ 94.

The base station of Wallace is illustrated in Figure 18, reproduced below.

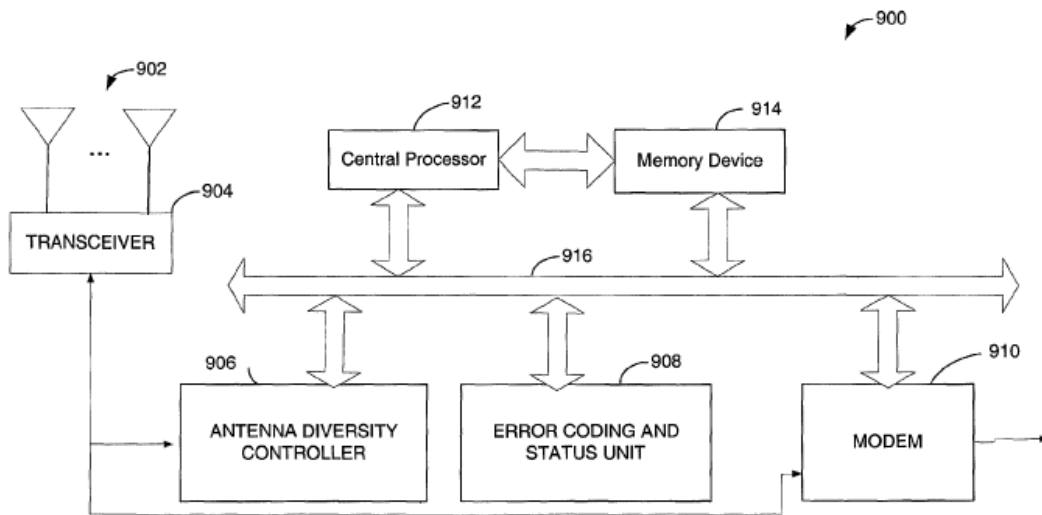


**FIG. 18**

Figure 18 illustrates base station 900 that includes, among other things, transceiver 904 coupled to multiple antennas 902 (including multiple transmit and receive antennas), central processor 912, and memory device 914. Ex. 1003 ¶ 122.

The mobile station of Wallace is illustrated in Figure 20, reproduced below.

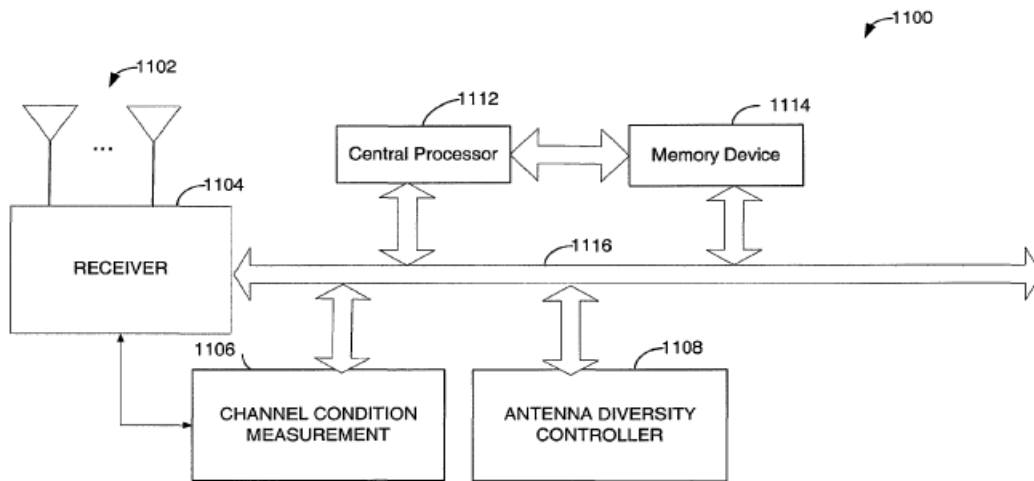


**FIG. 20**

Figure 20 illustrates mobile station 1100, which includes, among other things, receive antenna array 1102 coupled to receiver 1104 (which may be a transceiver), memory device 1114, and central processor 1112. Ex. 1003 ¶¶ 139, 140.

Wallace explains that the process of negotiating a forward link between a mobile user and a base station “starts with a query to the mobile user to determine diversity capability information,” including, for example, information regarding the “number of receive antennas used at the mobile station.” *Id.* ¶ 104. The base station may also request additional information concerning, for example, the “channel quality of [a] given link.” *Id.* In response to this information, the base station determines the appropriate configuration for the forward link. *Id.* The antenna diversity status may be sent as a message and include the number of transmit antennas, the number of receive antennas, the reception diversity configuration, and other information. *Id.* ¶ 125.

Wallace further discloses that, “[t]ypically, antenna diversity negotiations are performed at initiation of a communication, however,

alternate embodiments may allow adjustment during a communication, wherein the quality of the communication link channel degrades over time and environmental condition.” Ex. 1003 ¶ 127; *see also id.* ¶ 77 (“requires antenna diversity status information on initiation of an active communication”). Wallace further explains that “[i]nitiation refers to the start of a communication, including, but not limited to, response to a paging message from the base station, or a request for a communication from a mobile user.” *Id.* ¶ 123. In addition, Wallace discloses that its approach can be used in time division multiple access (“TDMA”) systems. *Id.* ¶¶ 33–35, 69.

#### *6. Analysis of Proposed Substitute Claim 21*

Petitioner presents arguments and evidence that proposed substitute claim 21 is anticipated by Wallace, obvious over the teachings of Wallace alone, and obvious over the combined teachings of Wallace and Mayrand. Opp. 3–15. Our analysis below only focuses on Petitioner’s arguments and evidence with respect to whether proposed substitute claim 21 is anticipated by Wallace and would have been obvious over the teachings of Wallace alone.

