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Paper 8
Entered: September 7, 2021

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CORNING OPTICAL COMMUNICATIONS LLC,
Petitioner,

v.

DALI WIRELESS, INC.,
Patent Owner.

IPR2021-00492
Patent 9,197,358 B2

Before MELISSA A. HAAPALA, *Senior Lead Administrative Patent Judge*, and KARL D. EASTHOM and SHARON FENICK, *Administrative Patent Judges.*

FENICK, *Administrative Patent Judge*.

DECISION
Denying Institution of *Inter Partes* Review
35 U.S.C. § 314

I. INTRODUCTION

A. Background and Summary

Corning Optical Communications LLC ("Petitioner") filed a Petition requesting *inter partes* review of claims 1–21 (the "challenged claims") of U.S. Patent No. 9,197,358 B2 (Ex. 1001, "the '358 patent"). Paper 2

("Pet."). Dali Wireless, Inc. ("Patent Owner"), filed a Preliminary Response. Paper 6 ("Prelim. Resp.").

The Board has authority to determine whether to institute an *inter partes* review. See 35 U.S.C. § 314(b); 37 C.F.R. § 42.4(a). Under 35 U.S.C. § 314(a), we may not authorize an *inter partes* review unless the information in the Petition and the Preliminary Response "shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition." For the reasons that follow, we do not institute an *inter partes* review as to the challenged claims of the '358 patent.

B. Real Parties in Interest

Petitioner identifies Corning, Inc., and Corning Research and Development Corp. as additional real parties in interest. Pet. 3. Patent Owner identifies no additional real parties in interest. Paper 4, 1.

C. Related Matters

Petitioner and Patent Owner each identify *Dali Wireless Inc. v. Corning Optical Communications LLC*, Case No. 3:20-cv-06469-EMC (N.D. Cal.) ("the related district court action") as a related action involving the '358 patent. Pet. 1; Paper 4, 1.

D. The '358 Patent

The '358 patent, titled "Method and System for Soft Frequency Reuse in a Distributed Antenna System," describes using soft frequency reuse (SFR) or fractional frequency reuse (FFR) techniques in a Distributed Antenna System (DAS) as part of a distributed wireless network. Ex. 1001, codes (54), (57), 1:39–47. In one embodiment, the '358 patent describes a method for "routing and switching operator RF signals" via Digital Remote Units (DRUs), which are remote antenna units geographically distributed to

be physically close to wireless subscribers, in order to reduce access distance, and cover dead spots in wireless communications systems. *Id.* at 1:27–29, 1:52–57, 2:59, 6:53–59. These DRUs are in communication with one or more Digital Access Units (DAUs), which may be themselves coupled to Base Transceiver Stations (BTS). *Id.* at 1:55–57, 2:59–63, 11:51–64. The DRUs of the DAS may be separated into geographically separate cells, with one or more DRUs providing service in each cell. *Id.* at 9:42–51, 10:57–59.

In order to mitigate inter-cell interference for users near the cell boundaries, frequency reuse techniques are combined with DAS techniques; these frequency reuse techniques "effectively reduce inter-cell interference by geographically spacing . . . competing transmissions farther apart, which benefits users near the cell boundaries." *Id.* at 5:49–54, 6:49–52, 7:3–9:4, Figs. 1A–1F. For example, in an SFR scheme, coverage in the central portion of a cell is provided by all frequencies in the allocated frequency spectrum, while coverage over peripheral portions of the cell is provided only by a portion of the frequency spectrum. *Id.* at 7:51–8:44, 18:48–19:8, Fig. 1C, 1F, 8. To provide this coverage, where one DRU is used for each cell, the DRU transmits at a first level for the portion of the frequency spectrum that covers only the central portion of a cell, and at a higher power level for the portion of the frequency spectrum that covers both the central and the peripheral portions of the cell. *Id.* at 7:57–61, 8:1–12, 10:56–59, 11:16–32. To mitigate inter-cell interference, in different cells the frequencies transmitted at higher power are grouped into subbands with little or no overlap between the subbands. *Id.* at 7:61–65, 8:23–32, 8:34–44, Fig. 1F. "Thus, at the intersections between cells, since different portions of the

available frequency band are being utilized, interference is reduced." *Id.* at 8:32–34.

Figure 1F of the '358 patent, reproduced below with our annotations in color, illustrates the transmit/receive power as a function of frequency according to SFR:

