

Filed on behalf of: Cellco Partnership d/b/a Verizon Wireless

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

IPR2023-00978
U.S. Patent No. 7,230,931

PETITIONER'S REPLY

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37 C.F.R. § 42.24	29
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Exhibit List

Ex. No.	Description
1001	U.S. Patent No. 7,230,931 (the “’931 patent”)
1002	Declaration of Kevin Almeroth, Ph.D.
1003	Curriculum Vitae of Kevin Almeroth, Ph.D.
1004	Ulrich Vornefeld et al., “SDMA Techniques for Wireless ATM,” IEEE Communication Magazine, November 1999 (“Vornefeld”)
1005	U.S. Patent No. 6,160,800 (“Atsuta”)
1006	U.S. Patent No. 6,154,661 (“Goldburg”)
1007	U.S. Patent No. 6,795,409 (“Youssefmir”)
1008	Michael Tangemann, “Influence of the User Mobility on the Spatial Multiplex Gain of an Adaptive SDMA System,” 5 th <i>IEEE International Symposium on Personal, Indoor and Mobile Radio Communications, Wireless Networks – Catching the Mobile Future</i> , The Hague, Netherlands, 1994 (“Tangemann”)
1009	<i>Sprint Spectrum L.P. v. General Access Solutions, Ltd.</i> , IPR2017-01778, Paper 43 (P.T.A.B. Mar. 7, 2019)
1010	<i>Sprint Spectrum L.P. v. General Access Solutions, Ltd.</i> , IPR2017-01778, Paper 61 (P.T.A.B. Jan. 29, 2021)
1011	<i>Sprint Spectrum L.P. v. General Access Solutions, Ltd.</i> , IPR2017-01778, Paper 25 (P.T.A.B. Aug. 3, 2018) (PO response)
1012	File History for U.S. Patent No. 7,230,931
1013	Claim Construction Order, dated September 29, 2020, from <i>General Access Solutions, Ltd. v. Virgin Mobile USA, L.P. et al.</i> , Case No. 2-20-cv-00007 (E.D. of Texas)
1014	<i>Sprint Spectrum L.P. v. General Access Solutions, Ltd.</i> , IPR2017-01778, Paper 1 (P.T.A.B. July 28, 2017) (Sprint Petition)

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1015	<i>Sprint Spectrum L.P. v. General Access Solutions, Ltd.</i> , IPR2017-01778, Paper 42 (P.T.A.B. July 28, 2017) (Sprint Petition) (Hearing Transcript)
1016	<i>General Access Solutions, Ltd. v. Verizon Communications, Inc.</i> , No. 2:22-cv-394 (Jan. 5, 2023) (infringement contentions)
1017	<i>General Access Solutions, Ltd. v. Virgin Mobile USA, L.P. et al</i> , Case No. 2:20-cv-00007, Document 350 (E.D. Tex. July 21, 2021)
1018	George McDaniel, IBM Dictionary of Computing (1994)
1019	Declaration of Sylvia D. Hall-Ellis, Ph.D.
1020	Correspondence Regarding <i>Fintiv</i> Stipulation
1021	Harry Newton, Newton’s Telecom Dictionary 16th ed. (2000)
1022	Walter H.W. Tuttlebe, CORDLESS TELECOMMUNICATIONS WORLDWIDE (1997) (excerpts)
1023	Theodore S. Rappaport, WIRELESS COMMUNICATIONS, PRINCIPLES & PRACTICE (1996) (additional excerpts related to EX2022))
1024	Deposition Transcript of Dr. Douglas A. Chrissan
1025	Reply Declaration of Dr. Kevin C. Almeroth
1026	Holma, et al., “Evaluation of interference Between Uplink and Downlink in Ultra/TDD,” IEEE, VCT (1999)
1027	Trial Transcript (Vol. 1) <i>General Access Solutions, Ltd. v. Verizon Communications, Inc.</i> , No. 2:22-cv-394
1028	Trial Transcript (Vol. 2) <i>General Access Solutions, Ltd. v. Verizon Communications, Inc.</i> , No. 2:22-cv-394
1029	Trial Transcript (Vol. 4) <i>General Access Solutions, Ltd. v. Verizon Communications, Inc.</i> , No. 2:22-cv-394

Ex. No.	Description
1030	Trial Transcript (Vol. 5) <i>General Access Solutions, Ltd. v. Verizon Communications, Inc.</i> , No. 2:22-cv-394
1031	5 FCC Red No. 14, FCC 90-233, 4123-30 (1990)
1032	ETSI TS 125 402 – Universal Mobile Telecommunications System (1999)

I. Introduction

GAS conceded in the prior IPR that Vornefeld discloses every limitation of the independent claims, which requires transmitting to a plurality of sectors and a TDD frame with downlink data traffic sent via beam signals. There is also no question Vornefeld discloses transmitting multiple beams to different devices in the same downlink phase of the TDD frame. 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 leave no doubt that is exactly what a person of ordinary skill (“POSA”) would do.

Atsuta, in particular, describes one frame that includes downlink transmissions to different sectors, as GAS's own expert admitted. EX1024, 191:6-193:15. And as a TDMA reference, Atsuta's teachings would be easily and naturally combined with Vornefeld's TDMA/TDD frame.

