

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CELLCO PARTNERSHIP D/B/A VERIZON WIRELESS,
Petitioner,

v.

GENERAL ACCESS SOLUTIONS, LTD.,
Patent Owner.

IPR2023-00978¹
Patent 7,230,931 B2

Before MELISSA A. HAAPALA, *Acting Deputy Chief Administrative Patent Judge*, and KEN B. BARRETT and TERENCE W. McMILLIN, *Administrative Patent Judges*.

BARRETT, *Administrative Patent Judge*.

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

¹ The Board joined Ericsson Inc. and Nokia of America Corporation as petitioners in this proceeding in IPR2024-00392 and IPR2024-00461, respectively.

I. INTRODUCTION

A. *Background and Summary*

Cellco Partnership d/b/a Verizon Wireless (“Petitioner” or “Verizon”)² filed a Petition requesting *inter partes* review of U.S. Patent No. 7,230,931 B2 (“the ’931 patent,” Ex. 1001). Paper 2 (“Pet.”). The Petition challenges the patentability of claims 28 and 29 of the ’931 patent. We instituted an *inter partes* review of all challenged claims on all proposed grounds of unpatentability. Paper 20.

Following institution, Ericsson Inc. and Nokia of America Corporation each filed a petition substantially identical to Verizon’s petition. *See* IPR2024-00392, Paper 2 (Ericsson); IPR2024-00461, Paper 1 (Nokia). Those proceedings were instituted and joined with this one. Papers 29, 30. Both Ericsson and Nokia agreed to an “understudy role” in this proceeding. *See* IPR2024-00392, Paper 3, 1–2; IPR2024-00461, Paper 3, 2.

General Access Solutions, Ltd. (“Patent Owner”)³ filed a Response to the Petition. Paper 25 (“PO Resp.”). Petitioner filed a Reply (Paper 31, “Pet. Reply”) and Patent Owner filed a Sur-reply (Paper 35, “PO Sur-reply”).

An oral hearing was held on September 17, 2024, and a transcript of the hearing is included in the record. Paper 42 (“Tr.”).

This Final Written Decision is entered pursuant to 35 U.S.C. § 318(a). For the reasons discussed below, we determine that Petitioner has shown by

² Petitioner identifies Cellco Partnership d/b/a Verizon Wireless, Verizon Communications Inc., and Verizon Corporate Resources Group LLC as real parties in interest. Pet. 3–4.

³ Patent Owner identifies General Access Solutions, Ltd. as the real party in interest. Paper 5, 1.

a preponderance of the evidence that claims 28 and 29 of the '931 patent are unpatentable.

B. Related Proceedings

One or both parties identify, as matters involving or related to the '931 patent, *General Access Solutions, Ltd. v. Cellco Partnership d/b/a Verizon Wireless et al.*, No. 2-22-cv-00394 (E.D. Tex.) (currently pending), *General Access Solutions, Ltd. v. Virgin Mobile USA, L.P. et al.*, No. 2-20-cv-00007 (E.D. Tex.) (no longer pending), and *General Access Solutions, Ltd. v. Sprint Corp. et al.*, No. 2-16-cv-00465 (E.D. Tex.) (no longer pending). Pet. 4–5; Paper 5, 1.

Additionally, the parties note that the '931 patent was the subject of a prior *inter partes* review before the Patent Trial and Appeal Board in *Sprint Spectrum LP v. General Access Solutions, Ltd.*, IPR2017-01889. Pet. 4–5; Prelim. Resp. 1. That *inter partes* review was the subject of a decision by the United States Court of Appeals for the Federal Circuit. *Sprint Spectrum L.P. v. General Access Sols., Ltd.*, 812 F. App'x 999 (Fed. Cir. 2020) (non-precedential).

C. The '931 Patent

The '931 patent describes a burst packet transmission media access system using selectively adaptable beam forming in a fixed wireless access network. Ex. 1001, 3:28–31. The fixed wireless network may comprise a plurality of transceiver base stations that transmit forward channel (downlink or downstream) broadband signals to subscriber premises and receive reverse channel (uplink or upstream) broadband signals from subscriber premises. *Id.* at Fig. 1, 11:57–64. Each of the transceiver base stations may cover a cell site that is divided into a plurality of sectors. *Id.* at Fig. 2,

12:25–27. Pre-programmed sets of directed beam patterns are used to cover a cell in an angular fashion, which is referred to as “beam scanning.” *Id.* at 28:1–3. The base station establishes a set of beams to cover the cell and based on physical location in the sector, a specific beam is used to communicate with one or more subscribers that lie in that sector. *Id.* at 28:9–12.

Figure 14 of the '931 patent is reproduced below:

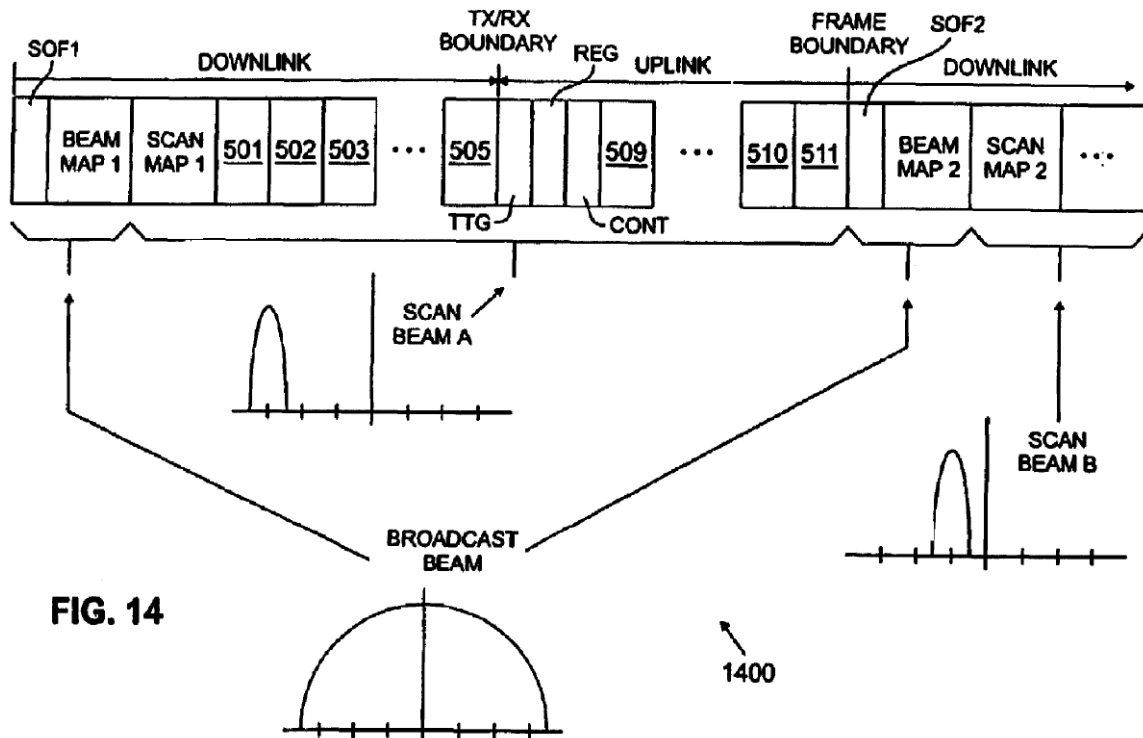


Figure 14 illustrates the use of broadcast beams and scanning beams in exemplary time division duplex (TDD) signal 1400. *Id.* at 29:3–5. TDD signal 1400 comprises a first TDD frame having a downlink portion comprising a first start-of-frame field (SOF1), a first beam map field (Beam Map 1), and a first scan map field (Scan Map 1). *Id.* at 29:6–10. “The remainder of the downlink portion comprises preamble field 501, management field 502, and N modulation groups, including exemplary modulation groups 503 and 505.” *Id.* at 29:10–13. “[A] modulation group

is a group of downlink slots transmitted to one or more subscribers using a common scheme of one or more of: 1) modulation format, 2) FEC [(forward error correction)] codes, and 3) physical beam forming.” *Id.* at 19:31–35.

The first TDD frame is followed by a second TDD frame, which comprises a second start-of-frame field (SOF2), a second beam map field (Beam Map 2), and a second scan map field (Scan Map 2). *Id.* at 29:21–25. A spread spectrum Broadcast Beam is used to transmit start-of-frame fields SOF1, SOF2 and beam map fields Beam Map 1, Beam Map 2 in each TDD frame. *Id.* at 29:26–30. Distinct scan beams (Scan Beam A and Scan Beam B) are used to transmit the scan map fields (Scan Map 1 and Scan Map 2) and the remainder of the uplink and downlink portions of each TDD frame. *Id.* at 29:30–33.

Broadcast Beam Maps 1, 2 provide data indicating which scanning beam (or beams) are used at which time for the frame and also transmit a synchronization field so that all subscribers can maintain synchronization. *Id.* at 29:34–36, 29:47–50. Scanning Beam Maps A, B provide the uplink and downlink map, which state at which time in the frame, using the scanning beam described in the associated Broadcast Beam Map, the downlink modulation groups and specific uplink slots are allocated for the frame using the specific scanning beam. *Id.* at 29:38–43.

D. Illustrative Claim

Challenged claim 28 depends directly from now-canceled independent claim 1. Challenged claim 29 depends directly from now-canceled independent claim 19. Dependent claim 28 is illustrative and is reproduced below along with the limitations of underlying independent claim 1.

1. For use in a wireless access network comprising a plurality of base stations, each of said plurality of base stations

capable of bidirectional time division duplex (TDD) communication with wireless access devices disposed at a plurality of subscriber premises in an associated cell site of said wireless access network, a transceiver associated with a first of said plurality of base stations comprising:

transmit path circuitry associated with a beam forming network capable of transmitting directed scanning beam signals each directed to substantially only wireless access devices within a different one of a plurality of sectors of a cell site associated with said first base station, wherein said transmit path circuitry

transmits, at a start of a TDD frame, a broadcast beam signal to wireless access devices within more than one of said sectors, the broadcast beam signal comprising a start of frame field, and

subsequently transmits, in a downlink portion of said TDD frame, first downlink data traffic to substantially only wireless access devices within one of said sectors using one of said directed scanning beam signals.

28. The transceiver as set forth in claim 1 wherein said transmit path circuitry transmits, in said downlink portion of said TDD frame, second downlink data traffic to substantially only wireless access devices within an other of said sectors using an other of said directed scanning beam signals.

Ex. 1001, 30:31–52, 33:4–9. Dependent claim 29 recites a method of communicating that includes the step of “transmitting” the second download data traffic in the manner substantially similar to that recited in claim 28. *Id.* at 32:21–22, 34:1–6.