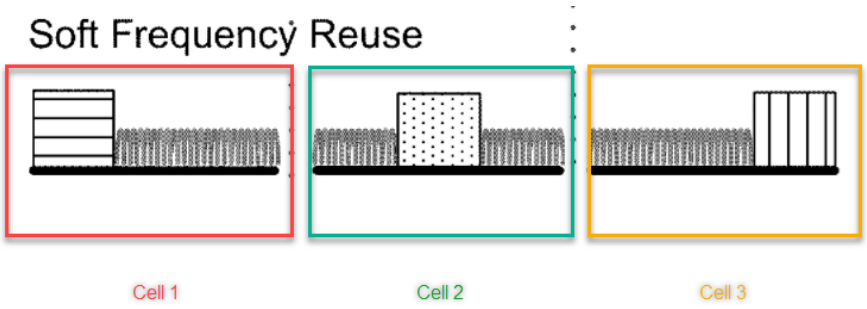


FIG. 1F

Figure 1F illustrates the use of the same frequency spectrum across three different cells. *Id.* at 5:7–9, 8:26–32. In a first cell, as illustrated at the left in the red box, the first part of the spectrum, approximately one-third of the spectrum (shaded with horizontal lines), is transmitted at a higher power, while the remaining two-thirds is transmitted at a lower power. *Id.* at 8:26–32, Fig. 1F. In the second cell, as illustrated in the center in the green box, a different portion of the spectrum is transmitted at a higher power (shaded with dots), and in the third cell, as illustrated at right in the orange box, a third portion of the spectrum (shaded with vertical lines) is transmitted at a higher power. *Id.* Thus, areas reached by only the higher power transmissions, at the edge of the cells will have less inter-cell interference, as no adjoining areas of two cells are covered by the same portion of the frequency spectrum. *Id.* at 8:32–34. This is seen in Figure 1C, reproduced below:

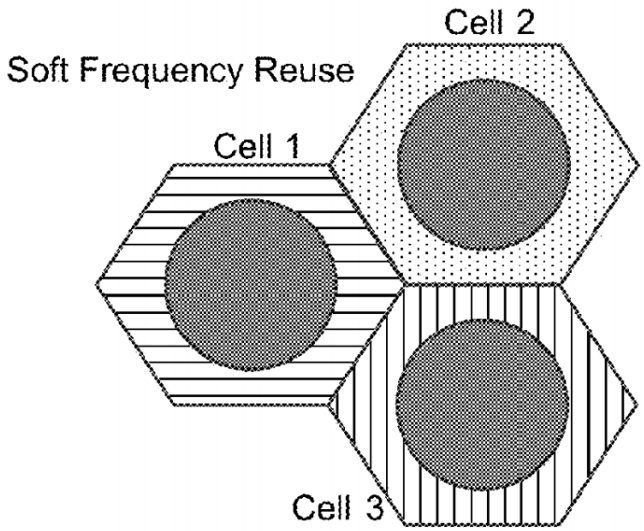


FIG. 1C

"Figure 1C illustrates the power and frequency assignments in the different cells of a system with SFR and a reuse factor of 3." *Id.* at 7:55–57. As can be seen in Figures 1C and 1F, the peripheral portions of the different cells are covered by different portions of the frequency spectrum, shaded to correspond with Figure 1F. *Id.* at 8:1–9.

The '358 patent presents an architecture that combines DAS and SFR for an Orthogonal Frequency Division Multiple Access (OFDMA) system such as the next generation wireless communications systems that use 3GPP LTE (Long Term Evolution). *Id.* at 5:44–46, 6:10–16, 9:7–8. The distributed antennas are connected to an eNodeB (eNB) LTE system. *Id.* at 6:59–61, "OFDMA provides the ability for each eNB to selectively allocate frequency sub-bands, data rates and power to the users depending on their location in the cell, according to some predefined frequency reuse pattern which may lead to significant capacity gains for the overall network." *Id.* at 7:34–38. Users are assigned resource blocks (RBs) in a frequency spectrum

that serves the area of the cell in which they are located. *Id.* at 7:40–46, 7:61–65, 12:15–43.

E. Illustrative Claims

The Petition challenges independent claims 1, 7, and 15, and dependent claims 2–6, 8–14, and 16–21. Claims 1 and 7 illustrate the challenged claims at issue:

> 1. A method for routing and switching operator RF signals, the method comprising:
>
> providing one or more Digital Remote Units (DRUs), each configured to receive one or more downlink radio frequencies and to transmit one or more uplink radio frequencies;
>
> providing at least one Digital Access Unit (DAU) configured to communicate with at least one of the one or more DRUs;
>
> wherein a first DRU in a first cell is operable to communicate using:
>
> a first set of frequencies characterized by a first frequency band over a first geographic footprint; and
>
> a second set of frequencies characterized by a second frequency band different from the first frequency band over a second geographic footprint including and surrounding the first geographic footprint;
>
> wherein a second DRU in a second cell is operable to communicate using:
>
> the first set of frequencies over a third geographical footprint; and
>
> a third set of frequencies characterized by a third frequency band different from the first frequency band and the second frequency band over a fourth geographic footprint including and surrounding the third geographic footprint.
>
> 7. A method of distributing communications frequencies, the method providing:
>
> providing a set of communications units;

transmitting and receiving, from a first communications unit of the set of communications units:

a first set of frequencies characterized by a first frequency band and a first geographic footprint; and

a second set of frequencies characterized by a second frequency band different from the first frequency band and a second geographic footprint larger than and at least partially surrounding the first geographic footprint; and

transmitting, and receiving, from a second communications unit of the set of communications units:

a third set of frequencies including one or more frequencies in the first frequency band and a third geographical footprint; and

a fourth set of frequencies including one or more frequencies in a third frequency band and a fourth geographical footprint larger than and at least partially surrounding the third geographical footprint.

