

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC., SAMSUNG ELECTRONICS CO., LTD., AND
SAMSUNG ELECRTORNICS AMERICA, INC.,

Petitioner,

v.

SMART MOBILE TECHNOLOGIES LLC,
Patent Owner.

IPR2022-01002
Patent 9,191,083 B1

Before JAMESON LEE, KEVIN F. TURNER, and
HYUN J. JUNG, *Administrative Patent Judges*.

LEE, *Administrative Patent Judge*.

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

I. INTRODUCTION

We issued a Final Written Decision on November 30, 2023, determining no challenged claim had been proved unpatentable by Samsung Electronics Co., Ltd., Samsung Electronics America, Inc., and Apple Inc. (collectively, “Petitioner”). Paper 41. Petitioner appealed to the U.S. Court of Appeals for the Federal Circuit. Papers 43, 44. On January 13, 2026, the Federal Circuit vacated and remanded, on the basis that the Board erred by not considering certain alternative arguments presented in the Petitioner’s Reply (Paper 29), which were properly responsive to claim construction proposed in the Patent Owner Response and adopted by the Board.¹ Paper 45. In its Reply, Petitioner alternatively argued that even under the Patent Owner’s claim construction relating to “the plurality of antennas,” the same prior art references nonetheless still rendered obvious the challenged claims.

In this remand proceeding, neither party requested the filing of additional briefing, despite having been given an opportunity to make and explain such a request. Paper 51. We have authority to conduct this *inter partes* review under 35 U.S.C. § 6. This Final Written Decision on Remand is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73.

Having considered all of the arguments presented in Petitioner’s Reply, we determine that Petitioner has proved by a preponderance of the evidence that claims 1–9 and 12–20 of U.S. Patent No. 9,191,083 B1 (Ex. 1001, “the ’083 patent”) are unpatentable.

A. Background

Petitioner filed a Petition requesting an *inter partes* review of claims 1–9 and 12–20 of the ’083 patent pursuant to 35 U.S.C. §§ 311–319.

¹ The Federal Circuit’s Mandate issued on February 20, 2026. Paper 48.

Paper 3 (“Pet.”). Patent Owner filed a Preliminary Response. Paper 7. The Decision to Institute was entered on December 5, 2022. Paper 9. Patent Owner filed a Response to the Petition (Paper 24, “PO Resp.”). Petitioner filed a Reply to the Patent Owner’s Response (Paper 29, “Reply”). Patent Owner filed a Sur-reply (Paper 36, “Sur-reply”).

Oral hearing was held on September 22, 2023. A copy of the hearing transcript has been entered into the record (Paper 40, “Tr.”).

B. Real Parties in Interest

Petitioner states that Apple Inc., Samsung Electronics Co., Ltd., and Samsung Electronics America, Inc., are the real parties-in-interest. Pet. 88. Patent Owner identifies Smart Mobile Technologies LLC as real party-in-interest. Paper 5, 1.

C. Related Matters

The parties state that the ’083 patent is the subject of *Smart Mobile Technology LLC v. Samsung Electronics Co., Ltd. et al.*, 6:21-cv-00701 (W.D. Tex.) and *Smart Mobile Technologies LLC v. Apple Inc.*, 6-21-cv-00603 (W.D. Tex.). Pet. 88–89; Paper 5, 1. Patent Owner also identifies *Samsung Electronics Co., Ltd. v. Smart Mobile Technologies LLC*, IPR2022-01003 (PTAB). Paper 5, 1.

D. The ’083 Patent

The ’083 patent states that it is an object of the invention to provide wireless enhancements to IP based cellular telephones/mobile wireless devices (CT/MD), and that the same enhancements are applied to IP based and locally based network switch boxes. Ex. 1001, 1:43–46. Specifically, the ’083 patent describes in its Summary of the Invention section:

The typical CT/MD has one transmitter and one receiver (T/R), with one antenna. An unfulfilled need exists for multiple T/R in a CT/MD, providing enhanced capabilities, and the multiple T/R capabilities will often be best met with multiple antennas. The present invention is possible due to advances in the art which allow the necessary components to be integrated, with the size shrunk to achieve the package, performance, and cost desired. *The multiple T/R capability allows the single (CT/MD to perform tasks in different environments—each T/R being specifically designed or configured for that specific purpose.*

Id. at 1:47–57 (emphasis added).

Claims 1, 5, 8, and 12 are independent. Claim 1 is representative and reproduced below:²

Claim 1:

- 1[pre] A network box which is portable and wireless enabled comprising:
- 1[a] a plurality of antennas;
 - 1[b] a plurality of ports; and
 - 1[c] a communication component coupled to the plurality of antennas, the communication component including a processor, a transmitter, and a receiver,
 - 1[d] the communication component configured to transmit a first data stream by simultaneously transmitting a first plurality of signal streams using the plurality of antennas, the first plurality of signal streams collectively representing the first data stream,
 - 1[e] the communication component configured to receive a second data stream by simultaneously receiving a second plurality of signal streams using the plurality of antennas

² The bracketed labels correspond to those used by Petitioner to reference the claim elements. *See* Pet. vi–vii. We use the same labels here for ease of reference, understanding, and consistency.

and generating the second data stream from the second plurality of signal streams;

- 1[f] wherein the communication component is configured to communicate via a first frequency band using a wireless communication protocol;
- 1[g] wherein the device is configured to process the first data stream and the second data stream in parallel and to process multiple channels; and
- 1[h] wherein the portable network box device is configured to transmit and receive a plurality of data from and to a separate network switch box over at least one network path.

Pet. vi–vii.

E. References and Declarations

Petitioner relies on the following references:

Name	Patent Document/Publication	Exhibit
Paulraj	US Pat. 6,351,499 B1 (Feb. 26, 2002)	1004
Heath	US Pat. 6,678,253 B1 (Jan. 13, 2004)	1005

Petitioner relies on the Declaration and Supplemental Declaration of Michael Allen Jensen, Ph.D. (Exs. 1003, 1051). Patent Owner relies on the Declaration of Todor Cooklev, Ph.D. (Ex. 2004).

F. Asserted Ground of Unpatentability

Petitioner asserts that the following ground of unpatentability:

Claims Challenged	35 U.S.C. § ³	References/Basis
1–9, 12–20	103	Paulraj, Heath

³ The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112-29, 125 Stat. 284, (2011), amended 35 U.S.C. §§ 102 and 103 effective March 16, 2013. Because the earliest priority date of the ’083 patent is prior to the effective date of the AIA, we apply the pre-AIA version of § 103.

Pet. 1.

II. ANALYSIS

A. *Burden of Proof*

Petitioner has the burden of proving unpatentability by a preponderance of the evidence. 35 U.S.C. § 316(e). That burden never shifts to Patent Owner except in limited circumstances not present here. *In re Magnum Oil Tools Int’l, Ltd.*, 829 F.3d 1364, 1375 (Fed. Cir. 2016). “Preponderance of the evidence means the greater weight of evidence, evidence which is, more convincing than the evidence which is offered in opposition to it.” *United States v. C.H. Robinson Co.*, 760 F.3d 1376, 1383 (Fed. Cir. 2014) (internal quotations omitted).

B. *Level of Ordinary Skill in the Art*

Petitioner contends a person of ordinary skill would have had a “Bachelor’s degree in electrical engineering, computer engineering, computer science, or a related field, and at least two years of experience related to the design or development of wireless communication systems, or the equivalent.” Pet. 2–3 (citing Ex. 1003 ¶¶ 27–28). Petitioner additionally states that “[a]dditional graduate education could substitute for professional experience, or significant experience in the field could substitute for formal education.” Pet. 3. Patent Owner does not in its Response address the level of ordinary skill. Patent Owner’s expert witness, Dr. Cooklev, testifies that he “will apply the same definition of the level of skill of a POSITA [as Petitioner].” Ex. 2004 ¶ 19.

Based on the evidence of record, we determine a person of ordinary skill would have had a bachelor’s degree in electrical engineering, computer engineering, computer science, or a related field, and two years of

experience related to the design or development of wireless communication systems. This is consistent with Petitioner’s articulation of the level of ordinary skill, with the exception of Petitioner’s open-ended reference to “at least” two years of experience, because that would improperly encompass a level of experience only possessed by an expert. This articulation of the level of ordinary skill is also the same as what we determined in the Final Written decision issued on November 30, 2023. Paper 41, 6.

C. Claim Construction

We use the same claim construction standard that would be used to construe a claim in a civil action under 35 U.S.C. § 282(b), including construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent. 37 C.F.R. § 42.100(b) (2022). The claim construction standard set forth in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc) is applicable.

Claim terms are generally given their ordinary and customary meaning as would be understood by one with ordinary skill in the art in the context of the specification, the prosecution history, other claims, and extrinsic evidence including expert and inventor testimony, dictionaries, and learned treatises, although extrinsic evidence is less significant than the intrinsic record. *Phillips*, 415 F.3d at 1312–17. Usually, the specification is dispositive, and it is the single best guide to the meaning of a disputed term. *Id.* at 1315.

The specification may reveal a special definition given to a claim term by the patentee, or the specification or prosecution history may reveal an intentional disclaimer or disavowal of claim scope by the inventor. *Id.*

at 1316. If an inventor acts as his or her own lexicographer, the definition must be set forth in the specification with reasonable clarity, deliberateness, and precision. *Renishaw PLC v. Marposs Societa' per Azioni*, 158 F.3d 1243, 1249 (Fed. Cir. 1998). The disavowal, if any, can be effectuated by language in the specification or the prosecution history. *Poly-Am., L.P. v. API Indus., Inc.*, 839 F.3d 1131, 1136 (Fed. Cir. 2016).

Only those claim terms that are in controversy need to be construed, and only to the extent necessary to resolve the controversy. *Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019) (“The Board is required to construe ‘only those terms . . . that are in controversy, and only to the extent necessary to resolve the controversy.’” (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

1. “*the plurality of antennas*” limitation

Limitations 1[b], 1[c], 1[d], and 1[e] recite as follows (emphasis added):

- 1[b] *a plurality of ports*; and
- 1[c] a communication component coupled to the plurality of antennas, the communication component including a processor, a transmitter, and a receiver,
- 1[d] the communication component configured to transmit a first data stream by simultaneously transmitting a first plurality of signal streams *using the plurality of antennas*, the first plurality of signal streams collectively representing the first data stream,
- 1[e] the communication component configured to receive a second data stream by simultaneously receiving a second plurality of signal streams *using the plurality of antennas* and generating the second data stream from the second plurality of signal streams;

Pet. vi–vii (emphasis added). Independent claims 5, 8, and 12 have similar recitations.

Patent Owner contends: “The plain meaning of the claims requires that the same ‘plurality of antennas’ be used for transmitting and receiving the plurality of signal streams.” PO Resp. 5, 9–12. Citing Dr. Cooklev’s testimony, Patent Owner contends that the ’083 patent’s Specification describes embodiments that use the same antennas for both transmitting and receiving data streams. PO Resp. 7–9 (citing Ex. 2004 ¶¶ 34–35).