E. Evidence

Petitioner relies on the following references:

Name	Reference	Exhibit(s)
Vornefeld	U. Vornefeld, et al., <i>SDMA Techniques for Wireless ATM</i> , IEEE COMMUNICATIONS MAGAZINE (Nov. 1999)	1004

Name	Reference	Exhibit(s)
Atsuta	US 6,160,800, issued Dec. 12, 2000	1005
Goldburg	US 6,154,661, issued Nov. 28, 2000	1006
Youssefmir	US 6,795,409 B1, issued Sept. 21, 2004	1007
Tangemann	M. Tangemann, <i>Influence of the User Mobility on the Spatial Multiplex Gain of an Adaptive SDMA System</i> , WIRELESS NETWORKS – CATCHING THE MOBILE FUTURE, PROCEEDINGS OF THE 5TH IEEE INTERNATIONAL SYMPOSIUM ON PERSONAL, INDOOR AND MOBILE RADIO COMMUNICATIONS (1994)	1008

Petitioner also relies on the declarations of Kevin C. Almeroth, Ph.D. (Exs. 1002, 1025) in support of its arguments, and Patent Owner relies on the declaration of Douglas A. Chrissan, Ph.D. (Ex. 2028) in support of its arguments. The parties also rely on other exhibits as discussed below.

F. Asserted Grounds of Unpatentability

Petitioner asserts that the challenged claims are unpatentable on the following grounds:

Claim(s) Challenged	35 U.S.C. § ⁴	Reference(s)/Basis
28, 29	103(a)	Vornefeld, Atsuta
28, 29	103(a)	Vornefeld, Goldburg
28, 29	103(a)	Youssefmir, Atsuta
28, 29	103(a)	Vornefeld, Atsuta, Tangemann
28, 29	103(a)	Vornefeld, Goldburg, Tangemann

II. PROCEDURAL HISTORY

All of the claims of the '931 patent have been before the Board in a previous *inter partes* review, specifically IPR2017-01889 (the “prior IPR”). *See* Ex. 1009, 2 (IPR2017-01889, Paper 43 (Final Written Decision dated

⁴ The '931 patent was filed before the effective date of the Leahy Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) (“AIA”), and we apply the pre-AIA version of 35 U.S.C. § 103.

March 7, 2019)). The petitioner in that prior IPR was Sprint Spectrum L.P. (“Sprint” or “the prior petitioner”). *Id.*

In the prior IPR, Patent Owner, in its response to the petition and again at oral argument, conceded that Vornefeld anticipates the independent claims of the ’931 patent. *See* Ex. 1009, 7 (IPR2017-01889, Paper 43 (the 2019 Final Written Decision citing and parenthetically quoting Patent Owner’s Response and the hearing transcript)). At the oral argument, counsel for Patent Owner stated:

I’ll also point out I’m not disputing that Petitioner has provided good evidence the independent claims are not valid. We concede that. And what’s claimed in the independent claims is the combination of a TDD transmission, time division duplex, a broadcast beam and a directed beam, with that broadcast beam being the announcement beam. And, Judge Haapala, . . . you asked if a broadcast beam was shown in Vornefeld. We concede that it is.

And our inventor, Mr. Struhsaker, thought that was what they had. They thought they had come up with the combination of TDD, which wasn’t new, with this broadcast announcement beam with directed beams and that’s what they put in their independent claims. Now, whoever Vornefeld was that was writing articles for the IEEE out in the wilderness somewhere, they didn’t know that he had written that article, but it’s out there. It’s a printed publication. It knocks out our independent claims. We concede that.

Ex. 1015, 56:19–57:9; *see also* Ex. 1011, 2 n.1 (Patent Owner Response in the prior IPR: “Patent Owner does not herein dispute the patentability of the independent claims 1, 10 and 19 of the ‘931 patent.”).

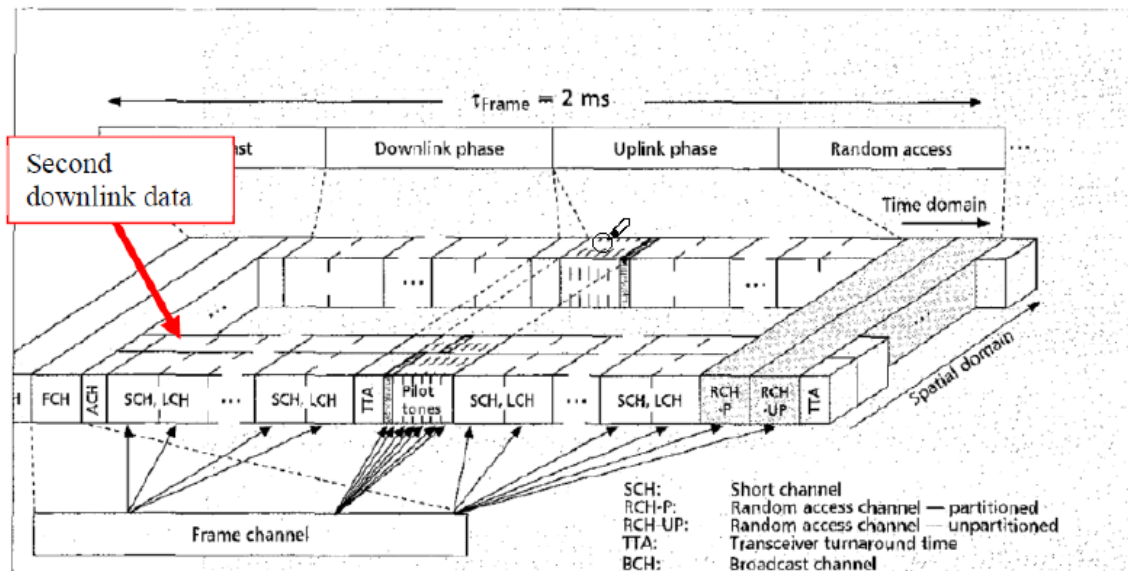
In light of this concession of unpatentability, the Board entered adverse judgment against Patent Owner as to independent claims 1, 10, and 19. Ex. 1009, 7. The Board went on to determine that prior petitioner Sprint had not met its burden to prove the unpatentability of the remaining

challenged claims, including the two presently before us. *Id.* at 7–32; *see e.g., id.* at 22–24, 30–31 (discussing dependent claims 28 and 29).

We will now discuss in detail the disposition of the prior petitioner’s challenges to dependent claims 28 and 29. The prior petitioner asserted that dependent claims 28 and 29 were anticipated by Vornefeld or would have been obvious over Vornefeld and Andersson⁵. Ex. 1009, 15. Independent claim 1, for example, calls for circuitry where first downlink data is transmitted in the download portion of a TDD frame to devices in one sector using a directed scanning beam signal. *See* Ex. 1001, 30:48–52. Claim 28 depends directly from independent claim 1 and adds the requirement of second downlink data being transmitted in the same downlink portion as the first downlink data but being transmitted to devices in another sector and using another directed scanning beam signal. *See id.* at 33:4–9.

As the Board explained, the prior petitioner argued that “Figure 3 of Vornefeld clearly shows ‘second downlink data traffic’ being transmitted in the downlink portion of the frame using a different directed scanning beam signal,” and the prior petitioner provided an annotated version of Figure 3, which we have reproduced below. Ex. 1009, 22 (the 2019 Final Written Decision setting out the contentions).

⁵ U.S. Patent No. 6,470,177 B1, issued Oct. 22, 2002.



■ Figure 3. The basic frame structure of the spatially extended MAC protocol.

Figure 3, as annotated by the prior petitioner, illustrates the prior petitioner's assertions that Vornefeld discloses second downlink data in its spatially extended medium access control (MAC) protocol. *Id.* (citing page 35 of the prior petition). As shown in the annotated figure, the prior petitioner identified the second row as containing the "second download data" of dependent claim 28. The prior petitioner further asserted that the figure "shows a single frame with multiple channels being transmitted in parallel in the spatial domain and that each channel represents a different directive scanning beam." *Id.* at 23 (citing page 15 of the prior petitioner's reply).

The Board was not persuaded by the prior petitioner's arguments, stating:

[The prior petitioner] has not met its burden to establish claim 28 is anticipated by, or would have been obvious over, Vornefeld. Claim 28 requires the transmit circuitry to transmit second downlink data traffic in the same (said) downlink portion of the same (said) TDD frame recited in claim 1. The block that Petitioner relies on for the second downlink data traffic is depicted as a different (spatially separated) TDD frame that is simultaneously transmitted with the other frames. *See*

Pet. 35; *see also* Ex 1004, 54 (describing concurrent transmission of MAC PDUs in the spatial domain). We agree with Patent Owner that [p]etitioner does not establish Vornefeld discloses using different beams in the same TDD frame (i.e., second downlink data traffic, transmitted in “said downlink portion of said TDD frame”) to transmit to devices within a different sector.

Id. at 23. The Board further stated that the prior petitioner relied on the same analysis in its challenge to dependent claim 29 and that the prior petitioner did not rely on the secondary reference, Andersson, for the recited features. *Id.* at 24. The Board thus concluded that the prior petitioner had not met its burden to demonstrate the unpatentability of either dependent claim 28 or dependent claim 29. *Id.*; *see also id.* at 30–31 (determining that the prior petitioner also failed to make an adequate showing for another ground (based on Newman, Ahy, and Andersson) because the analysis did not address the specific limitations recited in claims 28 and 29).

Sprint appealed the Board’s decision. The Federal Circuit reviewed the Board’s findings concerning dependent claims 28 and 29, and affirmed the Board’s decision regarding those claims. *See Sprint Spectrum L.P.*, 812 F. App’x at 1006–07. In identifying the pertinent finding under review, the Court stated: “The Board rejected Sprint’s view, finding instead that Figure 3 of Vornefeld discloses *multiple* spatially separated frames that are simultaneously transmitted in parallel—not a *single* frame with ‘second downlink data traffic,’ as required by claims 28 and 29.” *Id.* at 1006. The Court discussed Vornefeld’s Figure 3 and related disclosures, and concluded that, “[b]ecause the Board’s understanding of Figure 3 of Vornefeld is reasonable in view of these disclosures, it is supported by substantial evidence,” and “[w]e therefore affirm the Board’s determination as to claims 28 and 29.” *Id.* at 1007.

Independent claims 1, 10, and 19 were not on appeal because Patent Owner had conceded the unpatentability of those claims. *Id.* at 1000–01. As to the remaining claims on appeal, the Court determined that the Board’s construction of “a first beam map containing scanning beam information usable by said wireless access devices to detect said directed scanning beam signals” of claims 2, 11, and 20 was not the broadest reasonable interpretation (the standard applicable at that time). *Id.* at 1005. For that reason, the Court vacated the Board’s unpatentability determinations as to claims 2, 11, 20, and the claims that depend therefrom, and remanded the case for analysis under the proper construction. *Id.* The subject claim phrase is not at issue in the challenged claims now before us.

In a Final Written Decision on Remand, the Board determined that the prior petitioner had demonstrated by a preponderance of the evidence that claims 2–9, 11–18, and 20–27 were unpatentable either as anticipated by Vornefeld (including claims 2 and 20, which depend directly from independent claims 1 and 19) or as being obvious over Vornefeld in combination with one or more other references. Ex. 1010, 26 (IPR2017-01889, Paper 61 (Final Written Decision dated January 29, 2021)). The Board stated that “[t]he Federal Circuit affirmed our Decision as to claims 28–29, and thus, those claims are not before the Board on remand.” *Id.* at 3. Independent claims 1, 10, 19, having been the subject of adverse judgment, also were not before the Board on remand. *Id.* at 13 n.5. Subsequently, claims 1–27 were canceled. Ex. 1001, *Inter Partes* Review Certificate (issued Nov. 15, 2021) (located at the end of the challenged patent).