Ex. 1001, 21:12–38, 21:54–22:7.

F. Asserted Grounds

Petitioner asserts that claims 1–21 would have been unpatentable on the following grounds:

Claim(s) Challenged	35 U.S.C. §[1]	Reference(s)/Basis
1–21	103	Fujii[2]

[1] The Leahy-Smith America Invents Act ("AIA"), Pub. L. No. 112-29, 125 Stat. 284, 287–88 (2011), amended 35 U.S.C. § 103. Because the effective filing date for the claims of the '358 patent appears to be before the effective date of the applicable AIA amendment, we refer to the pre-AIA version of 35 U.S.C. § 103. *See* Ex. 1001, code (60) (provisional application filing date of May 18, 2012). Our institution determination would not change under the post-AIA version of these statutes.

[2] Masaaki Fujii, User Scheduling for Distributed-Antenna Zero-Forcing Beamforming Downlink Multiuser MIMO-OFDM Systems. IEICE Trans. Commun. 93-B(9): 2370-2380 (2010) (Ex. 1005).

Claim(s) Challenged	35 U.S.C. §[1]	Reference(s)/Basis
1–21	103	Fujii and Cannon[3]
4	103	Fujii, Cannon, and Oren[4]

Petitioner additionally relies on the declaration of James A. Proctor, Jr. (Ex. 1003).

II. ANALYSIS

A. Legal Standards

"In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable." *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (requiring [*inter partes*] review petitions to identify "with particularity . . . the evidence that supports the grounds for the challenge to each claim")). This burden never shifts to Patent Owner. *See Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) (citing *Tech. Licensing Corp. v. Videotek, Inc.*, 545 F.3d 1316, 1326–27 (Fed. Cir. 2008)) (discussing the burden of proof in *inter partes* review). Furthermore, Petitioner must explain with particularity how the prior art would have rendered the challenged claims unpatentable. 35 U.S.C. § 312(a)(3); 37 C.F.R. § 42.104 ("The petition must specify where each element of the claim is found in the prior art patents or printed publications relied upon.").

A claim is unpatentable under 35 U.S.C. § 103 if the differences between the subject matter sought to be patented 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

[3] Cannon et al., US 2010/0177760 A1, pub. July 15, 2010 (Ex. 1006).
[4] Oren et al., US 2008/0232305 A1, pub. Sept. 25, 2008 (Ex. 1007).

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) objective evidence of nonobviousness, i.e., secondary considerations. *See Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

B. Level of Ordinary Skill in the Art

Relying on the testimony of Mr. Proctor, Petitioner contends that one of ordinary skill in the art at the time of the invention "would have had: (1) a bachelor's degree in electrical engineering; and (2) a minimum of 3–4 years of industry experience in wireless communications networks and engineering" but that "an individual with an advanced degree in electrical engineering would require less industry experience (e.g., 1–2 years)." Pet. 19 (citing Ex. 1003 ¶ 28).

Patent Owner submits that prong (2) of Petitioner's definition should be modified to specify that one of ordinary skill in the art "should also have a minimum of 3–4 years of industry experience in wireless communications networks and engineering *including knowledge* <u>*and*</u> *experience with DAS*," citing testimony given by Mr. Proctor in the related district court action. Prelim. Resp. 11 (emphasis added) (citing Ex. 2011, 101:7–17). Reading the relevant portion of Mr. Proctor's testimony in its entirety, Mr. Proctor testifies that one of ordinary skill in the art would "understand the [DAS] art" and agrees that a person of ordinary skill "would have some experience <u>or</u> knowledge with DAS" at least to the extent that they would be aware of DAS art. Ex. 2011, 100:15–102:8 (emphasis added).

On the record, requiring "knowledge and experience with DAS" as part of industry experience does not appear to be supported. Rather, we adopt Petitioner's definition for one of ordinary skill in the art, with the addition of the requirement that the person of ordinary skill at the time of the invention would additionally possess some experience with or knowledge of DAS. This level of skill comports with the disclosures of the '358 patent and the asserted prior art. We note that our analysis and determinations with respect to unpatentability would be the same if we had adopted Petitioner's proposed definition or Patent Owner's proposed definition.

C. Claim Construction

Petitioner argues that, "unless stated otherwise in the discussion of particular limitations [in the Petition]," we should give all terms their plain and ordinary meaning under the standard articulated in *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–13 (Fed. Cir. 2015) (en banc); Petitioner proposes what those meanings would be for "Digital Remote Unit"/"DRU" and "Digital Access Unit"/"DAU," in claim 1 and its dependent claims. Pet. 20. Patent Owner suggests alternative claim constructions for these terms, and additionally proposes a construction for the claim term "geographic footprint" as found in each independent claim and as additionally used in certain dependent claims. Prelim. Resp. 12–18.