Faced with this simple and obvious combination, GAS devotes its POR to misdirection. GAS criticizes Vornefeld for allegedly lacking features GAS already conceded Vornefeld teaches. GAS attacks Atsuta for allegedly missing claim elements taught by Vornefeld. GAS also (incorrectly) attacks the combination for not achieving features such as “simultaneous” transmission, despite conceding “the

claims does not require ‘simultaneity.’” POR, 31. And GAS erroneously argues that Atsuta “teaches away” from, *e.g.*, Vornefeld’s simultaneity based on nothing more than Atsuta being silent on the topic. EX2028, ¶¶85-86. All of GAS’s attacks fail.

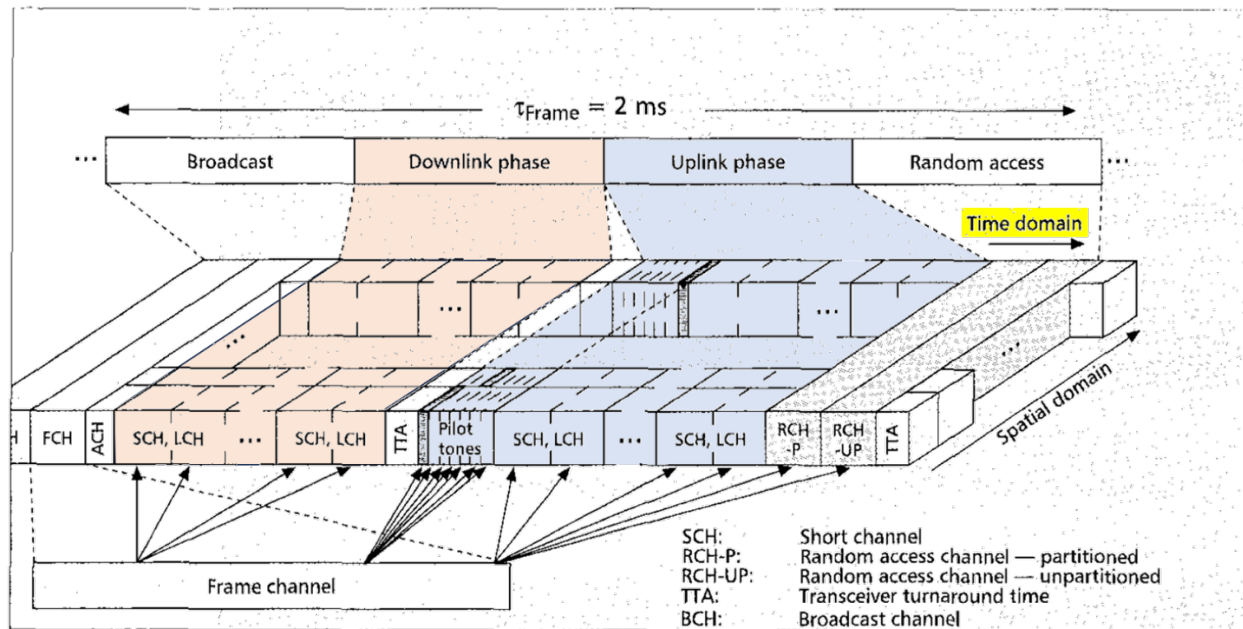
Moreover, after submitting its POR, GAS asserted positions in the District Court trial that nullify its arguments here. At trial, GAS repeatedly argued that the mere transmission of beams in different sectors following the same “timetable” necessarily satisfies the claims. EX1028, 374:25-375:10, 416:10-12. GAS’s trial positions contradict its attempts to distinguish Petitioner’s grounds.

II. GAS’s Trial Positions

At trial, GAS successfully argued that different TDD transmissions in each sector constitute one “TDD frame” with beams to different sectors, based on its assertion that a TDD frame “is simply a timetable.” EX1030, 1279:5-16; EX1028, 374:25-375:10, 401:4-402:22, 475:23-476:3, 545:11-21; EX1029, 1121:12-25. According to GAS, the claims are satisfied by sector-specific transmissions if the same “schedule or common timetable ... is carried out by the base station across all sectors” (EX1028, 416:10-12), because transmissions following the standard timing for downlink and uplink necessarily “share the same TDD frame.” EX1030, 1279:5-16; EX1028, 366:21, 370:12-16, 375:7-10 (“the TDD frame is just a schedule”), 506:4-5.

GAS's broad trial read is unnecessary to Petitioner's grounds because those grounds *expressly* establish a single TDD frame with downlink transmissions to multiple sectors (for example, in the Vornefeld-Atsuta combination). Nevertheless, GAS's trial positions flatly contradict GAS's representations to the Board. In particular, GAS repeatedly emphasizes that "Vornefeld does not disclose 'using ... *the same TDD frame* ... to transmit to devices within a different sector,'" as it successfully argued to overcome the Sprint IPR. POR, 1 (emphasis in original), 18, 19, 21, 26, 32, 46, 60, 61. But that position is irreconcilable with what GAS asserted at trial: that transmissions sent following the same downlink and uplink schedule are *necessarily* in the same TDD frame. See *Gillette Co. v. Energizer Holdings, Inc.*, 405 F.3d 1367, 1374 (Fed. Cir. 2005) (giving weight to party admissions in related cases).