III. ANALYSIS

A. Principles of Law

Petitioner bears the burden of persuasion to prove unpatentability of the claims challenged in the Petition, and that burden never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015). To prevail, Petitioner must establish by a preponderance of the evidence that the challenged claims are unpatentable. 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d).

A patent claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) if present, any objective evidence of obviousness or non-obviousness.⁶ *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

B. The Level of Ordinary Skill in the Art

In determining the level of ordinary skill in the art, various factors may be considered, including the “type of problems encountered in the art; prior art solutions to those problems; rapidity with which innovations are made; sophistication of the technology; and educational level of active

⁶ The parties have not directed our attention to any objective evidence of obviousness or non-obviousness.

workers in the field.” *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995) (quoting *Custom Accessories, Inc. v. Jeffrey–Allan Indus., Inc.*, 807 F.2d 955, 962 (Fed. Cir. 1986)).

Petitioner contends that:

A person of ordinary skill in the art (“POSA”) at the time of the purported invention would have a bachelor’s degree in computer science, electrical or computer engineering, or a related field, and at least 2 years of work or research experience in digital communications systems, such as wireless communications systems and networks, or equivalent, or a Master’s degree in electrical engineering, computer engineering, computer science or similar field. Ex. 1002, ¶42. Additional education could compensate for less practical experience and vice versa. *Id.*

Pet. 12. Patent Owner does not address the level of ordinary skill in the art. *But see* Ex. 2028 ¶ 19 (Patent Owner’s witness, Dr. Chrissan, stating: “Patent Owner has not offered a different understanding of a POSITA [as set forth in the Petition], and the PTAB accepted Petitioner’s submission. . . . [F]or the purposes of the subject IPR proceedings, I accept and use Petitioner’s and the PTAB’s definition of a POSITA.”).

Petitioner’s definition is consistent with the level of ordinary skill reflected in the prior art references of record. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (recognizing that the prior art itself may reflect an appropriate level of skill in the art). For purposes of this decision, we apply Petitioner’s definition of the person of ordinary skill in the art.

C. Claim Construction

We apply the same claim construction standard used in district court actions under 35 U.S.C. § 282(b), namely that articulated in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). *See* 37 C.F.R. § 42.100(b).

In applying that standard, claim terms generally are given their ordinary and customary meaning as would have been understood by a person of ordinary skill in the art at the time of the invention and in the context of the entire patent disclosure. *Phillips*, 415 F.3d at 1312–13. “In determining the meaning of the disputed claim limitation, we look principally to the intrinsic evidence of record, examining the claim language itself, the written description, and the prosecution history, if in evidence.” *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 469 F.3d 1005, 1014 (Fed. Cir. 2006) (citing *Phillips*, 415 F.3d at 1312–17). “[W]hile extrinsic evidence can shed useful light on the relevant art, . . . it is less significant than the intrinsic record in determining the legally operative meaning of claim language.” *Phillips*, 415 F.3d at 1317 (internal quotation marks omitted).

The Petition states, “Claims 28 and 29 would have been obvious under any reasonable construction pursuant to *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc).” Pet. 12. Petitioner asserts that Patent Owner advances, in related district court litigation, an implied proposed construction of “sector” as “simply ‘a portion of the cell site.’ ” *Id.* at 13–14 (citing Ex. 1016, Ex. A at 35 (infringement contentions)). Petitioner states that, “[t]o the extent a construction is necessary, Petitioner relies on Patent Owner’s implicit construction in the Related Litigation.” *Id.* Petitioner also contends that “this Petition demonstrates that the Challenged Claims are obvious over the prior art under any reasonable construction of ‘sector,’ including a narrower construction, such as a section of the cell site defined by the transmission area of a corresponding antenna array.” *Id.* at 14; *see also, e.g., id.* at 18–19

(Petitioner offering contentions “[u]nder Patent Owner’s definition of ‘sector’” and under this narrower construction).

After the Petition was filed and after we instituted an *inter partes* review but before Patent Owner filed its Response to the Petition, the District Court, in the related litigation, issued a claim construction order construing several terms of the ’931 patent. Ex. 2027. The District Court “construe[d] ‘sectors’ as ‘areas defined by an arc around the cell site, each covered by its own antenna.’” *Id.* at 18.

Patent Owner, in its Response, made us aware of the District Court’s claim construction order and stated that “[p]articularly relevant to Petitioner’s Grounds is the district court’s construction of ‘sector[s].’” PO Resp. 29–31. Patent Owner’s Response does not affirmatively advocate for adoption of the District Court’s construction and does not offer an explicit construction for that term. *See id.*

Petitioner, in its Reply, states:

[Patent Owner] GAS largely avoids taking claim construction positions. While noting the District Court’s claim construction findings, GAS does not specifically adopt the construction of, e.g., “sector,” or offer alternatives.

Pet. Reply 4 (citing PO Resp. 29–31). We observe that Petitioner’s Reply also does not “specifically adopt” the court’s construction. *See id.*

The parties, at oral argument, confirmed that a construction of “sector” is not necessary to decide this case. *See* Tr. 14:9–15:3 (Petitioner: “JUDGE MCMILLIN: Do we need to engage in claim construction in order to decide this case? MR. ROSENTHAL: I don't believe so, Your Honor.”); *id.* at 62:13–18 (Patent Owner: “That [prior IPR] proceeding was decided and did not turn on a definition of sector. In this case, this doesn’t need to turn on the definition of sector either.”).

On this record and for purposes of this decision, we determine that no claim terms require express construction.

*D. The Obviousness of Claims 28 and 29
Over Vornefeld and Atsuta (Ground 1)*

Petitioner contends that dependent claims 28 and 29 of the '931 patent would have been obvious over Vornefeld and Atsuta. *See, e.g.*, Pet. 15–21 (addressing the limitations of independent claim 1), 23–38 (addressing dependent claim 28). Petitioner contends that Vornefeld discloses the subject matter of the underlying independent claims and, for the added limitations of dependent claims 28 and 29, that Atsuta teaches that “using one frame to define the timeslots for transmission to different sectors was known in the field.” *See id.* at 2–3.

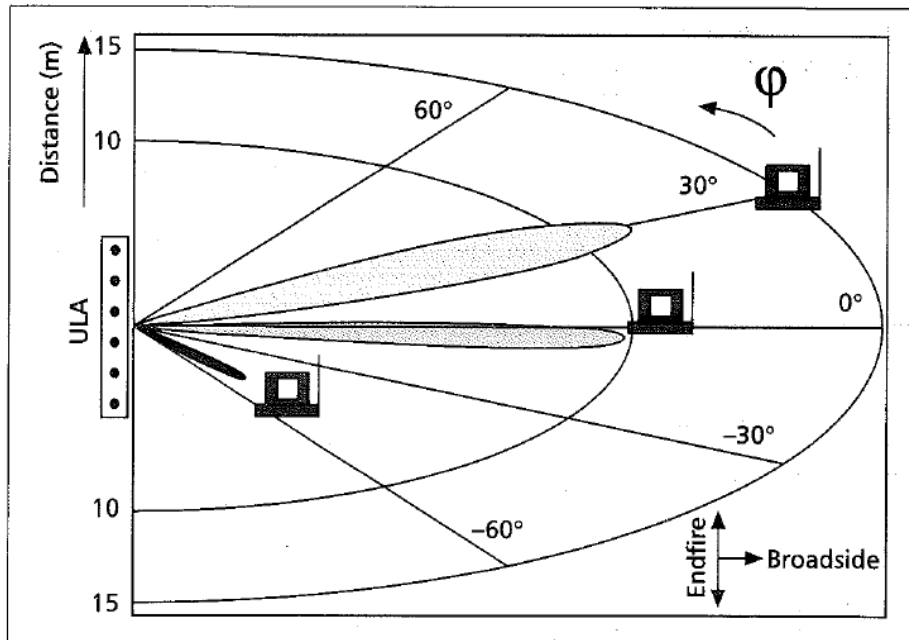
Patent Owner argues that Atsuta does not disclose a downlink transmission in a TDD frame and that a person of ordinary skill in the art would not combine Petitioner’s relied-on references. *See, e.g.*, PO Resp. 1– 3.

1. Vornefeld (Ex. 1004)

Vornefeld describes a joint time-division multiple access (TDMA) and space-division multiple access (SDMA) approach in the context of the HIPERLAN/2 system, which provides wireless network broadband services with guaranteed quality of service. Ex. 1004, 52. Vornefeld discloses that “[t]he deployment of a smart array antenna with several antenna elements opens up the spatial dimension within the single radio cell and permits, together with advanced signal processing techniques, the use of true space-division multiple access (SDMA),” and that “[t]his access technique allows different users to be served on the same frequency channel at the same time.” *Id.* “The ability to set up multiple antenna beams that can be

electronically directed to the mobile terminal (MT) locations adaptively leads to an increase in capacity and reduces signal interference.” *Id.* Depending on the number of antenna elements and the applied beamforming algorithm, array antennas are able to simultaneously direct several beams conveying individual user signals to different positions. *Id.* at Fig. 2, 53. The system uses a medium access control (MAC) protocol to coordinate the access of MTs to the shared radio channel. *Id.* at 54.

Vornefeld’s Figure 2 is reproduced below.



■ **Figure 2.** *Simultaneous transmission using directive beams.*

Figure 2 depicts a uniform linear array (ULA) antenna simultaneously transmitting to three positions using directive beams. *See id.* at 52, (ULA acronym), 53 (“Depending on the number of antenna elements and the applied algorithm, array antennas are able to simultaneously direct several beams to different positions conveying individual user signals (Fig. 2).”). Vornefeld also states that, “[d]ue to the single-element antenna characteristic, the covered area of the ULA is restricted to values below

180°; a triangular configuration of three ULAs might be used to cover the whole radio cell.” *Id.* at 52.