The constructions proposed by the parties for the claim terms are as follows:

Claim term	Petitioner's proposal	Patent Owner's proposal
"Digital Remote Unit" / "DRU"	"a unit of a Distributed Antenna System (DAS) that supports the transport of radio resource signals between users and a central facility and/or one or more Digital Access Units (DAUs)."	"a unit in communication with a digital access unit for providing communications to and from user devices"
"Digital Access Unit" / "DAU"	"a unit of a Distributed Antenna System (DAS) that supports the transport of radio resource signals between at least one signal source and the one or more Digital Remote [Units] (DRUs)."	"a unit that manages communications between an operator network and one or more radio remote units"
"geographic footprint"		"an area or region near one or more DRUs"

Pet. 20 (Petitioner's proposals), Prelim. Resp. 12–18 (Patent Owner's proposals).

No construction of any term is necessary for this decision. *See Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) ("[O]nly those terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy.").

D. Obviousness of Claims 1–21 over Fujii and Obviousness of Claims 1–21 over Fujii and Cannon

Petitioner argues that claims 1–21 are obvious over Fujii alone, or alternatively, over Fujii and Cannon. Pet. 20–65. Patent Owner argues that

Petitioner has not met its burden with respect to the alleged obviousness of the claims over Fujii or Fujii and Cannon. Prelim. Resp. 24–44.

1. Fujii

Fujii is a paper appearing in the IEICE (Institute of Electronics, Information and Communication Engineers) Transactions on Communications titled "User Scheduling for Distributed-Antenna Zero-Forcing Beamforming Downlink Multiuser MIMO-OFDM Systems." Ex. 1005. Fujii describes base stations that transmit spatially-multiplexed data to the user equipment located in cells, transmitting through antennas that are geographically distributed within a cell to reduce access distance between user equipment (UE) and a distributed antenna subset. *Id.* at 2370. Fujii provides one example of antenna locations within a cell in Figure 5, reproduced below.

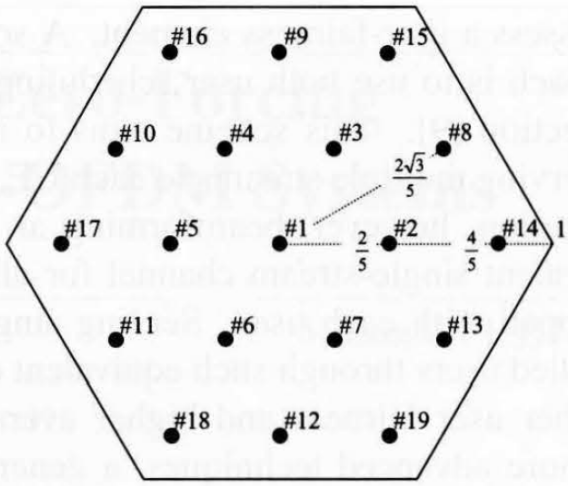


Fig. 5 Distributed antenna geometry.

Figure 5 depicts distributed antennas located throughout a cell. *Id.* at 2372.

Fujii describes using zero-forcing beamforming (ZFBF) multi-user (MU) multiple-input multiple-output (MIMO) OFDM to provide a higher average cell throughput. *Id.* at 2370. This technique, according to Fujii,

may be subject to degradation due to inter-cell interference and sacrifices fairness between users. *Id.* Thus, Fujii proposes using fractional frequency reuse techniques and improved user scheduling to provide high throughput and improved fairness in such a system. *Id.* at 2371.

Fujii describes a six step process that includes several preparatory back-and-forth communications steps from the base station to a UE: (1) a base station sends a general reference signal ("RS") for broadcast to any UEs in a cell, (2) a return signal including a "sounding RS" and a calculated average SIR (signal-to-interference ratio) is received from the UE in the cell, (3) the base station sends UE-specific RSs to the UEs, (4) each UE receives a UE-specific RSs and calculates additional information for the transmission, which is sent to the base station, (5) the base station receives the information and transmits spatially multiplexed-data to the UEs, and (6) the UEs detect the data and decode it. *Id.* at 2371–2372.

For transmissions specific to the UEs, Fujii's fractional frequency reuse technique first requires classifying all of the UEs in a cell to be classified into two groups: "inner-cell users" and "cell-boundary users." *Id.* at 2374. These are calculated using each UE's SIR returned to the base station from the UE, as described in step 2 above. *Id.* The UEs are sorted in descending SIR order separated into the two groups, for some value K_H: the "inner-cell" users are selected as the K_H ones with the highest SIR while "cell-boundary users" are the remaining (K_L) UEs with the lowest SIR. *Id.* Fujii notes that "the users are not classified here based on their distance from the center of a cell because the received signal power is not always attenuated proportional to the distance due to shadowing and instantaneous fading." *Id.*

Once the two groups of users have been established, Fujii describes the assignment of resource blocks to users according to a proportional fair scheduling technique and a zero forcing with selection technique. *Id.* at 2374–76, Fig. 8. This is performed separately for the inner-cell users and the cell-boundary users. *Id.* "The inner-cell users are allocated to RBs with FRF equal to one, whereas the cell-boundary users are allocated to cell-specific RBs with FRF equal to three." *Id.* N_{UF} RBs are allocated to inner-cell users, and N_{RF} RBs are allocated to cell-boundary users. *Id.*