As discussed in detail below, we credit Petitioner’s analysis and find Petitioner has demonstrated by a preponderance of the evidence that each element of claim 21 is disclosed by Wallace and thus Wallace anticipates claim 21. Further, we separately determine that Petitioner has established that each element of claim 21 is taught or suggested by Wallace and that the subject matter of claim 21, as a whole, would have been obvious in light of Wallace to a person of ordinary skill. Petitioner relies on its original Petition

to support arguments for claim terms that were not amended. Our reasoning follows.

- a. “A radio apparatus for communication by forming a plurality of spatial signals to another radio apparatus, comprising”*

Petitioner contends that, to the extent this preamble of proposed substitute claim 21 is limiting, Wallace discloses the preamble. Opp. 3. That is, Petitioner argues that Wallace discloses the preamble of proposed substitute claim 21 because it describes, for example, a base station and a mobile station that communicate “by forming a plurality of spatial signals using MIMO technology.” Pet. 38 (citing Ex. 1003 ¶ 31) (“Using Multiple-Input Multiple-Output, MIMO, the transmitter can send *multiple independent data streams* on the same carrier frequency to a user”) (emphasis added).

Regardless of whether the preamble is limiting, Petitioner has shown that Wallace discloses the preamble of proposed substitute claim 21 because it describes a wireless communication system with a base station and “terminals.” Ex. 1003 ¶¶ 43–44. The base station communicates with the terminals. *Id.* ¶ 71. Thus, the terminal of Wallace is “a radio apparatus,” and the base station is “another radio apparatus.”

Patent Owner does not challenge this assertion by Petitioner.

- b. “a plurality of transmission units connectable to a plurality of antennas” and “at least a signal processing unit capable of processing spatial signals to be transmitted through the plurality of transmission units and the plurality of antennas”*

Petitioner contends that Wallace discloses the “a plurality of transmission units” of proposed substitute claim 21. Opp. 4 (citing Pet. 39–41). We find that Wallace meets this limitation. Wallace discloses MIMO

communication system 300, shown in Figure 12 (reproduced *supra*), where data source 312 provides data to transmit data processor 314 and transmit MIMO processor 320. Ex. 1003, Fig. 12, ¶¶ 97–98, 100.

System 300 also has a number of receive antennas 352 and demodulators 354 that receive transmitted signals and provide demodulated signals to a receive MIMO processor 356. *Id.* ¶ 102. Thus, we find that a person of ordinary skill would have understood that this combination of transmit and receive data processors, transmit and receive MIMO processors, multiple modulators and demodulators, and multiple transmit and receive antennas is a plurality of transmission units connectable to a plurality of antennas. Ex. 1003 ¶¶ 97–102; Ex. 1002 ¶¶ 243, 245, 246.

For example, Petitioner explains that Wallace exemplifies base station 900 with transceiver 904 connected to antenna array 902. Pet. 39 (citing Ex. 1003 ¶ 122). Further, Wallace teaches “[t]he transceiver 904 coupled to antennas 902 prepares signals for transmission.” *Id.* (quoting Ex. 1003 ¶ 122). Petitioner notes that “Wallace also disclosed a base station transceiver that received ‘encoded signals for transmission’ and performed ‘frequency conversion of the encoded signal to generate a Radio Frequency, RF, signal.’” *Id.* (quoting Ex. 1003 ¶ 120).

Petitioner also relies on Wallace’s teaching of a base station transceiver, which includes multiple upconversion units connected to the multiple antennas, alleging that “[e]ach transmitter antenna sent an independent data stream.” *Id.* at 40 (citing Ex. 1002 ¶ 240; Ex. 1003 ¶¶ 31, 66). Petitioner notes that “MIMO communications depend on the individual spatial characteristics that arise from the spatial differences for separate antennas,” and, as such, a person of ordinary skill in the art “would

understand that each antenna required its own up-conversion circuitry to generate a unique waveform corresponding to the individual spatial signal it transmitted.” *Id.*

Petitioner likewise asserts that Wallace discloses mobile station 1100 that includes receiver 1004, or transceiver, and also multiple antennas 1102 coupled to receiver 1104. Pet. 40 (citing Ex. 1003 ¶ 139). Petitioner argues that “a skilled person would understand the mobile station’s transceiver to include multiple up-converters connected to the multiple antennas shown in Figure 20.” *Id.* at 41.

Petitioner also establishes how Wallace discloses “at least a signal processing unit capable of processing spatial signals to be transmitted through the plurality of transmission units and the plurality of antennas,” required by claim 21. *See* Pet. 41–43; Institution Dec. 25–26. Specifically, Wallace discloses a base station and a mobile station that included the claimed signal processing unit. Ex. 1003 ¶¶ 95, 105, 109, 139. Petitioner relies on Wallace’s disclosure of transmitting spatial signals through multiple transmission units connected to multiple antennas, and further argues that “[t]o generate those spatial signals, the base station and mobile station performed signal processing, including adaptive array processing.” Pet. 40–41; Ex. 1003 ¶¶ 95, 105, 109, 139. Petitioner then argues that “the transmitter (base station) directs the transmitted data by filtering and assigning it to individual spatial signals.” Pet. 43. Thus, according to Petitioner, “[l]ike the ’024 patent’s directivity, Wallace’s base station or mobile station transmitter filtered and weighted symbols to create directivity for the spatial signals.” *Id.* (citing Ex. 1003 ¶¶ 95, 101; Ex. 1002 ¶¶ 193, 241–44).

We find Petitioner’s uncontested evidence and argument persuasive for these limitations.

*c. “storage means for storing prior to any request to establish a link channel being sent to the another radio apparatus information on the maximum number of spatial signals that can be processed by the signal processing unit for multiplex communication”*

Below, we examine these claim limitations in regard to the parties’ positions and then provide our analysis. The second portion of this limitation (“information on the maximum number of spatial signals . . .”) of proposed substitute claim 21 lies at the core of Petitioner’s opposition to the Motion to Amend and Patent Owner’s response.