Although unnecessary to the Petition, it is notable that under GAS's trial read, the claims would be obvious over Vornefeld alone. Vornefeld itself discloses timeslots separated into downlink and uplink phases (shown in Vornefeld's Fig. 3, colored below), teaches that this TDD frame timing is established for "the whole radio cell," (Petition, 19; EX1004, 54), and discloses that the transmissions depicted for an exemplary sector could be replicated in three sectors "used to cover the whole radio cell" (Petition, 25; EX1004, 52).



Under GAS's trial read, nothing more is required to satisfy the claims.

Regardless, even assuming—as the Petition does—that Vornefeld does not expressly teach that its TDD frame assigns timeslots across sectors, GAS's trial positions reinforce the obviousness of doing so, including based on Atsuta's teaching of setting forth, in one frame, a timetable for sequential downlink transmissions to different sectors. Thus, there can be no doubt that a POSA would readily combine Vornefeld with Atsuta.

III. Claim Construction

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. POR, 29-31.

Also, while GAS's POR presents arguments as to "simultaneous" transmissions being a "key" aspect of the alleged invention (EX2028, ¶61), and attacks the prior art on this point, its construction concedes that no claim requires "simultaneity." POR, 31. That construction renders the simultaneity arguments moot.

IV. Ground 1: Vornefeld and Atsuta

Because the combination of Vornefeld and Atsuta unquestionably teaches the claimed invention, GAS attempts to divide and conquer by ignoring the combination and attacking each reference in isolation. As to Vornefeld, GAS makes a legally improper attempt to reverse its former concession that Vornefeld anticipates the independent claims. GAS then improperly attacks Atsuta for allegedly not teaching elements taught by Vornefeld, including elements already held unpatentable in the Sprint IPR, such as beamforming and antenna "arrays." POR, 20-22, 48-53. GAS's attacks are legally improper because they do not address the *combination*. See *In re Merck & Co., Inc.*, 800 F.2d 1091, 1097-98 (Fed. Cir. 1986); *In re Mouttet*, 686 F.3d 1322, 1333 (Fed. Cir. 2012). When asked why Atsuta would need to teach beamforming where Vornefeld already does so, GAS's expert offered: "I don't have any opinion on that." EX1024, 142:8-15. GAS's legally irrelevant attacks fail.

Moreover, GAS's argument that Atsuta cannot be used to fill any alleged gap in Vornefeld depends on equally erroneous arguments, such as GAS's faulty attempt to manufacture a divide between TDMA and TDD.

A. GAS's Attempted Reversal on Vornefeld Should Be Rejected

Despite conceding in the Sprint IPR that Vornefeld anticipates claims 1 and 19, GAS attempts to claw back its disclaimer by asserting that the Sprint IPR was decided under a different claim construction standard. POR, 14 n.3. But GAS presents no construction argument that would distinguish the outcome under one standard versus another, rendering its attacks on Vornefeld moot. POR, 15-19. And GAS's trial positions belie its argument as GAS presented a broad interpretation of "TDD frame" that makes Vornefeld even more applicable—it describes a schedule across sectors. EX1004, 52 ("a triangular configuration of three ULAs might be used to cover the whole radio cell"), 54 ("[c]onveys signaling information concerning the whole radio cell").

Regardless, GAS ignores that the prior adverse IPR judgment gives rise to estoppel. 37 C.F.R. § 42.73(d)(3); EX1009, 7.

GAS's other attacks on Vornefeld miss the mark. While GAS argues that the relative timing of downlink and uplink transmissions is a "key aspect" purportedly missing from Vornefeld (POR, 9, 17), arranging uplink and downlink transmissions so as not to overlap in time (within and across sectors) is simply a basic description

of conventional TDD operations. EX1024, 107:8-112:3; EX1025, ¶14. Moreover, nothing in the claims requires any relative timing of the transmissions. EX1024, 48:1-17 (acknowledging no timing requirement other than that implicit in TDD operations). Also, GAS's attacks on Atsuta for allegedly lacking certain claim elements ignore that Vornefeld discloses what GAS alleges Atsuta lacks, including:

- “beamforming”;
- “a TDD frame”; and
- “a downlink portion of said TDD frame.”

EX1001, claim 1; EX1009, 7; EX1024, 69:9-70:17, 84:17-85:16, 86:21-87:4. The Petition relied on Vornefeld's teachings on these points. Pet., 15-23, 26-38; EX1004, 52 (“time-division duplex (TDD)”; “smart antennas form their beams”), 54 (“broadcast channels ... followed by a downlink phase”), 55, 57; EX1024, 79:7-14; EX1025, ¶¶5-6, 15. In fact, GAS's expert confirmed that Vornefeld's downlink timeslots are assigned to different devices because of Vornefeld's TDMA design. EX1024, 97:11-101:9.

Ultimately, relative to the prior IPR, the *only* information even arguably needed to supplement Vornefeld is whether the prior art suggests sending “second downlink data” to a second sector within the same frame. EX1009, 23; EX1025, ¶21. The Vornefeld-Atsuta combination answers that question.

B. GAS's Attacks on Combining Vornefeld and Atsuta Are Meritless

1. GAS Ignores the Bases for the Combination

In attempting to manufacture confusion, GAS ignores the simple bases for the combination stated in the Petition, including:

- “Vornefeld and Atsuta ... are both directed to ... using TDMA frame-structured transmissions” (Pet., 28);
- “[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.” (Pet., 27);
- “Vornefeld acknowledges that computational complexity is a common concern” and “Atsuta’s design reduces the required number of functional circuits in order to ... reduce complexity.” (Pet., 27); and
- “While Vornefeld may have used different frames for different sectors [under GAS’s pre-district court “frame” position], 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.” (Pet., 28-29).