The use of fractional frequency reuse for the allocation for three cells is illustrated in Figure 10, reproduced below:

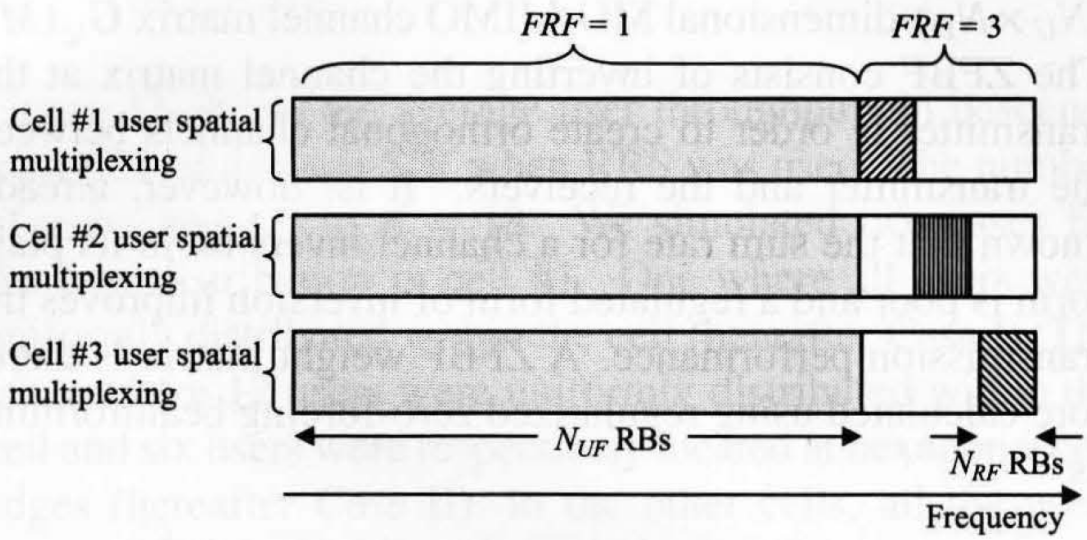


Fig. 10 Allocation of users to RBs with *FRF* = 1 and cell-specific RBs with *FRF* = 3.

As seen in Figure 10, the N_{UF} RBs from the portion of the spectrum that is reused in each cell are assigned to the inner-cell users, and the N_{RF} RBs assigned to cell-boundary users are in a portion of the spectrum that is not reused among the three cells. *Id.* at 2374–75.

Once the resource blocks have been assigned a scheduled user set is obtained, and a channel matrix is developed for transmission. *Id.* at 2375–76. The channel matrix is ($N_U \times N_D$) dimensional, where N_U is the number of users being transmitted to and N_D is the number of antennas in the cell. *Id.* at 2371, 2376.

A ZFBF weight matrix is then calculated for use in transmission, to maximize signal to interference and noise ratio at the receivers. *Id.* at 2376.

Fujii describes that, first:

> Data symbols or UE-specific RS to be transmitted to N_U users are arranged as $\boldsymbol{a}_{i_c}(m, n) = [a_{i_c,1}(m, n), a_{i_c,2}(m, n), \ldots, a_{i_c,N_u}(m, n)]^T$, where $a_{i_c,1}(m, n)$ has an average signal power of $E[|a_{i_c,1}(m, n)|^2] = 1/N_U$ for data symbols in the sub-channel where $FRF = 1$ and it is adjusted to FRF/N_U in the subchannel where $FRF = 3$ to maintain the same average total transmit signal power.

Id. Then, the beamformed transmit signal is obtained by using the weight matrix and the data symbols arranged as described. *Id.* The result is used to create of an N_D-dimensional OFDM signal for transmission from the N_D antennas. *Id.*

2. Analysis of Claims 1, 7, and 15

Petitioner argues that claims 1, 7, and 15 are obvious over Fujii alone, or Fujii and Cannon. Pet. 22–40, 44–49, 55–60. Patent Owner presents several arguments asserting that claims 1, 17, and 15 are not obvious over Fujii or over Fujii and Cannon. Prelim. Resp. 24–44.

a) Petitioner's Contentions – Claim 1

(1) Preamble and First Two Limitations of Claim 1

Petitioner argues that Fujii teaches a DAS that uses the FFR technique to reduce inter-cell interference, and that Cannon teaches a DAS employing a host unit that serves as an interface between a base transceiver station and a plurality of remote units. Pet. 20–21. Petitioner provides arguments regarding the motivation to combine Fujii and Cannon. *Id.* at 22–26.

Specifically, with respect to claim 1, Petitioner argues that, to the extent the preamble is limiting, Fujii discloses a "method for routing and switching operator RF signals," as in the preamble of claim 1, in the discussion of a base station equipped with multiple antennas, transmitting cell-specific data transmissions for users. *Id.* at 27–28 (citing Ex. 1005, 2370–71, Figs. 1, 2; Ex. 1003 ¶¶ 95–96). Petitioner additionally argues that Cannon discloses routing and switching operator signals from a base station for remote units. *Id.* at 28 (citing Ex. 1006 ¶¶ 18–21, Fig. 1; Ex. 1003 ¶ 91[5]).