#### Petitioner’s Contentions

Petitioner first contends that Wallace discloses “information on the maximum number of spatial signals,” as recited in proposed substitute claim 21. Opp. 4–5. In particular, Petitioner argues that Wallace describes using spatial paths for multiplex communication because it discloses “a MIMO communication channel between two wireless devices having multiple antennas (e.g., a mobile station and a base station) that includes ‘NC independent channels,’ where each is a separate ‘spatial subchannel.’” *Id.* at 4 (quoting Ex. 1003 ¶ 93; citing Ex. 1036 ¶¶ 26). According to Petitioner, Wallace’s creation of subchannels allows the transmitter of a mobile station to “‘send multiple independent data streams on a same carrier frequency’ using ‘spatial multiplexing, i.e., parallel channels.’” *Id.* at 5 (quoting Ex. 1003 ¶¶ 66, 95, 101, 106; citing Ex. 1036 ¶ 26).

Petitioner also contends that Wallace discloses values that correspond to “information on the maximum number of spatial signals,” as recited in proposed substitute claim 21. Opp. 5. Petitioner argues that, for MIMO

channels, Wallace discloses the number of transmit antennas (“NT”) or the number of receive antennas (“NR”), whichever is lower, provides an upper bound on the number of spatial subchannels (“NC”) formable. *Id.* at 4–5 (citing Ex. 1003 ¶¶ 66 (stating “ $N = \min(N_t, N_r)$ ”), 93 (stating “NC” is less than or equal to “{NT, NR}”)). Relying on the testimony of Dr. Wicker, Petitioner argues that, in a mobile station as an example, its number of transmit antennas represents the maximum number of spatial signals the station can transmit to a base station. *Id.* at 5 (citing Ex. 1036 ¶ 27). Similarly, Petitioner argues that “the mobile station’s number of receive antennas represents the maximum number of spatial signals that the station can receive from the base station.” *Id.* Petitioner asserts that the ’024 patent confirms that antenna number information may be indicative of the maximum number spatial signals a device can form by stating “the number of paths to be set should be equal to or smaller than the number of antennas.” *Id.* (quoting Ex. 1001, 9:65–10:3; citing Ex. 1001, 9:10–12).

Turning to “storing” information on the maximum number of spatial signals that can be processed by the signal processing unit “prior to any request to establish a link channel being sent to the another radio apparatus,” as recited in proposed substitute claim 21, Petitioner contends that Wallace describes this limitation because it discloses “an algorithm for a mobile station to send its number of transmit and receive antennas to a base station based on ‘a software module executed by a processor.’” Opp. 6 (quoting Ex. 1003 ¶ 145; citing Ex. 1003 ¶¶ 104, 107, 125). Petitioner further argues that Wallace discloses a storage medium, such as memory, “coupled to the processor” so that the processor can “read information from” the medium. *Id.* (quoting Ex. 1003 ¶ 145). More specifically, Petitioner asserts that

Figure 20 of Wallace illustrates double arrows pointing to and from memory device 1114, which convey that it stores information and shares information with other components within mobile station 1100, including central processor 1112. *Id.* (citing Ex. 1036 ¶ 28). Petitioner then represents that a person of ordinary skill in the art would have understood that central processor 1112 within mobile station 1100 must read the number of transmit and receive antennas from memory device 1114 in order to send the antenna number information, including in any link channel request. *Id.* (citing Ex. 1002 ¶¶ 251–258).

Alternatively, Petitioner contends that “it would have been obvious to use Wallace’s memory device 1114 to store the number of transmit and receive antennas before sending that information” because it was known in the field “to use memory to store parameters before sending them over a communication link.” Opp. 7 (citing Pet. 48). Petitioner argues that it would have been obvious to configure Wallace’s memory device 1114 in this way for the following two reasons: (1) “[u]sing Wallace’s memory device 1114 for that purpose would have applied a known method (storing values to be transmitted in memory) to achieve a predictable result (transmission of the values)”; and (2) “given the finite set of possibilities for storing the values in Wallace’s mobile station, using memory device 1114 for that purpose was an obvious design choice.” *Id.* (citing *KSR*, 550 U.S. at 416, 421).

Lastly, Petitioner contends that Wallace discloses that the mobile station stores the number of transmit and receive antennas prior to any request to establish a link channel so it can send those values to the base station, which, in turn, uses those values to select a transmission scenario.

Opp. 7. Petitioner argues that, consistent with Patent Owner’s position that a “request to establish a link channel” is one “that occurs at the very beginning of any communication,” Wallace discloses that a mobile station initiates a communication with a base station by sending a request. *Id.* at 7 (quoting Mot. to Amend 3; citing Ex. 1003 ¶ 123 (“Initiation refers to the start of a communication, including, but not limited to . . . a request for a communication from a mobile user.”)). Petitioner also argues that Wallace discloses that a message sent by the mobile station (e.g., the communication request) may include the antenna number information as part of antenna diversity status information. *Id.* at 8 (citing Ex. 1003 ¶ 125 (“The antenna diversity status . . . may be sent as a message to the base station 900 . . . [and] may include the number of transmit antennas, the number of receive antennas.”); Ex. 1036 ¶ 29). According to Petitioner, Wallace’s disclosure of sending antenna number information in a communication request allows the base station to select a transmission scenario for the mobile station. *Id.* (citing Ex. 1003 ¶¶ 123, 125; Ex. 1036 ¶¶ 29–31).

In its Sur-reply, Petitioner alleges that Patent Owner improperly constrains the limitation of “information on the maximum number of spatial signals” to require a “dynamically configurable” number of sub-arrays. Sur-reply 1–2. According to Petitioner, proposed substitute claim 21 neither recites nor requires a “dynamically configurable” number of sub-arrays. *Id.* at 2. Petitioner asserts that “a value indicating the maximum number of spatial paths formable” “logically extends to *any* value indicating a maximum.” *Id.*

Petitioner further argues that the specification of the '024 patent does not support Patent Owner's constrained reading of "information on the maximum number of spatial signals." Sur-reply 2. Petitioner argues that the specification discloses one example in which "antenna number information" is transmitted in a link channel request. *Id.* (quoting Ex. 1001, 9:61–64). According to Petitioner, the specification explains that "antenna number information" could be either the "number of antennas" or the "number of antennas capable of normal transmission/reception." *Id.* (quoting Ex. 1001, 8:32–50, 10:54–58). Petitioner argues that the specification clearly states that the "number of [spatial] paths to be set should be equal to or smaller than the number of antennas." *Id.* at 2–3 (alteration in original) (quoting Ex. 1001, 9:66–10:4; citing Ex. 1001, 9:9–14). In other words, Petitioner argues that "the number of [spatial] paths can never exceed the number of antennas, which sets the maximum." *Id.* at 2–3. Based on the aforementioned disclosures in the specification, Petitioner asserts that the claimed "information on the maximum number of spatial signals" is broad enough in scope to cover antenna number information. *Id.* at 3.