Figure 3 of Vornefeld is reproduced below:

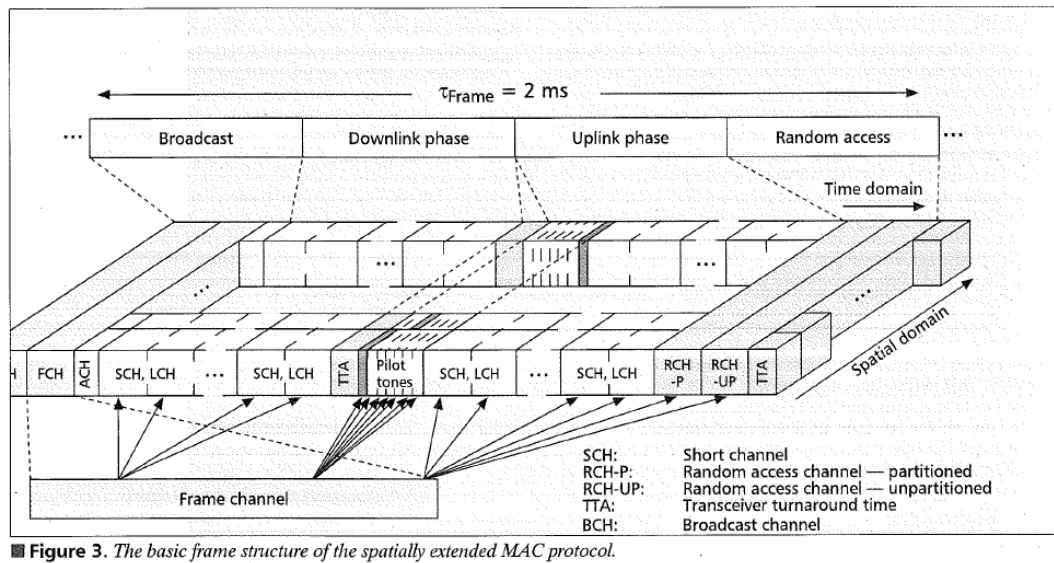


Figure 3 illustrates the basic MAC frame structure of the spatially extended MAC protocol. *Id.* at Fig. 3. MAC frame starts with broadcast channel (BCH), followed by frame channel (FCH), then a downlink phase, an uplink phase, and random access channels (partitioned, RCH-P, and unpartitioned, RCH-UP). *Id.* at 54. BCH conveys signaling information concerning the whole radio cell in the downlink direction and announces the location of the FCH and RCH within the actual MAC frame. *Id.* FCH is broadcast in the downlink direction and transmits information about the structure of the MAC frame for the uplink and downlink phases; it contains announcements and reservations of long and short transport channels the individual MTs have to transmit or receive. *Id.* Short Channel (SCH) conveys data link control information and Long Channel (LCH) serves to transmit user data bidirectionally on the uplink and downlink. *Id.* RCH-P and RCH-UP are contention channels. *Id.*

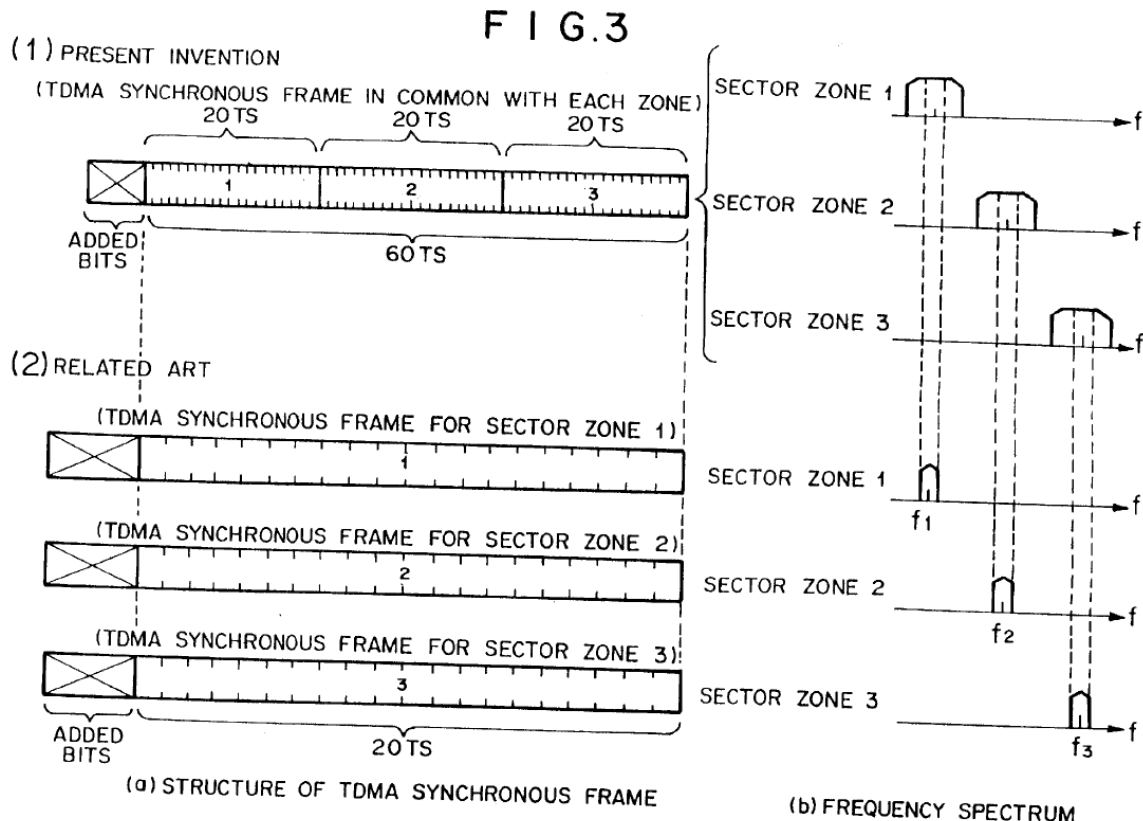
2. *Atsuta* (Ex. 1005)

Atsuta “relates to a TDMA [(Time Division Multiple Access)] Communicating Method and a TDMA receiving apparatus, in particular, to a TDMA communicating method of a base station that communicates with a plurality of zones that use different radio frequencies and a TDMA receiving apparatus thereof.” Ex. 1005, 1:7–11. Atsuta explains that, conventionally, a base station corresponding to a TDMA communicating method uses a fan-shaped beam antenna for sectoring a service area, and, “in the conventional sector zone type TDMA communicating method, independent frames are formed for respective divided zones with different radio frequencies.” *Id.* at 1:13–15, 1:53–55. In contrast, Atsuta provides:

a time division multiple access (TDMA) communicating method for performing time division multiple access for one-point-to-many-point communication between a base station and a plurality of subscriber stations with radio frequencies corresponding to zones. A subscriber station is adapted for transmitting TDMA signals with time slots of a common TDMA synchronous frame in such a manner that the TDMA signals of the subscriber stations do not overlap.

Id. at 2:64–3:5.

Atsuta's Figures 3(a) and 3(b) are reproduced below.



Figures 3(a) and 3(b) are schematic diagrams which compare TDMA synchronous frame structures (Figure 3(a) on the left) and frequency spectrums of the TDMA communication method (Figure 3(b) on the right) according to Atsuta's disclosure (the upper portions labeled "(1) PRESENT INVENTION") and the conventional TDMA communicating method (the lower portions labeled "(2) RELATED ART"). *See id.* at 5:21–25. According to Atsuta, in the conventional method, "each of three fan-shaped divided zone[s] has an independent TDMA synchronous frame," and each of those frames has a data region of 20 time slots (TS) assigned to subscriber stations in each fan-shaped divided zone. *Id.* at 5:25–30. Atsuta explains that:

On the other hand, according to the present invention [as shown in the upper portions of Figures 3(a) and 3(b)], 20 TS of

each fan-shaped divided zone are assigned to each fan-shaped divided zone in such a manner that time slots of individual fan-shaped divided zones do not overlap. Thus, the resultant TDMA synchronous frame has 60 TS corresponding to the subscriber station in all the fan-shaped divided zones and is common in all the fan-shaped divided zones.

Id. at 5:36–43. According to Atsuta, “a common TDMA synchronous frame for transmitting signals of individual fan-shaped divided zones can be used.”

Id. at 5:57–59.

Atsuta’s Figure 4 is reproduced below.

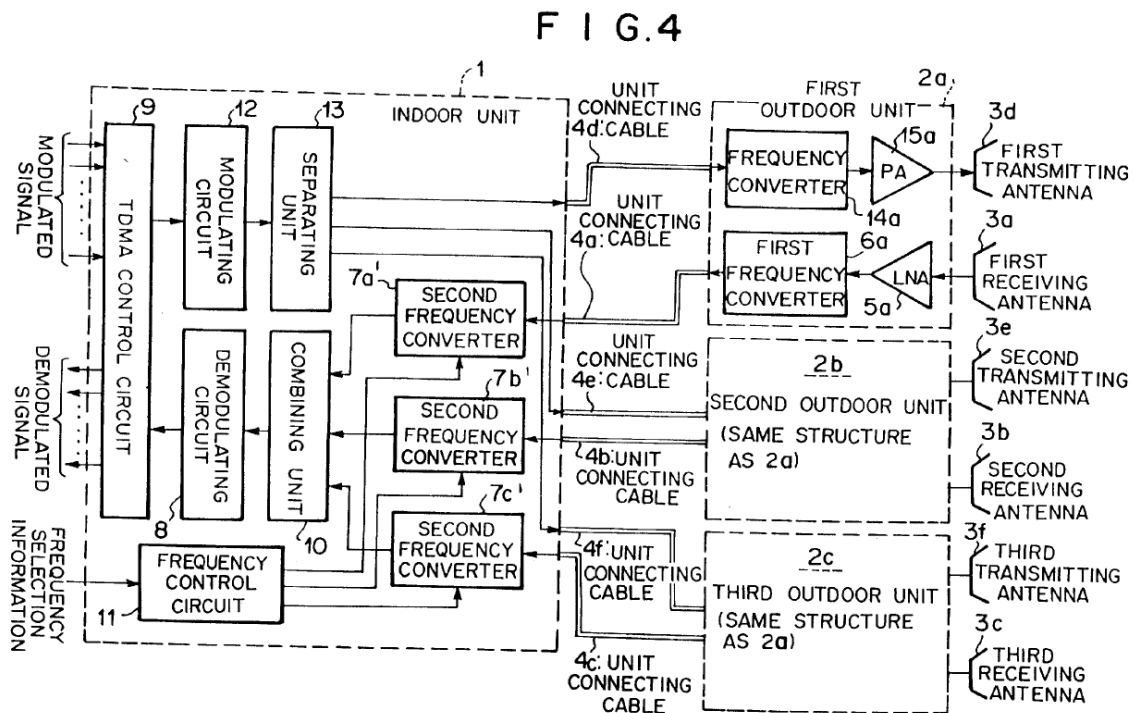


Figure 4 is “a block diagram showing the entire transmitting and receiving portions including the receiving apparatus . . . and a transmitting apparatus.”

Id. at 4:34–36.

[T]he TDMA control circuit 9 shown in FIG. 4 obtains information signals of subscriber stations of three fan-shaped divided zones from a demodulated signal sent from a demodulating circuit 8. In addition, the TDMA control circuit 9 shown in FIG. 4 receives a plurality of modulated

signals to be transmitted to the subscriber stations, arranges these signals into one signal sequence as a predetermined synchronous frame in the TDMA method, and outputs the resultant signal sequence to a modulating circuit 12.

* * *

Reference numerals 3d, 3e, and 3f are first to third transmission antennas that radiate the transmission frequency signals to three directional space or fan-shaped directional space. In FIG. 4, the transmitting antennas 3d, 3e, and 3f are paired with receiving antennas 3a, 3b, and 3c, respectively. However, when an omnidirectional antenna is used, one transmitting/receiving antenna may be used.