Petitioner next presents an argument that the first limitation of claim 1 "is drafted in a manner that does not correlate to the structures described in the specification of the '358 patent" and that the limitation must be rewritten to correct this inconsistency. *Id.* at 29 (citing Ex. 1003 ¶ 99); Ex. 1003 ¶ 64. Petitioner requests that we rewrite "providing one or more Digital Remote Units (DRUs), each configured to <u>receive</u> one or more downlink radio frequencies and to <u>transmit</u> one or more uplink radio frequencies" to replace the word "receive" with the word "transmit" and the word "transmit" with

[5] The citation in the Petition is to paragraph 91 of Ex. 1003, however paragraph 97 relates to this assertion and we assume this was a typographical error.

the word "receive." Petitioner argues that the rewritten form of this limitation is taught by Cannon's DAS with multiple remote units, in which DRUs transmit downlink RF signals, and receive uplink RF signals from subscribers for transmission to the host unit. Pet. 30–32 (citing Ex. 1006 ¶¶ 20, 29, 47; Ex. 1003 ¶¶ 101–103). With respect to Fujii alone, Petitioner argues that "Fujii discloses a user scheduling scheme for use in a DAS"; Petitioner makes no further assertions and provides no citations regarding Fujii's teachings regarding this limitation, either as it appears or as rewritten by Petitioner. Pet. 30, 32.

The second limitation of claim 1 requires "providing at least one Digital Access Unit (DAU) configured to communicate with at least one of the one or more DRUs." Ex. 1001, 21:18–20. Petitioner argues that one of ordinary skill in the art implementing the base station arrangement of Fujii, in which a base station interfaces with base station antennas located within a cell, would have implemented, as part of this interfacing, Cannon's host unit, which Petitioner argues is equivalent to the claimed DAU. Pet. 33–34 (citing Ex. 1005, 2370; Ex. 1006 ¶¶ 18–21, Fig. 1; Ex. 1003 ¶¶ 105–108).

Because Petitioner does not provide citations with respect to Fujii's teachings regarding the first limitation, and does not argue that Fujii alone teaches or suggests the second limitation, the challenge based on Fujii alone fails. However, we continue our analysis with respect to the challenge based on Fujii and Cannon.

(2) Wherein clauses: "[first/second] DRU . . . operable to communicate"

The last portion of claim 1 consists of two clauses ("the wherein clauses"):

> wherein a first DRU in a first cell is operable to communicate using:

> a first set of frequencies characterized by a first frequency band over a first geographic footprint; and
>
> a second set of frequencies characterized by a second frequency band different from the first frequency band over a second geographic footprint including and surrounding the first geographic footprint;
>
> wherein a second DRU in a second cell is operable to communicate using:
>
> the first set of frequencies over a third geographical footprint; and
>
> a third set of frequencies characterized by a third frequency band different from the first frequency band and the second frequency band over a fourth geographic footprint including and surrounding the third geographic footprint.

Ex. 1001, 21:21–38.

Petitioner argues that communication over a first geographic footprint and a second geographic footprint, as in the first wherein clause, is taught by Fujii's use of an FFR scheme, which allocates some frequency resources to users in the inner-cell zone of a cell, and some frequency resources to users within a cell boundary zone of a cell. Pet. 34–37 (citing Ex. 1005, 2370, 2372, 2374, Figs. 3, 5, 9, 10; Ex. 1003 ¶¶ 110–111).

Petitioner argues that communication using a first set of frequencies characterized by a first frequency band is taught by the Fujii's use for a first cell of a first portion of the frequency spectrum, the N_{UF} RBs in Figure 10. Pet. 37 (citing Ex. 1005, 2374, Figs. 9, 10; Ex. 1003 ¶ 113). Similarly, Petitioner argues that communication using a second set of frequencies characterized by a second frequency band different from the first frequency band is taught by the Fujii's additional use, for the first cell, of a second portion of the frequency spectrum, the N_{RF} RBs for cell #1 in Figure 10. *Id.* (citing Ex. 1005, 2374, Figs. 9, 10; Ex. 1003 ¶ 114).

Petitioner argues that in Fujii the first set of frequencies is used for communication over the inner-cell zone of cell #1, teaching communication "over a first geographic footprint," and the second set of frequencies is used for communication over "the inner-cell and outer-cell boundary zones for cell #1," teaching communication "over a second geographic footprint including and surrounding the first geographic footprint." *Id.* (citing Ex. 1005, 2374, Figs. 9, 10; Ex. 1003 ¶¶ 113–114). Petitioner further argues that

> [i]n Fujii, as described in Section 4.2, the average power is set at $1/N_U$ for inner-cell region where FRF=1 and it is adjusted to a higher level of $3/ N_U$ in the cell-boundary zone, where FRF=3. EX1005, p. 2376, Section 4.2. In view of this difference in power levels in Fujii, the second geographic footprint include[es] and surround[s] the first geographic footprint. EX1003, ¶116.

Id. at 38.