#### Patent Owner's Contentions

In its Reply, Patent Owner contends that there are several reasons as to why Wallace does not disclose "storage means for storing prior to any request to establish a link channel being sent . . . information on the maximum number of spatial signals," as recited in proposed substitute claim 21. Reply 1–2. First, Patent Owner argues that "Wallace does not contain any teachings of the use of subarrays." *Id.* at 2 (citing Ex. 2018 ¶ 98; Ex. 2026 ¶¶ 49, 50, 55). According to Patent Owner, "[t]he presence of subarrays will necessarily result in the maximum number of spatial paths

formable by a particular unit being different (and less) than the total number of antennas, as the antennas within each subarray function as a single antenna for purposes of establishing spatial paths.” *Id.* Patent Owner further argues that, although Wallace discloses transmitting antenna number information as part of diversity negotiations, “the number of spatial paths is a different parameter that does not have to be, and usually is not, the same as the number of antennas.” *Id.* (citing Ex. 2018 ¶ 98; Ex. 2026 ¶ 55); *see also id.* at 6 (arguing that, because “the number of spatial paths is dynamically configurable, so is the ‘maximum number of spatial paths,’ and that number cannot be described for all times by an absolute, fixed number like the actual number of antennas” (citing Ex. 2026 ¶ 53)).

Second, Patent Owner contends Wallace is directed to “diversity scenarios,” which, according to Patent Owner, are different than the “spatial multiplexing” purportedly required by proposed substitute claim 21. Reply 3 (citing Ex. 2018 ¶ 99; Ex. 2026 ¶¶ 17–20, 53, 56). Patent Owner argues that the antenna information transmitted from the remote terminal to the base station only is used to determine a transmission scenario (i.e., the type of configuration for a link, such as Single Input-Single Output, Single Input-Multiple Output, Multiple Input-Single Output, or MIMO). *Id.* (citing Ex. 2010 ¶¶ 7, 32, 124, Fig. 3). Patent Owner asserts that the antenna number information at either the remote terminal or the base station “is not relevant to the configuration,” nor is the antenna number information “used for any other purpose in Wallace.” *Id.* (citing Ex. 2018 ¶ 100).

Third, Patent Owner contends that Wallace does not disclose “the relationship between the specific number of antennas and the maximum number of spatial paths.” Reply 3. Patent Owner argues that, because

“Wallace does not contain any teaching of spatial signals or paths at all,” a person of ordinary skill in the art would not have been motivated to adapt Wallace’s disclosure of configuration modes to achieve the invention of proposed substitute claim 21. *Id.* (citing Ex. 2018 ¶ 101).

#### Analysis

We first consider the “storage means for storing prior to any request to establish a link channel” limitation in proposed substitute claim 21. Wallace discloses a memory for holding information on the number of antennas at least prior to when the link channel is initially established. Specifically, Wallace describes an algorithm for a mobile station to send its number of transmit and receive antennas to a base station based on “a software module executed by a processor.” Ex. 1003 ¶¶ 104, 107, 125, 145. A storage medium, such as memory, is “coupled to the processor” so the processor can “read information from” the medium. *Id.* ¶ 145. Wallace discloses “memory device 1114” that receives information for storage shares stored information, including with central processor 1112. Ex. 1036 ¶ 27; Ex. 1003 ¶ 140.

We agree with Petitioner that a skilled person would have understood “that the mobile station’s processor must read the number of transmit and receive antennas from a storage medium (e.g., memory device 1114) in order to send them, including in any link channel request.” Opp. 6 (citing Ex. 1002 ¶¶ 251–258). As Dr. Wicker testifies, “the antenna number information was necessarily stored before it was sent. Sending information is not possible without first storing it before transmission.” Ex. 1036 ¶ 29.

In light of the foregoing, we find that the “storage means for storing prior to any request to establish a link channel” limitations are disclosed in Wallace, both in function and corresponding structure.

We next examine the “information on the maximum number of spatial signals that can be processed by the signal processing unit for multiplex communication” limitation. As an initial matter, we agree with Petitioner that “information on the maximum number of spatial signals that can be processed by the signal processing unit for multiplex communication” does not require a “dynamically configurable” number of sub-arrays, but rather is broad enough in scope to encompass *any* value, or information, indicating a maximum number of spatial paths, such as antenna number information that sets the maximum of spatial paths. *See* Sur-reply 2. As such, Patent Owner’s argument (Reply 5) with regard to this limitation is not commensurate in scope with proposed substitute claim 21 because this claim does not recite a “dynamically configurable” number of sub-arrays. *See In re Self*, 671 F.2d 1344, 1348 (CCPA 1982) (explaining that limitations not appearing in the claims cannot be relied upon for patentability).

Our reading of this limitation to encompass antenna number information that sets the maximum number of spatial signals that can be processed finds support in at least one embodiment disclosed in the specification of the ’024 patent. As Petitioner correctly notes, the specification states that the “number of [spatial] paths to be set should be equal to or smaller than the number of antennas.” Sur-reply 2 (alteration in original) (quoting Ex. 1001, 9:65–10:3, referencing Figure 3). In other words, in at least one instance, the specification discloses that the number of spatial paths to be set should be equal to the number of antennas. The

specification also discloses that the number of spatial paths to be set should be smaller than the number of antennas. *Id.* at 9:48–52, 9:65–10:3, 10:59–64.