Id. at 6:32–58.

3. The Obviousness of Claim 28 over Vornefeld and Atsuta

Claim 28 depends directly from independent claim 1 and thus includes all the limitations of that underlying independent claim. Although Patent Owner, during the prior IPR, conceded that Vornefeld anticipates claim 1⁷ and claim 1 has been canceled, we first briefly discuss Petitioner’s contentions regarding the limitations of claim 1 as context for the discussion of the parties’ arguments concerning dependent claim 28.

⁷ See Ex. 1015 (IPR2017-01889, Paper 42), 56:19–57:9 (Counsel for Patent Owner, during oral argument, stating: “I’m not disputing that [prior petitioner Sprint] has provided good evidence the independent claims are not valid. We concede that. . . [Vornefeld] knocks out our independent claims. We concede that.”); see also Ex. 1011 (IPR2017-01889, Paper 25) at 2 n.1 (Patent Owner’s Response to the Petition stating: “Patent Owner does not herein dispute the patentability of the independent claims 1, 10 and 19 of the ‘931 patent.”)).

- a. [Claim 1] For use in a wireless access network comprising a plurality of base stations, each of said plurality of base stations capable of bidirectional time division duplex (TDD) communication with wireless access devices disposed at a plurality of subscriber premises in an associated cell site of said wireless access network, a transceiver associated with a first of said plurality of base stations comprising:*

Petitioner contends that Vornefeld discloses a “cellular mobile communications system” having base stations with “multiple antenna beams that can be electronically directed to the mobile terminal (MT) locations.” Pet. 16 (citing Ex. 1004, 52, Fig. 2). Petitioner further contends that “Vornefeld’s ‘radio subsystem operates . . . on a time-division duplex (TDD) channel,’” that “[t]he TDD channel uses ‘the same frequency for up- and downlink,’” and that “Vornefeld shows a base station communicating with a plurality of mobile terminals (MTs).” *Id.* (citing Ex. 1002 ¶ 73; Ex. 1004, 52–53, Fig. 2) (alteration in original). Petitioner additionally contends that “[e]ach base station includes one or more uniform linear array (ULA) antennas, which are part of the transceiver for that base station.” *Id.* at 17 (citing Ex. 1002 ¶ 74; Ex. 1004, 52, 56–57).

- b. transmit path circuitry associated with a beam forming network capable of transmitting directed scanning beam signals each directed to substantially only wireless access devices within a different one of a plurality of sectors of a cell site associated with said first base station,*

Petitioner contends that Vornefeld teaches the transmit path circuitry recited in this claim element. Pet. 17–19. Petitioner asserts that Vornefeld discloses downlink beamforming, and teaches “a base station having three ULAs [uniform linear arrays] which cover the cell site (e.g., each ULA covers a 120° sector of the cell site).” *Id.* at 18 (citing Ex. 1002 ¶ 76; Ex. 1004, 52, Fig. 2); *see also* Ex. 1002 ¶ 76 (Dr. Almeroth testifying:

“Vornefeld Fig. 2 . . . shows a uniform linear array (‘ULA’) antenna covering 120° of the cell site. . . . Vornefeld describes how three such ULAs in ‘triangular configuration’ may be used to cover the entire cell site.” (citing Ex. 1004, 52)). Petitioner further asserts:

“A beamforming algorithm computes a weight matrix for each time slot that adjusts the phases at the antenna elements to steer the main beam pointing direction toward the estimated DoA [direction of arrival] of the desired MT.” Ex. 1004, 53. Also, “[d]epending on the number of antenna elements and the applied algorithm, array antennas are able to simultaneously direct several beams to different positions conveying individual user signals (Fig. 2).” Ex. 1004, 53. Vornefeld’s Fig. 2 depicts several MTs within an exemplary 120° sector covered by the ULA, with a directed scanning beam signal transmitted to each of the MTs using transmit path circuitry associated with the ULA (*i.e.*, the claimed “signals transmitted using a beam pattern directed within a sector”).

Pet. 18 (third alteration in original).

Petitioner, applying what it asserts to be Patent Owner’s proposed construction of “section” in the parallel district court litigation, contends that “the MTs are each within a different ‘geographic portion of a cell site,’” and “[a]s such, Vornefeld’s base station comprises transmit path circuitry capable of transmitting to substantially only wireless access devices (MTs) within a different one of a plurality of sectors.” *Id.* at 18–19 (citing Ex. 1002 ¶ 76); *see id.* at 13 (“Patent Owner continues to advance a definition of sector as simply ‘a portion of the cell site,’ as evidenced by Patent Owner’s infringement allegations in the Related Litigation”). Petitioner additionally contends that “Vornefeld also discloses this element under a narrower construction of ‘sector’—such as a section of the cell site defined by the transmission area of a corresponding antenna array—as each of the three

ULAs transmits to substantially only MTs within a 120° sector corresponding to an antenna array.” *Id.* at 19.

- c. wherein said transmit path circuitry transmits, at a start of a TDD frame, a broadcast beam signal to wireless access devices within more than one of said sectors, the broadcast beam signal comprising a start of frame field, and*

Petitioner contends that Vornefeld teaches that “[e]ach MAC frame [transmitted to the MTs] ‘starts with two broadcast channels, the broadcast channel (BCH) and the frame channel (FCH), followed by a downlink phase, an uplink phase, and the random access channels (partitioned, RCH-P, and unpartitioned, RCH-UP).’” Pet. 19 (citing Ex. 1002 ¶ 77; Ex. 1004, 54). Petitioner asserts that, “[i]n Vornefeld, the BCH ‘conveys signaling information concerning *the whole radio cell* in the downlink direction . . . [and] every frame starts with a BCH.’” *Id.* (citing Ex. 1004, 54, Fig. 3 (first alteration in original)). Petitioner contends that, “[t]hus, a broadcast beam signal is transmitted at the start of a TDD frame to wireless access devices within more than one of said sectors (‘the whole radio cell’),” and that “the broadcast beam signal includes a start of frame field.” *Id.* at 19–20 (citing Ex. 1004, 54–55).

- d. [wherein said transmit path circuitry] subsequently transmits, in a downlink portion of said TDD frame, first downlink data traffic to substantially only wireless access devices within one of said sectors using one of said directed scanning beam signals.*

Petitioner contends that “[a]s shown [in Vornefeld’s Figure 3], each frame includes a ‘downlink phase,’ which can include long channel (LCH) portions that serve to transmit user data (e.g., the payload) on the up- and downlink.” Pet. 20–21 (citing Ex. 1004, 54, Fig. 3). Petitioner further contends that “[t]he LCHs dedicated to a single terminal are grouped

together,” and that “Vornefeld describes performing downlink transmission by forming ‘directive beams’ which enable the base station to send information to several locations within a sector.” *Id.* at 21 (citing Ex. 1002 ¶¶ 79–80; Ex. 1004, 54–55, Fig. 3).

- e. *[Claim 28] The transceiver as set forth in claim 1 wherein said transmit path circuitry transmits, in said downlink portion of said TDD frame, second downlink data traffic to substantially only wireless access devices within an other of said sectors using an other of said directed scanning beam signals.*

Dependent claim 28 calls for circuitry that transmits second downlink data “in said downlink portion of said TDD frame [of independent claim 1]” and to substantially only devices in a sector different than the sector recited in independent claim 1 and using a different directed scanning beam signal. Petitioner turns to Atsuta in addressing these features. Pet. 23–38.

Petitioner contends that “[l]ike Vornefeld, Atsuta is directed to TDMA frame-based communication between a base station and subscribers,” and that “Atsuta describes a base station that transmits downlink data to subscribers in different sectors within a single TDMA frame.” *Id.* at 24 (citing Ex. 1002 ¶ 88; Ex. 1005, 2:64–3:8, 6:24–61); *see also id.* at 30 (“Atsuta describes transmitting downlink data to multiple subscribers in different sectors within a single frame to allow for simplified hardware.” (citing Ex. 1002 ¶ 101; Ex. 1005, 6:31–55)), 32–33 (similar); Ex. 2028 ¶ 77 (Dr. Chrissan agreeing that “Atsuta is directed to a TDMA method and TDMA receiving apparatus.”). Petitioner asserts that “Figure 3 of Atsuta illustrates a TDMA frame comprising 60 time slots (‘TS’), wherein every 20 TS is assigned to a subscriber in a different zone: first 20 TS to sector zone 1, second 20 TS to sector zone 2, last 20 TS to sector

zone 3.” Pet. 24. Petitioner further contends that Atsuta’s sector zones are “sectors” within the meaning of the ’931 patent and that “[e]ach of Atsuta’s ‘sector zone[s]’ is a ‘fan-shaped’ subsection of the total service area, and each zone is assigned its own antenna array.” *Id.* at 25 (second alteration in original); *see also* PO Resp. 51 (Patent Owner, referring to Figure 1, stating, “[a] POSA would presume that the three sectors together provide 360 degrees of coverage around a base station site.”). Petitioner contends that, in the proposed modification, the circuitry of either Vornefeld or Atsuta could be used. Pet. 31 (citing Ex. 1002 ¶ 104); *see also id.* (Petitioner’s annotated version of Atsuta’s circuitry of Figure 4 along with the assertion that “[t]he highlighted apparatus is used to transmit downlink data from the base station to subscribers” (citing Ex. 1005, 6:35–64)).

Petitioner further contends:

Regarding “transmit[ting], in said downlink portion of said TDD frame,” Atsuta describes a “single synchronous frame,” within which there are sequential downlink signals transmitted from the base station to subscriber stations in different zones. Ex. 1005, 6:35–64. A [person of ordinary skill in the art] would have understood that the frames described by Atsuta are TDD frames inasmuch as Atsuta refers to transmitting data in both the downlink and uplink direction in the context of “sharing a TDMA synchronous frame.” Ex. 1002, ¶105; Ex. 1005, 5:65–6:12.

Id. at 31–32. Petitioner, in the alternative, further contends:

Moreover, Vornefeld already teaches TDD frames and the ’931 Patent admits that the same were well known at the time. Ex. 1004, 53; Ex. 1001, 6:32–8:31. At the very least, because the frames in Atsuta are comprised of different timeslots reserved for downlink transmission (Ex. 1005, 6:35–58) a

[person of ordinary skill in the art] would understand that they are compatible with a TDD frame. Ex. 1002, ¶105.