GAS distracts attention from these simple positions. But its expert’s admissions tell a different story. Critically, GAS’s expert did not dispute Atsuta teaches “different time slots in the same frame are assigned to different devices in

different sectors” and admitted a POSA would not “consider odd” Atsuta’s approach of including “in a single frame communications ... to devices in different sectors.” EX1024, 191:6-193:15, 169:14-170:5. GAS’s expert admission on this linchpin issue confirms Ground 1, and GAS’s scattershot attacks on combining Vornefeld and Atsuta all fail.

2. TDMA and TDD Are Combined in the Art

GAS’s lead argument against combining Atsuta with Vornefeld is an erroneous attempt to manufacture a divide between TDMA and TDD. POR, 1, 33-37; EX2028, ¶¶42-43, 109. GAS’s argument is meritless.

Vornefeld describes a TDMA/TDD frame with a downlink portion for transmissions to different devices, and the Petition establishes that Atsuta’s TDMA design is “compatible with a TDD frame.” Pet., 15-21, 31-32, 23-26; EX1004, 53, Fig. 3; EX1024, 70:10-17, 167:6-168:20; EX1025, ¶¶6-13, 18-20, 27; EX2028, ¶77 (“Atsuta discloses a basic, conventional TDMA method.”). Thus, GAS’s arguments that (i) Atsuta’s TDMA description renders it inapplicable to Vornefeld and (ii) Atsuta does not disclose TDD methods fail.

A POSA would not understand the concepts of TDMA and TDD to be alternatives, but rather related concepts used together. TDMA is a type of multiplexing (or “multiple access” for defining the division of resources amongst *different devices*) in which different devices are assigned different timeslots.

EX1021, 327-73, 876; EX2022, 400-01; EX1025, ¶¶7-10. TDD is a type of duplexing, which refers to dividing between the uplink and downlink directions (independent of the number of devices). EX1025, ¶¶11-12. Duplexing and multiplexing work together. EX1025, ¶¶5-17. GAS itself combined the concepts in explaining them in the District Court. EX1028, 370:12-371:5 (combing the concept of uplink and downlink times with timing for communications with different devices).

Beyond the fact that Vornefeld discloses TDMA/TDD operations coexisting in a frame, the '931 patent itself describes a TDMA/TDD frame. EX1001, 10:59-61, 14:28-33. GAS's expert likewise admits TDMA is not used in isolation but rather would be coupled with either TDD or FDD. EX2028, ¶44; EX1024, 25:20-27:11; EX1027, 273:9-274:1, EX1025, ¶¶12-13.¹ Notably, the very definition of "frame" is "[o]ne complete cycle of events *in time division multiplexing*"² (*i.e.*, TDMA). EX1021, pp. 372-73 (entry 3), 876; EX1024, 13:3-15:16; EX1025, ¶¶12-13. Even the textbook introduced by GAS on this point refers to "TDMA frame[s]" with TDD

¹ He also defined duplexing to mean *time* division of uplink and downlink (*i.e.*, TDD), despite elsewhere trying to paint an assumption of FDD duplexing when reading the prior art. EX1024, 23:4-14.

² Emphasis added throughout.

as a subpart of the multiplexing discussion. EX2022, pp. 395-402; EX1024, 19:10-14. Thus, GAS's attempt to create a divide between "TDMA" and "TDD" frames fails.

The combination addresses how a POSA would address arranging downlink transmissions to different devices in different sectors as required by claims 28 and 29. EX1024, 75:6-15; EX1028, 525:19-23, 457:24-458:9. The question of transmissions to *different* devices is one of multiplexing, which makes the common TDMA teachings of Vornefeld and Atsuta relevant to the question at hand regardless of whether Atsuta is TDD. EX1025, ¶7. Regardless of how one labels Atsuta's frame, the described frame includes (in the downlink) transmissions to devices in different sectors, which, in combination with Vornefeld, renders the claims unpatentable. EX1025, ¶¶22-23.

Moreover, the evidence reflects that Atsuta does teach a TDD frame, contrary to GAS's contention. POR, 33-37. A POSA would have understood Atsuta to be a TDD system based on its asymmetry discussion. EX1002, ¶105; Pet., 31-32; EX1005, 5:66-6:12; EX1025, ¶¶24-28. GAS's argument that an asymmetric transmission would indicate FDD rather than TDD is contradicted by GAS's expert's admissions, as well as dictionary definitions of "TDD" and "FDD." GAS's expert repeatedly admitted that asymmetry indicates a TDD operation. EX2028, ¶¶152, 44, EX1024, 32:4-17. Also, the very definitions of FDD and TDD indicate

that TDD is used in asymmetric applications. EX1021, 876 (TDD: “best suited for asymmetrical applications”), 349-50 (FDD: “appropriate for symmetrical services”); EX1024, 20:12-19, 44:15-45:15; 1026, Abstract; EX1025, ¶25.

TDD is used for asymmetric applications because the timeslots can be easily reassigned as needed (*e.g.*, dynamically providing more capacity in one direction). FDD presents a challenge for asymmetry because reassigning frequency bands would require retuning radios and because existing protocols often dictate uplink/downlink frequency bands, thus precluding reassignment to create asymmetry. EX1025, ¶25 (citing EX1023, p. 506); EX1024, 33:4-35:11.