Consistent with this embodiment disclosed in the specification of the '024 patent, Wallace discloses that, for MIMO channels, the number of spatial subchannels (“NC”) that can be formed is less than or equal to the number of transmit antennas (“NT”) or the number of receive antennas (“NR”), whichever is lower. Ex. 1003 ¶ 93 (stating “ $NC \leq \min \{NT, NR\}$ ”—i.e., “NC” is less than or equal to “ $\min \{NT, NR\}$ ”). Relying on this disclosure in Wallace, Petitioner’s declarant, Dr. Wicker, testifies that the maximum number of spatial signals that can be processed is limited by the number of transmit antennas at the base station or the number of receive antennas at the mobile station, whichever is fewer. Ex. 1036 ¶ 27 (citing Ex. 1003 ¶¶ 31, 66, 93). We credit Dr. Wicker’s testimony in this regard because it is consistent with the disclosures in Wallace identified above. *See* Ex. 1003 ¶¶ 31, 66, 93.

We do not agree with Patent Owner’s argument that Wallace fails to disclose the claimed “information” because Wallace is directed to “diversity scenarios,” whereas proposed substitute claim 21 purportedly requires “spatial multiplexing.” *See* Reply 2–3. To the extent Patent Owner argues that Wallace is non-analogous prior art to the invention covered by proposed substitute claim 21, we disagree. First, “the question whether a reference is analogous art is irrelevant to whether that reference anticipates.” *In re Schreiber*, 128 F.3d 1473, 1478 (Fed. Cir. 1997) (citing *Self*, 671 F.2d at 1350). Second, Wallace is analogous prior art to the invention covered by proposed substitute claim 21. Wallace includes teachings regarding spatial

multiplexing, which are at least reasonably pertinent to the particular problem of establishing multiplex communication between one radio terminal and a radio base station via a plurality of paths. *See In re Bigio*, 381 F.3d 1320, 1325 (Fed. Cir. 2004) (stating that “[t]wo separate tests define the scope of analogous prior art,” one of which is “whether the reference is still reasonably pertinent to the particular problem with which the inventor is involved” (citations omitted)); *see also Intel Corp. v. Hera Wireless S.A.*, IPR2018-01373, Paper 48, 35–37 (Feb. 3, 2020).

As noted above, Patent Owner contends that the information on number of antennas does not meet the claim limitation because Wallace does not contain any teaching of the use of subarrays. *See Reply 2–3*

We are not persuaded that these arguments are sufficient to rebut Petitioner’s showing that the antenna number information in Wallace is “information on the maximum number of spatial signals that can be processed by the signal processing unit for multiplex communication.” As noted above, we are more persuaded by Petitioner’s argument that the proposed substitute claims 21 and 22 do not mention or require subarrays. Sur-reply 2. Patent Owner could easily have added such a limitation as part of its amendment, but chose not to do so. Instead, all the proposed substitute claims require is “information on the maximum number of spatial signals.” Motion, Claims App.

Although it is true that the antennas in a communication system may be grouped in sub-arrays, the record does not indicate that this is a requirement for communications to take place. Thus, at least in situations where there are no sub-arrays, or where each “subarray” contains a single antenna, the number of antennas would be indicative of the maximum

number of paths and would meet the claim limitation. Ex. 2026 ¶ 55 (Patent Owner’s declarant, Dr. Sharony, testifying that “[t]he two numbers coincide when each subarray contains exactly one antenna and all antennas work and are used in the subarrays.”). Thus, we do not agree with Patent Owner’s argument distinguishing Wallace based on “antenna arrays,” as it is not supported by the language of proposed substitute claim 21.

At the oral hearing, Patent Owner shifted the focus of its argument against Wallace to one based on the Figure 7 Second Embodiment of the ’024 patent. *See, e.g.*, Hearing Tr. 37:15–40:16 (arguing “[t]he second version here where the number of P\_MAX is sent is the version that would be covered by the claims because it is information on the maximum number of spatial signals that can be sent”). Thus, to support its argument that the scope of proposed substitute claims 21 and 22 excludes Wallace’s transmitting the number of antennas as part of diversity negotiations, Patent Owner relies on the Figure 7 variation, discussed briefly *supra*, involving P\_MAX. *Id.* Figure 7 of the ’024 patent is reproduced below.

