

Paper No. ____

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

COMMSCOPE TECHNOLOGIES LLC.
Petitioner

v.

DALI WIRELESS, INC.
Patent Owner

Case IPR _____
U.S. Patent No. 9,197,358
Issued: Nov. 24, 2015
Filed: May 14, 2013

PETITION FOR *INTER PARTES* REVIEW OF U.S. PAT. NO. 9,197,358
UNDER 35 U.S.C. §§ 311-319 AND 37 C.F.R. § 41.100 ET SEQ.

Table of Contents

MANDATORY NOTICES.....	1
A. Real Parties-in-Interest.....	1
B. Related Matters	1
C. Lead and Back-Up Counsel	2
D. Service Information	2
I. PRELIMINARY MATTERS.....	1
A. Standing	1
B. Identification of Challenge	1
C. Supporting Declaration	2
D. Fees	2
II. THE ‘358 PATENT	2
A. Technology Background.....	2
1. Distributed Antenna Systems.....	2
2. Frequency Reuse Techniques	4
B. The specification.....	6
1. The first embodiment.....	6
2. The second embodiment	10
C. The Challenged Claims.....	12
III. PRIOR ART	13
A. Primary References.....	13
1. Xu.....	13
2. Ericsson.....	15
3. Stratford	15
B. Secondary references	16
1. Schwartz.....	16
2. Huawei	17
IV. CLAIM CONSTRUCTION.....	18
1. Interpretation of “a [first / second] communications unit” (claims 7, 15).....	18
2. Other terms.....	19

V.	LEVEL OF ORDINARY SKILL	19
VI.	DISCRETIONARY ISSUES	19
VII.	ARGUMENT	22
A.	Ground 1: Xu anticipates claims 7, 8, 9 and 11	22
	1. Claim 7	22
	2. Claim 8	30
	3. Claim 9	31
	4. Claim 11	32
B.	Ground 2: Xu alone or in combination Schwartz renders obvious claims 8, 15, 20 and 21	33
	1. Claim 8	33
	2. Claim 15	41
	3. Claim 20	42
	4. Claim 21	43
C.	Ground 3: Xu in combination with Schwartz and Huawei renders obvious claims 17 and 18	43
D.	Ground 4: Ericsson anticipates claims 7, 9 and 11.	47
	1. Claim 7	49
	2. Claim 9	55
	3. Claim 11	55
E.	Ground 5: Ericsson alone or in combination with Schwartz renders claims 7, 8, 9, 11, 15, 17, 18, 20 and 21 obvious	56
	1. Claim 7	56
	2. Claim 8	62
	3. Claims 9 and 11	62
	4. Claim 15	62
	5. Claim 17	63
	6. Claim 18	64
	7. Claim 20	64
	8. Claim 21	65
F.	Ground 6: Ericsson in combination with Stratford renders claims 7, 8, 9, 11, 15, 17, 18, 20 and 21 obvious	65
	1. Claim 7	65

2. Claim 8.....	72
3. Claims 9 and 11	73
4. Claim 15.....	73
6. Claims 17, 18, 20 and 21.	74
G. Ground 7: Stratford in combination with Ericsson renders claims 7, 8, 9, 11, 15, 17, 18, 20 and 21 obvious	74
1. Claim 7.....	74
2. Claim 8.....	86
3. Claim 9.....	88
4. Claim 11.....	89
5. Claim 15.....	91
6. Claim 17.....	98
7. Claim 18.....	99
8. Claim 20.....	101
9. Claim 21.....	101
CONCLUSION.....	102
Claims Listing Appendix	103
Exhibit List Appendix.....	106

MANDATORY NOTICES

A. Real Parties-in-Interest

CommScope Technologies LLC, CommScope, Inc. of North Carolina, CommScope, Inc, and CommScope Holding Company, Inc. are the real parties-in-interest (collectively, “CommScope”).

Based on current law and information available at this time, it is not clear to Petitioner that there are any other real parties-in-interest. Petitioner notes the following. Customers are named defendants in the related matters identified below. The customers are named as: AT&T Corp., AT&T Communications LLC, AT&T Mobility, AT&T Mobility II LLC, AT&T Services Inc., T-Mobile US, Inc., and T-Mobile USA, Inc. No entity other than CommScope (the listed real-party-in-interest) is funding, controlling, or otherwise had an opportunity to provide input regarding this Petition; no entity other than CommScope will fund, control, or otherwise have an opportunity to provide input regarding any resulting IPR trial; no entity other than CommScope has reviewed this Petition.

B. Related Matters

The challenged patent is asserted against petitioner CommScope in a complaint in *Dali Wireless, Inc. v. AT&T Corp. et al.*, Case No. 2:22-cv-12 (E.D. Tex.), which was served on January 13, 2022 and in *Dali Wireless, Inc. v. T-Mobile US, Inc. et al.*, Case No. 2:22-cv-414 (E.D. Tex.), which was served on October 25, 2022.

The challenged patent was also asserted against third party Corning in a complaint in *Dali Wireless, Inc. v. Corning Optical Communications LLC*, Case No. 3-19-cv-00714 (W.D.N.C.), subsequently *Dali Wireless, Inc. v. Corning Optical Communications LLC*, Case No. 20-cv-6469-EMC (N.D. Cal.). A petition for Inter Partes Review was filed against the challenged patent by third party Corning as *Corning Optical Communications LLC v. Dali Wireless, Inc.*, PTAB-IPR2021-00492.

C. Lead and Back-Up Counsel

Lead Counsel	Backup Counsel
Philip P. Caspers, Reg. No. 33,227 Capella Tower, Suite 4200 225 South Sixth Street Minneapolis, MN 55402 pcaspers@carlsoncaspers.com Phone: 612.436.9617 Fax: 612.436.9605	Samuel A. Hamer, Reg. No. 46,754 Capella Tower, Suite 4200 225 South Sixth Street Minneapolis, MN 55402 shamer@carlsoncaspers.com Phone: 612.436.9615 Fax: 612.436.9605

D. Service Information

Please address all correspondence and service to all counsel listed above.
Petitioner consents to service by email at the email addresses listed.

I. PRELIMINARY MATTERS

A. Standing

Petitioner certifies that IPR is available for the '358 Patent and that Petitioner is not barred or estopped.

B. Identification of Challenge

Petitioner requests invalidation of claims 7, 8, 9, 11, 15, 17, 18, 20, and 21.

	Claims	Basis for Unpatentability
Ground 1	7, 8, 9, 11	Anticipation: Xu
Ground 2	8, 15, 20, 21	Obviousness: Xu alone or in combination Schwartz
Ground 3	17, 18	Obviousness: Xu in combination Schwartz and Huawei
Ground 4	7, 9, 11	Anticipation: Ericsson
Ground 5	7, 8, 9, 11, 15, 17, 18, 20, 21	Obviousness: Ericsson alone or in combination with Schwartz
Ground 6	7, 8, 9, 11, 15, 17, 18, 20, 21	Obviousness: Ericsson in combination with Stratford
Ground 7	7, 8, 9, 11, 15, 17, 18, 20, 21	Obviousness: Stratford in combination with Ericsson

C. Supporting Declaration

Petitioner submits declarations from Dr. Acampora (EX-1003) and Dr. Hall-Ellis (EX-1022).

D. Fees

Petitioner authorizes the Patent Office to charge Deposit Account No. 502880 for the fee set forth in 37 C.F.R. § 42.15(a) and any other required fees.

II. THE ‘358 PATENT

A. Technology Background

The ‘358 patent addresses the problem of inter-cell interference (“ICI”) between neighboring cells of a cellular network. When the network’s entire available radio frequencies are used by adjacent cells to transmit different communications, “[u]sers located at the cell edge largely suffer from co-channel interference ... or inter-cell interference from base stations (BS) of neighboring cells.” EX-1001, 6:25-28; EX-1003, ¶¶63-64 (drawing A to illustrate).

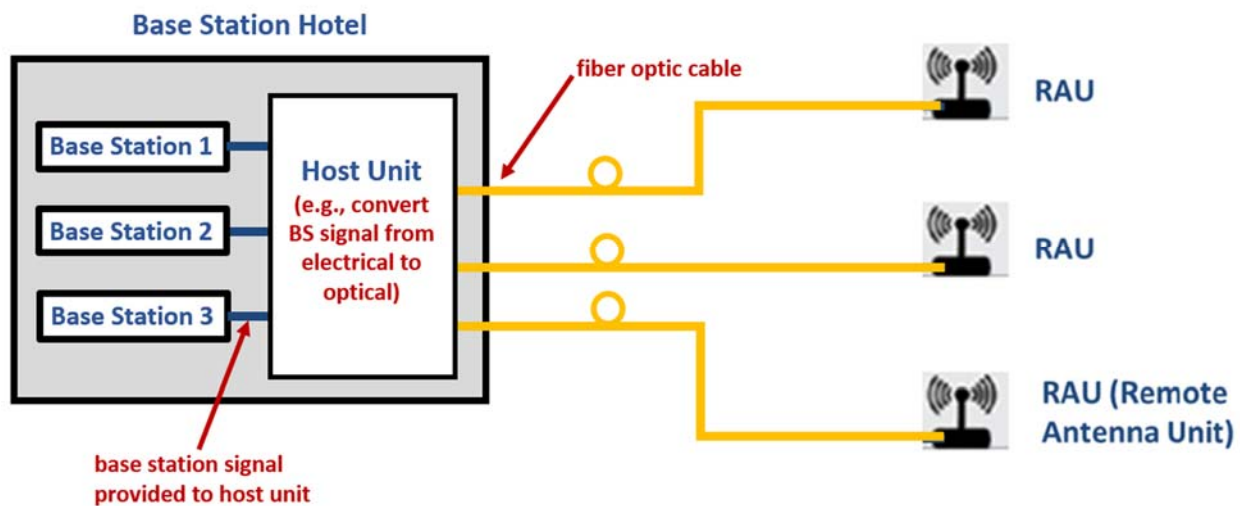
The ‘358 patent identifies two known techniques for mitigating ICI: (1) distributed antenna systems (DAS), and (2) frequency reuse schemes, including fractional frequency reuse (FFR) and soft frequency reuse (SFR).

1. Distributed Antenna Systems

Distributed antenna systems were “available” (EX-1001, 1:16-17), had been “widely implemented in state-of-the art cellular communication systems” (EX-1001, 6:53-55), and “typically” included “one or more host units.” EX-1001, 1:17-

18; EX-1003, ¶¶50, 129-144. That DASs helped to mitigate ICI was also known. EX-1005, 4439 (“a DAS improves the cell-edge throughput by placing the remote antennas (RAs) closer to the cell-edge terminals, hence naturally reducing the pathloss”); EX-1003, ¶66 (mitigating ICI is a known benefit of a DAS); EX-1001, 6:44-48 (by reducing the “overall transmit power by using” a DAS helps to “alleviate interference”), 1:16-32.

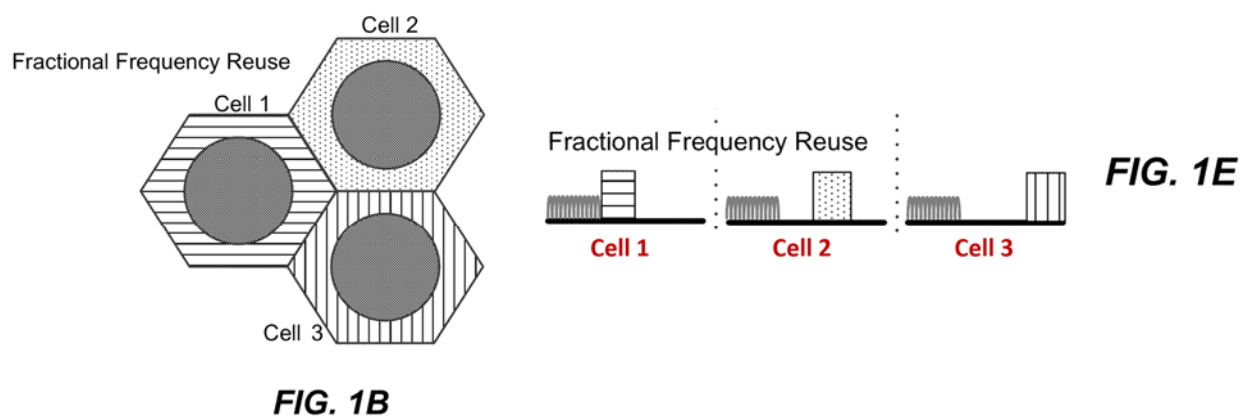
When deploying cellular systems in metropolitan areas, for practical reasons such as lack of access to property, it was also common to house the base station equipment at a location remote from the cell sites and antenna units. EX-1003, ¶¶133-134; EX-1001, 1:20-21 (“commonly known as a base station hotel”). For such deployments, a DAS host unit, together with the DAS transport links “provides a means for distribution of the base stations downlink and uplink signals among multiple remote antenna units.” EX-1001, 1:21-24; EX-1003, ¶¶135-136, ¶51 (including demonstrative below illustrating these background concepts).



2. Frequency Reuse Techniques

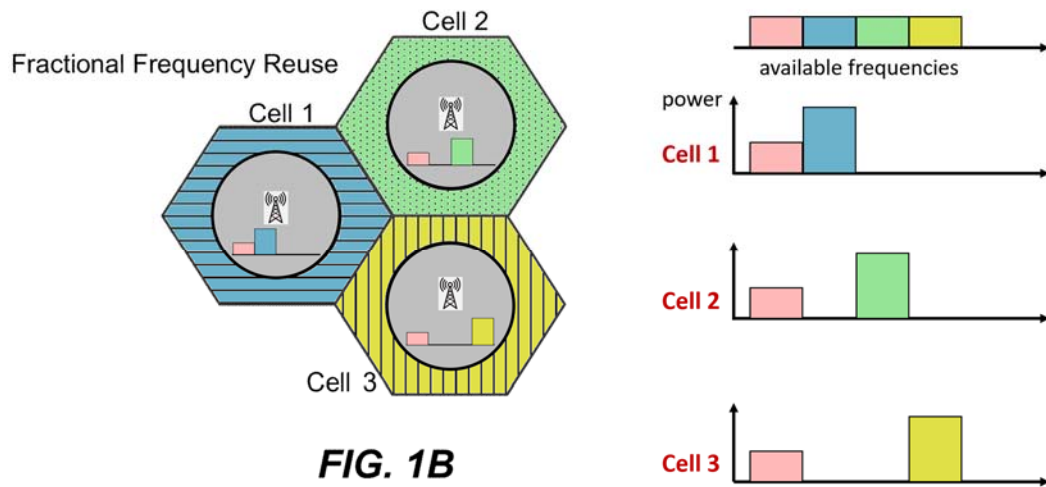
The '358 patent identifies two frequency reuse techniques: (1) fractional frequency reuse or FFR (Figs. 1B/1E) and (2) soft frequency reuse or SFR (Figs. 1C/1F (collectively, "frequency reuse techniques"). EX-1003, ¶¶69-70.

Figs. 1B/1E show an implementation of FFR.¹



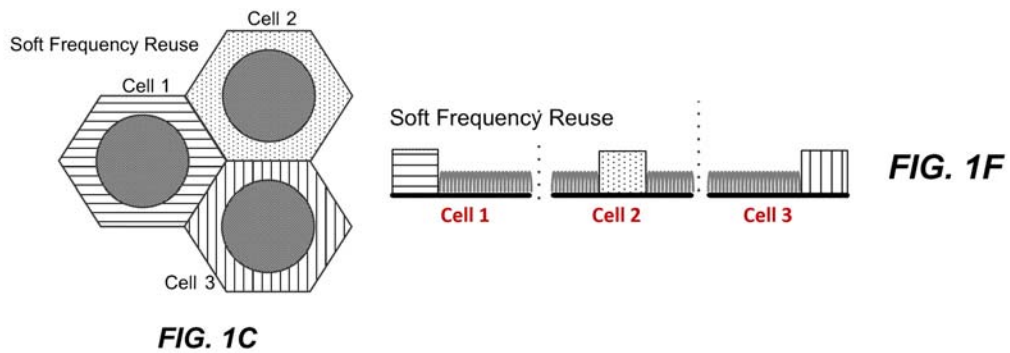
EX-1003, ¶69. Fig. 1B is annotated below.

¹ All annotations, emphasis, and highlighting added.



Id.

Figs. 1C/1F show an implementation of SFR.



EX-1003, ¶70. Fig. 1B is annotated below.