GAS tries to tie Atsuta’s asymmetry discussion to an FDD operation because the term “frequency” appears in the text. POR, 36-37; EX1005, 5:57-6:12. However, that section of Atsuta explains that the asymmetrical communication is needed to handle the differences in “transmission capacity” (along with bandwidth). *Id.* GAS’s expert admitted that “capacity” generally refers to the timeslots that can be reallocated to provide asymmetry in TDD methods. EX1024, 31:20-34:1, 40:13-17, 42:1-6, 43:15-44:5. The capacity discussion would indicate to a POSA a TDD operation. EX1025, ¶¶26-28. Even viewing Atsuta’s mention of “frequency band and transmission capacity” in a light most favorable to GAS, the same would, at most, indicate both options (TDD and FDD) could be used. *Id.*

Thus, Atsuta teaches a TDD system. Again, however, the Petition asserts that Atsuta's frame structure is *compatible* with a TDMA/TDD frame, making this question a strawman. No dispute exists on TDMA-TDD compatibility. EX1024, 136:21-137:6.

3. Atsuta Applies to the Downlink

GAS also argues that Atsuta “focuse[s] on the uplink” and “does not teach ... implementing its advantage in the downlink direction.” POR, 32-33 (emphasis removed), 41. This argument is factually and legally wrong. GAS tries to limit Atsuta to the “receiving” apparatuses shown in Fig. 2, while ignoring the “transmitting” devices shown in Fig. 4. *See* Pet., 30-31.

As a matter of law, a reference is not limited to what it “focuses” on but is taken for everything it teaches. *In re Fulton*, 391 F.3d 1195, 1200 (Fed. Cir. 2004) (explaining that the prior art must be understood for what it teaches “as a whole”). Atsuta clearly teaches that its combination of transmissions to different sectors into a single frame also occurs in the downlink direction. EX1005, Fig. 4, 6:35-64. (“receives a plurality 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 the modulating circuit 12”). Specifically, Atsuta describes creating “a” frame for the various sectors, which is sent from the centralized circuitry to the antennas directed

to those sectors. EX1025, ¶¶29-31. GAS's expert acknowledged that Atsuta's reference to "a predetermined synchronous frame" indicates a single frame. EX1024, 172:20-174:9 (also confirming the disclosure is for downlink).

4. GAS's Argument Regarding Simultaneous Transmissions Fails

GAS further argues that Atsuta would "thwart the very purpose of Vornefeld" because Vornefeld describes simultaneous transmissions and Atsuta does not. POR, 45. This argument fails in the first instance because GAS's own position is that the claims do not require simultaneous transmissions. POR, 31. Thus, the argument is a strawman.

In any event, GAS's assertion that Atsuta "teaches away" (POR, 22) from Vornefeld's simultaneous transmissions achieved through beamforming rests on Atsuta being *silent* as to beamforming. EX1024, 59:4-60:13, 135:22-136:4, 138:9-20. That assertion fails as a matter of law. *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 567 F.3d 1314, 1327 (Fed. Cir. 2009) (explaining that a reference does not teach away if it fails to "criticize, discredit or otherwise discourage" the option).

The argument also relies on the erroneous notion that Atsuta's TDMA frame assigns transmissions to different devices along the time axis in a way that is contrary to Vornefeld's simultaneous SDMA transmissions. POR, 46. But GAS ignores that Vornefeld is *also* a TDMA design. Vornefeld combines TDMA and SDMA operations such that the system uses TDMA to "split up transmission constellations

on the time axis” and, where spatial separation allows, can also use simultaneous transmissions in the same time slot through SDMA. EX1004, 55, 52; EX1024, 49:21-50:22; EX1024, 77:12-78:19, 80:9-19, 134:21-135:2, 136:21-137:19, 141:1-6. Thus, simultaneous transmissions through SDMA/beamforming would not be thwarted by a TDMA design where Vornefeld *already* combines both operations. EX1025, ¶¶43-45.

At base, Atsuta teaches that, in a single frame, the timeslots may be assigned to devices in different sectors. EX1005, Fig. 3, 5:21-43, 6:13-41, 3:1-5, 1:53-55 (comparing a multi-frame option). And Vornefeld already teaches a TDMA/TDD frame with timeslots in the downlink phase for different devices. Thus, Atsuta simply confirms that the timeslots can be assigned to devices in different sectors, which is all that is needed to render the claims unpatentable. EX1025, ¶45.

5. Interference Concerns Promote, Rather than Discourage, the Combination

GAS argues that a “key aspect” of the claims is the timing of the uplink and downlink transmissions in a TDD operation to avoid interference between sectors. POR, 9. It further argues that neither Vornefeld nor Atsuta addresses interference at sector boundaries. POR, 18, 21, 53-55. Notably, the claims recite no requirements for the relative timing of uplink and downlink transmissions and, in fact, recite no specific uplink transmission. *See* EX1001, claims 1, 19, 28, and 29; EX1025, ¶¶14, 56. In any event, GAS’s arguments fail for multiple other reasons.