FIG.7

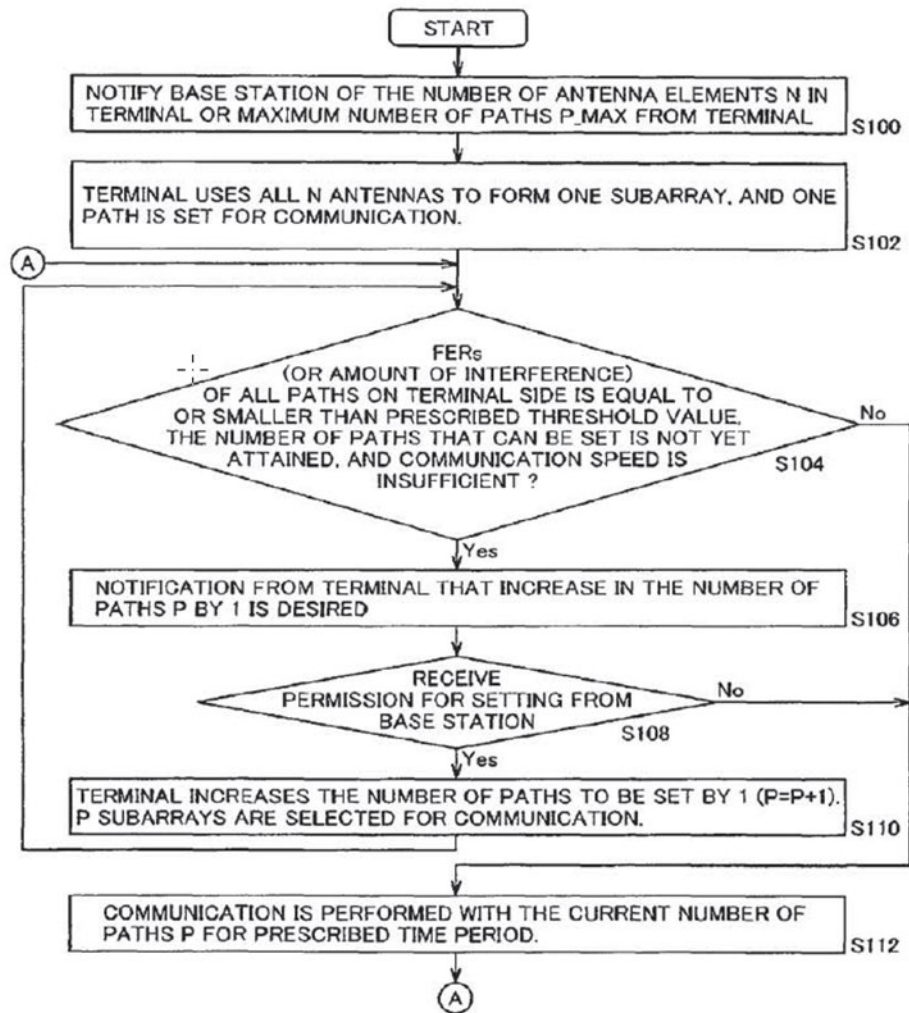


Figure 7 is a flowchart showing the steps in the adaptive control of the number of paths set in PDMA terminal. As noted previously in our written description analysis, Figure 7 is described in the '024 patent as a “Second Embodiment.” Ex. 1001, 12:17–24. As discussed, in the initial step (S100) of Figure 7, there are two alternatives: a first terminal either notifies base station CS1 of the “number of antenna elements N in the terminal *or* the maximum number of paths P\_MAX.” *Id.* at 12:30–32 (emphasis added). Patent Owner relies on the second (P\_MAX) variation in its argument to distinguish Wallace. According to Patent Owner at the oral argument,

Figure 7 “illustrates two possible embodiments. One is where you send the number of antennas, that’s the version one that we are not claiming.”

Hearing Tr. 39:1–6. Thus, Patent Owner argues that proposed substitute claims 21 and 22 should be limited to the variation of Figure 7 where the base station is given the maximum number of paths P\_MAX. *Id.* at 37:15–40:16.

For several reasons we do not agree with this argument. We first look at the claim language itself. The claim language imposes no requirement that the value be the actual number of paths, and, rather, only requires that it be “information on the maximum number of spatial signals that can be processed.” Motion, Claims App. There is no dispute that it is well known in MIMO spatial multiplexing that the number of antennas may set the upper limit for the number of paths, e.g., when there are no antenna arrays. *See, e.g.,* Hearing Tr. 40:17–41:18 (“That line is where the number of antennas equals the number of spatial paths.”). There is also no dispute that the number of antennas is a relevant factor.

Nor does the ’024 patent specification support this argument by Patent Owner. Patent Owner’s argument ignores the description of the First Embodiment of the ’024 patent, discussed *supra* in relation to Figures 2 and 3. Ex. 1001, 8:28–11:3. As explained *supra*, in that embodiment, the antenna number information is transmitted to the base station from terminal 1000 as control information in requesting establishment of a link channel (LCH allocation request). *Id.* at 9:61–64. “Base station CS1 gives an instruction for the number of paths stating that the number of paths to be set should be equal to or smaller than the number of antennas, as the control information for link channel allocation instruction, for example, based on the

antenna number information from the terminal.” *Id.* at 9:65–10:4. In addition, the Second Embodiment illustrated in Figure 7 discloses the alternative initial step of notifying the base station of the number of antennas. *See* Ex. 1001, Fig. 7, *supra*.

Patent Owner’s attempt to limit its claim by relying only on the Figure 7 “P\_MAX” variation is unconvincing. While claims must be read in view of the specification, “limitations from the specification are not to be read into the claims.” *Teleflex, Inc. v. Ficosa N. Am. Corp.*, 299 F.3d 1313, 1326 (Fed. Cir. 2002) (citations omitted). “[T]he claims of the patent will not be read restrictively, unless the patentee has demonstrated a clear intention to limit the claim scope using words or expressions of manifest exclusion or restriction.” *Liebel-Flarsheim Co. v. Medrad, Inc.*, 358 F.3d 898, 906 (Fed. Cir. 2004) (citing *Teleflex*, 299 F.3d at 1327). As noted *supra*, the ’024 patent discloses sending antenna number information to the base station as an upper bound for the number of paths. Moreover, as discussed *supra*, Patent Owner relies on that very disclosure as providing written description support for proposed substitute claims 21 and 22. *See* Motion 6–7.

In light of the foregoing, we credit Petitioner’s evidence for this limitation, supported by the testimony of Dr. Wicker, and find that the limitation is met by Wallace. Ex. 1036 ¶¶ 23–31.

Petitioner’s response to the P\_MAX argument alternatively asserts that P\_MAX is a value that is derived after communication is established. According to Petitioner, in the ’024 patent, a frame error rate counter (FER) calculates how many frames reach their destination terminal without an error. Hearing Tr. 53:12–54:24; Ex. 1001, 11:11–18. Petitioner explains

that this stored information, in turn, is used to determine the value P\_MAX. Ex. 1036 ¶¶ 14, 90; Ex. 1001, 11:37–42. Thus, Petitioner argues that in order to establish communication, the first step would be to transmit the antenna number information, and not P\_MAX. Ex. 1036 ¶¶ 90–96. Given Petitioner’s persuasive argument regarding the Second Embodiment examined above, we need not consider this alternative argument regarding whether or not P\_MAX is transmitted initially or derived after communication has started.

We find (and Patent Owner does not dispute) that in one variation of this Second Embodiment, communication is initiated by transmitting the number of antennas to the base station. For reasons discussed *supra*, we do not agree with Patent Owner’s attempt to limit its claim to exclude that variation of the Second Embodiment, or the description in the ’024 patent of the First Embodiment.