In the Final Written Decision, we determined:

Although we do not understand the claims to require both transmission and reception “via all antennas” all of the time, *we determine the claims require a set of antennas in which at least some of the antennas are for both transmitting and receiving.* We disagree with Petitioner that two separate sets of antennas—one set of transmitting antennas and a separate, nonoverlapping set of receiving antennas—fall within the scope of the challenged claims.

Paper 41, 13 (emphasis added). The Federal Circuit agreed with our claim construction. *Apple Inc. v. Smart Mobile Technologies LLC*, U.S. Ct. App. Fed. Cir., slip op. 24-1419 (January 13, 2026) (2026 WL 91021) (Paper 45, 2–4). We continue to apply the same construction here that we adopted in the Final Written Decision.

2. “*communication protocol*”

Independent claim 5 recites “wherein the transmitter is configured to transmit using a first communication protocol and a second communication protocol.” Independent claim 8 recites “wherein the system is enabled to transmit and receive using a first communication protocol and a second communication protocol.” Petitioner regards Paulraj’s disclosed “multiple

access techniques” as communication protocols. Pet. 48, 61 (citing Ex. 1003 ¶¶ 138, 167, 168). Petitioner asserts:

Paulraj’s user device (transmitter) can use “any wireless communication system using any combination of multiple access techniques such as TDMA, FDMA, CDMA, and OFDMA.” EX-1004, 3:28-31, 4:26-32, 5:11-14. Therefore, a POSITA would have understood or found obvious that the transmitter in Paulraj’s user device transmits signals formatted using a first communication protocol and a second communication protocol that are selected from the multiple access techniques, such as “TDMA, FDMA, CDMA, and OFDMA.” EX-1004, 4:26-32; EX-1003, ¶138.

Pet. 48.

Patent Owner argues, however, that “[b]oth plain meaning and the Patent’s specification make clear that Paulraj’s ‘access techniques’ are distinct from, and do not disclose, the claimed ‘communication protocols.’” PO Resp. 15. We disagree. For reasons discussed below, Petitioner persuades us that Paulraj’s “access techniques” are communication protocols, despite Patent Owner’s arguments to the contrary.

Patent Owner first argues that the Petition itself “provides no analysis or explanation whatsoever as to why Paulraj’s ‘multiple access techniques’ would be synonymous with, disclose, or suggest ‘communication protocols.’” PO Resp. 16. The argument is misplaced. Petitioner cannot anticipate what claim constructions Patent Owner would propose in the Patent Owner Response and is entitled to rebut that proposed construction in Petitioner’s Reply. *See Axonics, Inc. v. Medtronic, Inc.*, 75 F.4th 1374, 1384 (Fed. Cir. 2023). Also, it is not Petitioner’s contention that the term “access techniques” is *synonymous* with the term “communication protocol.” Petitioner simply asserts that “Paulraj’s access techniques, which are used

for communication, are ‘communication protocols.’” Reply 9 (citing Ex. 1051 ¶¶ 16–17).

Patent Owner does not refer to any express definition in the Specification for the term “communication protocol.” There is none. Patent Owner also does not adequately explain why a plain reading of “communication protocol” excludes Paulraj’s access techniques. Facially, Paulraj’s access techniques are protocols and are used for communication.

According to Patent Owner’s expert, Dr. Cooklev, access techniques such as CDMA and TDMA relate to how multiple users share the same channel, and are not “communication protocols” as that term is used in the ’083 patent. Ex. 2004 ¶¶ 42–44. Dr. Cooklev further testifies:

In contrast, a “communication protocol” is a complete set of rules that defines the procedure according to which two or more entities can communicate in a given type of network, such as cellular, Wi-Fi, Bluetooth, Z-wave (designed for home automation products), etc. Other references in the field similarly use the phrase “communication protocol.” For example, a scholarly publication by the IEEE compares the Bluetooth and Wi-Fi “communication protocols.” Ex. 2007 [Ferro] 1. Another IEEE publication “evaluated the reliability of the digital cellular communication protocol in communications between the vehicle and the center.” Ex. 2008 [Nojima] 1 (Abstract).

Id. ¶ 44. Such testimony does not explain why “communication protocol” must be limited to rules within a single type of network and are not sufficiently broad to cover access techniques used for communication within any type of network. We are persuaded by Petitioner that the term “communication protocol” is not so limited. In that regard, Petitioner explains:

The term “protocol” was broadly defined as “a set of rules governing information flow in a communications system” or “a set of rules followed by two computers [which] communicate

with one another.” EX-1051, ¶19; EX-1054, 422; EX-1055, 579; EX-1056, 412; EX-1058, 231–232; EX-1060, 710. Other similar terms like “communication protocol” and “transmission protocol” have similar broad definitions. EX-1057, 136 (defining “communication protocol” as “a set of rules that govern the communications between computers over telephone lines”); EX-1054, 108, 533 (defining “transmission protocol” as “[a] set of rules for the exchange of data over a communications network”); EX-1058, 55; EX-1056, 112, 543; EX-1059, 109; EX-1060, 210.

Dr. Cooklev’s definition of “communication protocol” is substantially in line with these definitions, except that he erroneously ties it to types of networks. EX-2004, ¶ 44 (“a complete set of rules that defines the procedure according to which two or more entities can communicate in a given type of network”). Dr. Cooklev, however, acknowledged in a related proceeding that “protocol” is a general term whose definition depends on the context. EX-1053, 17:8–15. Nowhere does the term “communication protocol” require a type of network and the Board should decline Patent Owner’s request to rewrite the claims to require the same. EX-1051, ¶20.

Reply 10–11. We understand that the term at issue is “communication protocol” and not just “protocol.” But in the absence of clear evidence that “communication protocol” was a well-known term of art specifically and narrowly referring to all rules within only a single type of network, the general nature of “protocol” sheds meaningful light on “communication protocol.”

Petitioner further explains:

Indeed, the claimed “communication protocol” clearly covers what Paulraj describes as “multiple access techniques” (e.g., TDMA, FDMA, CDMA), which each include “a set of rules” for data communications between multiple entities. EX-1051, ¶21; EX-1055, 493 (defining “multiple access” as “[a] means to increase communications capacity over a limited bandwidth medium” based on “multitasking and common

address schemes and **protocols**"); EX-1060, 585. Notably, Paulraj's multiple access techniques were commonly referred to as "protocols," as evidenced by Heath's description of the same technique as "multiple access protocols." EX-1051, ¶22; EX-1005, 5:1-20, 5:61-6:1, 8:54-63. Additional evidence confirms that a POSITA would consider Paulraj's "multiple access techniques" as "communication protocols." EX-1071, 13:17-18 (*"Another particularly suitable communication protocol ... is CDMA"*); EX-1072, 7; EX-1075, 2:34-35; EX-1076, 5:19 (*"TDMA communication protocol"*); EX-1077, 8:6-14 (*"TDMA communication protocol"*; *"CDMA communication protocol"*).

Reply 11 (emphasis added). Dr. Jensen, Petitioner's expert, testifies:

Further evidence confirms that a POSITA would consider Paulraj's "multiple access techniques" as "communication protocols." EX-1071, 13:17-18 (*"Another particularly suitable communication protocol for use with the present invention is CDMA"*); EX-1072, 7 (*"The following are some of the most important communication protocols: FDMA, TDMA, and CDMA."*); EX-1075, 2:34-35 (*"current communication protocols are referred to as GSM, CDMA. . . , and TDMA"*); EX-1076, 5:19 (*"TDMA communication protocol"*); EX-1077, 8:6-14 (*"TDMA communication protocol"*; *"CDMA communication protocol"*).

Ex. 1051 ¶ 22. The above-quoted assertions of Petitioner and testimony of Dr. Jensen are well supported by the cited evidence.

Relying on the Specification for support, Patent Owner refers to Figures 1A and 1B of the '083 patent. PO Resp. 21. Figures 1A and 1B are reproduced below:

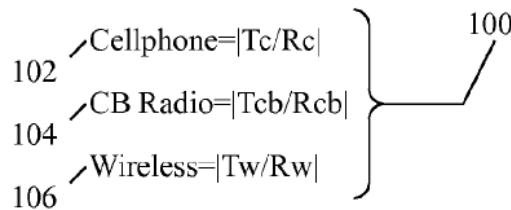


FIG. 1A
-Prior Art-

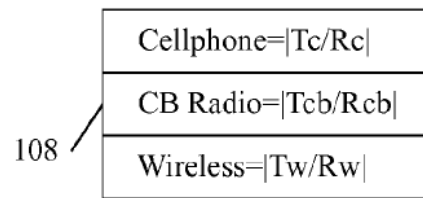


FIG. 1B

Figure 1A illustrates characteristics of a cellular telephone (CT/MD) of the prior art as opposed to a desired CT/MD of the invention, and Figure 1B shows the CT/MD of the invention having three transmit frequencies and three receive frequencies. Ex. 1001, 2:3–6.

Specifically, Figure 1A shows the prior art, with three devices, one each for communication on a different network, and Figure 1B shows three distinct units for cellular, CB radio, and wireless communication, respectively. Ex. 2004 ¶ 48. According to Patent Owner, this disclosure “reinforces the intended meaning of the recited ‘communication protocol’ as being distinct from access techniques under a single protocol.” PO Resp. 22 (citing Ex. 2004 ¶¶ 49–50). In that regard, Dr. Cooklev testifies:

The Patent explains that one of the benefits of the inventive embodiment with multiple antennas and T/R units is, for example, because “the design considerations for receiving cellular telephone frequencies may be totally different from those for streaming video or data signals, and with the present invention both can be combined into the CT/MD.” *Id.*, 4:10-13. As of the priority date of the Patent in 2000, streaming video was not a typical or even likely use of a cellular network. *Id.*, 2:61-65. Therefore, a POSITA would understand the Patent to refer to a cellular communication protocol in addition to another communication protocol for streaming video, such as Wi-Fi, so that a single device addressed the different needs that, at least at

the time of the invention, could have been efficiently addressed through using different types of networks.

Ex. 2004 ¶ 49 (emphasis added).

This argument is unavailing, because it seeks to further narrow the recitation of “first communication protocol” and “second communication protocol” to require one of them to be a “cellular communication protocol” and the other to be one that streams video. Plainly, there is no such requirement in “first communication protocol” and “second communication protocol” as claimed. Even if that combination is suggested as desirable in the Specification, we cannot read it into the claims absent corresponding claim language, and there is no such claim language.

Dr. Cooklev further testifies:

The Patent elsewhere uses the phrase “communication protocol” in connection with different types of networks. For example, the Patent explains that “Server C controls the communication protocols in conjunction with the network switching box or other devices, such as CT/MD 502.” Ex. 1001 [’083 Pat.] 4:49-51. A POSITA would understand that this reference to different “communication protocols” relates to, for example, the previously discussed cellular, CB Radio and wireless networks (*id.*, e.g., 3:26-34; 2:55-60). In another disclosure, the Patent explains that its system is connected to “wireless network 1304, optical network, such as a fibre [sic] optic channel 1308, and cable network 1312,” further explaining that “[o]ther networks could be used as well.” *Id.*, 8:40-45; Fig. 13.