First, even apart from Vornefeld's express teachings, it is a basic tenet of TDD operations that the uplink and downlink transmissions are timed so as not to overlap. EX1025, ¶14; EX1026, Abstract, 2617 (Sec. 4), 2619 (Secs. 9-10). GAS's own expert confirmed that any timing requirement in the claims for uplink and downlink would derive from a POSA's conventional understanding of TDD. EX1024, 48:1-17, 111:1-10, 115:11-20. And it was well known by the time of the invention that TDD transmissions had to be synchronized across sectors, as reflected in contemporaneous standards identifying it as "necessary to ensure that the uplink/downlink switching points are positioned at the same time instant at least in adjacent cells." EX1032, 24, 8-9.

Second, even if the '931 patent mentions cross-sector interference as a reason for its design, there is no requirement that a motivation to combine references must match the patent's reasoning. *In re Kahn*, 441 F.3d 977, 990 (Fed. Cir. 2006) (a POSA "need not be motivated to combine [] for the same reason contemplated by the [inventor]").

Third, both Vornefeld and Atsuta address avoiding interference among different devices and use TDMA methods. EX1004, 52 (col. 2), 55 (col. 2); Ex, 1005, 3:59-6:5, 3:1-5; EX1025, ¶¶41-42. GAS's expert admits that TDMA's purpose is to prevent interference, *including at sector boundaries*. EX1024, 90:22-91:5, 92:11-17, 134:3-8 (admitting that preventing interference is "fundamental to the purpose

of TDMA”). Atsuta describes avoiding potential interference (“colliding”), among different sectors by arranging the transmissions so as not to overlap in time. EX1005, 3:66-4:12, Fig. 3; EX1025, ¶42; EX1028, 368:17369:2 (equating colliding with interference). Thus, both references use TDMA methods to avoid interference between devices, with Atsuta applying the concept to avoid cross-sector interference.

Interestingly, GAS argues that Vornefeld’s interference problem is limited to beamforming and is solved in the reference, such that a POSA would have no reason to combine any reference related to interference with Vornefeld. POR, 53-54. This argument urges a view of obviousness in which any reference that offers a solution to a problem becomes inherently uncombinable with other references. That argument misapprehends the law. *Elekta Ltd. v. ZAP Surgical Sys., Inc.*, 81 F.4th 1368, 1374 (Fed. Cir. 2023) (“The inquiry into the existence of a motivation to combine assumes that a skilled artisan is a person of ordinary creativity with common sense, common wisdom, and common knowledge” such that the prior art need not “expressly state a motivation for every obvious combination”). The argument also views interference myopically. A POSA would have understood that addressing interference among transmissions to different devices is a concern within and across sectors, as well as independent of beamforming. EX1025, ¶42; EX1024, 119:5-14 (“it’s no secret that a [POSA] knows about intracell interference”), 120:11-

21.

Thus, GAS's interference arguments fail.

6. GAS's Assertions About Increased Complexity Are Baseless

Despite Atsuta specifically stating that its system simplifies hardware requirements and increases "transmission capacity ... without a problem" (EX1005, 5:65-67; *see* EX1024, 146:2-13, 148:4-6), GAS argues that a POSA would reject Atsuta as adding complexity (POR, 55-58). GAS's argument is untethered from the record and the law.

GAS alleges that Atsuta's system would increase the cost/complexity of the circuitry (due to TDMA control circuit 9's robustness, number of outputs, and clock speeds) and require the purchase of additional spectrum. These allegations rely on fuzzy math. For context, Atsuta's concept simplifies the hardware by replacing three different sets of circuits (*e.g.*, TDMA Control Circuits 9a-c in Fig. 1) with one centralized design (*e.g.*, inventive TDMA Control Circuit 9 in Fig. 2). EX1005, Figs. 1, 2, and 4, 3:51-66, 1:13-24, 2:60-63, 4:44-5:11, 7:24-30. GAS argues that the centralized TDMA Circuit 9 would require a more expensive/complex design. However, GAS compares TDMA Circuit 9 of Fig. 2 with *one* of TDMA Circuits 9a-c in the prior art design in Fig. 1. EX1024, 149:14-150:18, 158:8-16. But TDMA modulation circuit 9 in Fig. 3 replaces all *three* circuits. EX1005, 1:53-2:57, 4:44-16, 6:25-57; EX1024, 143:2-22. GAS's expert confirmed that Fig. 3's TDMA

Circuit 9 would not be 3 times more complex than the *aggregate* of the three circuits it replaces. EX1024, 158:8-16 (estimating 2-2.5 times more complexity as compared with one of the prior circuits). EX1025, ¶¶32-34. GAS's "outputs" argument suffers from the same error. EX1024, 150:10-18. Thus, there is no dispute that Atsuta's inventive design is less complex/expensive in the aggregate. EX1025, ¶¶32-34, 40.

Regarding clock speed, a similar analysis applies, because the centralization of the circuitry requires a third of the number of clocks. EX1024, 162:13-164:5; EX1025, ¶¶38-40. Moreover, GAS's clock argument incorrectly assumes that Atsuta's design would use shorter timeslots. EX2028, ¶127; EX1024, 159:8-15. However, as GAS's expert admits, this may not be the case given that some standards dictate the timeslot size, such that no change in duration could be implemented. EX1024, 161:17-162:12. Also, even where the duration of the timeslot rests with the designer, a POSA would have understood that timeslot duration can be set in any manner as a design choice. EX1025, ¶39.