Petitioner makes similar contentions regarding the wherein clause relating to the second DRU, referring to a second cell in Fujii. *Id.* at 38–40 (citing Ex. 1005, 2372, 2374, 2375, Figs. 3, 5, 9, 10; Ex. 1003 ¶¶ 117–120). Petitioner argues that Figure 10 shows that a second cell uses the same set of frequencies (corresponding to the "first set of frequencies" in the claim) as the first cell (N_{UF} RBs for cell #2)[6] for communication with users in the inner-cell zone of the second cell as the first cell used for communication with users in its inner-cell zone. *Id.* at 39 (citing Ex. 1005, Fig. 10; Ex. 1003 ¶ 118). Petitioner further argues that Fujii's use of a different set of frequencies (N_{RF} RBs for cell #2 in Figure 10) teaches the third set of frequencies characterized by a third frequency band that is different from the

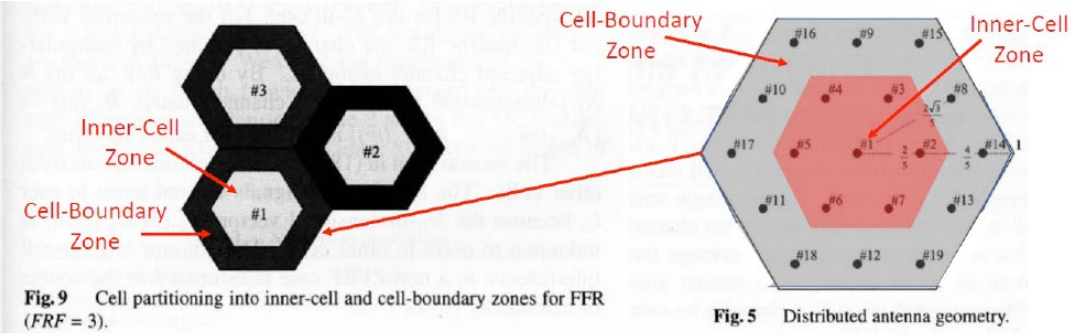
[6] While Petitioner and its declarant both describe this as corresponding to the N_{RF} RBs for cell #2, we understand this from context to be a typographical error. *See* Pet. 39; Ex. 1003 ¶ 118.

first frequency band and second frequency band. *Id.* at 39–40 (citing Ex. 1005, 2374, Figs. 9, 10; Ex. 1003 ¶¶ 119–120). Petitioner refers to its earlier explanation with respect to the fourth geographic footprint including and surrounding the third geographic footprint. *Id.* at 39–40.

b) Patent Owner's Arguments – Claim 1

Patent Owner makes a number of arguments related to the Petition's contentions regarding claim 1. Prelim. Resp. 24–36.

With respect to the wherein clauses of claim 1, Patent Owner asserts that Petitioner's argument is flawed, because, Patent Owner argues, in Fujii, certain antennas are located in the inner-cell zone, and others in the cell-boundary zone. Prelim. Resp. 29–30. Patent Owner provides an annotated version of Fujii's Figures 5 and 9, reproduced below, to illustrate.



Id. at 30. Patent Owner's version of Fujii's Figure 5 is shaded in red to show a hexagonal "inner cell zone" encompassing 7 antennas, including antenna #1. *Id.* Patent Owner argues that "[a] POSA reviewing Figs. 5 and 9 . . . would recognize that antenna #1 is located at the inner-cell zone (grey area) — not at the cell-boundary zone (black area)" and that because antenna #1 is located in the inner-cell area, antenna #1 would communicate only using the frequencies allocated for communications with user equipment in that inner-cell area. *Id.* at 29–31. Patent Owner argues that Petitioner does not support with any evidence how Fujii teaches one antenna

communicating at both the inner-cell and cell-boundary frequencies. Patent Owner contrasts the single-antenna cell disclosed in the '358 patent with the multiple-antenna cell described in Fujii. *Id.* at 31–33. Patent Owner makes the same arguments with respect to the second DRU. *Id.* at 33–34.

c) Analysis

We determine that the Petition does not adequately show how Fujii teaches or suggests the wherein clauses of claim 1.

Petitioner's contentions do not adequately set forth how Fujji's system teaches the wherein clauses of claim 1. Petitioner's unpatentability arguments that Fuji teaches "a second geographic footprint including and surrounding the first geographic footprint" and the similarly recited "fourth geographic footprint" rely on the assertion that Fujii teaches that antenna #1 transmits its first set of frequencies (N_{UF} RBs) at a first power level and its second set of frequencies (N_{RF} RBs) at a second power level, which is three times as high. Pet. 38 (citing Ex. 1005, 2376; Ex. 1003 ¶ 116). Petitioner asserts that in view of the different power levels, the second geographic footprint includes and surround the first geographic footprint. Pet. 38; *see also id.* at 39–40 (similar assertions for the rought geographic footprint). However, Petitioner's assertions are based on one paragraph in which Fujii describes the "average signal power" of one element ($a_{i_c,1}(m, n)$) of a matrix ($\boldsymbol{a}_{i_c}(m, n)$). *Id.*; Ex. 1005, 2376. Petitioner does not discuss or explain how the matrix or elements contained in the matrix describe transmissions from one antenna, or how Fujii's disclosure regarding the average signal power of $a_{i_c,1}(m, n)$ for data symbols in the different sub-channels relates to the power of transmissions from one antenna, antenna #1, at the center of a cell. We note that the superscript "1" in $a_{i_c,1}(m, n)$ does not appear to relate to the first

antenna, as the superscripts in that position range from 1 to N_U, that is, from one to the number of users who are intended recipients of the transmission. *See* Ex. 1005, 2374 ("The user scheduling procedures that select N_U out of K users at each RB are as follows.")