Ex. 2004 ¶ 50. This argument also is unavailing, because the cited evidence does not support that the scope of “communication protocol” excludes what Paulraj refers to as “access techniques.” A broader scope is not inconsistent with the disclosure cited by Patent Owner.

Patent Owner additionally asserts that because the '083 patent refers to access techniques as “transmission protocols,” and not as “communication protocols,” Paulraj’s access techniques are not communication protocols. PO Resp. 23 (citing Ex. 1001, 11:11–17; Ex. 2004 ¶ 51). In that regard, the '083 patent states: “In addition the units have the ability to multiplex between one or more transmission protocols such as CDMA, TDMA to ensure that the fast data rates of the optical network [are] matched closely in a wireless network to minimize the potential data transmission speed degradation of a wireless network.” Ex. 1001, 11:11–17. The reference in the '083 patent to “CDMA” and “TDMA” as “transmission protocols” more supports Petitioner’s assertion that “CDMA” and “TDMA” are “communication protocols.” It cannot be reasonably disputed that “transmission” is a form of communication. Further, Dr. Jensen testifies that CDMA and TDMA “were well-known to be used for both transmission and reception of data, which collectively constitute ‘communication’ and, thus, ‘communication protocols.’” Ex. 1051 ¶ 24. We credit that testimony of Dr. Jensen.

Patent Owner additionally asserts: “when the Patent refers to a ‘cellular network,’ it never distinguishes between standards that use different access techniques such as CDMA or TDMA.” PO Resp. 24 (citing Ex. 2004 ¶ 51). We do not see the significance of that assertion. Even if true, that does not mean “CDMA” and “TDMA” are not communication protocols. Furthermore, the '083 patent clearly regards CDMA and TDMA as different transmission protocols. Ex. 1001, 11:11–17 (“In addition the units have the ability to multiplex between one or more transmission protocols such as CDMA, TDMA . . .”).

For all of the foregoing reasons, we find that the term “communication protocol” in claims 5 and 8 is sufficiently broad to encompass access techniques such as “CDMA,” “TDMA,” and “FDMA,” regardless of the specific type of network.

3. “a processor” / “the processor”

Independent claim 5 recites “a processor” followed by “wherein the processor is configured to process the first data stream and the second data stream in substantially parallel.” Independent claim 8 recites “a processor” followed by “wherein the processor is configured to process multiple channels and the first data stream and the second data stream in parallel.” Patent Owner asserts that this language means there must be only a single processor which performs all of the recited processing. PO Resp. 24–25. Also according to Patent Owner, “[i]t is undisputed that Paulraj utilizes different processors to process incoming and outgoing signals.” *Id.* at 24. This assertion is disputed by Petitioner. Reply 16.

The Petition appears to take the position that claims 5 and 8 do not require the same processor to perform the operations recited in the claims as being performed by the processor and applies Paulraj on that basis. Pet. 49. For instance, with respect to claim 5, Petitioner asserts:

Additionally, Paulraj’s user device includes **processor(s)** for processing the **first data stream** (see 5[d]), such as “data processing block” (Figure 2) or “data processing block 54” (Figure 3), and **processor(s)** for processing the **second data stream** (see 5[e]), such as “data processing block 38” (Figure 2) or its corresponding block in Figure 4. EX-1004, 6:26-41, 7:20-40, 9:1-12, 9:22-31, 9:46-48, 10:42-46; EX-1003, ¶140; see 5[b] and 1[g].

To the extent that the processor in this element requires a single processor, a POSITA would have found it obvious to implement Paulraj’s processors (e.g., data processing blocks 28

and 38) in a single processor. EX-1003, ¶141. For example, it would have been known or obvious to use a single-chip multiprocessor with multiple channels for parallel processing of multiple data streams. *Id.* (citing EX-1009, EX-1010).

Pet. 49.

In the Reply, and in response to Patent Owner's assertion that a single processor must perform all of the recited operations, Petitioner disagrees and argues the contrary. Reply 14–15. We do not find this argument in the Reply to be untimely, because it is directly responsive to Patent Owner's proposed claim construction in the Patent Owner Response. For reasons discussed below, however, we agree with Patent Owner that the pertinent language in claims 5 and 8 require the same processor, i.e., a single processor, to perform all of the operations executed by “the processor.”

Patent Owner explains that after first reciting “a processor,” claims 5 and 8 both refer back to that “a processor” as “the processor” and requires “the processor” to perform certain recited functions, i.e., “configured to process the first data stream and the second data stream in substantially parallel” per claim 5 and “configured to process multiple channels and the first data stream and the second data stream in parallel” per claim 8. PO Resp. 25–26. Patent Owner contends, on that basis: “Therefore, the claim requires that a single processor processes the incoming and outgoing data streams substantially in parallel.” *Id.* at 25.

Patent Owner further notes that independent claim 12, which also recites a processor, does not have such a limitation because claim 12 refers to “the system” as opposed to “the processor” as configured “to process the plurality of signals streams and/or a plurality of data streams in parallel.” *Id.* at 26. According to Patent Owner, the contrast with claim 12 supports Patent Owner's position that in claims 5 and 8, one and the same single

processor processes the first data stream and the second data stream in substantially parallel. *Id.*

Patent Owner additionally looks to the Specification of the '083 patent for support and asserts:

The Patent's specification also supports the requirement of claims 5 and 8 that a single processor processes the incoming and outgoing signals in parallel. The Patent explains that in an embodiment, there may be two processors that separately process incoming and outgoing signals. However, "[a]lternatively, a single processor may have multiple channels for parallel processing." Ex, 1001 ['083 Pat.] 4:20-29. Claims 5 and 8 are directed at this "alternate" embodiment. *Accord id.*, 4:53-56 ("This can also be done with a single processor that has the parallelism and pipeline capability built in for handling one or more data streams simultaneously.").

PO Resp. 27 (emphasis added).

We are not persuaded by Patent Owner's reliance on the language of independent claim 12 to indicate what the "the processor" language of independent claims 5 and 8 means, because claim 12 does not recite "the processor," and it is thus highly speculative to conclude what claim 12 indicates about the meaning of "the processor" in another claim. However, all other contentions of Patent Owner are logical and supported by the cited evidence, despite Petitioner's arguments to the contrary, discussed below.

Petitioner argues, first, that Patent Owner's interpretation requiring use of only a single processor because "the processor" refers back to "a processor" is inappropriately narrow (1) because that would be inconsistent with established case law which confirms that the term "a" is generally interpreted as "one or more," and (2) because claims 5 and 8 do not recite a "a single" processor but "a processor." Reply 15. This argument is misplaced.

Petitioner conflates scope versus equivalence. Although it is true that “a” can be met by disclosure of “one or more,” that does not mean the claim term “a” can be freely replaced by a substitute term “one or more.” Only by such unjustified replacement can Petitioner show that the recitation of “the processor” does not refer back to the same processor. Further, although claims 5 and 8 do not recite “single processor,” but recite “the processor” after introducing “a processor,” the effect is the same, i.e., there must be one processor, a single processor, which performs all the operations recited as being performed by “the processor,” no matter how many other processors are present and no matter what the other processors do. It matters not whether there are additional processors and what the additional processors do, so long as there is one processor, a single processor, which performs the specific functions recited as performed by the processor.

With regard to a similar issue, the U.S. Court of Appeals for the Federal Circuit has explained:

We agree with the district court that while the claim term “a microprocessor” does not require there be only one microprocessor, the subsequent limitations referring back to “said microprocessor” require that at least one microprocessor be capable of performing each of the claimed functions. This approach is entirely consistent with our precedent.

Salazar v. AT&T Mobility LLC, 64 F.4th 1311, 1317 (Fed. Cir. 2023). We apply the same principle here. One processor must perform all of the recited functions of “the processor.” That is Patent Owner’s position, referring to “single processor.” PO Resp. 25.

Petitioner argues, second, that “Patent Owner’s narrow interpretation also is not supported by the ’083 patent, which actually contradicts Patent Owner’s interpretation through description of multiple processor devices,”

and that the claims “broadly cover any type of processor, including processors with multiple processing elements (e.g., multiprocessor, multi-core processor, multiple-thread processor), such as those described in the ’083 patent.” Reply 15. Petitioner refers to the following description in the ’083 patent: “In FIG. 4 the processor 406 is shown as a single processor, however, the processor 406 is not limited to only one processor and may contain multiple processors.” Ex. 1001, 4:20-23 (cited at Reply 15–16). This argument also is misplaced.

We agree with Patent Owner that the language referred to by Petitioner is directed to a multi-processor embodiment, and claims 5 and 8 are drawn to a single processor embodiment also disclosed in the Specification of the ’083 patent. Patent Owner does not disagree that the claimed single processor, i.e., a processor which performs all of the recited functions of “the processor,” can be a multi-core processor or a multi-thread processor. Patent Owner expressly states: “This does not mean that a multi-core processor cannot constitute ‘a processor’ as claimed.” PO Resp. 26 n.9. That is true. Nothing precludes a “processor” from being a multi-core or multi-thread processor. But, still, it does not help Petitioner.

The following deposition testimony of Petitioner’s expert, Dr. Jensen, further undermines Petitioner:

When I see “the processor” in the claims, my understanding and the way I applied this in my analysis is “the processor” refers back to a processor that was previously – previously disclosed in the claim.

So, that – just so that we’re clear on that.

And again, the article “a” means there is a processor, one processor that —that includes those functions.

Ex. 2011, 53:12–21.

Finally, Petitioner contends that “if Patent Owner had intended to [sic] the ‘processor’ to mean a ‘single processor’ as expressly described in the specification, ‘it should have.’” Reply 21. Although the claims would be clearer had Patent Owner expressly included the word “single,” even without it the claims are sufficiently clear that the same processor, one processor, performs all of the recited functions performed by “the processor.”

For the foregoing reasons, we agree with Patent Owner that claims 5 and 8 require a single processor, which may have multiple-cores or multiple-channels within it, to process the first data stream and the second data stream in substantially parallel (claim 5), and to process the first data stream and the second data stream in parallel (claim 8), no matter how many other processors may be present and no matter what the other processors do. Claims 5 and 8 do not encompass entirely separate processors, one for processing the first data stream and one for processing the second data stream.

4. “*multipath communication*”

Claim 7 depends from claim 6 and further recites “wherein the device operates with a plurality of streams including a first stream and a second stream and *multipath communication*.” Ex. 1001, 12:54–56 (emphasis added). Claim 14 depends from claim 13 and further recites “wherein the system is enabled to send and receive a plurality of streams using *multipath communication*.” Ex. 1001, 14:12–14 (emphasis added).