GAS also argues that Atsuta's inventive design would require the purchase of more of the spectrum. POR, 58. That argument rests on the idea that more of the intermediate frequencies between, *e.g.*, f_1 and f_2 would be used in Atsuta's design in Fig. 3, as compared to the prior art design.

understood that there is spectrum dedicated for public use without a license, such the assumption that spectrum would have to be purchased is factually incorrect. EX1025, ¶36; EX1031, 4123 (“non-licensed spread spectrum”). Also, financial cost is not a proper rebuttal to obviousness. *In re Farrenkopf*, 713 F.2d 714, 718 (Fed. Cir. 1983) (rejecting the idea that a businessperson may reject an idea to costs as a basis for finding a lack of motivation for a POSA); EX1024, 145:13-146:1; EX1025, ¶37.

GAS’s expert’s ultimate retreat on the application of *Atsuta* was to assert that a POSA would not rely on *Atsuta* “at all” for any teaching. EX1024, 149:11-13. That absurd position—namely, that GAS hopes to ignore *Atsuta* completely—underscores the strength of *Atsuta*’s teachings.

Finally, GAS’s attack on *Atsuta* directly contradicts its District Court position, which alleged that a key to the ’931 patent is “centralized control[] ... across multiple sectors.” EX1029, 1115:11-1116:10. Such a centralized design is exactly what *Atsuta* describes (and what GAS criticizes in this IPR).

V. Ground 2 – Vornefeld and Goldberg

A. Vornefeld

Vornefeld applies in the same manner as discussed above for Ground 1. EX1025, ¶46.

B. Goldberg

As with Atsuta, GAS (incorrectly) attacks Goldberg as not being a TDD reference. POR, 58-61. Additionally, GAS attempts to sidestep Ground 2 by alleging that it should be limited to only the alternative construction not adopted by the District Court. POR, 63. Those arguments fail.

1. TDD

As discussed above, Vornefeld already teaches a TDMA/TDD frame with a downlink portion that contains timeslots to be assigned to different devices, such that the only remaining question is whether those timeslots can be assigned to devices in different sectors. Thus, whether Goldberg describes TDD or FDD methods does not change the outcome of the combination. EX1025, ¶¶47-48.

Nevertheless, Goldberg in fact teaches TDD methodology. While GAS alleges that “all embodiments” of Goldberg use the GSM standard (POR, 25, 59), Goldberg explicitly states that its invention “is applicable to all download broadcast and transmissions.” EX1006, 2:6-12. Furthermore, Goldberg identifies a specific TDD protocol as being part of its invention. Goldberg states that “[s]ome examples of a cellular system to which the present invention can be applied are systems using variants of the Personal Handy Phone System (PHS) ... [and] systems that use the ... []GSM[] protocol.” EX1006, 1:48-61. GAS wholly ignores the PHS protocol—a TDMA/TDD design. EX1022, pp. 429-430; EX1025, ¶¶49-52. GAS’s expert

admitted that he did not know whether PHS was a TDD design, despite the textbook he relied upon for his understanding of TDMA and TDD explicitly describing the PHS standard. EX1023, 544; EX1024, 176:13-178:7. Also, Goldberg explains that “[h]ow to adapt these for other air interfaces and for other multiplexing schemes would be clear to one of ordinary skill in the art.” EX1006, 6:50-58, 11:12-23. Consequently, Goldberg describes both TDMA/TDD and TDMA/FDD options and acknowledges that a POSA would be able to mix and match methodologies with ease. EX1025, ¶¶50-51.³

Additionally, both Vornefeld and Goldberg describe combining TDMA and SDMA multiplexing functionality together in sectorized systems, such that a POSA would have immediately understood their compatibility. EX1006, 2:21-33, 3:47-4:18, 10:10-13, 20:7-35; EX1004, 52; EX1024, 178:19-179:13; EX1025, ¶51.

Ultimately, a reference must be understood for all that it teaches. *In re Fulton*, 391 F.3d at 1200. Consequently, a POSA would understand that Goldberg teaches the applicability of its teachings for TDMA/TDD designs such as used in Vornefeld. Again, the question at issue relates to multiplexing—namely, whether to put in one frame downlink transmissions to devices in different sectors.

³ These teachings in Goldberg also rebut GAS’s similar arguments with respect to Ground 1, above.

2. Goldberg Applies Under Any Construction

Given the applicability of Goldberg, GAS attempts to exclude Goldberg from consideration by falsely alleging that it applies only under the alternative construction of “sector” not adopted by the District Court. POR, 63. However, the Petition explicitly states that Goldberg applies under any construction. Pet., 40 (“obvious under any reasonable construction of ‘sector’”).

GAS cites to the deposition of Verizon’s expert—Dr. Almeroth—to allege that he admitted that Goldberg should be limited to only one construction. POR, 62 (citing EX2029, 35:1-37:3). A plain reading of the cited testimony shows that Dr. Almeroth made no such admission. He simply stated that he was not able to find in his declaration a specific statement on the issue. Elsewhere, he made clear that his analysis of Goldberg was not limited to one construction. EX2029, 26:10-28:13 (“Goldberg discloses both of the parties’ constructions.”).

Notably, nowhere does GAS dispute that Goldberg teaches that the division of user devices into distinct regions spans sectors, so as to meet both constructions. Specifically, the Petition established that Goldberg suggests that the various regions to which devices are assigned “are created without regard to [the] antenna array transmission area,” such that Goldberg applies under either construction of “sector.” Pet. 40 (citing EX1002, ¶117); *see* EX1024, 202:18-22. GAS never actually disputes the cross-sector operation.