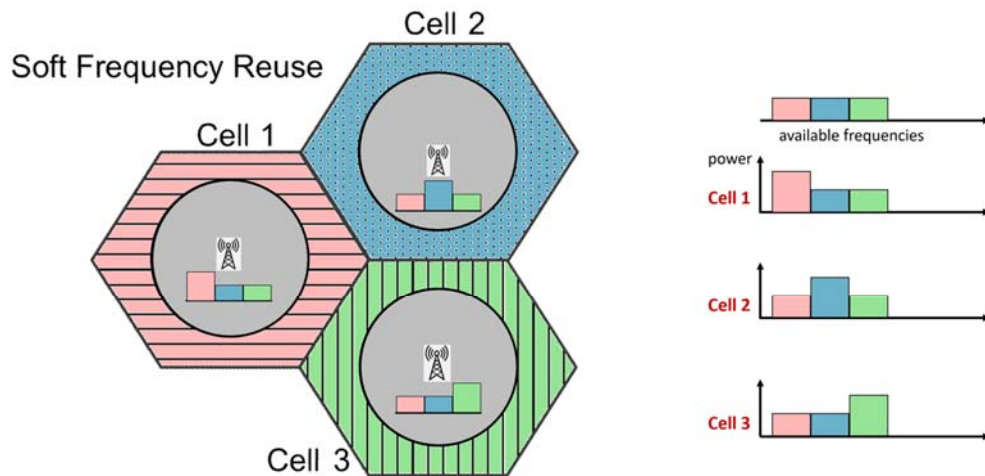


FIG. 1C

Id.

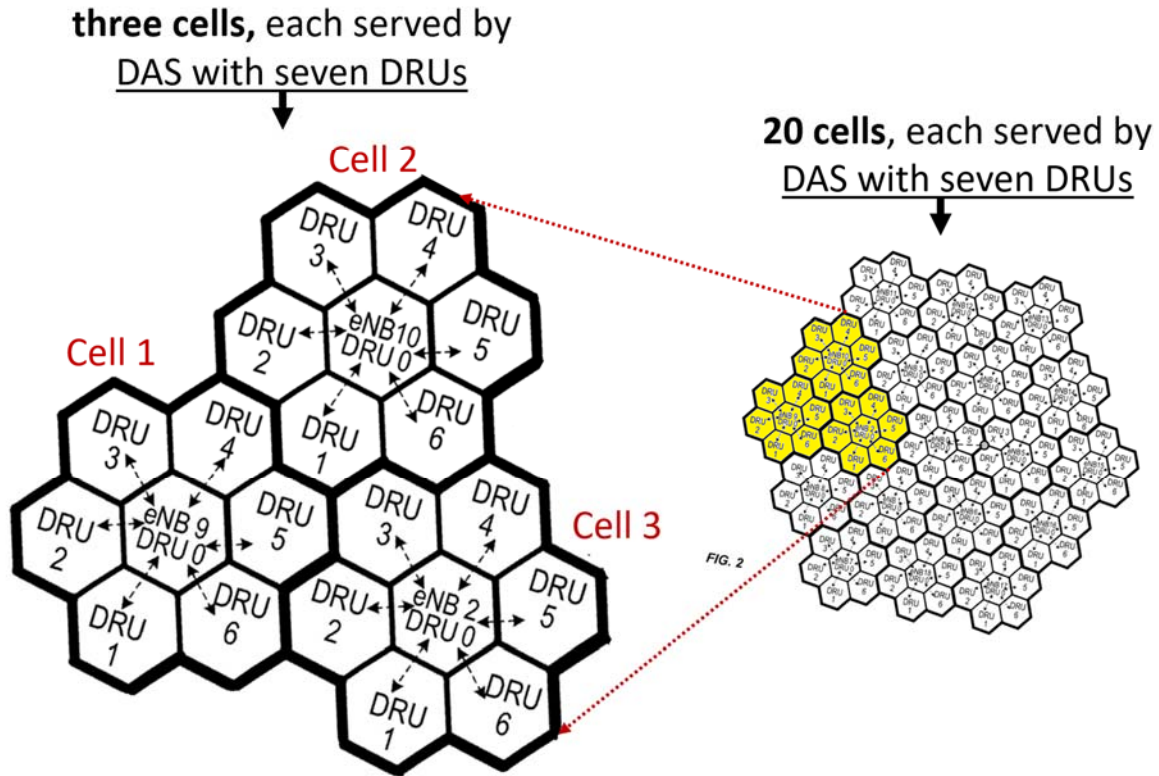
B. The specification

The specification describes two embodiments. EX-1003, ¶¶ 79-96.

1. The first embodiment

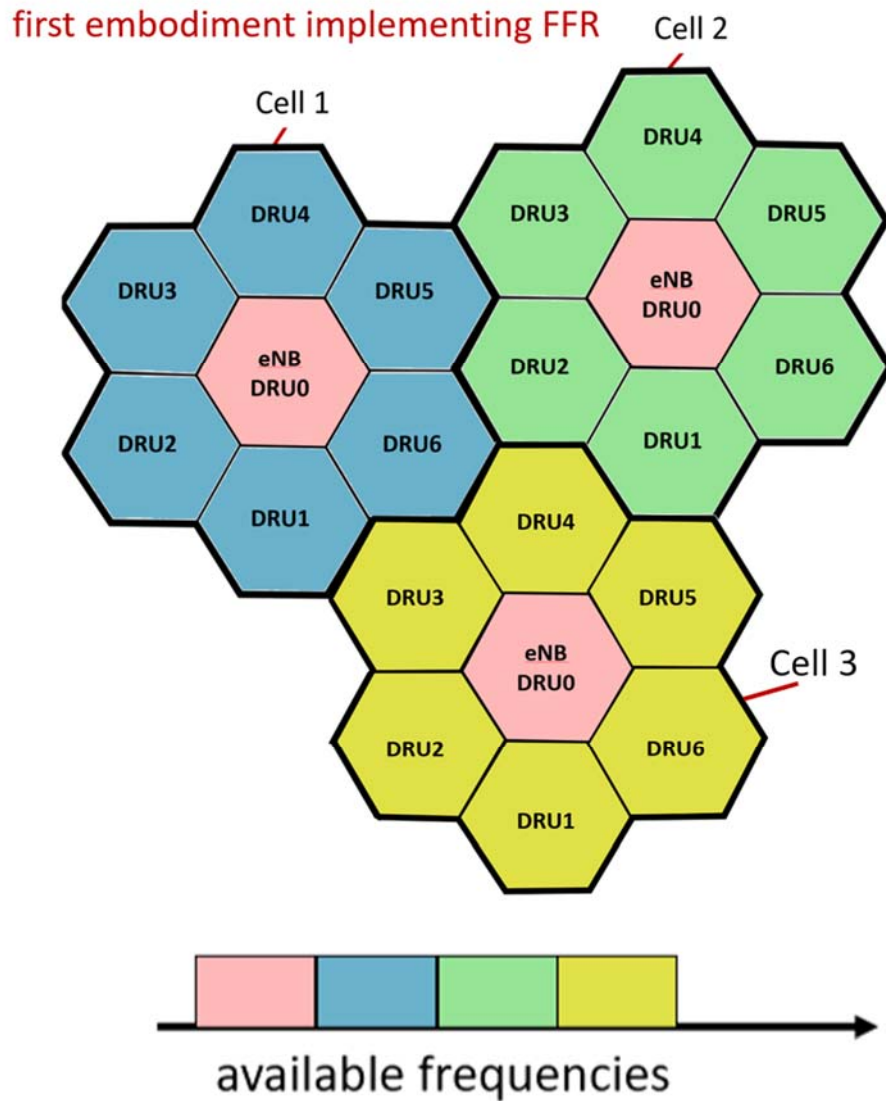
Fig. 2 is directed to the first embodiment. EX-1001, 11:16-32. Three cells from Fig. 2 are pulled out and enlarged (below). Each cell's "communications unit" includes **seven antenna units** (including one centrally located antenna to serve the cell-center area and six periphery antenna units to serve the cell edge area). EX-1001, Fig. 2, 9:42-45 ("Referring to FIG. 2, the DAS includes a central cell referenced as eNB0, which includes DRU0 through DRU6...").

first embodiment



EX-1003, ¶81.

Three cells from Fig. 2 are re-drawn in a cleaner form (below) to illustrate the first embodiment. EX-1003, ¶84; EX-1001, 11:16-32. In each cell, a central antenna provides service to and defines a cell-center coverage area in which the pink band is reused. The six “periphery” antennas of cell 1 transmit/receive the blue band to serve and define a cell-edge coverage area for cell 1. For cells 2 and 3, the respective six “periphery” antennas transmit/receive the green and yellow bands, respectively. *Id.*



For each cell, all seven antenna units are disclosed to transmit at the **same power**.

EX-1001, 15:53-55 (“The transmit power of each distributed antenna module is P whereas the transmit power of eNB in the conventional cellular system is 7P.”).

The specification also describes implementation of FFR and SFR with reference to Figs. 1B and 1C (illustrated below). EX-1001, 10:25-30 (FFR); 10:40-49 (SFR); EX-1003, ¶¶86-87

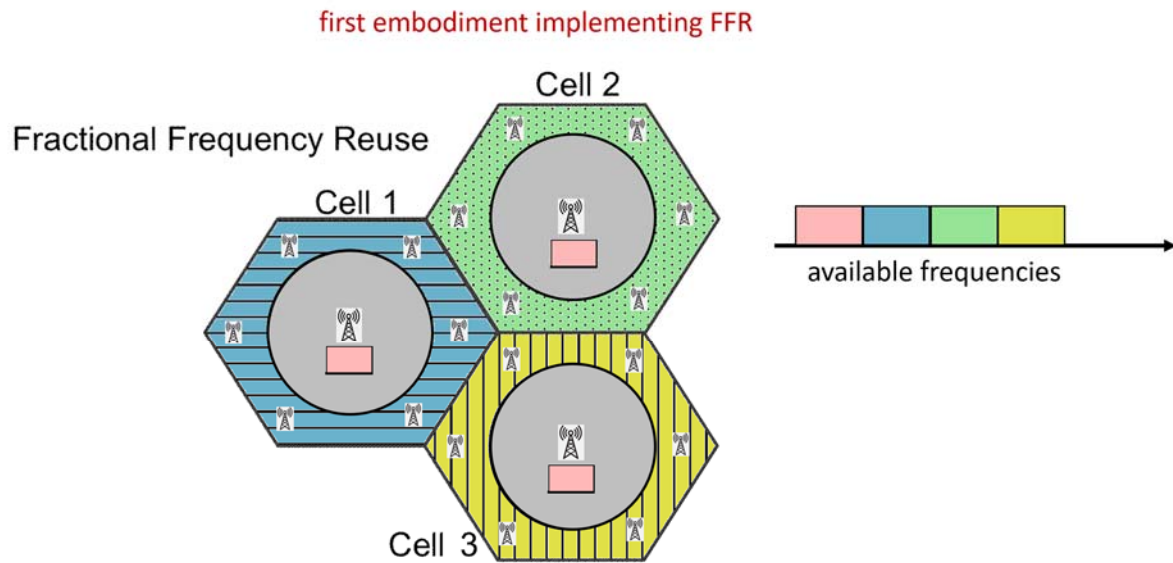


FIG. 1B

first embodiment implementing SFR

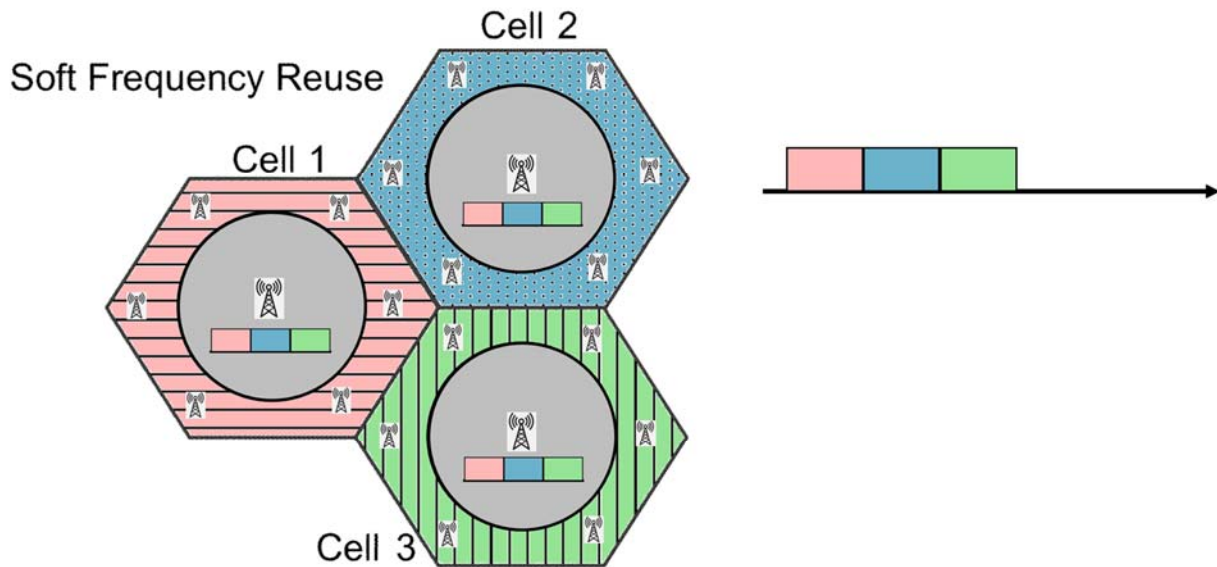
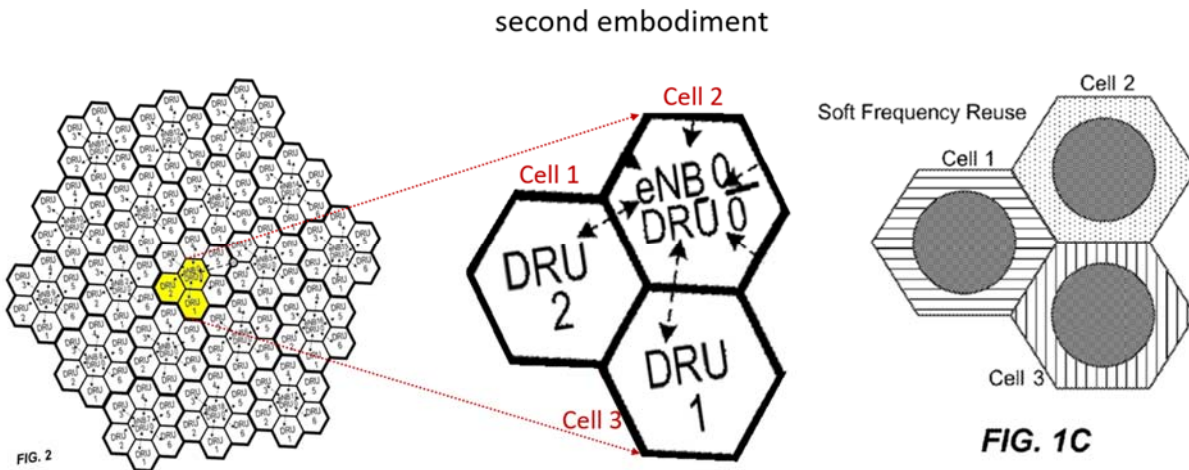


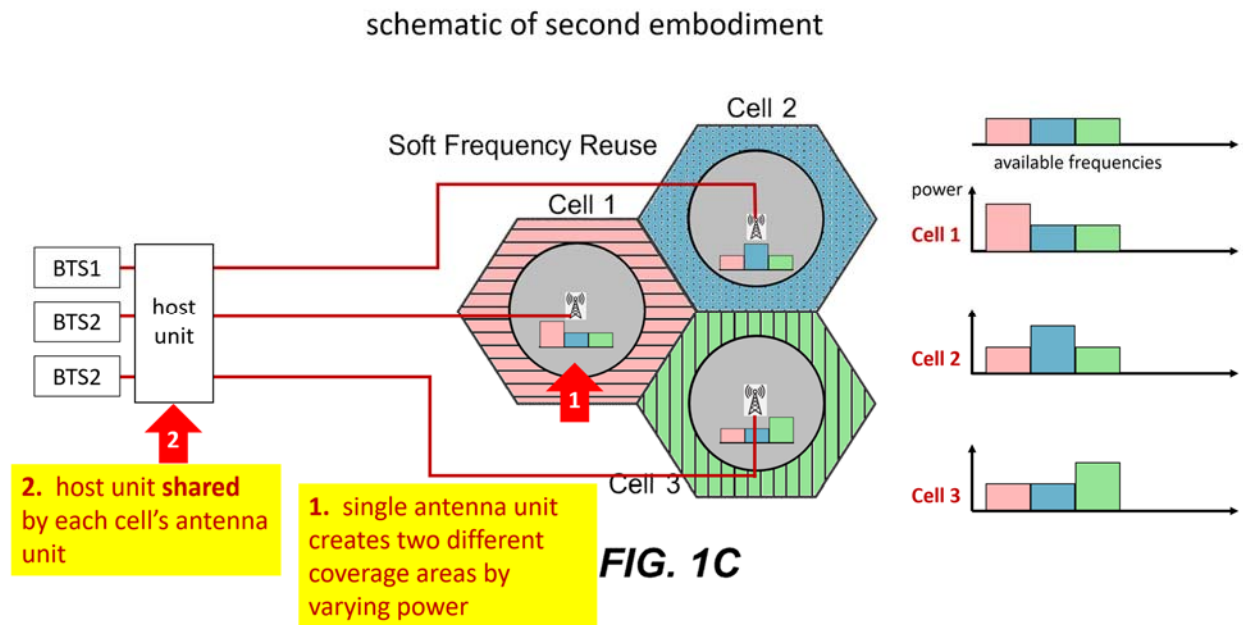
FIG. 1C

2. The second embodiment

In the second embodiment, each cell is served by a single, centrally located antenna unit. Instead of all seven DRUs of Fig. 2 serving one cell, the coverage area of **an individual DRU** is equated to a cell of Figs. 1A-1C. EX-1001, 9:45-47 (“DR0 can be considered to be Cell 1 in FIGS. 1A-1C, DRU1 can be considered to be Cell 2 in FIGS. 1A-1C, and DRU2 can be considered to be Cell 3 in FIGS 1A-1C.”). EX-1003, ¶¶88-96.