Petitioner’s accounting for claim 7 and 14 treats communication of signal streams by use of multiple transmitting antennas and multiple receiving antennas as satisfying “multipath communication.” Pet. 56, 80. Patent Owner argues, however, that “multipath communication” requires communication through different networks each forming a separate path of

communication, and cannot be met simply by using multiple antennas for transmitting a signal stream through a single network, e.g., wireless network or cellular network. PO Resp. 33–39.

Neither party has asserted that “multipath communication” is a technical term of art having a well established and generally understood meaning to one of ordinary skill in the art. We also do not see in the Specification of the ’083 patent any express definition for the term.

Although Dr. Cooklev testifies that the term “multipath communication” is specifically defined in the Specification of the ’083 patent (Ex. 1052, 182:19–22), we see no such express definition in the portions of the Specification ’083 patent cited by Dr. Cooklev (Ex. 2004 ¶ 54 (citing Ex. 1001, 8:38–50, 6:24–26, 8:15–18)). Dr. Cooklev’s position that the term “multipath communication” is “specifically defined in the ’083 patent somewhere” (Ex. 1052, 182:19–183:17) is not creditable. As we noted above, if an inventor acts as his or her own lexicographer, the definition must be set forth in the specification with reasonable clarity, deliberateness, and precision. *Renishaw PLC*, 158 F.3d at 1249. The circumstance here falls far short of that standard.

According to Patent Owner, in the context of the ’083 patent, “multipath communication” refers to the ability of the inventive device to communicate through different networks and does not cover simply using multiple antennas for transmission or reception of a data stream within the same network. PO Resp. 33–34. Patent Owner asserts:

The ’083 Patent is clear that its reference to “multipath communication” refers to the ability of the device to communicate via multiple networks. EX2004 [Cooklev-Decla.] ¶ 54. For example, the Patent explains that “multipath communication” is achieved because its device can communicate

to a wireless network 1304, fiber optic channel 1308 and cable network 1312:

FIG. 13 is an embodiment of the present invention showing how Virtual Private Network or Networks (VPN) system 1300 may be provided. In FIG. 13, VPN 1302, 1306 and 1310 are connected through a wide area network (WAN) or a local area network (LAN) to **wireless network 1304, optical network, such as a fibre [sic] optic channel 1308, and cable network 1312**. Other networks could be used as well All the VPNs such as VPN 1302 and optionally the connections may be under the supervision of a Server C 1314 or many servers, VPN 1302 is shown with a network switch box 1316, server 1318, and a CT/MD 1320, **which allows multipath communication through the network switch box 1316 to server 1318**.

EX1001 [’083 Pat.] 8:38-50; *see also id.*, 6:24-26 (“Server C 706 then communicates **with a network such as the Internet of other path** to data such as a local WAN/LAN line, etc., through connection 708.”); 8:15-18 (“In FIG. 12, multiple communication channels such as USB 1202, telephone 1204, cable 1206, fibre optic channel 1208, and wireless 1210 are all employed to communicate data. . .”).

Id.

Patent Owner’s argument is misplaced and unpersuasive. The issue is not whether transmissions going through different networks constitute “multipath communication,” but whether “multipath communication” is limited to communication transmitted through different networks such that it is unreasonable to treat transmissions and receptions by different antennas as communicating through multiple paths. We see nothing restrictive in the above-quoted portion of the Specification or any other part of the Specification cited to by Dr. Cooklev. It is not inconsistent with the cited disclosures to regard transmission of a signal stream through different

antennas also as providing multiple paths of communication.

Patent Owner asserts that Petitioner's expert, Dr. Jensen, testified that "multipath communication" does "not have a precise universal definition in the art." Sur-reply 23. Patent Owner further asserts that "multipath" means different things depending on context. *Id.* We agree with both assertions. We just do not agree that "multipath communication" has the very narrow and restrictive meaning Patent Owner contends, in the context of the Specification of the '083 patent.

Patent Owner addresses Petitioner's reliance (Pet. 56) on Paulraj's discussion of "multipath fading" as supporting a disclosure in Paulraj of "multipath communication." PO Resp. 34–35. Patent Owner asserts that "multi-path fading is a term of art that has no relationship to the Patent's 'multipath communication,' and in fact does not even have a relationship with using one or multiple antennas." *Id.* at 35. Patent Owner explains:

When an electromagnetic wave is transmitted, it will be reflected one or more times from various objects in its path. These reflections produce reflected or scattered copies of the transmitted signal. These reflections plus the line-of-sight component (if it exists) will be summed together at the receiver.

The various paths will have different phases, and their phase differences may be such that they either reinforce each other or attenuate each other, a phenomenon known as "multipath fading." This phenomenon is unique to electromagnetic waves, and the phrase "multipath fading" is a term of art used to describe it. It is true whether the signal is sent from one antenna or multiple antennas. Therefore, "multipath fading" does not disclose the claimed "multipath communication."

Id. (citing Ex. 2004 ¶¶ 56–58).

The assertion that "multipath fading" bears no relationship whatsoever to "multipath communication" is premised on an assumption that Patent

Owner's proposed narrow understanding of "multipath communication" is correct. We do not make such an assumption. As for the assertion that "multipath fading" can exist whether one antenna or multiple antennas are used, that still more supports Petitioner's broader understanding of "multipath communication" than Patent Owner's narrow understanding. Even when only one network is involved in communication, Paulraj uses the word "multipath" to describe the type of communication made. That undermines Patent Owner's position requiring use of different networks for transmission to meet "multipath communication." Also, the use of additional antennas for transmission adds to the potential for various reflections along the way as described by Patent Owner and is consistent with Petitioner's broader understanding of "multipath communication."

Patent Owner discusses Petitioner's citations to Paulraj's disclosure of "spatial multiplexing" (Ex. 1004, 9:1–12, 9:46–48), where a data stream is split into multiple portions each transmitted from a different antenna. PO Resp. 35–36. According to Patent Owner, "spatial multiplexing" does not help Petitioner because, still, "Paulraj's antennas are all in the context of a single network, e.g., cellular network." *Id.* at 35. In that regard, Patent Owner states: "Nor does spatial multiplexing have any relationship to 'multipath communication.'" *Id.* at 36. That again assumes Patent Owner's proposed narrow reading of "multipath communication" is correct, an assumption we have no sufficient basis to make. Nonetheless, we find that the existence of "spatial multiplexing" in Paulraj does not add or detract from Petitioner's position.

Petitioner has submitted extrinsic evidence in the form of Exhibits 1021⁴ (“Wolniansky”) and 1022⁵ (“Cimini”). The disclosures in these references support Petitioner’s position that transmissions over one network through multiple antennas reflects multipath transmission and undermines Patent Owner’s position that “multipath communication” requires transmission through multiple different types of networks.

Figure 1 of Wolniansky is reproduced below:

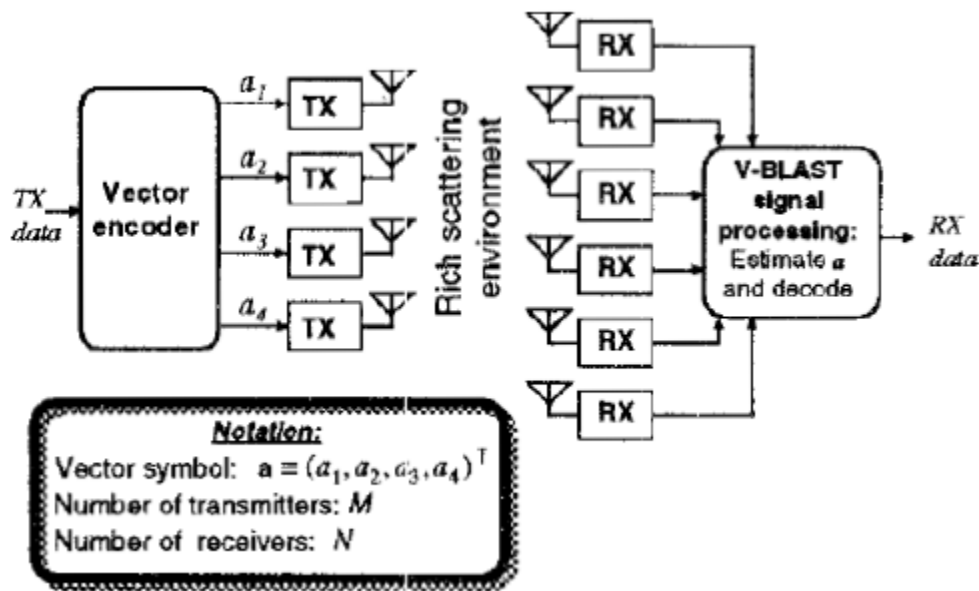


Figure 1 illustrates a high level block diagram of a system according to Wolniansky. Ex. 1021, 295. Wolniansky describes:

In the past few years, theoretical investigations have revealed that the *multipath wireless channel* is capable of enormous capacities, provided that the multipath scattering is sufficiently rich and is properly exploited through the use of an appropriate processing architecture [1-4]. The diagonally-layered space-

⁴ P.W. Wolniansky, et al. (1998), V-BLAST: An Architecture for Realizing Very High Data Rates Over the Rich-Scattering Wireless Channel, *Proceedings of the URSI International Symposium on Signals, Systems, and Electronics* (297–300) IEEE Xplore.

⁵ U.S. Patent No. 6,005,876.

time architecture proposed by Foschini [1], now known as diagonal BLAST (Bell Laboratories Layered SpaceTime) or D-BLAST, is one such approach. D-BLAST utilizes multi-element antenna arrays at both transmitter and receiver and an elegant diagonally layered coding structure in which code blocks are dispersed across diagonals in space-time. In an independent Rayleigh scattering environment, this processing structure leads to theoretical rates which grow linearly with the number of antennas (assuming equal numbers of transmit and receive antennas) with these rates approaching 90% of Shannon capacity.

Ex. 1021, 295.

Wolniansky's use of the word "multipath" to describe a wireless channel within one network undermines Patent Owner's proposed narrow interpretation of "multipath communication" to require use of multiple networks.

Similarly, Cimini describes: "In the present example it is proposed that $M=4$ so that there are four transmit antennas (309_t and 309_m) providing four separate paths to a single receive antenna." Ex. 1022, 4:17–20.

Cimini's use of the word "paths" to describe the links originating from four separate antennas within one network also undermines Patent Owner's proposed narrow interpretation of "multipath communication" to require use of multiple networks.

Finally, Patent Owner asserts that interpreting "multipath communication" as merely requiring transmission of signals through multiple antennas, instead of communicating with multiple networks, would render this limitation superfluous. PO Resp. 37 (citing Ex. 2004 ¶ 62). Patent Owner notes that claim 7 depends from claim 5 and claim 14 depends from claim 12, and that both claims 5 and 12 already require transmitting a

plurality of signal streams using the plurality of antennas and receiving a second plurality of signal streams using the plurality of antennas. *Id.*

We understand that “[a] claim construction that gives meaning to all the terms of the claim is preferred over one that does not do so.” *Merck & Co. v. Teva Farms. USA, Inc.*, 395 F.3d 1364, 1372 (Fed. Cir. 2005).