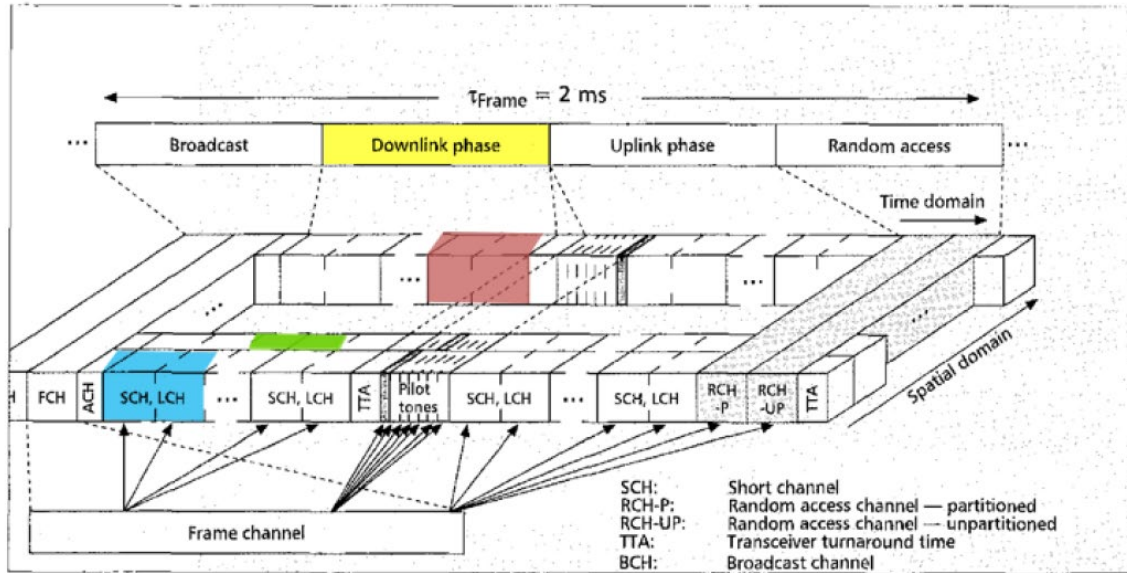
Id. at 32. According to Petitioner, “[b]y transmitting to subscribers in different sectors within a single frame, Atsuta distinguishes itself from the ‘conventional’ system that uses separate frames.” *Id.* at 33 (citing Ex. 1005, 5:25–30).

Petitioner contends, “regarding transmitting to ‘substantially only wireless access devices within an[]other of said sector using a second directed scanning beam signal,’ Vornefeld describes using different antenna arrays (with different beams) for different sectors such that a second beam signal assigned to the different sector transmits to substantially only subscribers in a second sector,” and that, “[i]n addition to there being different arrays for different sectors, the beams from one array are directed towards specific subscribers at their specific location.” *Id.* at 34 (citing Ex. 1002 ¶ 107; Ex. 1004, 52–53, 55) (first alteration in original).

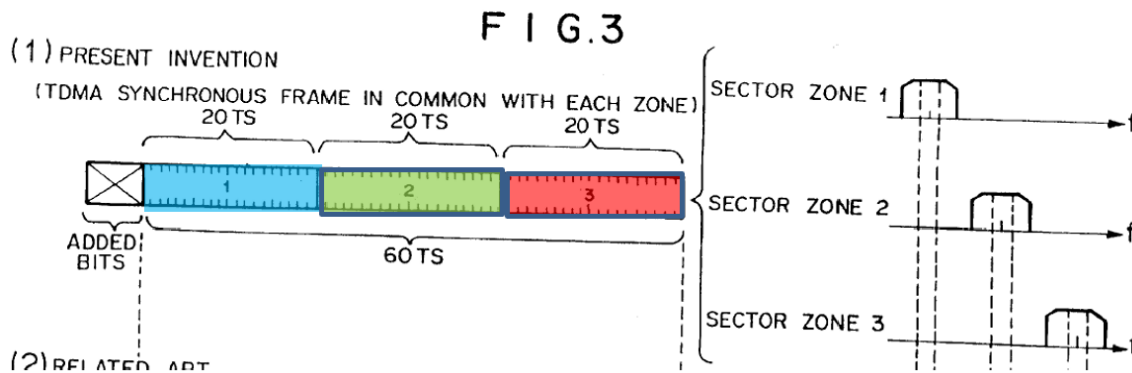
According to Petitioner, “[t]his is the nature of beam forming, where an array targeting a particular sector can target the beam at a specific subscriber in that sector[; t]hus, Vornefeld transmits towards ‘substantially only wireless devices’ within that sector by, at least, using different arrays in different sectors for the first and second transmission and, under Patent Owner’s implied construction, aiming beams to different regions (regardless of the use of separate antenna arrays).” *Id.* at 34–35 (citing Ex. 1002 ¶ 106; Ex. 1004, 53, Fig. 2). Petitioner contends that “Atsuta also describes directional antennas using beams to transmit to specific subscribers in specific sectors in which they are located,” and that a person of ordinary skill in the art “would have understood that such ‘directional’ transmission would be transmitted to ‘substantially only wireless access devices’ in the

desired sector, as the same is the intent of a ‘fan-shaped beams’ directed to a sector.” *Id.* at 35 (citing Ex. 1002 ¶ 107; Ex. 1004, 52; Ex. 1005, 1:12–18, 6:24–64, Fig. 4). For similar reasons, Petitioner contends that Atsuta teaches the use of another directed scanning beam signal for a given sector and that “[m]oreover, Vornefeld already describes using multiple beam signals to transmit to different sectors.” *See id.* at 35–36 (citing Ex. 1004, 55; Ex. 1005, 1:12–18, 6:24–64, Fig. 4; Ex. 1002 ¶ 107).

For the proposed combination, Petitioner contends that a person of ordinary skill in the art “would have readily understood how to incorporate Atsuta’s technique of transmitting to different subscribers (in different sectors) within a single TDD frame into Vornefeld’s system.” *Id.* at 36 (citing Ex. 1002 ¶ 108). Petitioner asserts that “the combination would use one known frame structure in place of another—specifically, Atsuta’s design that includes transmissions to multiple sectors in one frame.” *Id.* at 38 (citing Ex. 1002 ¶¶ 109–111). Petitioner provides annotated versions of Vornefeld’s Figure 3 and Atsuta’s Figure 3, reproduced below, to explain its proposed combination.



■ Figure 3. The basic frame structure of the spatially extended MAC protocol.



Above are Petitioner's annotated version of Vornefeld's Figure 3 (upper figure, which illustrates the basic MAC frame structure of the spatially extended MAC protocol) and an annotated and cropped version of Atsuta's Figure 3 (lower figure, which depicts schematic diagrams comparing TDMA synchronous frame structures and frequency spectrums of the TDMA communication method). *Id.* at 36–37; Ex. 1005, 5:21–25; Ex. 1006, Fig 3 (title). Petitioner asserts that:

The equivalent downlink data in Atsuta Fig. 3 and Vornefeld Fig. 3 are highlighted [above]. In Vornefeld's Fig. 3, each row is a transmission to a different portion of the cell site (as

indicated on the ‘spatial domain’ axis). Thus, the blue, green, and red downlink data in Vornefeld Fig. 3 show downlink data transmitted to subscribers in different sectors, and the same blue, green, and red downlink data are shown in Atsuta Fig. 3 all within a single frame.

Pet. 36–37. Petitioner contends that, “[b]ecause Vornefeld recognized the need to split up transmissions on the time axis, implementing Atsuta’s teachings of transmitting in sequential timeslots, where timeslots for different sectors are included within a single frame, would have been an obvious variation.” *Id.* at 38 (citing Ex. 1002 ¶ 113).

Petitioner asserts that “Atsuta addresses the issue that, in a conventional sectorized TDMA method, such as the one described in Vornefeld, if transmissions to different sectors occurs in separate TDMA frames, separate demodulating circuits and TDMA control circuits are typically used for each sector.” *Id.* at 25 (citing Ex. 1002 ¶ 90; Ex. 1005, 2:22–57, 5:21–30). According to Petitioner, “[b]y transmitting to multiple different users (in different sectors) in the same TDD frame, Atsuta allows the TDMA communication to run on a ‘simpl[ified]’ structure that only requires a single demodulating circuit and TDMA control circuit, thus reducing the ‘size and power consumption’ of the system,” and that “[s]pecifically, Atsuta’s system provides a ‘common’/‘shared’ functional circuit for the various antenna arrays.” *Id.* at 25–26 (citing Ex. 1005, 2:60–3:8, 2:60–63, 3:23–27, 3:58–60) (alteration in original).

Petitioner additionally contends that a skilled artisan would have been motivated to combine the relevant teachings of Vornefeld and Atsuta, asserting that:

A POSA would have had a reason to combine Vornefeld and Atsuta because they are both directed to the same field of endeavor and attempt to solve the same issues—e.g., efficient

broadcasting between a base station and subscribers using TDMA frame-structured transmissions. Ex. 1002, ¶91. Vornefeld recognizes that certain sets of subscribers are not suited for concurrent transmission due to signal interference constraints. Ex. 1004, 56. Vornefeld's solution to multiple access involves splitting up transmissions on the time axis. Ex. 1004, 55. Similarly, Atsuta describes splitting on the time axis by assigning different timeslots within a single downlink frame to subscribers in different sectors, thus mitigating interference between subscribers and simplifying the signal processing structure at the base station. Ex. 1005, 6:24-58.

Vornefeld acknowledges that computational complexity is a common concern. Ex. 1004, 53, 57. Atsuta's design reduces the required number of functional circuits in order to simplify the overall design (i.e., reduce complexity). Ex. 1002, ¶92-93. Because Vornefeld recognized the need to split up transmissions on the time axis, and Atsuta teaches a form of that technique with the benefit of using simpler hardware to transmit to different subscribers and sectors in a single frame, a POSA would have found the use of Atsuta's single-frame structure (and simplified hardware design) with Vornefeld's system to be an obvious design choice. *See SDI Technologies, Inc., v. Bose Corp.*, IPR2013-00350, Paper 36 at 26 (Nov. 7, 2014) ("known elements would have been an obvious matter of design choice"); Ex. 1002, ¶95.

Pet. 26–27. Petitioner further contends that "the combination of broadcasting to multiple sectors within a single TDD frame represents no more than the predictable use of prior art elements according to their established functions," and, "[s]pecifically, Atsuta's single-frame structure would be used with Vornefeld's system, which already uses frames." *Id.* at 28 (citations and internal quotations omitted). According to Petitioner, "[w]hile Vornefeld may have used different frames for different sectors, Atsuta combines the slots for different sectors into one frame, so as to provide the same information Vornefeld would have provided, just in a

single-frame format[, a]nd by doing so, Atsuta allows for a simplification of the hardware used.” *Id.* at 28–29 (citing Ex. 1005, 2:60–64; Ex. 1002 ¶ 96).

Petitioner additionally contends that “[g]iven the fit between these technologies, this combination would not result in a difference in function or give unexpected results” and that a person of ordinary skill in the art would have a reasonable expectation of success in combining the teachings. *Id.* at 27–29 (citations and internal quotations omitted).

Patent Owner notes that the challenged claims recite transmitting in a downlink frame in a TDD system. *See* PO Resp. 33. Patent Owner asserts that both TDD and downlink are important concepts in the ’931 patent. *See, e.g., id.* at 33–34. Patent Owner argues that Atsuta discloses only an uplink frame in a frequency division duplexing (FDD) system. *See id.* at 32–45. Patent Owner further argues that, “[b]ecause Atsuta does not disclose transmitting ‘in said **downlink** portion of **said TDD frame**, second downlink data traffic to substantially only wireless access devices in a second of said sectors using a second directed scanning beam signal’ as the Challenged Claims recite, Petitioner’s Ground 1 challenge relying on Atsuta for this claim element must fail.” *Id.* at 44–45 (citing Ex. 2028 ¶¶ 110–111).