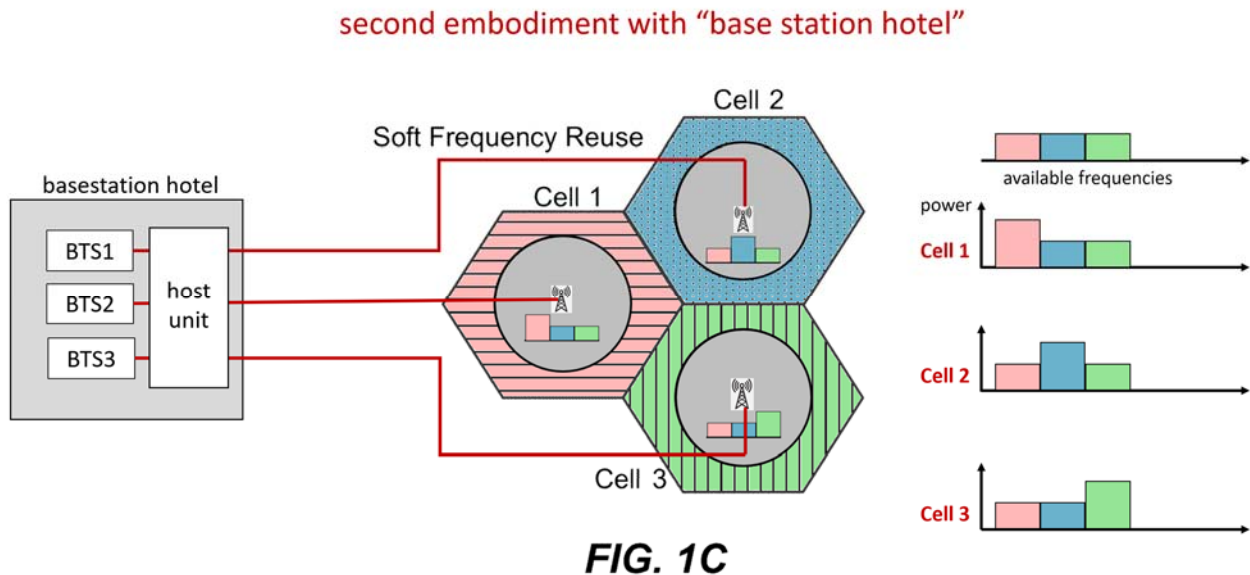
EX-1003, ¶89.² The schematic below illustrates the second embodiment implementing SFR.



EX-1003, ¶90. The second embodiment is different from the first embodiment in two ways. First, each cell is served by a single, centrally located DRU (antenna

² All bold, italic or underline emphasis herein is added, unless otherwise indicated.

unit) that implements a frequency reuse by transmitting different frequency bands at different power levels. Second, each of the communications units (i.e., the respective antenna unit for cell 1, cell 2 and cell 3) is coupled to one host unit. For illustrating the second embodiment, the **shared** host unit and base stations are moved to a location outside the cell, commonly referred to as “a base station hotel” (Ex-1001, 1:21). EX-1003, ¶¶90, 96.



C. The Challenged Claims

Claims 7-9, 11, 15, 17-18, 20-21 are challenged. This includes two independent claims (7, 15) and seven dependent claims. EX-1003, ¶¶97-102.

The claims are agnostic to whether “the first communications unit” (e.g., serving cell 1) or “second communications unit” (e.g., serving cell 2) comprise

multiple antennas (first embodiment) or one centrally located antenna (second embodiment). EX-1003, ¶¶98-100.

III. PRIOR ART

A. Primary References

1. Xu

Xu (EX-1005) is a prior art printed publication of the journal *IEEE Transactions on Vehicular Technology* that was publicly available at least as of November 20, 2011. EX-1005; EX-1022 ¶¶28, 48-57. Xu addresses the problem of inter-cell interference. EX-1005, 4439. Xu discloses the same solution – combining the techniques of DAS and fractional reuse to improve cell-edge throughput. EX-1003, ¶¶117-124. Xu’s solution is virtually the same as the first embodiment of the ‘358 patent. EX-1003, ¶¶117-124.

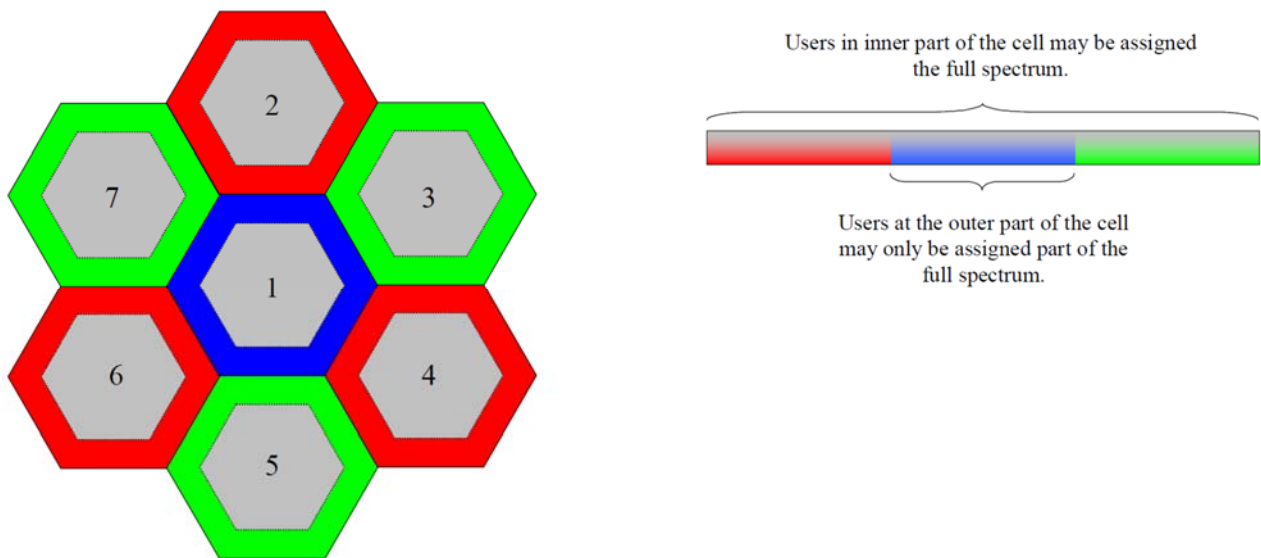
For Xu’s system of Fig. 1, Dr. Acampora provides a map for the abbreviations and annotations. EX-1003, ¶¶120-122 (describing how each cell in Xu’s system employs a DAS to implement a frequency reuse technique). *Id.*

2. Ericsson

Ericsson (EX-1007) is a prior art printed publication that was publicly available no later than August 25, 2005. EX-1007; EX-1022 ¶¶28, 62-65.

Ericsson also addresses the problem of inter-cell inference. EX-1003, ¶¶125-128.

In Section 3, Ericsson discloses a frequency reuse technique in which “only a part of the total resources is used for transmission to/from cell-edge users, thereby reducing the interference experienced by these users....” EX-1007, 2. (Fig. 2, below). To achieve this, each cell’s centrally located antenna transmits a different RF band at a higher power to cover a cell-edge area than bands used to cover a central area. EX-1007, 2, Fig. 2.



3. Stratford

Stratford (EX-1009) is a prior art patent (US6,785,558) issued in 2004.

Stratford discloses a distributed antenna system for distributing cellular

communication signals between a base station hotel and remote cell sites with digitized RF carrier signals. EX-1009, Abstract, Fig. 3, 2:37-44, 3:9-20, 6:29-51. Stratford Figure 3 illustrates the system used to distribute RF signals digitally from base stations located in a base station “hotel” to multiple remote cell sites. EX-1009, Fig. 3, 1:26-65; 3:9-20.

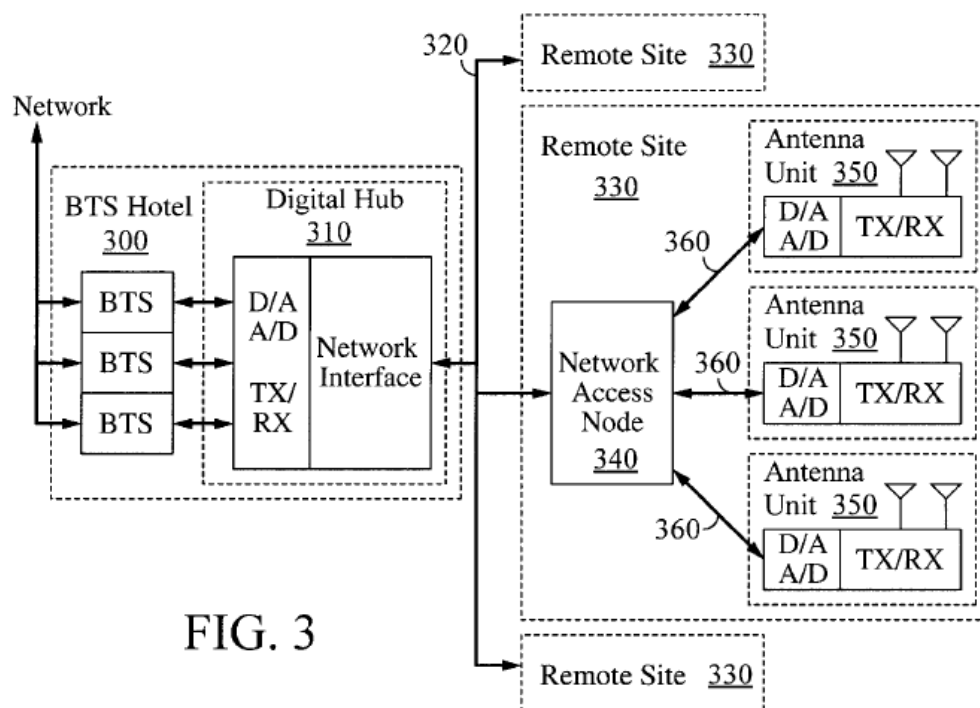


FIG. 3

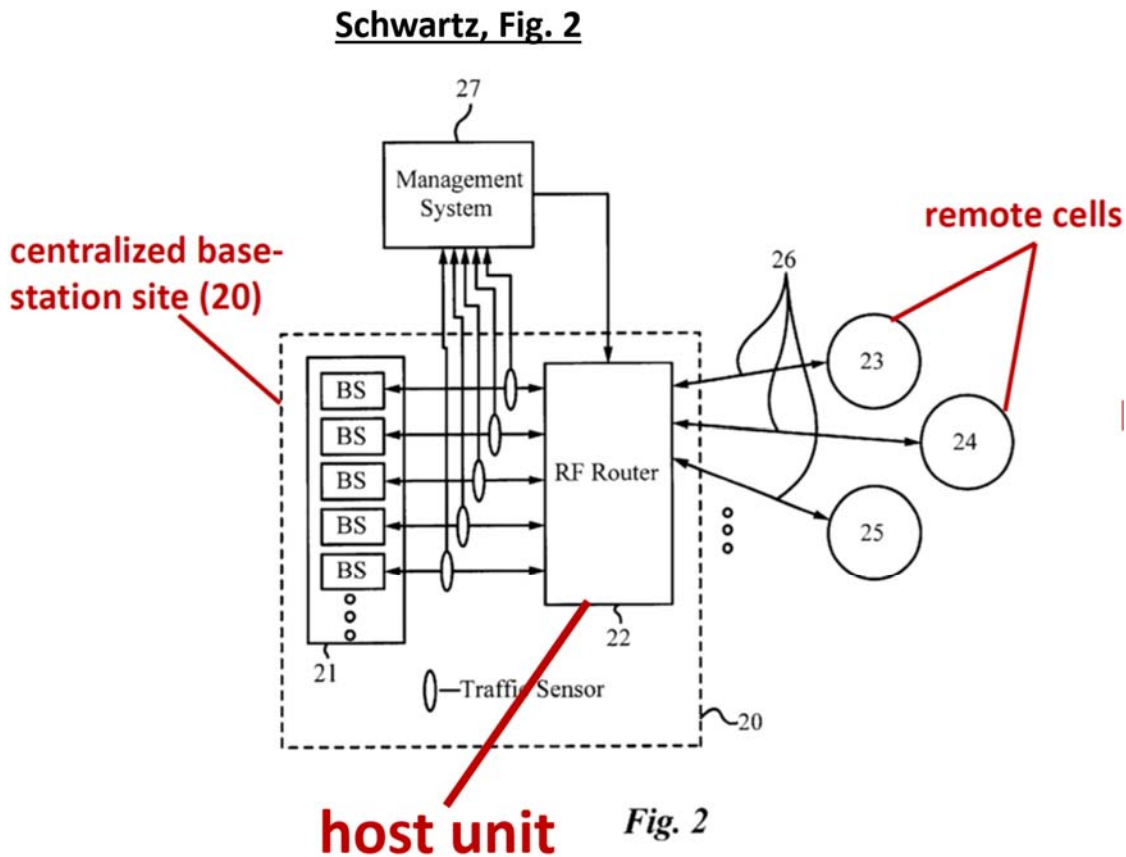
EX-1009, Fig. 3; EX-1003, ¶¶129-132.

B. Secondary references

1. Schwartz

Schwartz (EX-1008) is a prior art patent (US6,353,600) that issued in 2002. At Fig. 2 Schwartz teaches a system that includes a base station site that includes multiple base station units and a router (i.e., a host unit) that distributes the base station signals to multiple remote cell sites, each having an antenna unit. The

centrally located router at the base station site (which does not need to be within any of the cell sites (EX-1008, 3:30-32; 5:1-17)) allows centralized channel resources to be dynamically allocated to remote cells according to demand. EX-1008, 2:55-58; 3:30-48, 6:24-41; Fig 2; EX-1003, ¶¶133-140.



EX-1003, ¶140.

2. Huawei

Huawei (EX-1006) is a prior art publication that was publicly available no later than August 25, 2005. EX-1006; EX-1022 ¶¶28, 66-69. Huawei teaches

utilizing soft frequency reuse schemes to mitigate inter-cell interference. EX-1006, 1. Huawei illustrates soft frequency reuse as shown in Figure 1.

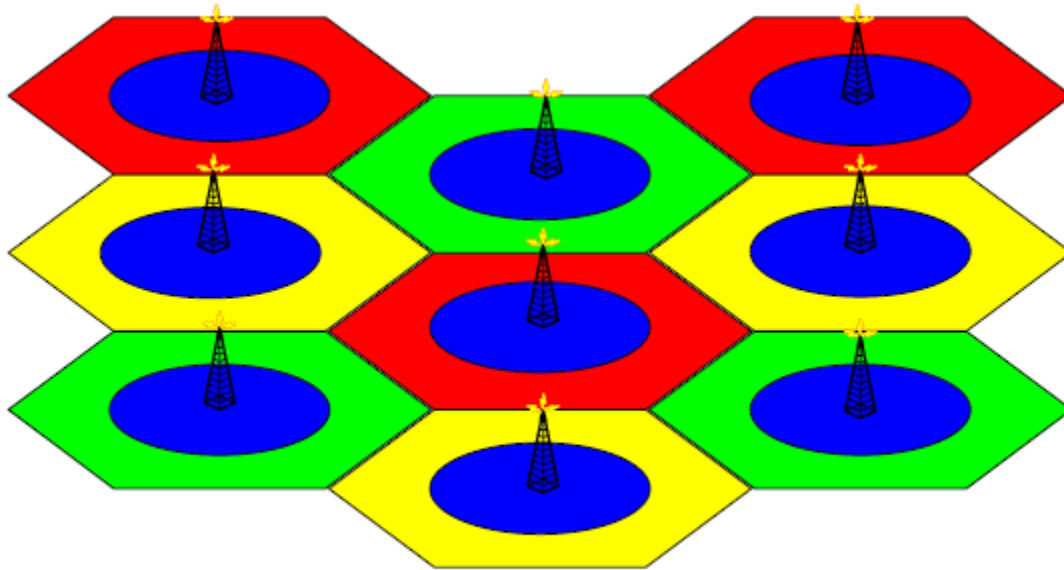


Figure 1, Cell deployment

IV. CLAIM CONSTRUCTION

1. Interpretation of “a [first / second] communications unit” (claims 7, 15)

A “communications unit” can include multiple separate remote antenna units or DRUs. EX-1001, 3:46-48 (“The first communications unit can include a central DRU and a plurality of peripheral DRUs”); 4:29-30 (“The first communications unit can include a plurality of DRUs...”); 4:43-46 (“The first communications unit can include a first plurality of digital remote units and the second communications unit comprises a second plurality of digital remote

units.”); 5:49-60; Fig. 2; 9:48-59; 10:43-49 (“In an embodiment in which multiple DRUs are utilized per cell, the horizontal stripe geographical area in Cell 1 is associated with the outer DRUs in the communications unit illustrated as eNB0 in FIG. 2 (i.e., DRUs 1-6) and the grey geographical area in Cell 1 is associated with the central DRU in the communications unit illustrated as eNB0 in FIG. 2 (i.e., DRU0).”).