Likewise, “interpretations that render some portion of the claim language superfluous are disfavored.” *SimpleAir, Inc. v. Sony Ericsson Mobile Commc’ns AB*, 820 F.3d 419, 429 (Fed. Cir. 2016). But that is not an absolute prohibition under all circumstances. There is, at the same time, a stronger and well-established rule of claim interpretation at work, i.e., not reading extraneous limitations from the Specification into the claims.

“It is improper to read limitations from a preferred embodiment described in the specification, even if it is the only embodiment, into the claims absent a clear indication in the intrinsic record that the patentee intended the claims to be so limited.” *EPOS Techs. Ltd. v. Pegasus Techs. Ltd.*, 766 F.3d 1338, 1341 (Fed. Cir. 2014); *Liebel–Flarsheim v. Medrad, Inc.*, 358 F.3d 898, 913 (Fed. Cir. 2004); *Teleflex, Inc. v. Ficosa N. Am. Corp.*, 299 F.3d 1313, 1327 (Fed. Cir. 2002). The Specification of the ’083 patent is not sufficiently clear, for reasons discussed above.

“Though understanding the claim language may be aided by the explanations contained in the written description, it is important not to import into a claim limitations that are not a part of the claim.” *Superguide Corp. v. DirecTV Enterprises, Inc.*, 358 F.3d 870, 875 (Fed. Cir. 2004). Here, we find that accepting some redundancy is better than reading into the claims an extraneous limitation from the Specification not otherwise required by the claim.

For the foregoing reasons, we determine that “multipath communication” does not require communication through different types of networks as Patent Owner contends.

D. Alleged Unpatentability of Claims 1–9 and 12–20 over Paulraj and Heath for Obviousness under § 103

1. The Law on Obviousness

A claim is unpatentable under 35 U.S.C. § 103 “if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains.” 35 U.S.C. § 103; *see KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) where in evidence, so-called secondary considerations, including commercial success, long-felt but unsolved needs, failure of others, and unexpected results. *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1, 17–18 (1966).

2. Overview of Paulraj (Ex. 1004)

Paulraj is titled “Method and Wireless Systems Using Multiple Antennas and Adaptive Control for Maximizing a Communication parameter.” Ex. 1004, code (54). The communication parameter can be data capacity, signal quality, or throughput of a channel between a transmit unit with M transmit antennas and a receive unit with N receive antennas. *Id.* code (57). Figure 1 of Paulraj is reproduced below:

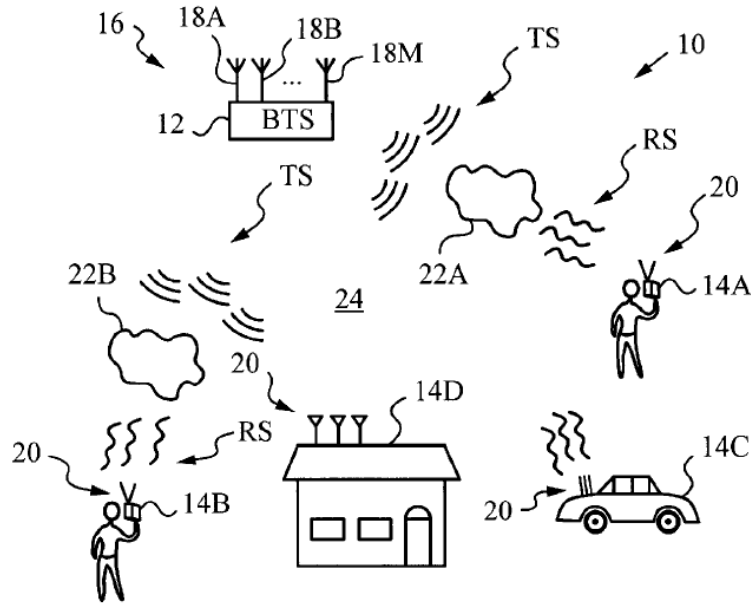


FIG. 1

Figure 1 is a simplified diagram illustrating a communication system in which the method of the invention is applied. Ex. 1004, 5:21–22.

Paulraj describes:

Figure 1 illustrates a portion of a wireless communication system 10, e.g., a cellular wireless system. For explanation purposes, the downlink communication will be considered where a transmit unit 12 is a Base Transceiver Station (BTS) and a receive unit 14 is a mobile or stationary wireless user device. Exemplary user devices include mobile receive units 14A, 14B, 14C which are portable telephone and car phones and stationary receive unit 14D, which can be a wireless modem unit used at a residence or any other fixed wireless unit. Of course, the same method can be used in uplink communication from wireless units 14 to BTS 12.

Ex. 1004, 5:47–58.

Figure 2 of Paulraj is reproduced below:

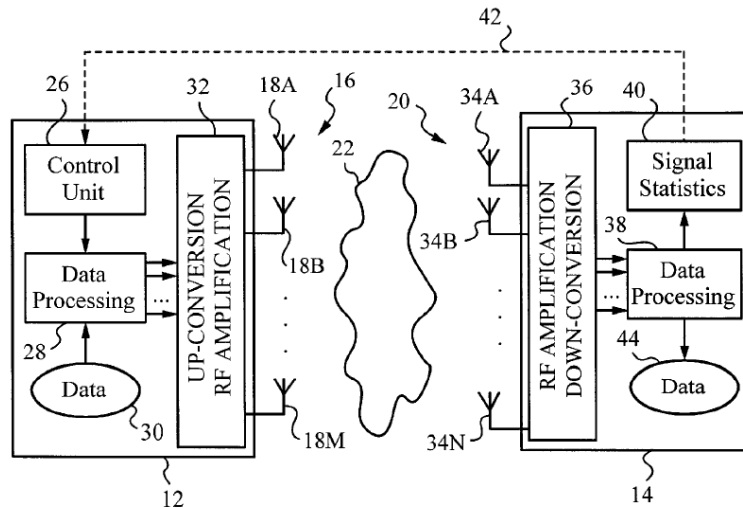


FIG. 2

Figure 2 is a simplified block diagram illustrating the transmit and receive units according to the invention. Ex. 1004, 5:23–24.

As shown, transmit unit 12 would be located in Base Transceiver Station BTS and receive unit 14 would be in a stationary or mobile user device.

Paulraj describes:

Figure 2 illustrates the fundamental blocks of transmit unit 12 and one receive unit 14 necessary to employ the method. Transmit unit 12 has a control unit 26 connected to a data processing block 28 for receiving data 30 to be formatted, coded and mapped to antennas 18A, 18B, . . . , 18M for transmission therefrom. An up-conversion and RF amplification block 32 supplies the transmit signals TS to antennas 18A, 18B, . . . , 18M.

On the other side of the link, receiving unit 14 has N antennas 34A, 34B, . . . , 34N in its array 20 for receiving signals RS. An RF amplification and down-conversion block 36 processes RS signals and passes them to data processing block 38. A signal statistics unit 40 assesses a quality parameter of RS signals and/or recovered data 44 and feeds back quality parameter to control unit 26 of transmitter 12. The feedback is indicated by dashed line 42. Using this quality parameter, unit

26 controls data processing 28 to ensure appropriate spatial multiplexing, diversity processing, coding and mapping of data 30 such that a selected communication parameter or parameters are continuously maximized.

Ex. 1004, 6:28–48.

3. *Overview of Heath (Ex. 1005)*

Heath discloses a method and apparatus for implementing spatial multiplexing in conjunction with one or more multiple access protocols during the broadcast of information in a wireless network. Ex. 1005, code (57). Specifically, Heath describes:

Spatial multiplexing (**SM**) is a transmission technology which *exploits multiple antennas at both the base station(s) and at the subscriber units to increase the bit rate in a wireless radio link* with no additional power or bandwidth consumption. Under certain conditions, spatial multiplexing offers a linear increase in spectrum efficiency with the number of antennas. Assuming, for example, N=3 antennas are used at the transmitter and receiver, the stream of possibly coded information symbols is split into three independent substreams. These substreams occupy the same channel of a multiple access (**MA**) protocol, the same time slot in a time-division multiple access (**TDMA**) protocol, the same frequency slot in frequency-division multiple access (**FDMA**) protocol, the same code/key sequence in codedivision multiple access (**CDMA**) protocol or the same spatial target location in space-division multiple access (**SDMA**) protocol.

Ex. 1005, 5:52–6:1 (emphasis added).

4. *Independent Claim 1*

At issue for adjudication of claim 1 are limitations [1.b], [1.d], and [1.e]. As we discussed above in Section II.C.1., the claim requires a set of antennas in which at least some of the antennas are for both transmitting and receiving. In that regard, Petitioner presents two theories in its Reply: (1) that Paulraj expressly discloses that the same antennas used for

transmitting can be used for receiving; and (2) that it would have been obvious to one of ordinary skill in the art that Paulraj's "transmit antennas" and "receive antennas" are implemented as the same set of antennas. Reply 5–9.

For reasons discussed below, we are not persuaded by Petitioner that Paulraj expressly discloses that the "transmit antennas" and the "receive antennas" are implemented by the same antennas, but we are persuaded by Petitioner that it would have been obvious to one of ordinary skill in the art to use some of Paulraj's antennas as both "transmit antennas" and "receive antennas."

With respect to its argument that Paulraj expressly discloses using the same antennas for transmission and reception, Petitioner asserts: "Paulraj describes the functions of 'transmit unit' and 'receive unit' in the context of 'downlink communication' in Figures 1–2, but expressly states that the same units are used for 'uplink communication' where the functions of 'transmit unit' and 'receive unit' are reversed." Reply 5–6 (citing Ex. 1004, 5:45–58). On that basis, Petitioner contends that "[a]s such, in Paulraj, the device (e.g., 'wireless units 14' or 'BTS 12') transmits (in uplink) or receives (in downlink) using the same antennas." *Id.* at 6.

Petitioner relies heavily on the following sentence in Paulraj in the same paragraph introducing paragraphs 1 and 2: "Of course, the same method can be used in uplink communication from wireless units 14 to BTS 12." Ex. 1004, 5:56–58. However, Petitioner has read too much into the sentence. The sentence is broad and does not necessarily mean the same antennas are used for both transmitting and receiving. Rather, it can simply mean within the BTS there is a separate "receive unit" with its own

antennas, and that in the user devices there is a separate “transmit unit” with its own antennas. Also, Patent Owner correctly asserts: “This portion of Paulraj only explains that the ‘wireless units’ (not the receiver of the wireless units) can use ‘the same method’ (not the same unit) for ‘uplink communication.’” Sur-reply 6. Patent Owner additionally correctly asserts that Paulraj describes its BTS as having distinct transmit and receive units. *Id.* (citing Ex. 1004, 4:46–48).

We further note the following testimony of Petitioner’s expert, Dr. Jensen, on cross-examination:

Q. So, is it your testimony that Paulraj is silent as to whether it uses the same or different sets of antennas for transmitting and receiving?