Even if Patent Owner’s argument regarding Atsuta’s purported lack of disclosure of TDD and downlink frames is correct, that does not show a fatal flaw in Petitioner’s obviousness case. Patent Owner’s argument is directed to Atsuta individually, rather than addressing Petitioner’s proposed combination of the teachings of Vornefeld and Atsuta. *In re Merck & Co.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986) (“Non-obviousness cannot be established by attacking references individually where the [challenge] is based upon the teachings of a combination of references.”).

The requirements of TDD and a downlink portion of a frame first arise in independent claim 1, which has been conclusively found to be anticipated by Vornefeld, the primary reference in this IPR. *See also* Ex. 1004, 53 (Vornefeld stating, “we describe and evaluate concepts for a joint TDMA-SDMA approach” with characteristics including TDD); *id.* at 54 (“A MAC frame starts with two broadcast channels, the broadcast channel (BCH) and the frame channel (FCH), followed by a *downlink phase*, . . .” (emphasis added)); *id.* at Fig. 3 (depicting a frame having a downlink portion). Petitioner’s proposed combination retains Vornefeld’s TDD and downlink portion aspects. *See, e.g.,* Pet. 29 (for dependent claim 28, “Vornefeld describes all the features of claim 1.”); Pet. Reply 1 (“The sole question remaining is whether an ordinarily skilled artisan would use Vornefeld’s TDD frame—which already broadcasts to multiple sectors, and already has a downlink portion supporting beams to different devices—to send a downlink data to second sector. The secondary references Petitioner provides [including Atsuta] leave no doubt that is exactly what a person of ordinary skill (‘POSA’) would do.”). Petitioner’s proposed combination is the use of Atsuta’s frame structure in the downlink portion of Vornefeld’s TDD system. *See, e.g.,* Pet. 27 (“Atsuta teaches a form of that technique with the benefit of using simpler hardware to transmit to different subscribers and sectors in a single frame, a POSA would have found the use of Atsuta’s single-frame structure (and simplified hardware design) with Vornefeld’s system to be an obvious design choice.”; *id.* at 28 (“Atsuta’s single-frame structure would be used with Vornefeld’s system, which already uses frames.”). Thus, even if Patent Owner is correct that Atsuta

does not disclose a TDD system or a downlink portion, the proposed combination does include those aspects.

Building on its assertion that Atsuta uses a FDD system while Vornefeld uses TDD, Patent Owner argues that TDD and FDD are mutually exclusive and incompatible alternatives and, therefore, the references cannot and would not be combined. *See, e.g.*, PO Resp. 36–37; PO Sur-reply 1–2, 11–19. For example, Patent Owner (PO Sur-reply 16) relies on Dr. Chrissan’s response to the question, “what would prevent any given TDMA frame from not being compatible with a TDD frame,” with the opinion that, “[i]f a TDMA frame is already employed in an existing system that is designed for FDD, and you would have to completely rip that system up and start over to change it to TDD, which is typically the case, they are that different.” Ex. 1024, 167:11–168:3; *see also* Tr. 41:1–5 (Patent Owner arguing that its “expert, as explained in the briefing, explained that a POSA would not have been able to combine the FDD with TDD because they’re mutually exclusive, and so would have to start over.”).

Even if Patent Owner is correct that Atsuta is an FDD system, that argument does not show a fatal flaw in Petitioner’s obviousness case. Petitioner is not, as Patent Owner implies, proposing to change Atsuta’s purportedly FDD system to a TDD system or to bodily incorporate Atsuta’s entire system into Vornefeld’s system or to make a system that attempts to use both FDD and TDD together. Rather, Petitioner is applying Atsuta’s frame structure—the organization, in the same portion of the same frame, of timeslots for users located in different sections—in Vornefeld’s downlink portion of a frame in a TDD system. *See, e.g.*, Pet. 38 (“the combination would use one known frame structure in place of another—specifically,

Atsuta's design that includes transmissions to multiple sectors in one frame.”). Patent Owner does not persuasively argue that Atsuta's teachings in that regard are uniquely applicable to an uplink portion in a FDD system such that they are not also applicable to Vornefeld's system. Rather, Patent Owner, in response to Petitioner's contention that Atsuta's frames are compatible with a TDD frame, argues that, “[b]ecause Atsuta provides little explanation as to how its invention could be modified to apply to downlink transmissions at all, let alone in addition to uplink, a POSA would not have applied Atsuta's invention to downlink transmissions in a TDD frame as Petitioner alleges without support.” PO Resp. 44 (citing Ex. 2028 ¶ 109). That is an argument that there is no reason to combine the references' teachings because Atsuta lacks an explicit teaching to combine them. It is not an argument that Atsuta's frame structure cannot work in Vornefeld's system and therefore the teachings cannot be combined. Additionally, Patent Owner's requirement of an explicit teaching to combine in the references themselves has been rejected. *KSR Int'l Co.*, 550 U.S. at 415; *see also id.* at 421 (“A person of ordinary skill is also a person of ordinary creativity, not an automaton.”).

In contrast, Petitioner persuasively presents argument and evidence that the pertinent teachings of Atsuta are compatible with Vornefeld's system.⁸ Dr. Almeroth, in support of the Petition, testifies that “the frames

⁸ To the extent that Patent Owner asserts that the argument and evidence regarding compatibility in Petitioner's Reply is untimely, we disagree. *See, e.g.*, PO Sur-reply 16–17 (arguing that certain evidence “is support for Petitioner's *prima facie* obviousness case, and so must have been provided in the Petition, if at all.”). The Petition contains the contention that a person of ordinary skill in the art would understand that Atsuta's frames “are

in Atsuta are comprised of different timeslots reserved for data transmission (Ex. 1005, 6:35-58), just as a TDD frame is.” Ex. 1002 ¶ 105 (cited at Pet. 32 for the “compatible” proposition); *see also id.* ¶ 94 (“Vornefeld’s and Atsuta’s frame structures are consistent with each other. Both are directed to TDMA frame structured transmissions between a base station and subscribers.”). Dr. Almeroth also provided credible testimony in support of Petitioner’s contention (Pet. 28–29) that a person of ordinary skill in the art would have had a reasonable expectation of success in combining the teachings. *See* Ex. 1002 ¶¶ 95–97; *see, e.g., id.* ¶ 96 (“A POSA would readily understand that combining Atsuta with Vornefeld would have been straightforward. Atsuta’s method for allocating time slots to subscribers in different sectors within a single TDMA frame matches Vornefeld’s MAC protocol, which allows transmission to a subscriber with the ‘granularity of a single time slot.’” (citing Ex. 1004, 54)). Dr. Almeroth further testifies that certain cited disclosures in Atsuta “is all the information a POSA would need to determine that it would be obvious that a single frame in Vornefeld could include downlink transmissions to different sectors,” and “[t]hat would be true regardless of Atsuta’s duplexing method (e.g., FDD or TDD).” Ex. 1025 ¶ 22 (citations omitted). Dr. Almeroth additionally opines that “a POSA would understand that Atsuta’s description of a TDMA frame would indicate to a POSA a methodology that would incorporate one or

compatible with a TDD frame.” Pet. 32; *see also id.* at 27–29 (contentions regarding a reasonable likelihood of success in making the proposed combination). In the Response, Patent Owner argues that Petitioner’s compatibility contention is incorrect. PO Resp. 44. We find that Petitioner’s subsequent argument and accompanying evidence is an appropriate reply to Patent Owner’s argument of incompatibility.

more of TDD and FDD, such that a POSA would immediately picture both options, . . . [a]nd, either way, Atsuta’s frame structure would still be compatible with Vornefeld regardless of the duplexing method.” *Id.* ¶ 27.

Patent Owner argues that “TDD and FDD frame structures are fundamentally incompatible.” PO Sur-reply 13 (citing Ex. 2028 ¶¶ 44, 148); *see also id.* at 11–19. The basis for Patent Owner’s argument is Dr. Chrissan’s testimony that FDD and TDD are mutually exclusive alternatives that cannot be combined in the same system and that one must select one or the other. *See id.* at 13–14 (citing Ex. 1024, 30:21–31:19; Ex. 2022, 4, 6; Ex. 2030, 9–10). This is not on point as Petitioner’s proposed combination does utilize one, namely Vornefeld’s TDD duplexing. Patent Owner does not address adequately the pertinent issue—whether Atsuta’s teaching of a portion of frame having timeslots for users in different sectors may be applied to Vornefeld’s TDD downlink frame.

Dr. Almeroth’s testimony is credible and persuasive, and we find that Atsuta’s frame structure teachings are compatible with and applicable to the downlink portion of Vornefeld’s TDD frame. We do not find to be persuasive Patent Owner’s arguments and Dr. Chrissan’s associated testimony that the references are not combinable because they purportedly are different in certain ways.

Patent Owner argues that a person of ordinary skill in the art “would not seek to combine Atsuta with Vornefeld because such a combination would thwart the very purpose of Vornefeld.” PO Resp. 45 (citing Ex. 2028 ¶ 130); *see also id.* at 45–48. Patent Owner, discussing that purported purpose, asserts that “[t]he system disclosed in Vornefeld was intended to allow for the simultaneous transmission of beamformed signals to different

wireless devices.” *Id.* at 45–46 (citing EX1004, 53; Ex. 2028 ¶¶ 130–131). Patent Owner argues that “Atsuta, by contrast, repeatedly and consistently teaches that each subscriber within a sector must be allocated a separate portion of the frame so that the transmissions from each subscriber station ‘do not overlap.’” *Id.* at 46.

These arguments are not persuasive at least because, in making these arguments, Patent Owner is improperly superimposing the purported purpose of Vornefeld onto the ordinary artisan. However, the intended purpose of a prior art reference does not control the obviousness inquiry. *Intel Corp. v. Qualcomm Inc.*, 21 F.4th 784, 800 (Fed. Cir. 2021). Our reviewing court recently explained:

The [motivation-to-combine] inquiry is not whether a relevant artisan would combine a first reference’s feature with a second reference’s feature to meet requirements of the first reference that are not requirements of the claims at issue. A contrary view would run counter to established principles, including that the claim defines the invention whose obviousness is being assessed and that a skilled artisan may be motivated to combine particular features of different references, *e.g.*, to secure some benefits at the expense of others, even when bodily incorporation would be impossible or inadvisable.

Axonics, Inc. v. Medtronic, Inc., 73 F.4th 950, 957 (Fed. Cir. 2023).

Patent Owner acknowledges that the claims of the ’931 patent do not require simultaneous transmission. *See* PO Resp. 31. And, for the reasons discussed below, we determine that Petitioner has adequately explained why a person of ordinary skill in the art would have been motivated to make the proposed combination.