2. Other terms

In view of the art applied, other terms are not expected to require construction for this proceeding.

V. LEVEL OF ORDINARY SKILL

A person of ordinary skill in the art (“POSA”) would have had a bachelor’s degree in electrical engineering and a minimum of 3-4 years of industry experience in wireless communications networks and engineering, including some knowledge of or experience with distributed antenna systems. An individual with a master’s degree in electrical engineering would require less industry experience (e.g., 1-2 years). EX-1003, ¶24.

VI. DISCRETIONARY ISSUES

The Board should not deny institution under 35 U.S.C. §314(a) for two reasons. First, per the interim guidelines, “the PTAB will not rely on the *Fintiv* factors to discretionarily deny institution in view of parallel district court litigation where a petition presents ***compelling evidence of unpatentability***.” PTO

Director’s Memorandum at 2 (June 21, 2022). This Petition presents “compelling” evidence of unpatentability because it presents multiple prior art references (Xu, Ericsson, Huawei) that disclose the limitations that PO argued were not present in the prior art in order to traverse the examiner’s rejection of claim 7: “a second geographic footprint larger than and at least partially surrounding the first geographic footprint” and “a fourth geographical footprint larger and at least partially surrounding the third geographical footprint.” EX-1002, 255. Second, the *Fintiv* factors do not favor denying institution.

Factor 1 is neutral because none of the parties have requested a stay.

As to Factor 2, PO has asserted the ‘358 patent in two cases against Petitioner and its customers. In weighing factor 2, the Board should consider the trial dates in both cases. *HP Inc. v. Neodron Ltd.*, IPR2020-00459, Paper 17 at 36 (PTAB Sep. 9, 2020) (“we consider...all venues”). Considering both cases and the uncertainty around the trial dates, factor 2 weighs against discretionary denial.

First, in *Dali Wireless, Inc. v. T-Mobile US, Inc. et al.*, No. 2:22-cv-414 (E.D. Tex. Oct. 21, 2022) (“T-Mobile case”), no trial has been scheduled. EX-1029. This weighs “significantly against” discretionary denial. *Google LLC v. Uniloc 2017 LLC*, IPR2020-00441, Paper 13 at 35 (PTAB July 17, 2020). The

estimated trial date per median time-to-trial is November 2024³—well after the July 2024 FWD date. Second, in *Dali Wireless, Inc. v. AT&T Corp.*, No. 2:22-cv-12 (E.D. Tex. Jan. 7, 2022) (the “AT&T case”), the court has not yet set any of the individual trial dates, which again weighs “significantly against” a discretionary denial. *Google*, IPR2020-00441, Paper 13 at 35. To explain, the Court set an initial schedule, but afterwards, the PO agreed to sever the case into multiple, different cases, and the Court has not yet sent these individual trial dates. EX-1031; EX-1032; EX-1033; EX-1034; EX-1035; EX-1036.

As to factor 3, neither the court nor the parties have invested in the new T-Mobile case. EX-1029 (listing no substantive events). In the AT&T case, the Court has not yet issued any substantive orders. *Apple Inc. v. Fintiv Inc.*, IPR2020-00019, Paper 11 at 10 (PTAB Mar. 20, 2020) (precedential). Neither party has taken any fact depositions, which weighs against a denial. *HP*, IPR2020-00459, Paper 17 at 40 (“no depositions”). Factor 3 weighs against discretionary denial.

As to factor 4, if this IPR is instituted, Petitioner commits to entering a stipulation not to raise in district court any of the grounds raised in this Petition. Thus, Factor 4 weighs against discretionary denial.

As to factor 5, Petitioner is a defendant in the AT&T and T-Mobile cases.

³ This is 24.5 months (EX-1030 at 35) from the filing date of Oct. 21, 2022.

As to factor 6 (other circumstances), the fact that this petition presents compelling evidence of unpatentability constitutes “other circumstances” that weigh against discretionary denial.

VII. ARGUMENT

A. Ground 1: Xu anticipates claims 7, 8, 9 and 11

1. Claim 7

Fig. 1 illustrates how Xu’s system employs a DAS in each cell to implement FFR. EX-1003, ¶¶120-123, 147-148(including map of abbreviations used in Xu); EX-1005, 4440, Fig. 2, Section II(A).

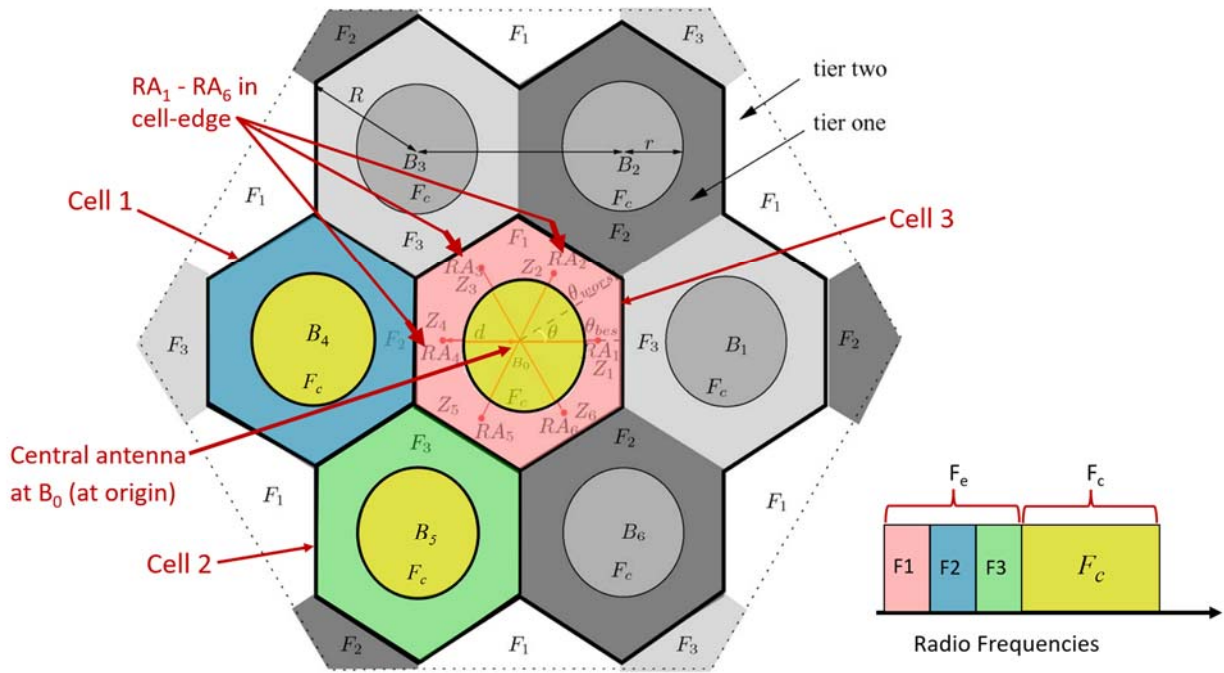


Fig. 1. Topology of two tiers of 19 cells relying on an FFR and DAS arrangement, where $N_r = 6$ RAs are employed. The structure of the cells in tier two is the same as that in tier one.

Cells 1 and 2 of Fig. 1 are isolated below and annotated to show the six periphery antenna units of Xu's model DAS for each cell. Xu's system implements FFR in each cell by using DAS that includes seven distributed antenna units – the same as the '358 patent's first embodiment. EX-1005 ¶148. For the same reasons that claim 7 reads on the first embodiment of the '358 patent, it also reads on Xu's system. EX-1005 ¶¶103-105, 149.

a. Element 7A⁴

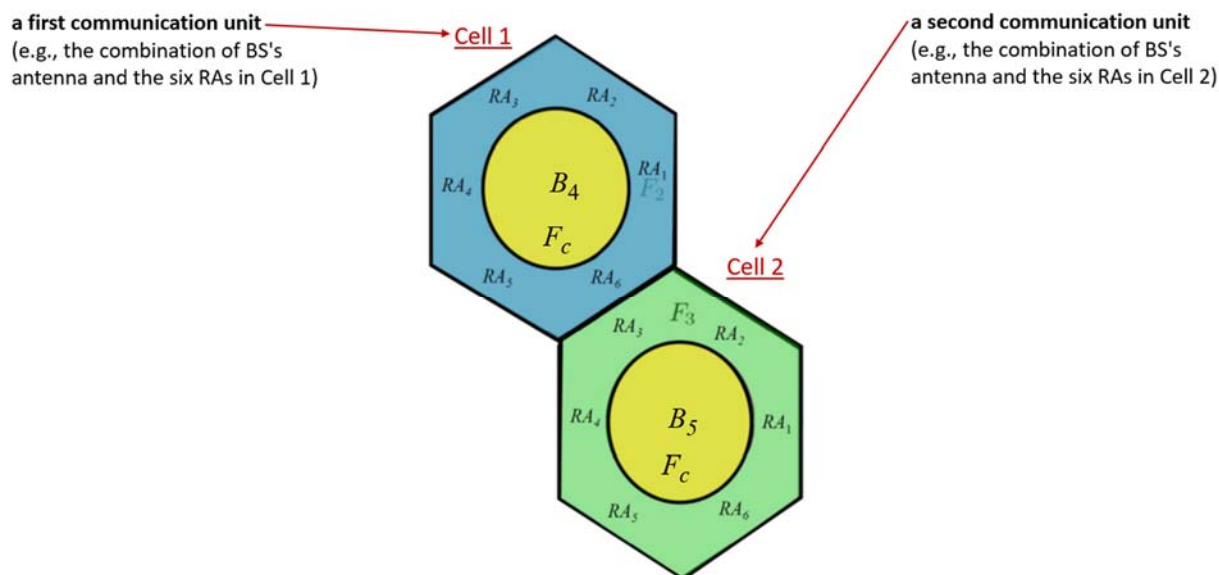
“distributing communications frequencies”

Xu teaches this element because it discloses a multi-cell wireless communication system for transporting wireless communications. EX-1003, ¶150; EX-1005, 4439 (“Distributed Antennas With Fractional Frequency Reuse in Multicell Multiuser Networks”); Fig. 1; 4440, Section II.A (describing the “Multicell Multiuser System Topology” for transporting wireless communications); 4442, Section III.A (describing “Noncooperative DAS with FFR Systems” using FFR and DAS arrangement of Fig. 1). Within each cell, Xu's system transports wireless communications from a base station via a distributed antenna system (DAS) that implements a frequency reuse technique (e.g., FFR). EX-1003, ¶150.

⁴ Element designations (such as “Element 7A”) are defined in the Claims Listing Appendix and have been added for ease of reference.

b. Element 7B

In Xu, the plurality of antennas serving cell 1 is a “first communications unit” (below, left), and the plurality of antennas serving cell 2 is a “second communications unit” (below, right). EX-1003, ¶¶151-153. Xu’s first/second communications units satisfy “a set of communications units” of Element 1B. *Id.*



EX-1003, ¶151.

For the same reason that “a set of communications units” that includes “a first communications unit” and “a second communications unit” reads on the ‘358 patent’s first embodiment (EX-1003, ¶¶104-105), those limitations also read on Xu’s system. EX-1003, ¶¶149-153. Just as in the first embodiment of the ‘358 patent, Xu’s seven antennas serving cell 1 is “a first communications unit” and Xu’s seven antennas serving cell 2 is “a second communications unit”. *Id.* Collectively, Xu’s first/second communications units is a “set of communications

units.” EX-1001, 4:29-30 (“The first communications unit can include a plurality of DRUs...”); 3:46-48 (“The first communications unit can include a central DRU and a plurality of peripheral DRUs disposed adjacent the central DRU.”).

c. Element 7C

As shown, Element 7C reads on Xu’s system. EX-1003, ¶154.

Element 7C

Transmitting and receiving, from

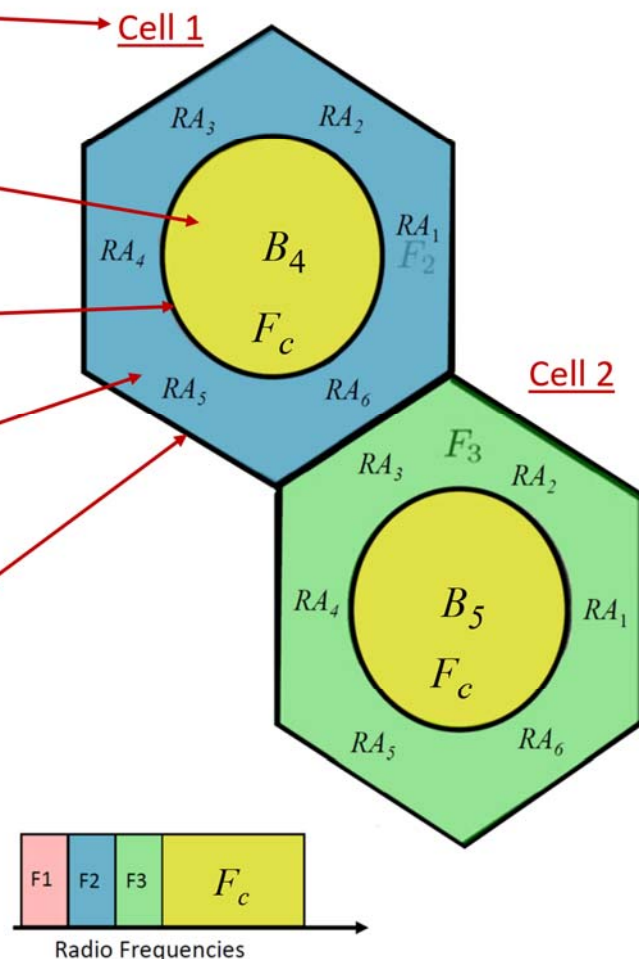
a first communication unit
(e.g., the combination of BS's antenna and the six RAs in Cell 1)

a first set of frequencies F_c
characterized by a first frequency band (e.g., yellow band)

a first geographic footprint
(e.g., coverage area of B_4 for the yellow band)

a second set of frequencies F_2
characterized by a second frequency band (e.g., the blue band serving the cell-edge)

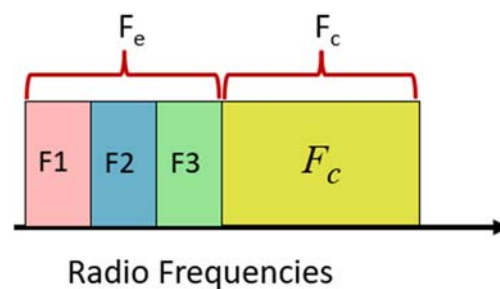
a second geographic footprint
larger than and at least partially surrounding the first geographic footprint (the coverage area of RA1 - RA6 of Cell 1, i.e., blue area)



EX-1003, ¶154. That Xu discloses Element 7C is consistent with the same logic under which Element 7C reads on the first embodiment of the '358 patent. EX-1003, ¶¶104-105, 155-156.

In Xu's system, the central antenna (i.e., base station antenna B_4 of cell 1, above) of the first communications unit transmits a first set of frequencies characterized by a first frequency band (F_c), i.e., the yellow band. EX-1003, ¶157. In Xu's system the yellow band will, therefore, be transmitted from the central antenna unit of Cell 1 to user devices and will be received from the central antenna unit by the user devices (in the downlink) and by the base station (in the uplink). EX-1003, ¶157. Dr. Acampora explains the fractional reuse scheme of Xu Fig. 1 and illustrates how Xu's system partitions the available frequencies. *Id.*

F_c = cell center's frequency
 F_e = "cell edge's frequency which is divided into three orthogonal bands" (F_1 F_2 F_3).