A. My understanding of Paulraj is he never expressly states that the transmit antennas and the receive antennas disclosed are the same physical antennas.

Ex. 2011, 39:12–18.

For all of the foregoing reasons, we are not persuaded by Petitioner’s reply argument that Paulraj expressly discloses using some antennas both for transmitting and receiving.

With respect to Petitioner’s contention that it would have been obvious to one of ordinary skill in the art to use the same antennas both as “transmit antennas” and “receive antennas” in Paulraj, Petitioner asserts that “antennas were well-known to be used for both transmitting and receiving signals.” Reply 7 (citing Ex. 1051 ¶ 13; Ex. 1078, 1:60–63). Petitioner also asserts that “well-known full-duplex communication transmits data on one frequency and receives data on another frequency, allowing both transmission and reception to occur simultaneously [even on the same antenna].” *Id.* at 7 (citing Ex. 1003 ¶ 51; Ex. 1051 ¶ 12). Petitioner further

notes that even Heath, a reference specifically named in the alleged ground of obviousness, discloses antennas which are used both for transmission and reception, supporting Petitioner's assertion that that was well-known. Reply 7–8 (citing Ex. 1005, 8:25–26, 13:15–56, 14:40–59, 23:1–3, Figures 1A, 3A; Ex. 1051 ¶ 14).

Patent Owner asserts that Petitioner's reply argument to modify Paulraj based on obviousness, including its reliance on certain disclosure in Heath, is untimely. Sur-reply 7. However, we have been instructed by the Federal Circuit to consider that argument because it is properly responsive to claim construction proposed by Patent Owner and substantially adopted by the Board. Paper 45, 5–6. *See Axonics*, 75 F.4th at 1384.

Patent Owner additionally argues that Petitioner has not provided a legally sufficient motivation for modifying Paulraj, but only attempted to show that the modification “could” have been made by one of ordinary skill in the art which is not enough for a showing of obviousness. Sur-reply 8–9. We disagree with Patent Owner. Establishing that certain technique was well-known to one of ordinary skill in the art at the effective filing date of the challenged patent constitutes sufficient motivation to make a modification in accordance with what was well-known in the art to one of ordinary skill, absent factors not present here.

Indeed, “if a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill.” *KSR*, 550 U.S. at 417. That would be the situation where a technique was well-known to one of ordinary skill in the art, unless there is actual difficulty in making the application.

The “improvement” here, although not articulated by Petitioner, is inherent with the technique, not requiring use of separate antennas for transmitting and receiving, i.e., eliminating the need for additional parts. Further, it is not necessary to show that a modification is the “best option,” because any “suitable option” would suffice. *See Intel Corporation v. Qualcomm Incorporated*, 21 F.4th 784, 800 (Fed. Cir. 2021).

Here, Patent Owner does not assert that one of ordinary skill in the art would have had difficulty modifying Paulraj to use some of the same antennas both for transmitting and for receiving. Nor does Patent Owner dispute that it was well known to one of ordinary skill in the art to use the same antenna(s) for both transmitting and for receiving. We further note the following description in the Specification of the ’083 patent: “The typical CT/MD [cellular telephone/mobile device] has one transmitter and one receiver (T/R), with one antenna.” Ex. 1001, 1:47–48. That statement is fully consistent with Petitioner’s assertion that it was well-known to use the same antenna for transmitting and for receiving.

For the foregoing reasons, notwithstanding Patent Owner’s arguments to the contrary, we determine that Petitioner sufficiently has shown that it would have been obvious to one of ordinary skill in the art to modify Paulraj such that some of the same antennas would be used both for transmitting and for receiving, according to limitations 1[b], 1[d], and 1[e].

We have reviewed Petitioner’s remaining assertions, reasonings, and evidence for claim 1, none of which has been disputed by Patent Owner apart from Patent Owner’s arguments discussed above in the context of limitations 1[b], 1[d], and 1[e], and determine that Petitioner has made a persuasive accounting therefor. Petitioner has established by a

preponderance of the evidence that claim 1 is unpatentable under 35 U.S.C. § 103 as obvious over Paulraj and Heath.

5. *Dependent Claims 2–4*

Claims 2–4 each depend, directly or indirectly, on claim 1. Patent Owner has not presented any argument with respect to claims 2–4 beyond what it has argued for independent claim 1 and discussed above. We have reviewed Petitioner’s assertions, reasonings, and evidence for claims 2–4, and determine that Petitioner has made a persuasive accounting therefor. Petitioner has established by a preponderance of the evidence that claims 2–4 are unpatentable under 35 U.S.C. § 103 as obvious over Paulraj and Heath.

6. *Independent Claims 5 and 8*

Claim 5 is reproduced below:⁶

5[pre] A portable wireless communication device comprising:

5[a] a plurality of antennas;

5[b] a processor; and

5[c] at least three transmit and receive units for
communication of three signal streams simultaneous or
sequentially;

5[d] the system configured to simultaneously transmit a first
plurality of signal streams using the plurality of antennas,
the first plurality of signal streams collectively
representing a first data stream;

5[e] the system configured to receive a second plurality of
signal streams using the plurality of antennas, the second

⁶ The bracketed labels correspond to those used by Petitioner to reference the claim elements. *See* Pet. viii–ix. We use the same labels here for ease of reference, understanding, and consistency.

plurality of signal streams collectively representing a second data stream;

- 5[f] wherein the device is configured to transmit on a plurality of frequencies including a first frequency and a second frequency;
- 5[g] wherein the transmitter is configured to transmit using a first communication protocol and a second communication protocol;
- 5[h] wherein the processor is configured to process the first data stream and the second data stream in substantially parallel; and
- 5[i] wherein the device is enabled for multiplex wireless communication of a plurality of signals using one or more channels and the plurality of antennas.

Pet. viii–ix.

Claim 8 is reproduced below:

- 8[pre] A system for a portable wireless communication device comprising:
 - 8[a] a plurality of antennas for communication of signal streams from at least one transmitter and receiver unit and/or communication component; and
 - 8[b] a processor;
 - 8[c] the system configured to transmit a first data stream by simultaneously transmitting a first plurality of signal streams using the plurality of antennas, the first plurality of signal streams collectively representing the first data stream,
 - 8[d] the system configured to receive a second data stream by simultaneously receiving a second plurality of signal streams using the plurality of antennas and generating the

second data stream from the second plurality of signal streams;

- 8[e] wherein the system is enabled for multiplexed wireless communication; and
- 8[f] wherein the system includes at least one additional transmit and receive unit;
- 8[g] wherein the system is enabled to transmit and receive using a first communication protocol and a second communication protocol;
- 8[h] wherein the processor is configured to process multiple channels and the first data stream and the second data stream in parallel; and
- 8[i] wherein the device is a cellular telephone with multiple processors; and
- 8[j] wherein the device is enabled to communicate to a server.

Pet. ix–xi.

At the outset, we note that independent claims 5 (limitations 5[a], 5[d], and 5[e]) and 8 (limitations 8[a], 8[c], and 8[d]) share the same issue of “plurality of antennas” discussed in the context of claim 1 above. In that regard, the arguments of the parties and our analysis are the same and will not be repeated here. Accordingly, the same conclusion we made in the context of claim 1 applies to claims 5 and 8.

Independent claims 5 and 8 involve issues not shared with independent claim 1. Those are discussed below.

- a) first communication protocol and second communication protocol*

With regard to claim 5’s and claim 8’s recitation of a first communication protocol and a second communication protocol, the parties

dispute whether Paulraj's disclosed multiple access techniques, e.g., TDMA, FDMA, CDMA, and OFDMA constitute communication protocols. The issue is one of claim construction and has been addressed and discussed above in Section II.C.2. We determined that "communication protocol" in claims 5 and 8 is sufficiently broad to encompass access techniques such as "CDMA," "TDMA," and "FDMA," regardless of the specific type of network.

Consequently, each of Paulraj's disclosed "access technique" is a "communication protocol." Thus, we are persuaded by Petitioner that Paulraj discloses claim 5's recitation of "wherein the transmitter is configured to transmit using a first communication protocol and a second communication protocol" and claim 8's recitation of "wherein the system is enabled to transmit and receive using a first communication protocol and a second communication protocol."

b) the processor

We determined above in Section II.C.3. that claims 5 and 8 require a single processor, which may have multiple-cores or multiple-channels within it, to process the first data stream and the second data stream in substantially parallel (claim 5), and to process the first data stream and the second data stream in parallel (claim 8), no matter how many other processors may be present and no matter what the other processors do. Claims 5 and 8 do not encompass entirely separate processors, one for processing the first data stream and one for processing the second data stream.

Petitioner relies on Paulraj's data processing block 28 (Figure 2) or data processing block 54 (Figure 3) for processing the first data stream, and Paulraj's data processing block 38 (Figure 2) or its corresponding block in Figure 4 for processing the second data stream. Pet. 49. Patent Owner

argues that Paulraj's data processing blocks 28 and 38 do not collectively constitute a single processor as claimed. PO Resp. 24. We agree with Patent Owner, despite Petitioner's arguments to the contrary.

First, Petitioner contends Paulraj's data processing blocks 28 and 38 are not separate components. Reply 16. But it is not clear what Petitioner's basis is for that assertion. As best we can determine, the reasoning appears to be that data processing blocks 28 and 38 are merely functional depictions and that Paulraj's transmitting and receiving components are contained in the same device (Reply 17, 22–23). But, still, that does not establish that Paulraj discloses use of a single processor, i.e., one and the same processor, for implementing the functions of data processing blocks 28 and 38. Thus, the argument is unpersuasive.

Second, Petitioner asserts that “Paulraj describes the claimed ‘processor’ through its combination of data processing blocks 28, 38.” Reply 16 (citing Ex. 1051 ¶ 32). But it is unclear how and where Petitioner has explained such a “combination.” Neither has an adequate explanation been provided in the cited paragraph of Dr. Jensen's supplemental declaration. Ex. 1051 ¶ 32. We have not been specifically pointed to any description in Paulraj, which effectively describes that data processing blocks 28 and 38 are implemented as one single processor, with or without multiple cores or multiple channels. Thus, the argument is unpersuasive.

Third, Petitioner contends that “Paulraj does not preclude an implementation where the functionalities of the data processing blocks 38, 28 are implemented in a ‘single processor.’” Reply 16 (citing Ex. 1051 ¶ 33). But not precluding a feature is not the same as affirmatively disclosing a feature. Thus, the argument is unpersuasive.

For the foregoing reasons, Petitioner has not shown that Paulraj discloses single processor, which may have multiple-cores or multiple-channels within it, to process the first data stream and the second data stream in substantially parallel (claim 5), or to process the first data stream and the second data stream in parallel (claim 8).