Instead, GAS argues that “there is nothing in Goldberg that teaches ‘transmit[ting] to multiple subscribers within the same frame.’” POR, 64. But that assertion is demonstrably false as Goldberg describes a single “downlink frame” where timeslots are assigned to different mobile devices, as GAS’s expert agreed. EX1006, 12:11-24 (time-slot 1 might contain [] data for one mobile ... and time-slot 7 might contain [] data for yet another mobile”; “[a]ll of this data ... is assembled into a 1250 bit frame”); EX1024, 186:14-187:7; EX1025, ¶¶53-55. That clearly erroneous argument does nothing to address a POSA’s understanding of cross-sector applicability of timeslots. GAS may have refrained from making such a rebuttal given its trial position in which a frame “is the schedule ... *across all sectors*.” EX1028, 416:10-12. Alternatively, GAS’s refrain may reflect the fact that Goldberg describes as much on this concept as the ’931 patent itself. EX1001, Fig. 3, 14:23-15:20; EX1024, 63:11-64:17. Regardless, GAS’s silence on this issue leaves no credible rebuttal to the application of Goldberg.

Finally, GAS argues that Goldberg describes nothing more than what Vornefeld describes and that the Board and Federal Circuit “ruled that Vornefeld does not teach” the claimed subject matter. POR, 64. The Board found that the prior “Petitioner ha[d] not demonstrated that claim 28 is anticipated by Vornefeld.” EX1009, 24. A ruling on the burden is not a ruling as to whether a POSA would find obvious the inclusion of downlink transmissions to different sectors in a single

frame. As discussed above, GAS's own expert testified that a POSA would not find that concept odd. EX1024, 191:6-193:15.

C. The Combination of Vornefeld and Goldberg

GAS's arguments against the combination of Vornefeld and Goldberg repeats arguments made against Ground 1. For instance, GAS argues that (i) Vornefeld solves an interference problem and, thus, a POSA would not combine Goldberg (POR, 61) and (ii) a POSA would not rely upon an FDD reference for use with Vornefeld (POR, 64). Those arguments fail for reasons discussed above. EX1025, ¶56.

Interestingly, GAS refers to "an FDD multiplexing scheme" and states that FDD "is an older approach to multiplexing." POR, 64, 59. As discussed above, FDD does not address multiplexing at all. FDD is a duplexing method. Thus, GAS confuses multiplexing and duplexing but acknowledges that multiplexing is the relevant issue. Both Vornefeld and Goldberg use TDMA multiplexing, which is a basis for the combination. Pet., 39, 41-42.

Finally, GAS argues that the reasons to combine somehow rests on a construction of "sector" that GAS states is not applicable. POR, 61-62. That argument is nonsensical. The reasons to combine provided in the Petition are based how a POSA would have viewed the prior art, not on how a POSA would have viewed the claims. The Petition does not argue (and it would be legally flawed to

assert) that the POSA had knowledge of the content of the claims, let alone the claim construction.

VI. Ground 3: Yousseffmir and Atsuta

GAS alleges that Yousseffmir lacks claim 1[d] because it does not explicitly describe a broadcast beam sent to more than one sector. POR, 65-67. Yousseffmir makes clear that the system (i) sends, at the beginning of a frame, a broadcast beam (“frame marker”) from the base station to “*all* remote user terminals” (EX1007, 18:30-33; 25:52-62) and (ii) may be a sectorized system (*id.*, 9:13-19). EX1025, ¶¶57-58. GAS disputes neither point. Also, the Petition established that, with sectorization, “transmissions to all users would be understood to be across sectors.” Pet., 59-60, 54. GAS conceded this very point at trial, when its expert explained that the ’931 patent’s disclosure of sending a broadcast signal to “all the subscribers” in a sectorized system necessarily meant sending to multiple sectors. EX1029, 1111:18-1113:19. GAS also conceded this feature was known based on a similar disclosure in Vornefeld. EX1009, 16-17, 3-4, 7; EX1025, ¶59. GAS also fails to appreciate the ground as a whole, which relies upon Atsuta for teaching that a single frame would encompass multiple sectors. Pet., 52.

Furthermore, at trial, GAS’s expert testified that the claimed “broadcast beam” to multiple sectors is not one signal, but rather “a composition of ... individual broadcast beams” sent in individual sectors. EX1028, 370:21-371:1,

390:8-11 (“The combination of the broadcast beams in each sector is the broadcast beam signal.”), 401:11-13, 402:2-22. Thus, GAS’s challenge contradicts its trial admissions.

GAS also challenges the combination of Youssefmir and Atsuta using the same reasoning offered for Ground 1. POR, 69-70. Those arguments fail for the reasons discussed above. EX1025, ¶¶60-62.

VII. Conclusion

For these reasons, claims 28 and 29 are unpatentable.

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CERTIFICATE OF COMPLIANCE WITH 37 C.F.R. § 42.24

I hereby certify that this Reply complies with the word count limitation of 37 C.F.R. § 42.24(a)(1) because the Reply contains a total of 5,594 words. This total excludes the cover page, signature block, and the parts of the petition exempted by 37 C.F.R. § 42.24(a)(1).

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The undersigned certifies that a complete copy of this Reply and all Exhibits and other documents filed together with this Reply were served on the Patent Owner at:

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