Id.; EX-1005, 4440, Section II(A), Fig. 1.

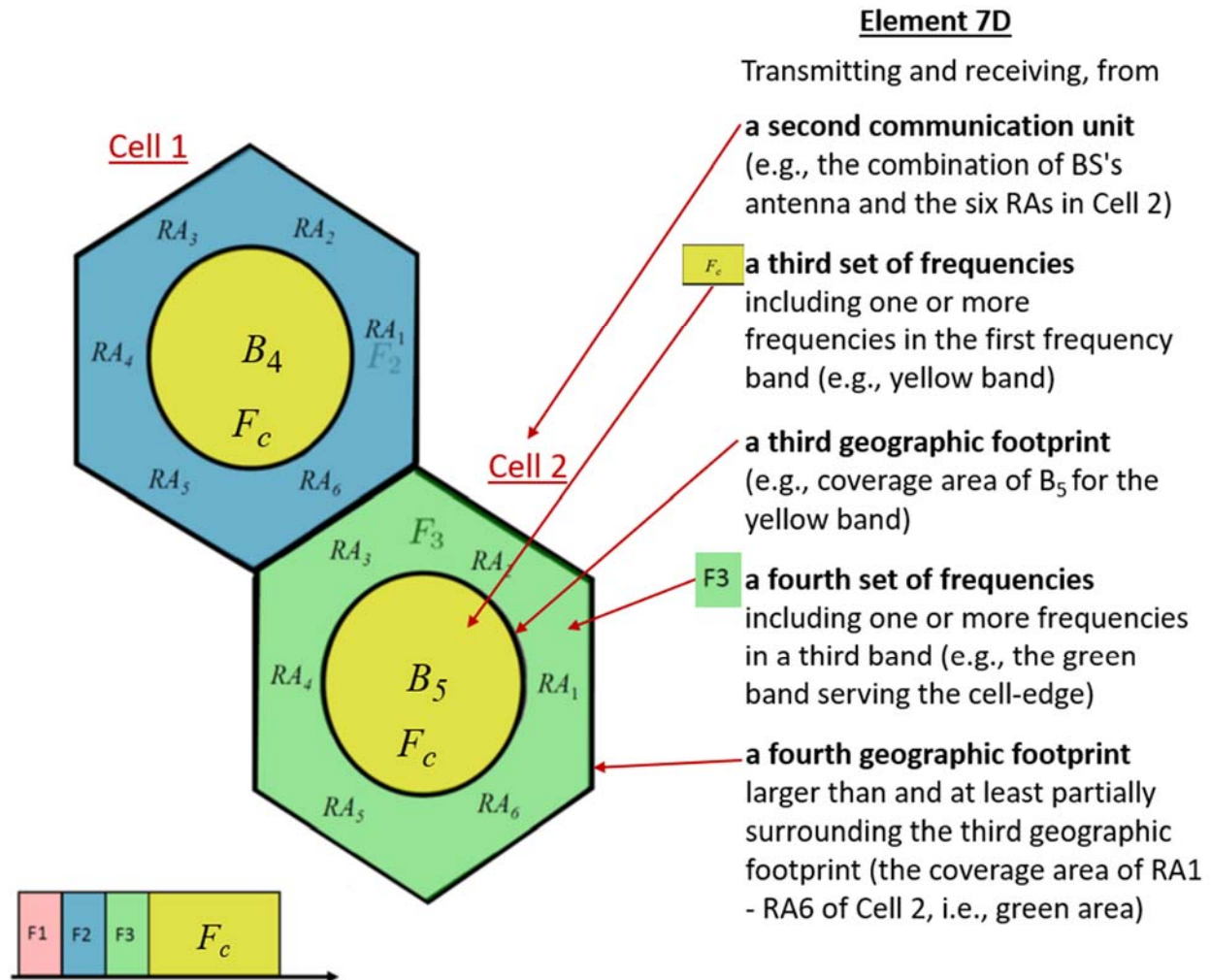
In Xu's cell 1, the radio coverage area of the central antenna (i.e., the base station antenna B_4) for the yellow band (F_c) is "a first geographic footprint". EX-1003, ¶158. The central circle shown in Fig. 1 of Xu corresponds to the first geographic footprint. *Id.*

In cell 1 of Xu's system, six periphery antennas ($RA_1 - RA_6$) of the first communications unit transmits a second set of frequencies characterized by a second frequency band (band F2 of the cell-edge frequencies F_c), i.e., the blue band. EX-1003, ¶159. Therefore, in Xu's system the blue band will be transmitted from the periphery antenna units of Cell 1 to user devices and will be received from the periphery antenna units by the user devices (in the downlink) and by the base station (in the uplink). *Id.*

In Xu's cell 1, the radio coverage area of six periphery antennas ($RA_1 - RA_6$) for the blue band is "a second geographic footprint". EX-1003, ¶160. The geographical area of the second footprint is larger than and completely encompasses the geographical area of the first geographic footprint. *Id.*

d. Element 7D

As shown, Element 7D reads on Xu's system. EX-1003, ¶161.



EX-1003, ¶161. That Xu discloses Element 7D is consistent with the same logic under which Element 7D reads on the first embodiment of the ‘358 patent. EX-1003, ¶¶104-105, 162-163.

In Xu’s system, the central antenna (i.e., base station antenna B_4 of cell 2, above) of the second communications unit transmits a third set of frequencies that include one or more frequencies in the first frequency band, the yellow band (F_c).

EX-1003, ¶¶164-165. Therefore, in Xu’s system the yellow band will be transmitted from the central antenna unit of Cell 2 to user devices and will be

received from the central antenna unit by the user devices (in the downlink) and by the base station (in the uplink). *Id.*

In Xu's cell 2, the radio coverage area of the central antenna (i.e., the base station antenna B_5) for the yellow band (F_c) is "a third geographic footprint". EX-1003, ¶166. The central circle of cell 2 shown in Fig. 1 of Xu corresponds to the third geographic footprint. *Id.*

In cell 2 of Xu's system, six periphery antennas (RA1 – RA6) of the second communications unit transmits a fourth set of frequencies including one or more frequencies in a third band (band F2 of the cell-edge frequencies F_e), i.e., the green band. EX-1003, ¶167. Therefore, in Xu's system the green band will be transmitted from the periphery antenna units of Cell 2 to user devices and will be received from the periphery antenna units by the user devices (in the downlink) and by the base station (in the uplink). *Id.*

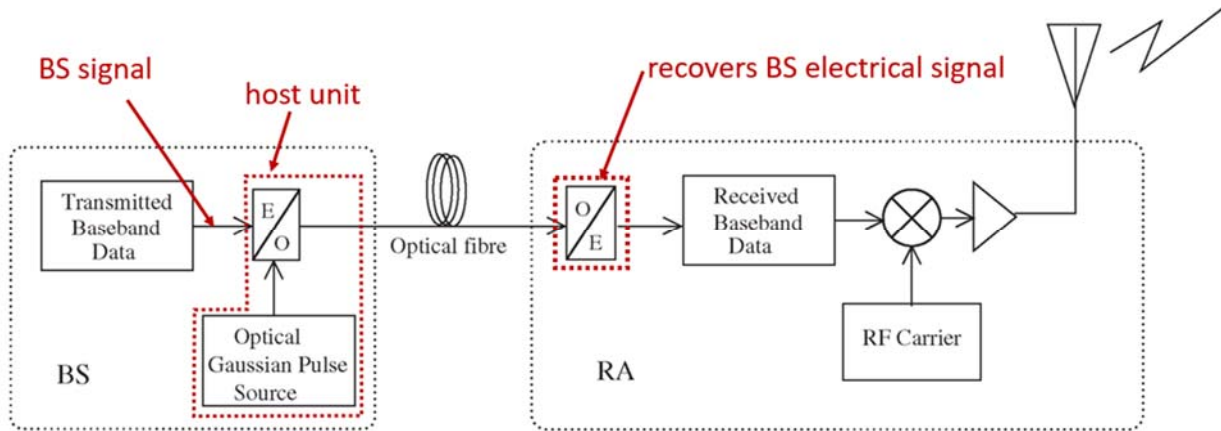
In Xu's cell 2, the radio coverage area of six periphery antennas (RA1 – RA6) for the green band is "a fourth geographic footprint". EX-1003, ¶168. The geographical area of the fourth footprint is larger than and completely encompasses the geographical area of the third geographic footprint. *Id.*

2. Claim 8

“the set of communications units includes a plurality of remote units in communication with a host unit”.

Xu discloses this limitation by the system architecture within Fig. 2 that supports the transport of the base station signals over the DAS links to a plurality of remote antenna units in Xu’s system. EX-1003, ¶¶170-174.

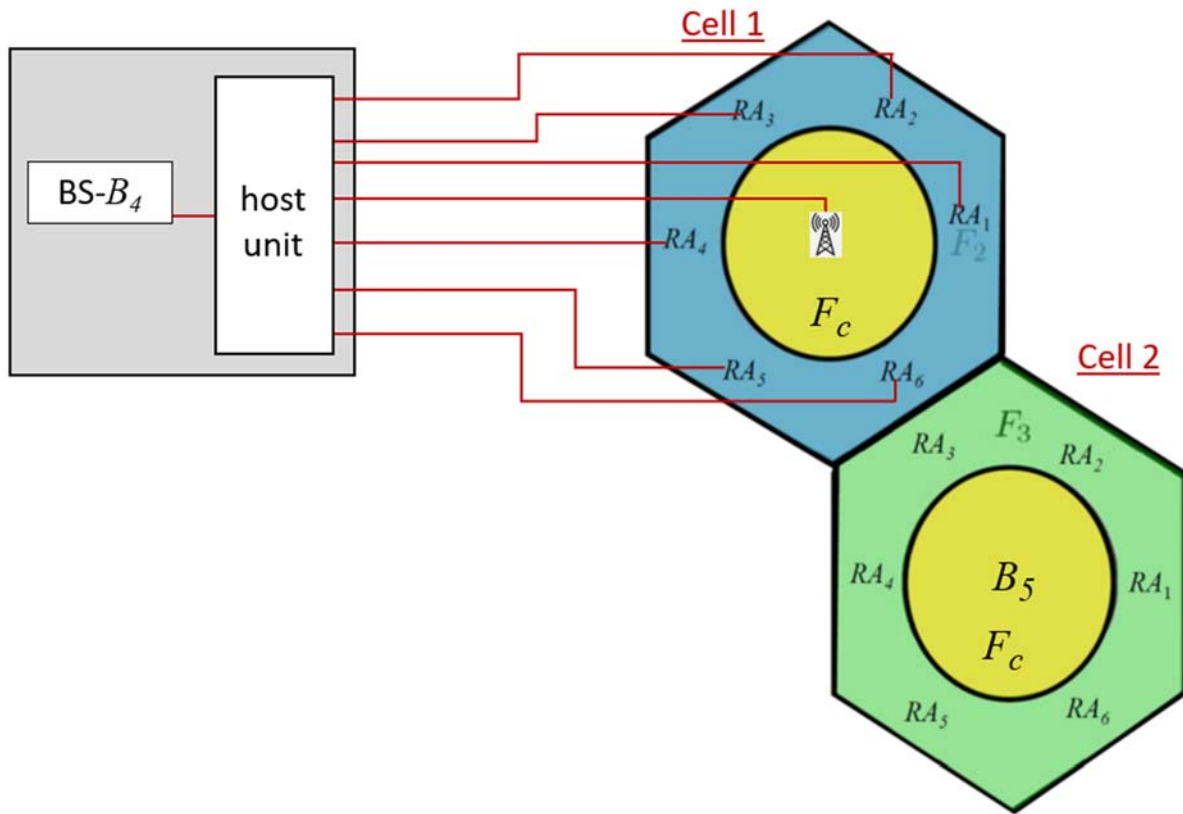
Xu’s Fig. 2 discloses circuitry that constitutes a DAS host unit. EX-1003, ¶171.



EX-1003, ¶171. Within the box labeled “BS” of Fig. 2, Xu’s system includes DAS host unit functionality, i.e., the base station signal is received by the circuitry labeled “host unit” which converts the base station signal from an electrical signal to an optical signal for transport over fiber optic link. *Id.* Using this circuitry, the BS of Xu distributes communications frequencies between the base station and the remote antenna units and defines an interface between (a) the base station of the operator’s network and (b) the remote antenna units of the distributed antenna

system. *Id.* This host unit functionality allows Xu's BS to manage communications between the remote antennas and the operator's network. *Id.*

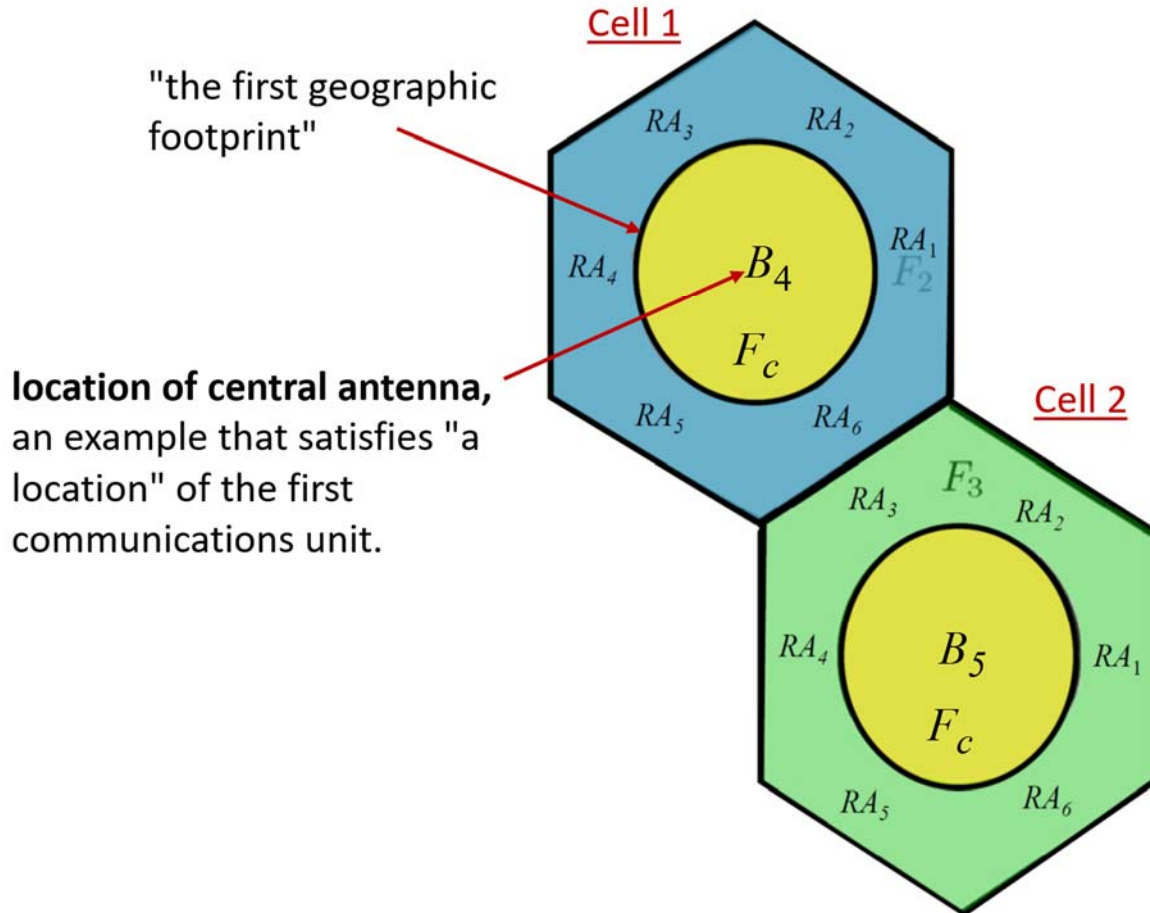
A DAS DFO (digital fiber optic) link is used to connect each of Xu's RAs to the base station. EX-1003, ¶172; EX-1005, 4439 ("...we ***opted for the DFO link.***"). To illustrate the DAS link to each RA in cell 1 of Xu's system, the base station B_4 is moved to a location outside of cell 1. EX-1003, ¶174.