In the Petition, Petitioner also asserts:

To the extent that processor in this element requires a single processor, a POSITA would have found it obvious to implement Paulraj's processors (e.g., data processing blocks 28 and 38) in a single processor. EX-1003, ¶141. For example, it would have been known or obvious to use a single-chip multiprocessor with multiple-channels for parallel processing of multiple data streams. *Id.* (citing EX-1009, EX-1010).

Pet. 49. In its Reply, Petitioner substantially builds on this theory of obviousness. Reply 17–19. Patent Owner argues that the alleged benefits for using a single processor, articulated on page 18 of the Reply are untimely. We disagree. We do not regard these additional assertions about desirable benefits as a motivation to combine or to make a modification as untimely, because they are directly responsive to Patent Owner's proposed claim construction that there must be only a single processor which processes both the first data stream and the second data stream.

Petitioner explains:

[A] POSITA would have understood that Paulraj's data processing blocks 38, 28 represent processing functionalities when Paulraj's device operates as the receive unit and the transmit unit, respectively. *Id.* Further, it was widely known and would have been obvious to implement blocks 28 and 38 in a single processor (e.g., single-chip multiprocessor) for several known benefits, as originally noted in the Petition and further elaborated herein. EX-1009, 1 ("large amounts of parallelism"), EX-1010, 1 ("high performance"; "high throughput and low interactive response time"); EX-1061, 2:35-37 ("high-

availability parallel processing server utilizing a scalable building-block architecture”), EX-1062, 2:11-15 (“reduces wasted cycle time resulting from stalling and idling, and increases the proportion of execution time”); EX-1063, 4:36-45 (“increases the performance due to parallel and macro-scheduled execution of a multitude of program streams, high performance and efficiently synchronized data exchange between the processors”; “more simple structure and limited parallel execution abilities, which promotes to the clock frequency increase, reduces time for parallel processing, and reduces time for the processor design and verification”).

Reply 17.⁷

The above-explanations are amply supported by the cited evidence. There were numerous benefits, known to one of ordinary skill in the art, to be obtained by using a single processor to implement data processing blocks 28 and 38. Dr. Jensen further explained, in his supplemental Declaration:

Again, blocks 28 and 38 in Paulraj could be implemented in a chip that includes a single processor. Such single processor systems were well-known and a POSITA would have been motivated to implement Paulraj using a single processor to gain the known benefits of single processor systems. For example, single processor systems are (i) simple and easy to design without requiring complicated synchronization between multiple processors that exist on the same chip, (ii) easy to integrate with other hardware, (iii) a relatively small size, (iv) a lower power consumption solution than multiprocessor systems, and (v) a cost effective design. EX-1079, 1-2, 6-7; EX-1080, 1-2. The decision to use a single-chip multiprocessor system or a single-chip single processor would be a design choice made by the POSITA based on the benefits offered by each.

Ex. 1051 ¶ 35 (cited at Reply 18). We credit this testimony, which is supported by the cited evidence.

⁷ Exhibits 1009 and 1010 were initially cited in Dr. Jensen’s initial declaration. Ex. 1003 ¶ 141.

Patent Owner additionally argues that Petitioner does not address or explain why parallel processing, even if beneficial as Petitioner asserts, “may be *preferable* to parallel processing across different processors.” Sur-reply 19 (emphasis added). Patent Owner also asserts that Petitioner fails to discuss why the alleged benefits outweigh the drawbacks. *Id.* Specifically, Patent Owner states:

For example, utilizing two threads within a single processor for parallel processing requires substantial overhead to synchronize the two threads whereas using two independent processors for two independent streams (such as transmitting and receiving) does not incur such an overhead. As another example, two smaller processors may provide more design flexibility for physical layout compared to a single, larger multi-processor. This is precisely why Board rules do not permit such new evidence with the Reply, since Patent Owner cannot proffer counter evidence of its own at this stage.

Sur-reply 19. These arguments do not undermine Petitioner’s sufficient showing.

Petitioner is not required to show that its proposed modification is the best option. Rather, only a showing of “suitable option” is required. *Intel Corp. v. Qualcomm Inc.*, 21 F.4th 784, 800 (Fed. Cir. 2021). Also, “a given course of action often has simultaneous advantages and disadvantages, and this does not necessarily obviate motivation to combine.” *Medichem, S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1165 (Fed. Cir. 2006).

The Petition and the initial Declaration of Dr. Jensen (Ex. 1003 ¶ 141) already cited to Exhibits 1009 and 1010 for their disclosure of the benefits of using a single processor with multiple channels for parallel processing of multiple data streams. Pet. 49; Ex. 1003 ¶ 141. If Patent Owner wants to raise the issue of benefits not outweighing drawbacks to an extent that one of ordinary skill in the art simply would not make the proposed modification,

or that the modification is not a suitable option, Patent Owner needed to raise it in its Response so that Petitioner can then address it in the Reply. Raising these issues for the first time in the Sur-reply is belated. Patent Owner cannot reasonably assert that it has not had an earlier opportunity to raise these issues.

For the foregoing reasons, we are persuaded by Petitioner that Paulraj reasonably would have suggested to one of ordinary skill in the art using a single processor to process the first data stream and the second data stream in substantially parallel (claim 5) and to process multiple channels and the first data stream and the second data stream in parallel (claim 8).

c) transmit and receive units

Claim 5 recites: “at least three transmit and receive units for communication of three signal streams simultaneously or sequentially.”

Claim 8 recites: “a plurality of antennas for communication of signal streams from at least one transmitter and receiver unit and/or communication component,” and “wherein the system includes at least one additional transmit and receive unit.”

Petitioner provides the following annotated combined Figures 1 and 2 of Paulraj (Pet. 45) to show that Paulraj satisfies these limitations of claims 5 and 8:

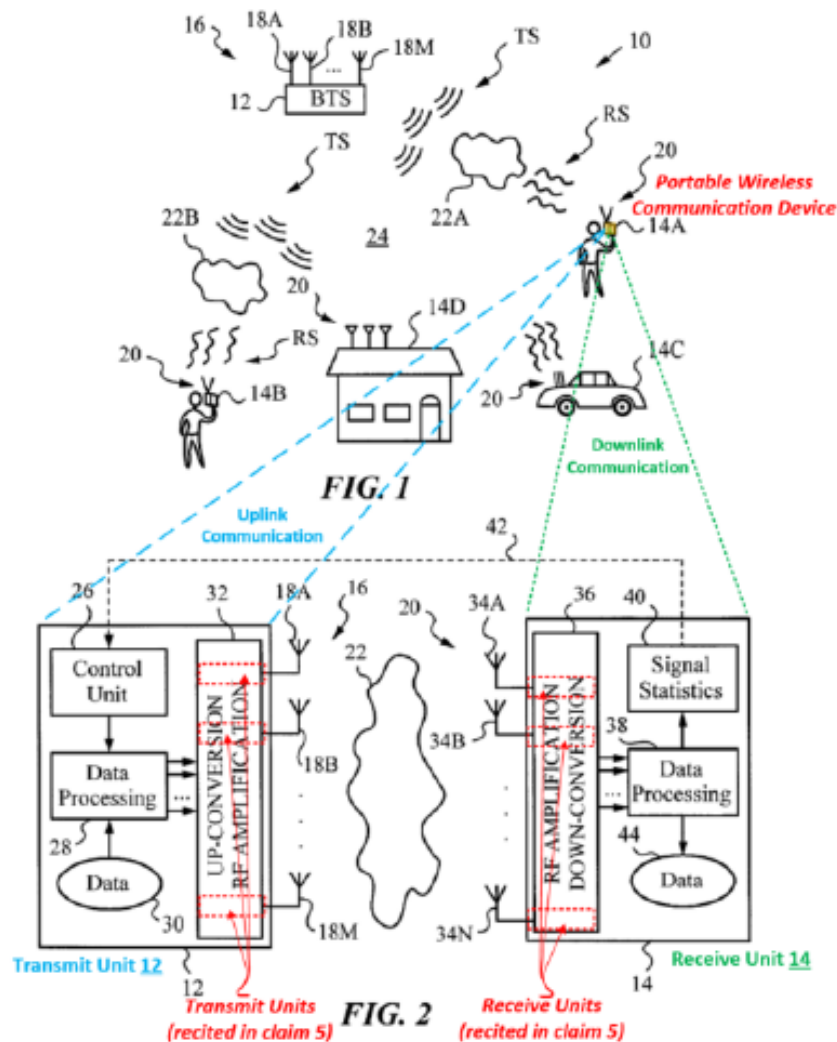


Figure 1 shows a communicating system according to Paulraj and Figure 2 shows a block diagram illustrating “the transmit and receive units” in a user device according to Paulraj. Ex. 1004, 5:21–24. Petitioner has colored in blue the uplink communication from the user to BTS and in green the downlink communication from the BTS to the user device. Petitioner also has colored in red the transmit units and the receive units.

Petitioner asserts: “a POSITA would have understood or found obvious that Paulraj’s transmit unit [12] includes (or operates as) multiple transmitters (at least three transmit units) for transmitting signal streams via

respective transmit antennas, and that the receive unit includes (or operates as) multiple receivers (at least three receive units) for receiving signal streams via respective receive antennas.” Pet. 45–46 (citing Ex. 1003, ¶ 126; Ex. 1004, 6:26–49, 8:35–40, 9:22–31). In more detail, Petitioner provides the following annotated combined Figures 6 and 7 of Paulraj (Pet. 46) (Figure 6 occupying the left half of the illustration; Figure 7 occupying the right half of the illustration):

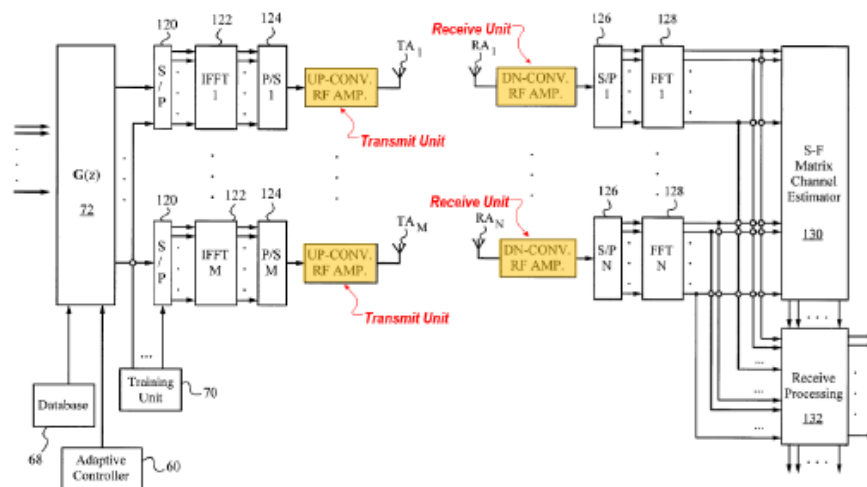


Figure 6 is a block diagram of a portion of a high level transmit unit according to Paulraj, and Figure 7 is a block diagram of a portion of a high level receive unit according to Paulraj. Ex. 1004, 5:35–39. Petitioner has colored each internal transmit unit and each internal receive unit in orange and labeled each in red.