Patent Owner argues “Atsuta *teaches away* from the objective of Vornefeld . . . , instead teaching that transmissions must be made sequentially so they never overlap in time.” PO Resp. 2–3; *see also id.* at 46. Even if

Vornefeld's purported purpose is simultaneous transmission and even if the proposed combination would not retain such, as Petitioner contends (Pet. Reply 14–15), Patent Owner's argument is not persuasive because the teaching of something different does not constitute a teaching away. *See In re Fulton*, 391 F.3d 1195, 1201 (Fed. Cir. 2004) (“the prior art's mere disclosure of more than one alternative does not constitute a teaching away from any of these alternatives because such disclosure does not criticize, discredit, or otherwise discourage the solution claimed”). Patent Owner points to Vornefeld's disclosure of simultaneous transmissions and to Atsuta's disclosure of transmitting in a manner such that the signals to the stations do not overlap, but does not explain why a person of ordinary skill in this art would be discouraged from combining the references teachings so as to arrive at claimed subject matter that does not require simultaneous transmissions. *See* PO Resp. 45–46.

Petitioner contends, with the supporting testimony of Dr. Almeroth, that a person of ordinary skill in the art would have been motivated to combine the references' teachings because the modification would reduce the overall complexity of the system. *See* Pet. 26–27; *see also* Pet. Reply 8–9. Petitioner asserts that Atsuta discloses “simplifying the signal processing structure at the base station,” that “Vornefeld acknowledges that computational complexity is a common concern,” and that “Atsuta's design reduces the required number of functional circuits in order to simplify the overall design (i.e., reduce complexity).” Pet. 26–27 (citing Ex. 1004, 53, 57; Ex. 1005, 6:24–58; Ex. 1002 ¶¶ 92–93). According to Petitioner, “[b]ecause Vornefeld recognized the need to split up transmissions on the time axis, and Atsuta teaches a form of that technique with the benefit of

using simpler hardware to transmit to different subscribers and sectors in a single frame, a POSA would have found the use of Atsuta's single-frame structure (and simplified hardware design) with Vornefeld's system to be an obvious design choice." *Id.* at 27.

Patent Owner counters that there is no motivation to combine because "a POSA would have recognized that Atsuta's design would have provided little to no benefit of reduced power or hardware complexity relative to the added costs of its implementation in Vornefeld." PO Resp. 58 (citing Ex. 2028 ¶ 128); *see also id.* at 55–56. We do not agree with Patent Owner. Atsuta explains that, in the then-conventional TDMA method, each of three zones had an independent frame and used three independent apparatuses. *See* Ex. 1005, 1:53–60, 5:21–27, Fig. 1 (depicting three circuits of the prior art). Atsuta teaches using one apparatus and a single frame for three zones. *See id.* at 3:59–66; Figs. 2, 4 (depicting one combined circuit). Atsuta further teaches that, due to the use of a common frame, "regardless of the number of divided zones, the demodulating circuit and the TDMA control circuit can be shared," and, "[t]hus, the size of the receiving apparatus can be reduced and thereby the power consumption can be decreased." *Id.* at 3:59–66; *see also id.* at 2:60–63 ("An object of the present invention is to share the same functional circuit so as to simplify the structure the entire apparatus and reduce the size and power consumption thereof."). We agree with Petitioner that Patent Owner's complexity argument is incorrectly based on a comparison of only one of the three circuits of the conventional system to Atsuta's system. *See* Pet. 18–19; PO Resp. 55–56 (arguing, for example, that Atsuta's invention of Figure 2 has to handle three times the number of outputs and handle three times the number of mobile stations as

the prior art device but failing to acknowledge that the prior art device required three circuits to do the same). Dr. Chrissan agreed on cross-examination that the TDMA control circuit itself in the combined system would not be three times as complex as one of the three in the conventional system. *See* Ex. 1024, 157:12–158:16. Dr. Almeroth credibly and persuasively testifies that “Atsuta’s system also simplifies the signal processing structure at the base station, reducing the required number of functional circuits (and computational requirements) to a single circuit.” Ex. 1002 ¶ 92 (citing Ex. 1005, 2:60–64). We agree with Petitioner that a person of ordinary skill in the art would see a benefit in using a single-frame system, as taught by Atsuta, to reduce the number of functional circuits and the overall complexity of the device, and that provides a motivation for making the proposed combination. *See* Pet. 27.

Patent Owner argues that Atsuta’s frame structure—combining into a single frame what before was three frames for three sector zones—will require more bandwidth and that the TDMA control circuit will have to run at a higher clock rate, thereby offsetting some of the power savings. *See* PO Resp. 56–58. We disagree that a person of ordinary skill in the art would not make the combination because of this purported tradeoff, as Patent Owner urges. *See id.* at 58. “It’s not necessary to show that a combination is ‘the best option, only that it be a *suitable* option.’” *Intel Corp.*, 21 F.4th at 800 (quoting *PAR Pharm., Inc. v. TWI Pharms., Inc.*, 773 F.3d 1186, 1197–98 (Fed. Cir. 2014)); *see also In re Mouttet*, 686 F.3d 1322, 1334 (Fed. Cir. 2012) (“[J]ust because better alternatives exist in the prior art does not mean that an inferior combination is inapt for obviousness purposes.”); *Medichem, S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1165 (Fed. Cir. 2006) (“[A] given

course of action often has simultaneous advantages and disadvantages, and this does not necessarily obviate motivation to combine.”).

Patent Owner argues that “Atsuta does not teach or describe beamforming anywhere, and a POSA would not look to combine Atsuta with Vornefeld to achieve the Challenged Claims.” PO Resp. 53; *see id.* at 48–53. Patent Owner, however, agrees that Vornefeld discloses beamforming. *Id.* at 52; *see In re Merck & Co.*, 800 F.2d at 1097 (“Non-obviousness cannot be established by attacking references individually where the [challenge] is based upon the teachings of a combination of references.”). Patent Owner does not explain adequately why a person of ordinary skill in the art would need to see a teaching of beamforming in Atsuta to recognize the obviousness of the claimed subject matter. Patent Owner’s declarant, when asked on cross-examination “why would a secondary reference such as Atsuta need to teach beamforming if the primary reference Vornefeld already does,” responded: “I don’t have an opinion on that.” Ex. 1024, 142:8–15.

Patent Owner asserts that Petitioner’s expert opined that Atsuta provides another motivation to combine by teaching a solution to an interference problem recognized by Vornefeld. *See* PO Resp. 53 (citing Ex. 1002 ¶ 91). Because we have determined above that Petitioner has adequately shown that a person of ordinary skill in the art would have made the proposed combination, we need not reach this additional interference-based contention.

Having considered the parties’ arguments and evidence, we determine that Petitioner has demonstrated by a preponderance of the evidence that Vornefeld in combination with Atsuta discloses or suggests all of the

limitations of dependent claim 28. We also determine that Petitioner has shown that a person of ordinary skill in the art would have been motivated to make the combination proposed by Petitioner and would have had a reasonable expectation of success in doing so.

4. The Obviousness of Claim 29 over Vornefeld and Atsuta

Dependent claim 29 recites “a method of communicating” between base stations and wireless access devices that is substantively similar to the recitations of dependent claim 28. *See* Ex. 1001, 32:16–34 (underlying independent claim 19), 34:1–6. For claim 29, Petitioner relies on its contentions regarding claim 28 with an additional discussion of the requirement of the underlying (canceled) independent claim 19 that “the broadcast beam signal compris[es] a start of frame field capable of synchronizing receivers in said wireless access devices.” Pet. 21–23 (discussing limitation 19[c]), 38–39; Ex. 1001, 32:28–30. Patent Owner does not make any additional arguments for claim 29 beyond those addressed above. *See, e.g.*, PO Resp. 1–2 (addressing claims 28 and 29 together), 32 (heading for Ground 1 addressing the claims together).

Having considered Petitioner’s arguments and evidence, we determine that Petitioner has demonstrated that the combination of Vornefeld and Atsuta renders obvious the subject matter of claim 29.

E. The Remaining Grounds (Grounds 2–5)

Petitioner contends that claims 28 and 29 would have been obvious over Vornefeld and Goldberg (Ground 2), over Youssefmir and Atsuta (Ground 3), over Vornefeld, Atsuta, and Tangemann (Ground 4), and over Vornefeld, Goldberg, and Tangemann (Ground 5). Pet. 39–82.

For the reasons discussed above, Petitioner has shown persuasively that claims 28 and 29 would have been obvious over Vornefeld and Atsuta (Ground 1). As a result, we need not determine whether the claims also would have been obvious under Petitioner’s challenges of Grounds 2 through 5. *See SAS Inst. Inc. v. Iancu*, 138 S. Ct. 1348, 1359 (2018) (holding that a petitioner “is entitled to a final written decision addressing all of the claims it has challenged”); *Boston Sci. Scimed, Inc. v. Cook Grp. Inc.*, 809 Fed. App’x. 984, 990 (Fed. Cir. Apr. 30, 2020) (non-precedential) (recognizing that the “Board need not address issues that are not necessary to the resolution of the proceeding” and, thus, agreeing that the Board has “discretion to decline to decide additional instituted grounds once the petitioner has prevailed on all its challenged claims”).

IV. CONCLUSION⁹

Petitioner has shown by a preponderance of the evidence that claims 28 and 29 of the ’931 patent are unpatentable over Vornefeld and Atsuta.

⁹ 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).

In summary:

Claim(s)	35 U.S.C. §	Reference(s)/Basis	Claim(s) Shown Unpatentable	Claim(s) Not Shown Unpatentable
28, 29	103(a)	Vornefeld, Atsuta	28, 29	
28, 29	103(a) ¹⁰	Vornefeld, Goldburg		
28, 29	103(a) ¹¹	Youssefmir, Atsuta		
28, 29	103(a) ¹²	Vornefeld, Atsuta, Tangemann		
28, 29	103(a) ¹³	Vornefeld, Goldburg, Tangemann		
Overall Outcome			28, 29	

V. ORDER

For the foregoing reasons, it is

ORDERED that claims 28 and 29 of the '931 patent have been proven to be unpatentable; and

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

¹⁰ As explained above, we do not reach this Ground 2, which is cumulative of the challenge of Ground 1.

¹¹ As explained above, we do not reach this Ground 3, which is cumulative of the challenge of Ground 1.

¹² As explained above, we do not reach this Ground 4, which is cumulative of the challenge of Ground 1.

¹³ As explained above, we do not reach this Ground 5, which is cumulative of the challenge of Ground 1.

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PETITIONER:

Justin Oliver
Stephen Yam
VENABLE LLP
joliver@venable.com
syam@venable.com

Counsel for IPR2024-00392(joined):

Chad Walters
Doug Kubehl
Jeffery Becker
Joseph Grado
BAKER BOTTS L.L.P.
chad.walters@bakerbotts.com
doug.kubehl@bakerbotts.com
jeff.becker@bakerbotts.com
andrew.grado@bakerbotts.com

Counsel for IPR2024-00461 (joined):

John Haynes
Wes Achey
Michael Deane
Christopher Douglas
ALSTON & BIRD LLP
john.haynes@alston.com
wes.achey@alston.com
michael.deane@alston.com
christopher.douglas@alston.com

PATENT OWNER:

Sarah Spires
SKIERMONT DERBY LLP
sspires@skiermontderby.com