*d. “control means for controlling a process of transmitting the information on the maximum number of spatial signals, wherein the information on the maximum number of spatial signals is transmitted in a request to establish a link channel”*

Petitioner contends that this limitation is met by Wallace. Opp. 11–13; Ex. 1036 ¶¶ 41–43. We agree. Wallace’s mobile station 1100 (Fig. 20, *supra*) includes central processor 1112 which “controls operation within the mobile station.” Ex. 1003 ¶ 140; Ex. 1002 ¶¶ 252, 261. According to Petitioner, “Wallace’s base station or mobile station transmitted information on the number of spatial signals that can be processed, including information such as the number of the transmit antennas or CSI (*e.g.*, interference values).” Pet. 50–51 (citing Ex. 1003 ¶¶ 103, 104, 97, 126).

We find also that a person of ordinary skill would have recognized that Wallace discloses a process of transmitting antenna number information in a message for initiating a communication link with a mobile station. Ex. 1003 ¶¶ 77, 123, 125; Ex. 1036 ¶ 32. Wallace’s base station “*requires* antenna diversity status information on initiation of an active communication” with a mobile station. Ex. 1003 ¶ 77 (emphasis added). When a mobile station initiates communication by sending a request, that request includes the required antenna diversity information. *Id.* ¶¶ 123, 125; Ex. 1036 ¶ 33. We find that a person of ordinary skill would have understood that antenna diversity information to include the number of transmit and receive antennas. Ex. 1003 ¶¶ 123, 125 (“For a given mobile user, the antenna diversity status may include the number of transmit antennas, the number of receive antennas . . .”).

Sending antenna number information in such a request allows the base station in Wallace to select a transmission scenario for the mobile station. Ex. 1003 ¶ 124; Ex. 1036 ¶ 29. To configure the communications link, the base station needs “antenna diversity status information” from the requesting mobile station, such as its number of transmit and receive antennas. Ex. 1003 ¶¶ 77, 125. If a mobile station has multiple transmit and receive antennas, it can communicate using a MIMO scheme, with the number of spatial paths limited by the number of antennas; if not, it must use some other scheme. *Id.* ¶¶ 62, 66, Fig. 3. Thus, we find that a person of ordinary skill in the art at the time of the alleged invention would have understood that Wallace’s mobile station initiated communication by sending a message that included antenna number information to the base station. Ex. 1036 ¶ 29.

Similarly, Wallace discloses that the mobile station provides information on “the resources of the receiver” to a base station before initiation of communications when the receiver registers with the base station. Ex. 1003 ¶ 141. A person of ordinary skill reasonably would have understood this to include antenna number information. Ex. 1036 ¶¶ 44–46.

Alternatively, Petitioner relies on Mayrand in combination with Wallace to meet this limitation. Opp. 14–15. According to Petitioner, “Mayrand disclosed a mobile station that identifies its capabilities and characteristics to the system (i.e., base station) in a request ‘seeking access to a communication channel.’” *Id.* at 14. Relying on Dr. Wicker, Petitioner contends “[a] skilled person would have applied Mayrand’s teachings in Wallace’s mixed mode system.” *Id.* (citing Ex. 1036 ¶¶ 52–53). Because we find that Wallace both discloses this limitation for purposes of anticipation, and also teaches or reasonably suggests this limitation for purposes of obviousness, we do not find it necessary to reach Petitioner’s alternative argument based on Mayrand.

Patent Owner presents additional arguments against Wallace that are not necessarily tied to the limitations of proposed substitute claim 21 examined above. Reply 3–12. For example, Patent Owner contends Wallace teaches that the antenna number information transmitted from the remote terminal to the base station “is used only to determine a transmission scenario, i.e., the ‘type of configuration’ . . . for a link.” *Id.* at 3. In addition, Patent Owner argues “Wallace does not contain any teaching of the relationship between the specific number of antennas and the maximum number of spatial signals. In fact, Wallace does not contain any teaching of spatial signals or paths at all.” *Id.* We do not agree with these arguments.

We find that Wallace teaches MIMO communication links where the number of antennas is used to determine the maximum number of independent channels (i.e., the maximum number of spatial paths) that can be formed by the terminal for multiplex communication. Ex. 1003 ¶¶ 93, 94. Thus, we find that Wallace teaches a relationship between antennas and spatial paths: the maximum number of spatial paths that can be formed by a terminal depends on the number of antennas at the terminal. *Id.* Further, we find that Wallace uses this information to determine “the maximum number of spatial paths that can be formed.” *Id.*

Patent Owner next argues that Wallace does not teach a “request to establish a link channel” as this request must come from the mobile/requesting station and “Wallace teaches that the base station queries the mobile end for information.” Reply 3–4; *see id.* at 4 (arguing the terminal must “affirmatively provide specific information . . . in its initial request”).

We find Dr. Wicker’s explanation and reasoning more persuasive. Specifically,

[t]he base station 900 uses some or all of this information in selecting a transmission scenario for the mobile user, i.e., for a given communication link. Wallace taught that “[t]ypically, antenna diversity negotiations are performed at initiation of a communication” and that a base station “requires antenna diversity information on initiation of an active communication with each” mobile station. In a mixed mode system such as the one taught in Wallace, the base station needed to know antenna diversity information, such as antenna number information, at initiation of a communication so the base station was able to select the transmission scenario for the communication, as also taught in Wallace.

Ex. 1036 ¶ 29 (quoting Ex. 1003 ¶¶ 125, 127, 77, 141) (internal citations omitted). As Dr. Wicker further explains, “[t]o facilitate selecting the transmission scenario and determining the form of communication (e.g., MIMO), the mobile station provided its antenna number information, which is part of ‘antenna diversity’ information, to the base station at initiation of a communication.” Ex. 1036 ¶ 46 (quoting Ex. 1003 ¶ 77). And, as we explained above, the claims only require that a terminal transmit the information in a request to establish a link channel.