More generally, Petitioner does not address or explain the operation of or transmissions from any single antenna in Fujii, which describes the operation of multiple antennas per cell using ZFBF in which "antenna-common" transmissions are computed and sent from all antennas. *See* Ex. 1005, 2371 (Fig. 1). Thus, the Petition is deficient because it does not provide the necessary explanation. *See* 37 C.F.R. §§ 42.104(b)(4) (A petition must identify "[h]ow the construed claim is unpatentable under the statutory grounds identified [including by] "specify[ing] where each element of the claim is found in the prior art patents or printed publications relied upon"), 42.22(a)(2), 42.104(b)(5); *Harmonic Inc.*, 815 F.3d at 1363 ("[P]etitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable."). Petitioner's citation of the "average signal power" without discussing what it pertains to in Fujii and how it relates to the challenged claim does not sufficiently show how or whether Fujii teaches the signal strength differences relating to transmissions from a specific single antenna on which Petitioner relies in its unpatentability contentions regarding the wherein clauses of claim 1.

We note that our analysis differs from that presented by Patent Owner in the Preliminary Response. Patent Owner's arguments describe antennas, and not UEs, being assigned to inner-cell or cell-boundary zones, however Fujii describes UEs being assigned to certain zones. *See* Prelim. Resp. 19–20; Ex. 1005, 2374. Additionally, Patent Owner's hexagonal shaped inner-cell zone does not appear to correspond with either the use of distance from

the center of a cell to determine an inner-cell zone, or with Fujii's categorization of UE into inner-cell or cell-boundary based on the SIR measured with cell-specific downlink RS transmissions to a user. *See* Ex. 1005, 2374. Patent Owner argues that in Fujii that "the center antenna #1 in the inner-cell zone **would not communicate the FRF=3 frequencies allocated to the cell-boundary zone**." Prelim. Resp. 30. But this does not appear to correspond with Fujii's disclosure of a ZFBF system in which multiple antennas are used to communicate with UE. *Id.* at 2371 (Fig. 1), 2376 (Section 4) (referencing N_D dimensional OFDM signals, where N_D is the number of antennas). However, for the reasons described above in our analysis of Petitioner's arguments, we find Petitioner's arguments insufficient to show a reasonable likelihood that Petitioner would be able to prove the unpatentability of claim 1 over Fujii or over Fujii and Cannon.

d) Conclusion

For these reasons, we determine that Petitioner has not shown a reasonable likelihood of succeeding in showing that claim 1 would have been obvious over Fujii or over Fujii and Cannon.

Claims 7 and 15 contain a similar limitation to the wherein clauses of claim 1, and Petitioner argues them with reference to the arguments for claim 1 or by recapitulating these arguments. Pet. 44–47, 56–58. Thus, for the same reasons, we determine that Petitioner has not shown a reasonable likelihood of succeeding in showing that claims 7 or 15 would have been obvious over Fujii or over Fujii and Cannon.

3. Claims 2–6, 8–14, and 16–21

Claims 2–6, 8–14, and 16–21 depend from claims 1, 7, and 15, directly or indirectly. With respect to the patentability of these claims, Petitioner incorporates its arguments with respect to claims 1, 7, and 15, and

thus, for the same reasons given with respect to those independent claims, we determine that Petitioner has not shown a reasonable likelihood of succeeding in showing that claims 2–6, 8–14, or 16–21 would have been obvious over Fujii or over Fujii and Cannon.

E. Obviousness of Claim 4 over Fujii, Cannon, and Oren

Petitioner argues that claim 4 would have been obvious over Fujii, Cannon, and Oren. Pet. 65–69. Petitioner's argument relies on its arguments with respect to the obviousness of claim 3 (from which claim 4 depends) and claim 1 (from which claim 3 depends) over Fujii and Cannon, and does not provide further support or argument regarding the wherein clauses of claim 1. Thus, for the same reasons given above, we determine that Petitioner has not shown a reasonable likelihood of succeeding in showing that claim 4 would have been obvious over Fujii, Cannon, and Oren.

III. CONCLUSION

For the foregoing reasons, we determine that Petitioner has not shown a reasonable likelihood that it would prevail in showing the unpatentability of any challenged claim of the '358 patent, and accordingly, we do not institute an *inter partes* review of claims 1–21 of the '358 patent.

IV. ORDER

In consideration of the foregoing, it is hereby

ORDERED that, the Petition is denied, and no trial is instituted.

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