3. Claim 9

Since the first geographic footprint of Xu's cell 1 includes the antenna unit co-located with based station B_4 , claim 9's limitations are satisfied. EX-1003,

¶175. The location of any one of the seven antennas would satisfy "a location" of the first communications unit. *Id.*



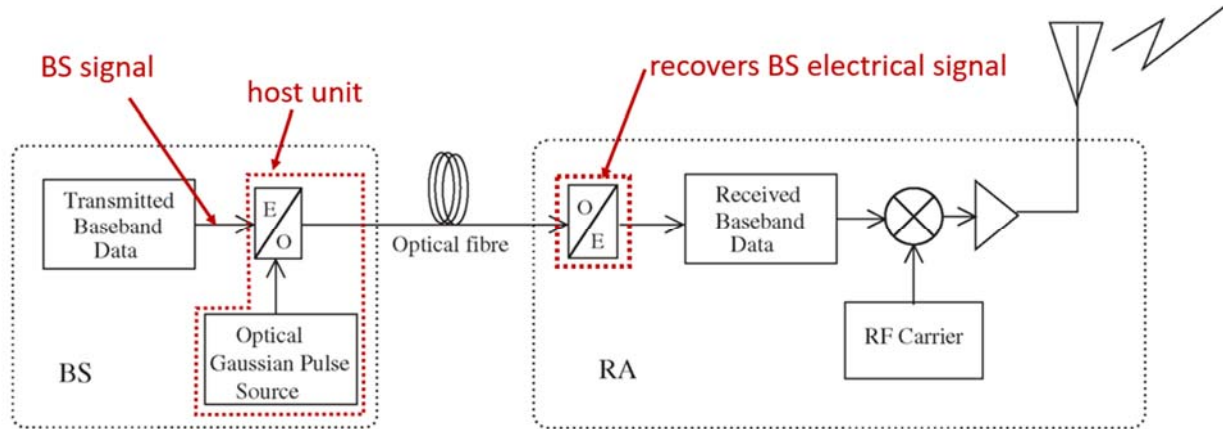
Id.

4. Claim 11

Since the third geographic footprint of Xu's cell 2 includes the antenna unit co-located with based station B_4 , claim 11's limitations are satisfied. EX-1003, ¶176.

B. Ground 2: Xu alone or in combination Schwartz renders obvious claims 8, 15, 20 and 21

1. Claim 8



Patent Owner may argue that the circuitry labeled “host unit” is not a host unit of claim 8 because the circuitry is not included within a separate housing forming a “unit” or the circuitry by itself does not satisfy the host unit limitation for some other reason. Regardless, based on Xu alone or in combination with Schwartz, it would have been obvious to include a host unit to facilitate the efficient and reliable transport of the base station signals to Xu’s remote antenna units. EX-1003, ¶¶177-190.

Motivation to employ a host unit in deploying Xu’s system in densely populated areas. In densely populated, metropolitan areas the real estate necessary to house the base station equipment can be particularly costly or simply not available within every cell. EX-1003, ¶178. For this reason, A POSA would have known: (a) that it was common for the base stations to be located, for example, at a

“base station hotel” (EX-1001, 1:21), a long distance from the cell site; and (a) that a host unit would “typically” be used to facilitate the transport of the base station’s RF signals long distances over DAS links to the remote antenna sites. EX-1003, ¶178; EX-1001, 1:17-23. The prior art reinforces what the ‘358 patent states as background. *E.g.*, EX-1003, ¶178; EX-1009, 1:26-65 (explaining base station hotel solution to mitigate problems with placing BTS in each cell); EX-1008, 1:34-40, 3:30-35; Fig. 2; EX-1014, ¶0005, Fig. 6; EX-1010, Fig. 1.

Further, as noted in prior art discussed below, there are efficiency benefits to centralizing base station resources (such as ease of upgrading all the base stations when the equipment is centralized versus when that equipment is dispersed throughout a large metropolitan area) that would have also motivated a POSA to modify Xu’s system by moving the base station equipment to a centralized location, such as a base station hotel, that is remote from the cell sites. EX-1003, ¶179; EX-1009, 1:60-65.

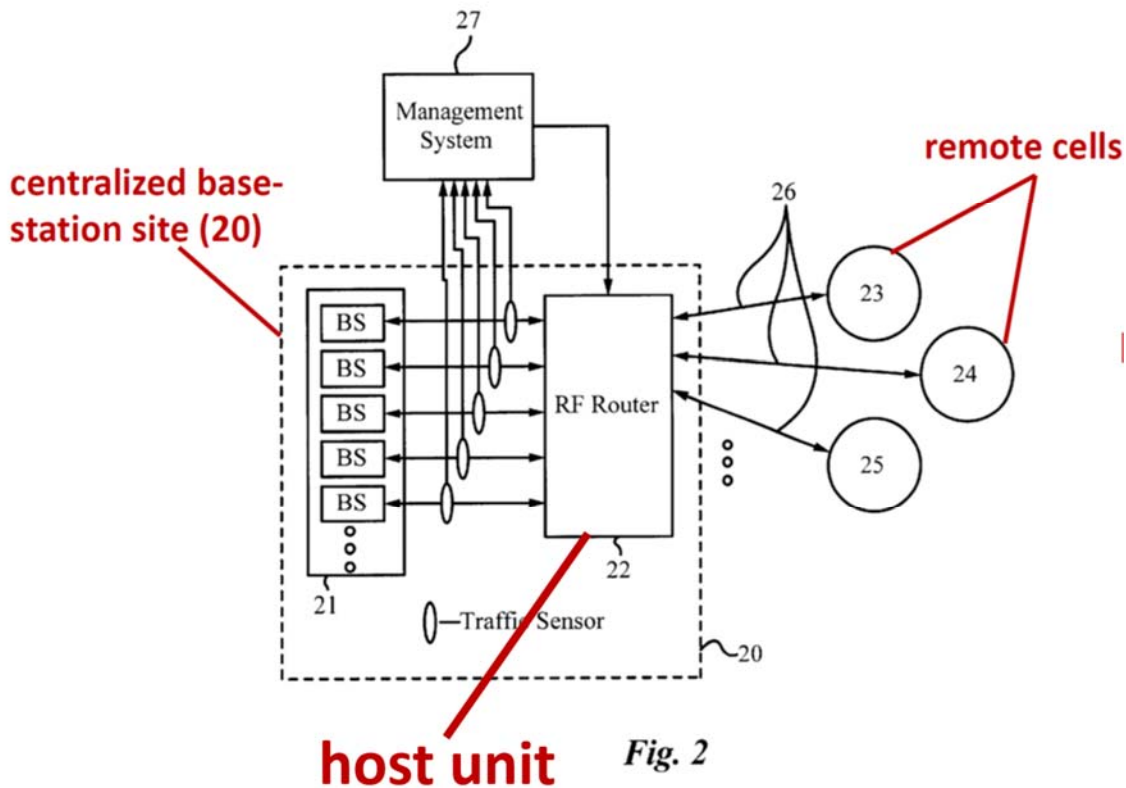
For deployments in which the base station had to be located a long distance from the cell and the remote antenna units, the well-known benefit of including a host unit (i.e., to facilitate the transport of the base station’s RF signals over long distances to the remote antenna cites) would have motivated a POSA to include a host unit that receives the base station signals and performs the appropriate functionality (e.g., converting the base station signals to digital or optical signals)

to more efficiently and reliably transport the signals long distances over the DAS links to the remote antenna units. EX-1003, ¶180. Using a host unit separate from a base station (not relying on a base station that includes host unit functionality) would also allow the system to work with existing base stations that may not include host unit functionality for converting communication frequencies to formats suitable for long-distance transport. *Id.* Thus, claim 8 would have been obvious to a POSA based on Xu alone.

Alternatively, it would have been obvious based on Xu in combination with Schwartz to include a host unit as an interface to either or both DASs that serve Xu's cells 1 and 2. EX-1003, ¶181.

Motivation based on Schwartz's teaching. Schwartz teaches the use of a common host unit that serves as the interface between (1) a centralized site that houses a collection of base stations and (2) a plurality of cells. EX-1003, ¶182.

Schwartz, Fig. 2



Id.; EX-1008, Fig. 2; 6:24-41.

Based on Schwartz (and reinforced by the background in the ‘358 patent) a POSA would have known that distributed antenna systems “*typically*” included “one or more host units” (EX-1001, 1:17-18) that together with the DAS links would provide the “means for distribution of the base stations downlink and uplink signals among multiple remote antenna units.” EX-1001, 1:20-24; EX-1003, ¶183.

Schwartz teaches the benefits of employing “a centralized base-station site containing a plurality of base-station units” (i.e., a base station hotel) and using a

DAS with a host unit to transport resources from the centralized base station location to remote cells. EX-1008, 3:22-27, Fig. 2; 1:16-67 (reducing costs, enhancing capacity, and meeting dynamic capacity needs). EX-1003, ¶184.

Based on Schwartz, a POSA would have understood that, for cost and efficiency reasons as well as lack of access to cell site property, in deploying cellular communication systems: (a) the base station often must be located remote from the cell sites at a centralized location (commonly referred to as a base station hotel) and (b) for such deployments, a DAS host unit (e.g., router 22 of Schwartz Fig. 2) as taught by Schwartz would facilitate the transport of radio resources from the hotel to Xu's cells. EX-1003, ¶185.

For such deployments, Schwartz teaches to use a host unit (e.g. "RF router 22") as an interface between one or more base stations to facilitate the transport of the base station signals over the DAS links to the remote antenna units. EX-1008, Fig. 2, 6:24-41; EX-1003, ¶186.

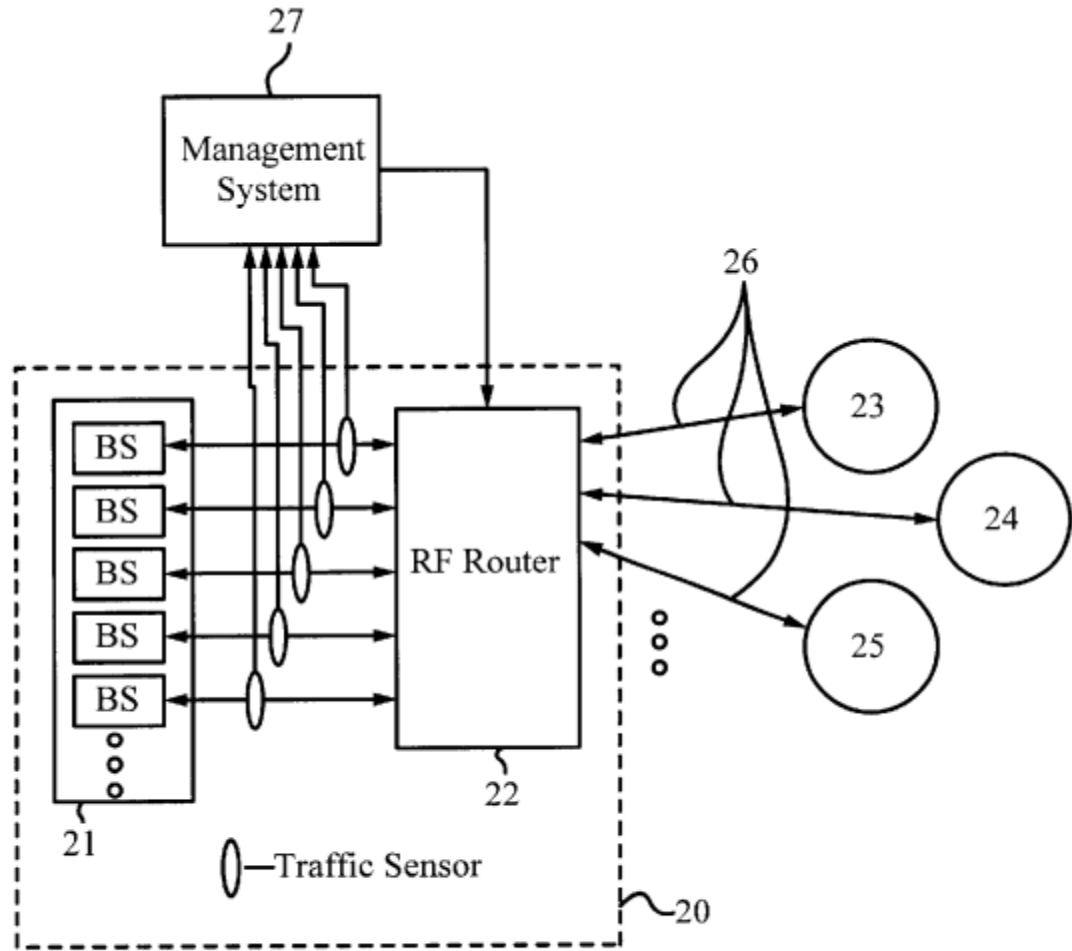


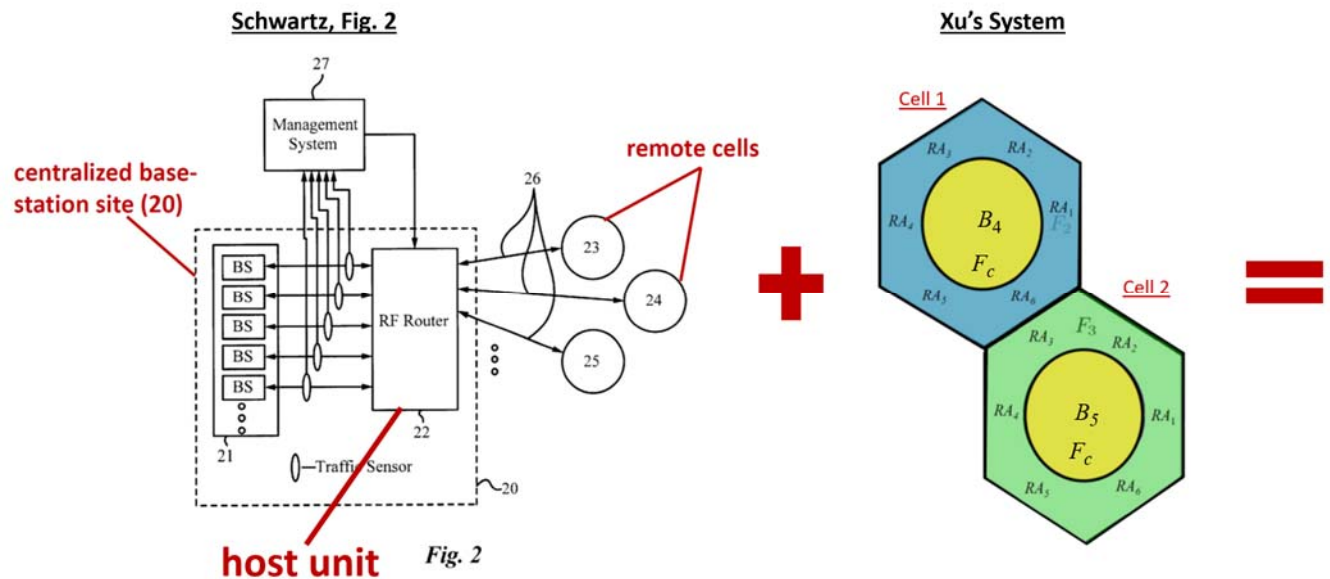
Fig. 2

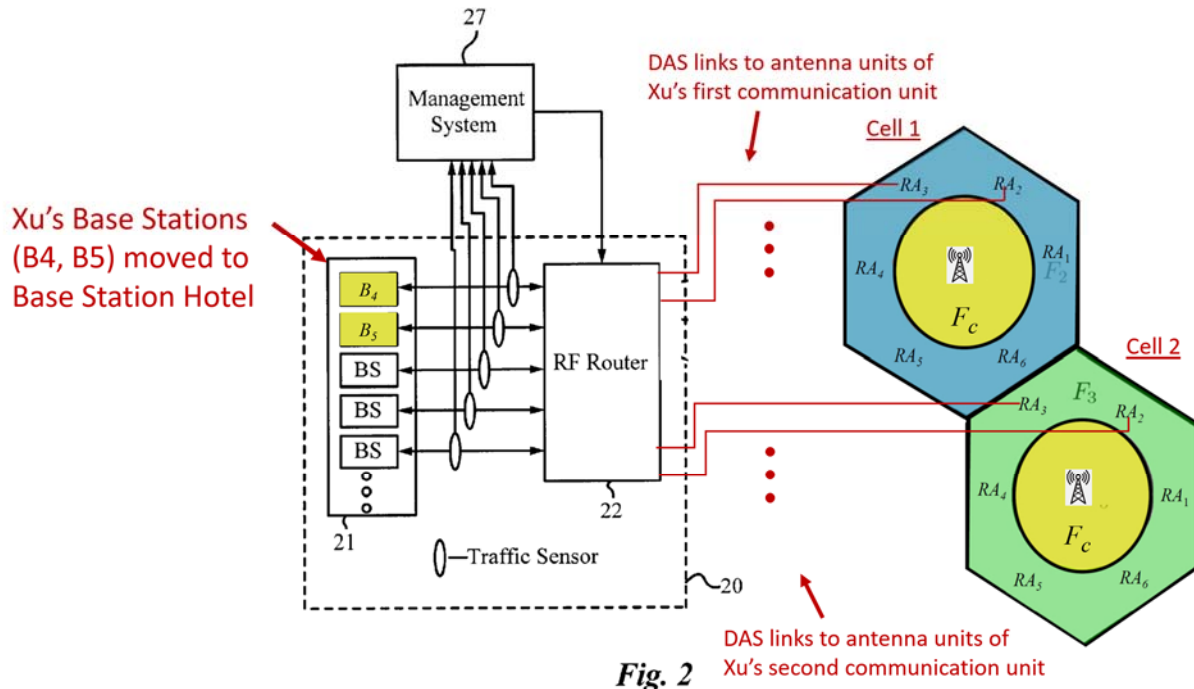
Xu and Schwartz both disclose using optical fiber for the DAS link to the remote antenna units. EX-1008, 6:65-66; EX-1005, Fig. 2; EX-1003, ¶187.