Antenna TA₁ is not necessarily the same as antenna RA₁, and so forth for each aligned TAs and RAs, because Paulraj does not itself disclose that the same antenna is used for both transmitting and receiving. We have discussed and determined that issue in Section II.D.4 above. Partially on that basis, Patent Owner argues that Petitioner may not call a transmit unit and receive unit, which are separate from each other, as collectively forming

a “transmit and receive unit.” PO Resp. 30–32. Specifically, Patent Owner asserts:

However, it is undisputed that Paulraj’s transmitters and receivers are separate units, and Paulraj does not disclose any “unit” that is both a transmitter and a receiver.

As the Petition’s own annotation shows, Paulraj’s transmit unit 12 is a distinct unit from its receive unit 14, including with separate antennas and different processors, without any overlap of any elements [referring to Petitioner’s annotated illustration on page 45 of the Petition, reproduced above].

PO Resp. 30.

Patent Owner further asserts:

In fact, Petitioner’s expert at deposition testified that he is not even proposing to combine Paulraj’s transmit and receive units into a single unit:

Q. You’re not proposing to actually combine the transmitter and the receiver into one unit in paragraph 71?

A. **That’s not what I am proposing. It’s just that both units exist in the device.**

Ex. 2006 [Jensen-Depo.] 80:20-23.

Petitioner appears to have taken the position that disclosure of separate transmitter and receiver units disclose the claimed “transmitter and receiver unit.” Pet., 58-59. However, Petitioner provides no explanation as to why two different transmitter and receiver units disclose a single unit that is both a transmitter and a receiver.

PO Resp. 31–32.

Patent Owner’s argument has some facial appeal. It appears arbitrarily to link a particular transmit unit and a particular receive unit, in a pool of transmit units and receiver units, which are not related to each other in any way but for being present within the same device, together and call

the two as forming a “transmit and receive unit.” However, we must be cognizant that in discussing “the plurality of antennas” limitations of independent claims 1, 5, and 8 above, we concluded that Petitioner sufficiently has shown that it would have been obvious to one of ordinary skill in the art to modify Paulraj such that some of the same antennas would be used both for transmitting and for receiving, according to limitations 1[b], 1[d], and 1[e] of claim 1, limitations 5[a], 5[d], and 5[e] of claim 5, and limitations 8[a], 8[c], and 8[d] of claim 8. In that context, the illustration on page 45 of the Petition actually depicts Petitioner’s grouping of a transmit unit and a receive unit, which work with and operate on the same antenna, e.g., TA₁ and RA₁. Treating each aligned pair of transmit unit and receive unit, which work with and operate on the same antenna, as a “transmit and receive unit” is reasonable and not arbitrary. Each such “transmit and receive unit” is associated with a respective corresponding shared antenna.

Patent Owner has not argued that a “transmit and receive unit” must have its own exclusive housing separate from other “transmit and receive units,” and we see no reason why it must. The Specification also contains no definition of any kind for “transmit unit,” “receive unit,” “transmit and receive unit,” and “unit.” Further, Petitioner is relying on the orange colored boxes which are labeled in red in Figures 6 and 7 as “Transmit Unit” and “Receive Unit,” rather than blue colored element 12 in Figure 2 as Transmit Unit and green colored element 14 in Figure 2 as “Receive Unit.” Consequently, Petitioner’s illustration on page 45 of the Petition shows the “at least three transmit and receive units for communication of three signal streams simultaneously or sequentially” as required by claim 5 and also the number of “transmit and receive unit” required by claim 8.

For the foregoing reasons, we are persuaded by Petitioner that Paulraj reasonably would have suggested the requirement in claim 5 that there be “at least three transmit and receive units for communication of three signal streams simultaneous or sequentially,” and the requirement in claim 8 that there be “at least one transmitter and receiver unit and/or communication component,” and “wherein the system includes at least one additional transmit and receive unit.”

d) Conclusion for Claims 5 and 8

We have reviewed Petitioner’s remaining assertions, reasonings, and evidence for claims 5 and 8, none of which has been disputed by Patent Owner apart from Patent Owner’s arguments already discussed above, and determine that Petitioner has made a persuasive accounting therefor. Petitioner has established by a preponderance of the evidence that claims 5 and 8 are unpatentable under 35 U.S.C. § 103 as obvious over Paulraj and Heath.

7. Claims 6 and 9

Claim 6 depends from claim 5 and claim 9 depends from claim 8. We have reviewed Petitioner’s assertions and corresponding evidence presented for claims 6 and 9 and find them persuasive. Patent Owner raises no argument not already discussed and determined above in the context of claims 5 and 8. Petitioner has proved by a preponderance of the evidence that claims 6 and 9 are unpatentable under 35 U.S.C. § 103 as obvious over Paulraj and Heath.

8. Claim 7

Claim 7 depends from claim 6 and further recites “wherein the device operates with a plurality of streams including a first stream and a second

stream and multipath communication.” Ex. 1001, 12:54–56. Petitioner asserts:

As noted, Paulraj’s user device operates to transmit the **first plurality of signal streams** (5[d]) and receive the **second plurality of signal streams** (5[e]), thereby **operating with a plurality of streams including a first stream and a second stream**. See 5[d] and 5[e]; EX-1003, ¶151.

Further, referring to Figure 2, Paulraj’s device communicates with the BTS via multiple paths (**multipath communication**) by transmitting multiple signal streams using multiple antennas, and receiving the transmitted multiple signal streams using multiple antennas. EX-1004, 6:4-7 (“multi-path fading”). 7:20-40, 9:1-12, 9:22-31, 9:46-48, 10:42-46; EX-1003, ¶152; EX-1005, 11:5-46.

Pet. 56. Patent Owner asserts that “multipath communication” requires communication through different networks each forming a separate path of communication, and cannot be met by using multiple antennas for transmitting a signal stream through a single network, e.g., wireless network or cellular network. PO Resp. 33–39. We addressed and rejected this argument in Section II.C.4 above. We are persuaded by Petitioner that Paulraj discloses the added limitations of claim 7. We determine that Petitioner has proved by a preponderance of the evidence that claim 7 is unpatentable under 35 U.S.C. § 103 as obvious over Paulraj and Heath.

9. *Claim 12*

Claim 12 is reproduced below:

12[pre] A portable wireless device communication system including at least one processor in communication with a radio frequency (RF) module and a plurality of antennas, the communication system comprising:

12[a] a communication unit coupled to the plurality of antennas, a transmitter, and a receiver,

- 12[b] the communication unit configured to transmit a first data stream by simultaneously transmitting a first signal stream using the plurality of antennas,
- 12[c] the communication unit configured to receive a second stream simultaneously using the plurality of antennas;
- 12[d] wherein each signal is processed for a specific frequency band of the signal;
- 12[e] wherein the system is enabled to process at least two signal streams separately;
- 12[f] wherein the system is enabled for multiband communication;
- 12[g] wherein the system is configured to process the plurality of signal streams and/or a plurality of data streams in parallel via multiple channels and
- 12[h] wherein the system is enabled to process a plurality of streams parallel; and
- 12[i] wherein the system is enabled for multiplex communication of wireless signals using one or more channels and the plurality of antennas.

Pet. 13:26–14:9.

Independent claim 12 (limitations 12[a], 12[b], and 12[c]) share the same issue of “plurality of antennas” discussed in the context of claim 1 above. In that regard, the arguments of the parties and our analysis are the same and will not be repeated here. The same conclusion we made in the context of claim 1 applies to claim 12.

We have reviewed Petitioner’s remaining assertions, reasonings, and evidence for claim 12, none of which has been disputed by Patent Owner apart from Patent Owner’s arguments discussed above in the context of claim 1, and determine that Petitioner has made a persuasive accounting

therefor. Petitioner has established by a preponderance of the evidence that claim 12 is unpatentable under 35 U.S.C. § 103 as obvious over Paulraj and Heath.

10. Claims 13 and 15–20

Claims 13 and 15–20 each depend, directly or indirectly, from claim 12. We have reviewed Petitioner’s assertions and corresponding evidence presented for claims 13 and 15–20 and find them persuasive. Patent Owner raises no argument not already discussed and determined above in the context of claim 12. Petitioner has proved by a preponderance of the evidence that claims 13 and 15–20 are unpatentable under 35 U.S.C. § 103 as obvious over Paulraj and Heath.

11. Claim 14

Claim 14 depends from claim 13 and further recites “wherein the system is enabled to send and receive a plurality of streams using multipath communication.” Ex. 1001, 14:12–14. Petitioner makes the same arguments for claim 14 as it does for claim 7. Pet. 80. Patent Owner makes the same argument for claim 14 as Patent Owner does for claim 7, i.e., that “multipath communication” requires communication through different networks each forming a separate path of communication, and cannot be met by using multiple antennas for transmitting a signal stream through a single network, e.g., wireless network or cellular network. PO Resp. 33–39. We addressed and rejected this argument of Patent Owner in Section II.C.4 above.

We are persuaded by Petitioner that Paulraj discloses the added limitations of claim 14. We determine that Petitioner has proved by a preponderance of the evidence that claim 14 is unpatentable under 35 U.S.C. § 103 as obvious over Paulraj and Heath.

III. CONCLUSION⁸

We determine that Petitioner has proved by a preponderance of the evidence that claims 1–9 and 12–20 of the '083 patent are unpatentable.

In summary:

Claims	35 U.S.C. §	References/Basis	Claims Shown Unpatentable	Claims Not shown Unpatentable
1–9, 12–20	103	Paulraj, Heath	1–9, 12–20	
Overall Outcome			1–9, 12–20	

IV. ORDER

In consideration of the foregoing, it is hereby

ORDERED that claims 1–9 and 12–20 of the '083 patent have been proved unpatentable by a preponderance of the evidence; and

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

⁸ Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this Decision, we draw Patent Owner's attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. See 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. See 37 C.F.R. § 42.8(a)(3), (b)(2).

IPR2022-01002
Patent 9,191,083 B1

FOR PETITIONER:

Andrew Ehmke
Clint Wilkins
HAYNES AND BOONE, LLP
andy.ehmke.ipr@haynesboone.com
clint.wilkins.ipr@haynesboone.com

Walter Renner
Jeremy Monaldo
Hyun Jin In
Sangki Park
Amir A. Kazi
Christopher O. Green
FISH & RICHARDSON P.C.
Axf-ptab@fr.com
jjm@fr.com
in@fr.com
spark@fr.com
kazi@fr.com
cgreen@fr.com

FOR PATENT OWNER:

Kenneth Weatherwax
Parham Hendifar
Vinson Lin
LOWENSTEIN & WEATHERWAX LLP
weatherwax@lowensteinweatherwax.com
hendifar@lowensteinweatherwax.com
lin@lowensteinweatherwax.com

Philip J. Graves
Greer N. Shaw
GRAVES & SHAW LLP
pgraves@pgravesshaw.com
gshaw@gravesshaw.com