Patent Owner further argues that

Wallace stores a fixed value of its actual number of antennas before transmitting the value to a base station in order to select a transmission scenario for spatial diversity communications. This fixed number of the actual number of antennas in the terminal does *not* represent the maximum number of spatial paths that can be processed for multiplex communication at any given time of an initial request to establish a link channel.

Reply 4–5 (citing Ex. 2026 ¶ 49); *see also id.* at 6 (Patent Owner arguing that the maximum number of spatial paths must be “dynamically configurable.”). We do not agree with these arguments as they are contrary to the language of proposed substitute claims 21 and 22. These claims do not call for a dynamically changing parameter or for transmitting the actual number of paths formed; rather, the claims only require “information on the maximum number of spatial signals that can be processed by the signal processing unit.” Motion 1, Claims App. Patent Owner does not dispute that the number of paths cannot exceed the number of antennas. *See supra.*

Patent Owner also raises the issue of the transmission in Wallace of antenna number information by the terminal during location registration. Reply 6–7. Patent Owner contends that the timing of this transmission does

not correspond to sending a request to establish a link channel because those times “are usually different.” *Id.* We address this issue in our discussions of proposed substitute claim 21, *supra*. We find, furthermore, that Wallace meets the actual claim limitation because Wallace explicitly teaches providing antenna number information at the “initiation of a communication,” e.g., “when the receiver registers with the base station.” Ex. 1003 ¶¶ 127, 141; Ex. 1036 ¶¶ 29, 77.

Thus, we credit Petitioner’s analysis and find Petitioner has demonstrated by a preponderance of the evidence that each element of claim 21 is disclosed by Wallace, and thus Wallace anticipates claim 21. Further, we separately determine that Petitioner has established that each element of claim 22 is taught or suggested by Wallace and that the subject matter of claim 22, as a whole, would have been obvious in light of Wallace to a person of ordinary skill.

### 7. *Analysis of Claim 22*

Proposed substitute claim 22 is nearly identical in scope to proposed substitute claim 21. The only differences are that claim 22 substitutes “a storage unit that stores” for the “storage means for storing” of claim 21, and claim 22 requires “a control unit that controls a process of transmitting,” as compared to claim 21’s requirement of “control means for controlling a process of transmitting.” *See* Motion, Claims App. As admitted by the parties and discussed *supra*, these limitations are similar in scope and not argued separately by either party. Petitioner contends Wallace discloses (or teaches) these limitations “for the same reasons described above” with respect to claim 21. Opp. 15. Likewise, Patent Owner argues “[f]or the same reasons discussed above as to substitute claim 21,” Wallace does not

disclose or teach the limitations of claim 22.

Thus, for the same reasons set forth above for claim 21, we credit Petitioner's analysis and find Petitioner has demonstrated by a preponderance of the evidence that each element of claim 22 is disclosed by Wallace, and thus Wallace anticipates claim 22. Further, we separately determine that Petitioner has established that each element of claim 22 is taught or suggested by Wallace and that the subject matter of claim 22, as a whole, would have been obvious in light of Wallace to a person of ordinary skill.

#### *8. Summary*

Based on the full record developed during trial, we conclude that Petitioner has demonstrated by a preponderance of the evidence that each limitation of proposed substitute claims 21 and 22 is disclosed by Wallace and that each claim is thus anticipated by Wallace.

Petitioner also has separately established by a preponderance of the evidence that the subject matter of proposed substitute claims 21 and 22 would have been obvious over Wallace at the time of invention to a person of ordinary skill in the art.

#### *E. Patentability of Proposed Substitute Claims 21 and 22 over Paulraj*

As noted, Petitioner asserts that proposed substitute claims 21 and 22 are anticipated by and would have been obvious in light of Paulraj.<sup>8</sup> Opp.

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<sup>8</sup> To meet certain limitations of the proposed substitute claims, Petitioner relies on the combination of Paulraj and Mukerjee and the combination of Paulraj, Mukerjee, and Mayrand as alternatives to Paulraj alone. Opp. 16–24.

16–24. Because we have already determined that Petitioner has demonstrated those claims are not patentable over Wallace, is it unnecessary for us to reach the remaining grounds of unpatentability proposed by Petitioner. *Cf. In re Gleave*, 560 F.3d 1331, 1338 (Fed. Cir. 2009) (not reaching other grounds of unpatentability after affirming a ground based on anticipation); *see also Beloit Corp. v. Valmet Oy*, 742 F.2d 1421, 1423 (Fed. Cir. 1984) (an administrative agency is at liberty to reach a decision based on a dispositive issue).

### III. CONCLUSIONS

Patent Owner’s request to cancel challenged claims 1, 5, 6, 12, 16, and 17 of the ’024 patent is *granted*.

Patent Owner has demonstrated that proposed substitute claims 21 and 22 meet all the statutory and regulatory requirements set forth in 35 U.S.C. § 316(d) and 37 C.F.R. § 42.121. However, based on the arguments and evidence presented during trial, Petitioner has demonstrated by a preponderance of the evidence that proposed substitute claims 21 and 22 are anticipated pursuant to 35 U.S.C. § 102 and also unpatentable under 35 U.S.C. § 103(a). Patent Owner’s request to substitute claims 21 and 22 is, therefore, *denied*.

A summary of our conclusions are set forth in the table reproduced below.

| Motion to Amend Outcome                           | Claims              |
|---------------------------------------------------|---------------------|
| Original Claims Cancelled by Amendment            | 1, 5, 6, 12, 16, 17 |
| Substitute Claims Proposed in the Motion to Amend | 21, 22              |

|                                           |        |
|-------------------------------------------|--------|
| Substitute Claims: Motion to Amend Denied | 21, 22 |
|-------------------------------------------|--------|

#### IV. ORDER

In consideration of the foregoing, it is

ORDERED that claims 1, 5, 6, 12, 16, and 17 of the '024 patent are *cancelled*;

FURTHER ORDERED that, because Petitioner has demonstrated that proposed substitute claims 21 and 22 are unpatentable, Patent Owner's request to substitute claims 21 and 22 for cancelled independent claims 1 and 12 is *denied*; and,

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

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