For those deployments requiring the base station equipment to be located remote from the cell sites, a POSA would have been motivated by the benefit of using a DAS host, as taught by Schwartz, in Xu's system to facilitate the transport of the base station signals to Xu's remote antenna units. EX-1003, ¶188.

This combination of Xu and Schwartz below. *Id.* Further, one of skill would be motivated to use a host unit as taught by Schwartz's router 22 that is not integral with one base station so that the host unit could serve and manage signals from multiple base stations, not just one base station, which produces significant cost savings (only one host required, not multiple, i.e., one within each base station). *Id.*

This combination of Xu and Schwartz below.





EX-1003, ¶189.

A POSA would have a reasonable expectation that such a combination would be successful. EX-1003, ¶190. That host units have been so long used in the art of DAS (Schwartz filed in 2000 more than a decade before the ‘358 patent) would lead a POSA to have a reasonable expectation of success, a fact that is confirmed by the ‘358 patent itself which recognizes that host units are “typical” in DAS deployments (EX-1001, 1:17-18). EX-1003, ¶190. One of reasons a DAS typically includes a host unit is to prepare the signals for successful transport over longer distances without degradation of the data carried on the signals. *Id.* Moreover, a POSA would have understood the importance of including a host unit

to ensure that the combination would be successful for deployments in which long distance transport of the base station signals is required. *Id.*

2. Claim 15

The claimed communication system of Claim 15 is similar to the claimed method of distributing communications frequencies of claim 7. Xu does not disclose one host unit that is coupled to the first and second communications units (Element 15B). It would have been obvious based on Xu alone or in combination with Schwartz to include a common host unit that couples the base stations (e.g., located at a base station hotel) to the first and second communications units. EX-1003, ¶191.

Element 15A: Xu's distributed antenna system is a communications system providing wireless coverage to multiple cells. EX-1005, Abstract; EX-1003, ¶192.

Element 15B: For the same reasons discussed above with respect to claim 8, it would have been obvious based on Xu alone or in combination with Schwartz to provide a common host unit that is coupled to the first communication unit of Xu's cell 1 and to the second communications unit of Xu's cell 2. EX-1003, ¶¶194-208. The discussion of claim 8 above is included here for claim 15 by reference.

Elements 15C and 15D: The other limitations of claim 15 are disclosed by Xu for the same reasons that Xu discloses all the limitations of claim 7. EX-1003,

¶192 (“communication system” of Element 15A); and ¶193 (Elements 15C and 15D). Dr. Acampora maps the limitations of Elements 15C/15D to Ericsson’s system. EX-1003, ¶193.

3. Claim 20

“wherein the first frequency band and the second frequency band are contiguous frequency bands”

Claim 20 reference to “the first frequency band” and “the second frequency band” is not clear because there is no prior recitation of frequency bands in claim 15 or claim 20. If these are construed to be referring to the first and second frequency ranges introduced in claim 15, then this limitation is disclosed by Xu. For the charts showing Xu’s cells, either of the cells could be designated cell 1. In the mapping of Elements 15C and 15D below, the cell associated with base station B₅ is designated as cell 1. As shown, the first range (yellow) and the second range (green) are continuous and therefore the limitation of claim 20 is disclosed by Xu.



EX-1003, ¶209.

4. Claim 21

Xu teaches the limitations added by claim 21 because in Xu system, the first frequency range (yellow), the second frequency range (green), and the third frequency range (blue) include distinct frequencies. EX-1003, ¶210.

C. Ground 3: Xu in combination with Schwartz and Huawei renders obvious claims 17 and 18

Xu alone or in combination with Schwartz renders the limitations of independent claim 15 for the reasons described above. Claims 17 and 18 add the limitations that the different footprints are created using different power levels.

Huawei (EX-1006) is a prior art publication entitled “Further Analysis of Soft Frequency Reuse” authored by Huawei for the 3GPP TSG RAN Working Group 1#42 in 2005. Huawei teaches utilizing soft frequency reuse schemes to mitigate inter-cell interference. EX-1006, 1:

In the proposed soft frequency reuse scheme, sub-carriers are divided into two groups in every cell. One group is called major sub-carriers group, and the other one is called minor sub-carriers group. For each group of sub-carriers, one maximum allowed transmission power is set for them. Normally, the maximum allowed transmission power for major sub-carriers is higher than minor sub-carriers. The transmission power on each sub-carrier shall not exceed this limitation. The major sub-carrier can be used to cover the whole cell area, while the minor sub-carrier is used only in the inner part of the cell, as is showed in figure 1(the blue represents the inner zones and the other colors represent the cell edges). Major subcarriers in neighboring cell are orthogonal (i.e. no overlap). The so called “Power Ratio” is the ratio

between transmit power limitation of minor sub-carriers and major subcarriers. Power Ratio adjusted gradually from 0 to 1, the effective reuse factor changes from 3 to 1 smoothly. So, the SFR is the compromise of reuse 1 and reuse 3.

Huawei illustrates soft frequency reuse as shown in Figure 1.

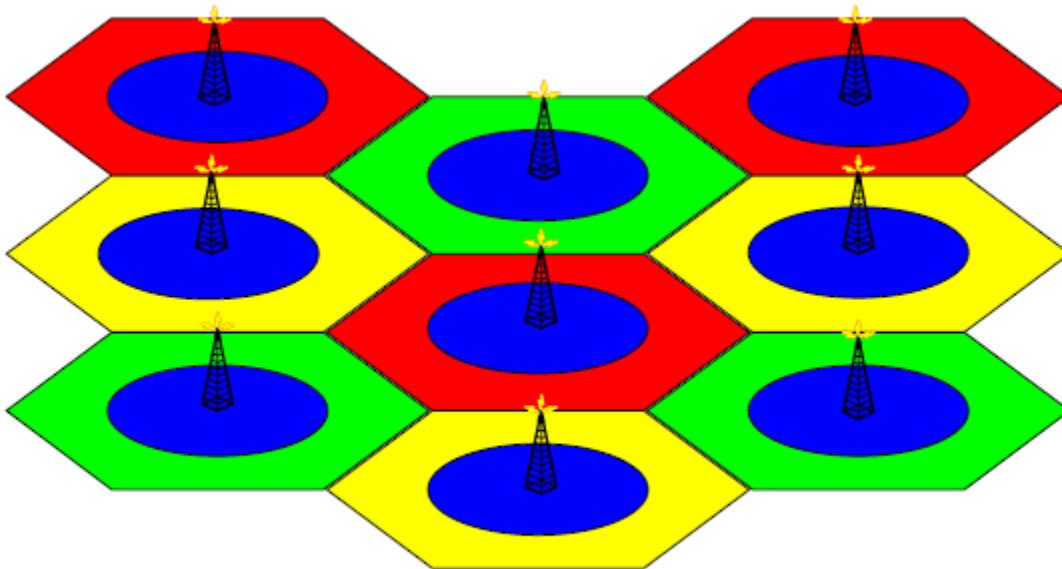


Figure 1, Cell deployment

EX-1006, Fig. 1.

As shown in Figure 1, the major subcarriers of adjacent cells are orthogonal (not the same), while the minor subcarriers within each cell are the same and reused in each cell. EX-1003, ¶214. This is achieved by transmitting the minor subcarriers at lower power levels. *Id.* The ratio of the power of the minor subcarriers to the power of the major subcarriers is defined by Huawei as the

Power Ratio. *Id.*; EX-1006, 1 (“The so called ‘Power Ratio’ is the ratio between...”).

Huawei teaches that it is advantageous to reduce the Power Ratio (to values less than 1) when high traffic happens at the cell edge to improve the throughput for cell edge users.

By adjusting the power ratio, SFR can adapt the variation of the service distribution in each cell. When the high traffic happens at the cell edge, the power ratio should be set to a relatively small value to get a high cell edge bit rate. On the contrary, when the traffic is mainly located at the inner part of the cell, a relatively large value for the power ratio is reasonable.

EX-1006, 1; EX-1003, ¶215.

When the Power Ratio is less than one, this means that communications using the **frequencies associated with the cell edge (the major subcarriers) are being transmitted at higher power levels** than the communications using the frequencies associated with the inner zone. EX-1003, ¶216.

Huawei includes simulation results that show the throughput at the cell edge increases when the power ratio is dropped. EX-1006, 3 (explaining figures show cell edge and inner zone throughputs for different power ratios); EX-1003, ¶217.

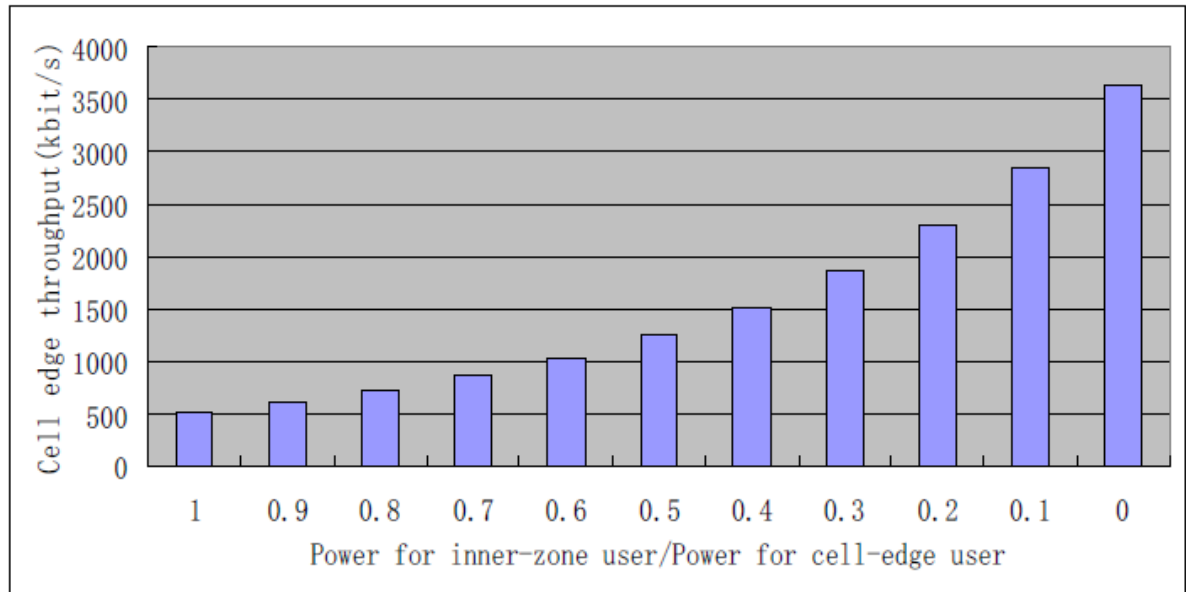


Figure 2, cell edge throughput in soft frequency reuse scheme

EX-1006, Figure 2.

Although Huawei notes that the throughput of the inner portion of the cell will drop when the power ratio drops less than 1, Huawei teaches that when traffic load is highest at the cell edge, the tradeoff will result in better throughput performance. EX-1003, ¶218

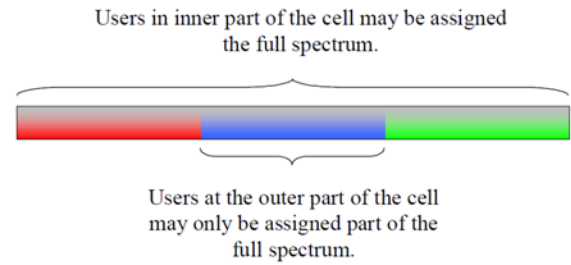
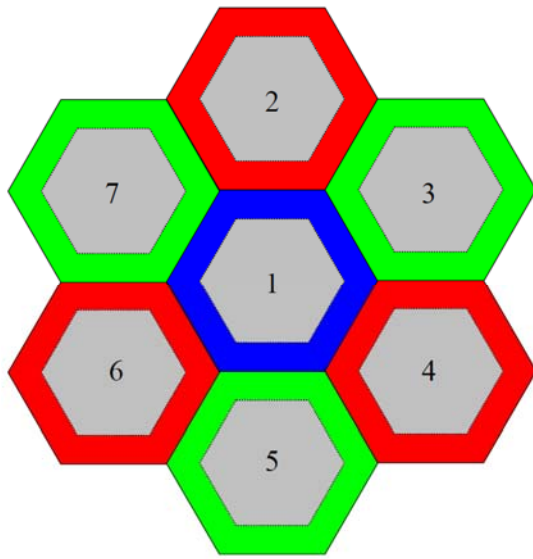
Similarly, one of skill in the art would be motivated to improve Xu using Huawei by adjusting, when the traffic load is high in the cell edge areas, the power ratio of the communications in the Xu reference so that the power level of communications on the frequencies used by cell edge antenna units (RAs) of Xu is greater than the power level of communications on the frequencies used by the central base station antenna unit (e.g., at B₀) to obtain the benefit taught by Huawei which is to improve throughput in the cell edge areas. EX-1003, ¶219. This

modification would satisfy claim 17. *Id.* One would have a reasonable expectation of success because power levels can be easily controlled using power amplifiers. *Id.* Therefore, claim 17 would have been obvious in light of Xu, Schwartz and Huawei. EX-1003, ¶220.

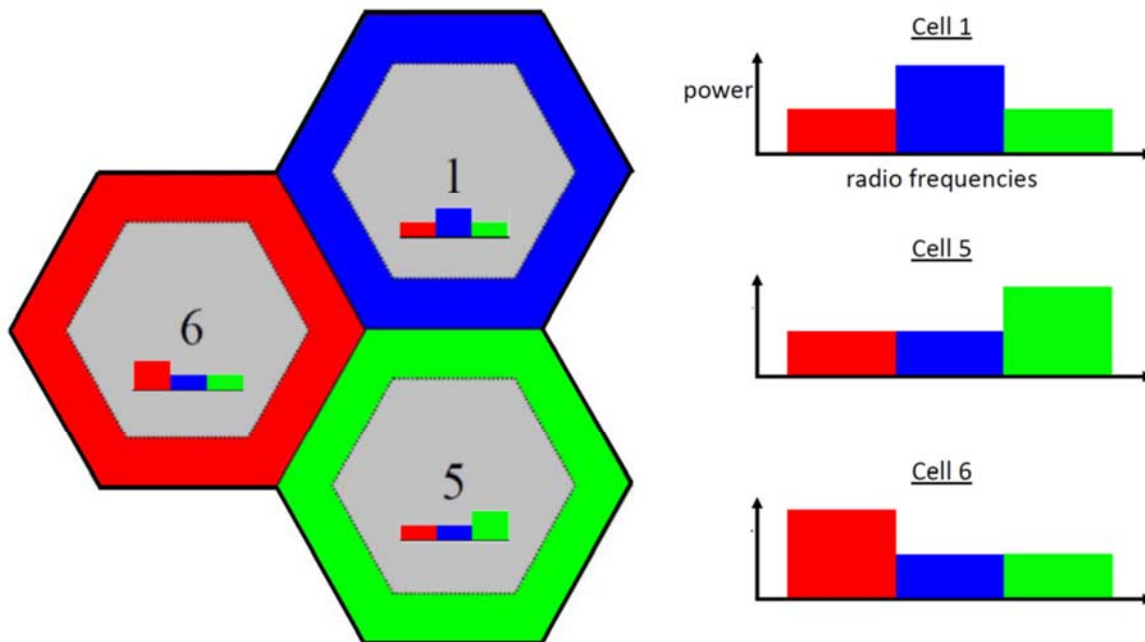
For the same reasons claim 18 would also have been obvious. EX-1003, ¶221. The same approach would provide the same benefit if applied to each cell. Claim 18 is about the power levels in the second cell. *Id.* Huawei's approach to vary the power levels so that the cell edge power level is greater than the cell inner area power level would benefit the second cell, not just the first cell, when the second cell has high traffic in its cell edge area. *Id.*

D. Ground 4: Ericsson anticipates claims 7, 9 and 11.

Ericsson (EX-1007) addresses the problem of inter-cell inference. In Section 3, Ericsson discloses a frequency reuse technique in which “only a part of the total resources is used for transmission to/from cell-edge users, thereby reducing the interference experienced by these users....” EX-1007, 2, Fig. 2 (below); EX-1003, ¶¶125-128.



Cells 1, 5 and 6 of Ericsson’s Figure 2 are isolated below with annotations to illustrate Ericsson’s implementation of a frequency reuse scheme, in much the same way as Figs. 1C & 1F of the ‘358 patent. EX-1001, 4:64–5:9. To mitigate inter-cell interference in cell-edge areas, each cell’s centrally located antenna transmits a different RF band at a higher power to cover a cell-edge area, e.g., Cell 1 (blue), Cell 5 (green), and Cell 6 (red). EX-1007, 2 (e.g., “only cell 1 is allowed to transmit with *full power* using the ‘blue’ part of the spectrum”); EX-1003, ¶128.



1. Claim 7

None of the limitations in the preamble or body of claim 7 require a DAS. EX-1003, ¶223. A system, such as a base station, can distribute communications frequencies to its antenna unit and to user equipment in its coverage area without employing a distributed antenna system. *Id.*

a. Element 7A (preamble)

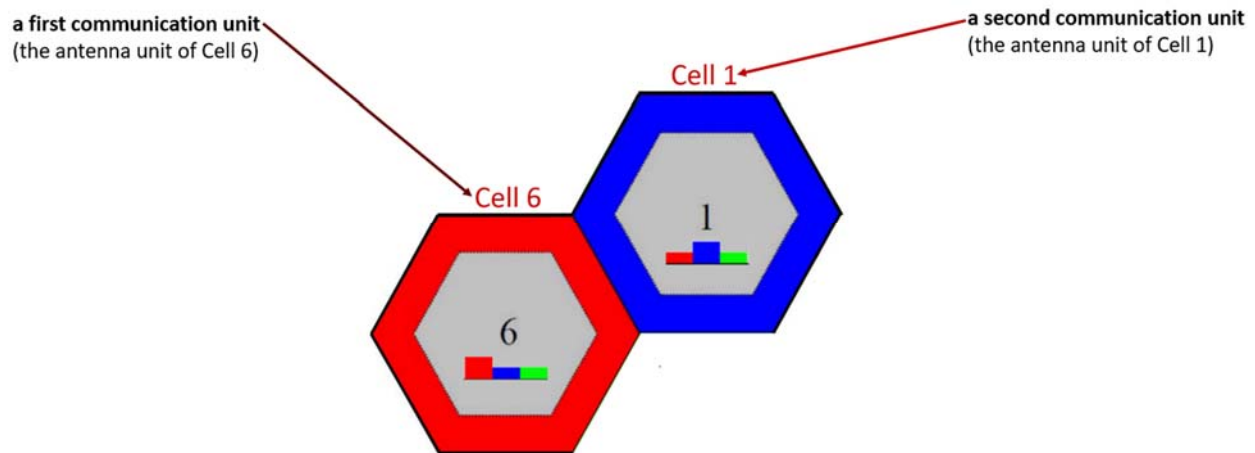
“distributing communications frequencies”

Ericsson discloses a method for a cellular communication system that distributes communications frequencies in a way that implements a frequency reuse technique for “reducing the interference experienced by these users....” EX-1007, 2, Section 3; EX-1003, ¶224.

b. Element 7B

“providing a set of communications units”

In Ericsson, the antenna unit that serves cell 6 is a “first communications unit” (below, left), and the antenna unit that serves cell 1 is a “second communications unit” (below, right). EX-1003, ¶¶222-226, 245-246. Ericsson’s first and second communications units satisfy “a set of communications units” of Element 7B. *Id.*



c. Element 7C

As shown, Element 7C reads on Ericsson’s system. EX-1003, ¶¶227-233.

Element 7C

Transmitting and receiving, from

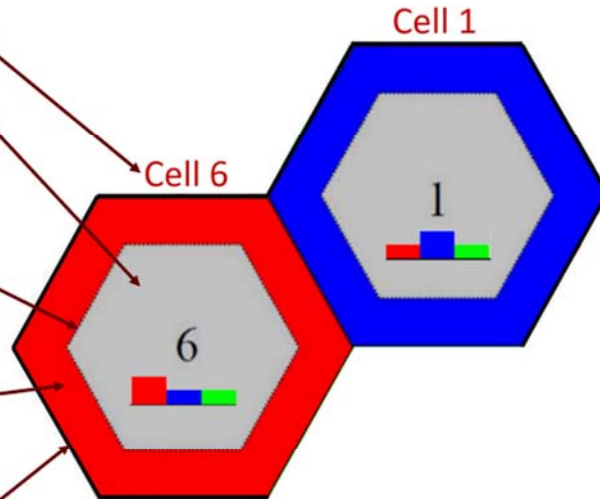
a first communication unit
(the antenna unit of Cell 6)

a first set of frequencies 
characterized by a first frequency
band (the band that includes the
blue and green bands)

a first geographic footprint
(radio coverage area of antenna
unit of cell 6 for blue and green
bands)

a second set of frequencies 
characterized by a second
frequency band (the red band
serving the cell-edge)

a second geographic footprint
larger than and at least
partially surrounding the first
geographic footprint (radio
coverage area of antenna unit
of cell 6 for red band)



Id.

That Ericsson discloses Element 7C is consistent with the same logic and reason under which Element 7C reads on the second embodiment of the ‘358 patent. EX-1003, ¶¶106, 228.

The antenna unit that serves Ericsson’s cell 6 (above), is “a first communications unit”. EX-1003, ¶¶229, 245-246. That each cell inherently includes an antenna unit is understood because this is a wireless communication system (i.e., a RAN “radio access network”) and further because antenna

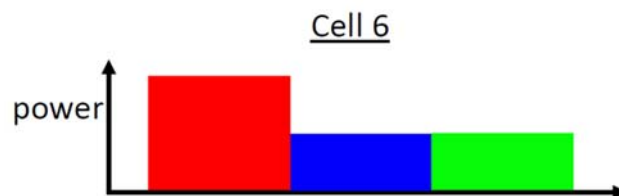
configurations are illustrated, for example, on page 3 of Ericsson. *Id.*; EX-1007, 1 (“RAN”), 3 (Figure 3).

In Ericsson’s system, cell 6’s antenna unit transmits/receives a first set of frequencies characterized by a first frequency band that includes the blue and green bands. EX-1003, ¶230; EX-1007, 2, Fig. 2.

In Ericsson’s cell 6, the radio coverage area of cell 6’s antenna unit for the blue and green bands is the “a first geographic footprint”. EX-1003, ¶231; EX-1007, 2, Fig. 2. The cell-center area of cell 6 (gray area) corresponds to the first geographic footprint. *Id.*

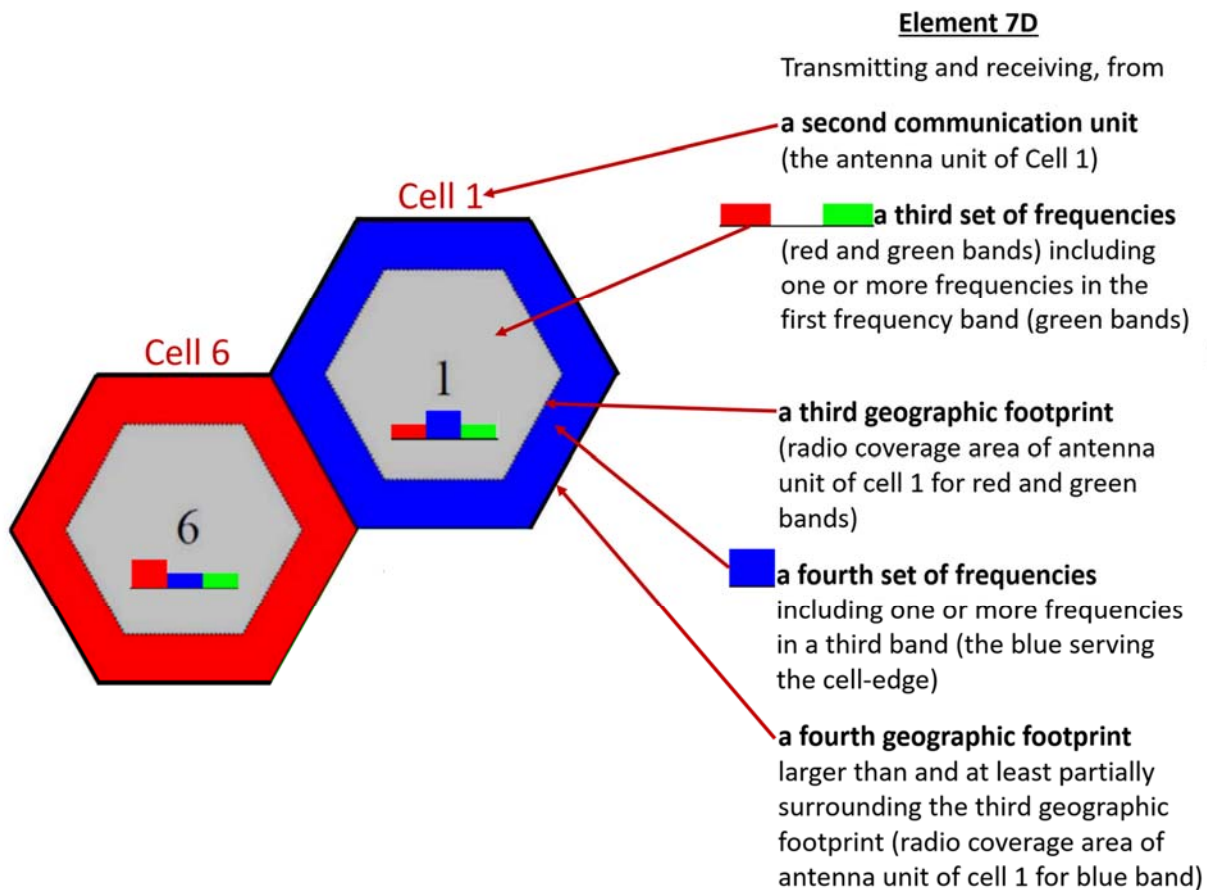
In Ericsson’s system, cell 6’s antenna unit transmits a second set of frequencies characterized by a second frequency band (red band). EX-1003, ¶232; EX-1007, 2, Fig. 2.

In Ericsson’s cell 6, the radio coverage area of cell 6’s antenna unit for the red band is “a second geographic footprint”. As illustrated below, cell 6’s antenna unit transmits the red band at a higher power resulting in the larger coverage area shown for the second geographic footprint. EX-1003, ¶233; EX-1007, 2, Fig. 2.



d. Element 7D

As shown, Element 7D reads on Ericsson's system. EX-1003, ¶234



Id.

That Ericsson discloses Element 7D is consistent with the same logic and reason under which Element 7D reads on the second embodiment of the '358 patent. EX-1003, ¶¶106, 235.

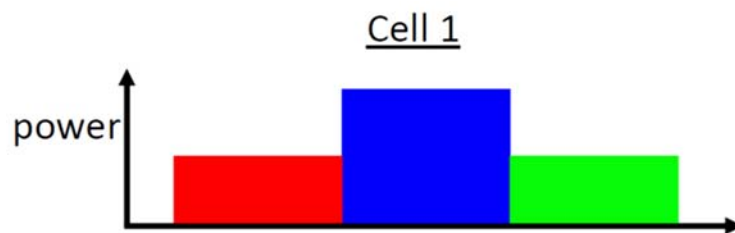
The antenna unit that serves Ericsson's cell 1 (above), is "a second communications unit." EX-1003, ¶¶236, 245-246.

In Ericsson's system, cell 1's antenna unit transmits/receives a third set of frequencies (red and green) that include one or more frequencies in the first frequency band (green). EX-1003, ¶237; EX-1007, 2, Fig. 2.

In Ericsson's cell 1, the radio coverage area of cell 1's antenna unit for the red and green bands is "a third geographic footprint". EX-1003, ¶¶238; EX-1007, 2, Fig. 2. The cell-center area of cell 1 (gray area) corresponds to the third geographic footprint.

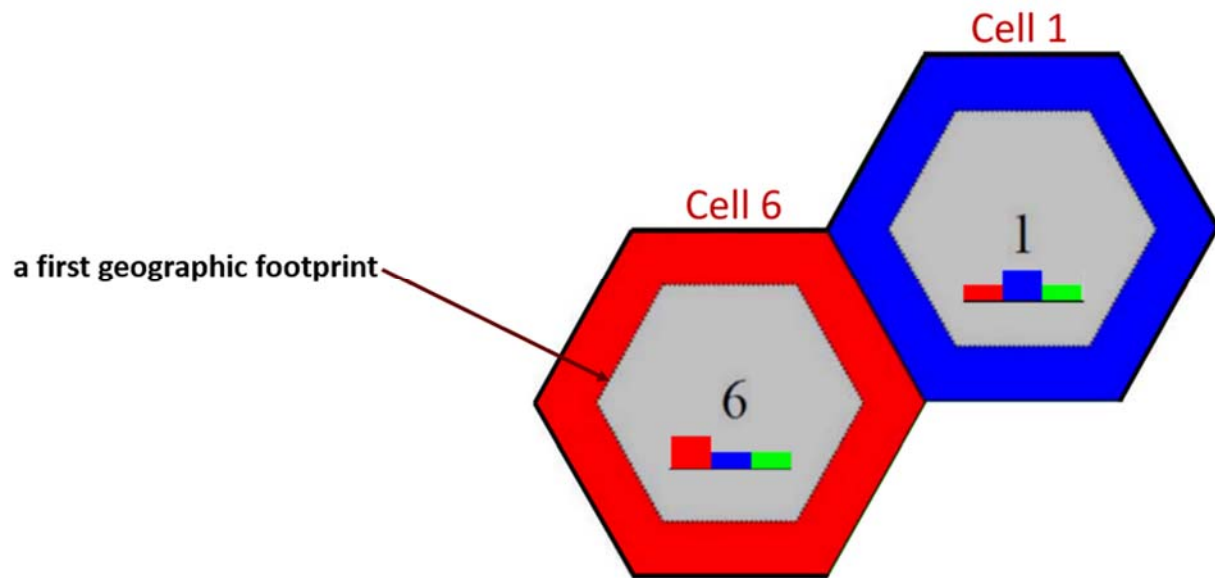
In Ericsson's system, cell 1's antenna unit transmits a fourth set of frequencies including one or more frequencies in a third band (blue band serving the cell-edge area). EX-1003, ¶239; EX-1007, 2, Fig. 2.

In Ericsson's cell 1, the radio coverage area of cell 1's antenna unit for the blue band is "a fourth geographic footprint". As illustrated below, cell 1's antenna unit transmits the blue band at a higher power resulting in resulting in larger coverage area for the fourth geographic footprint. EX-1003, ¶¶240; EX-1007, 2, Fig. 2.



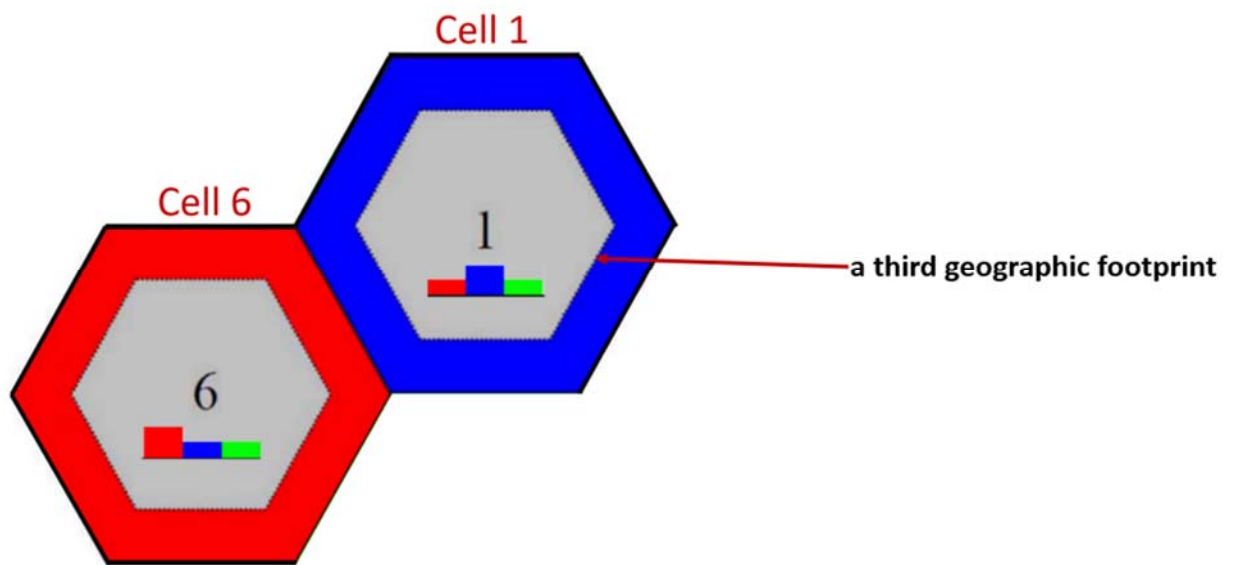
2. Claim 9

Since the first geographic footprint of Ericsson's cell 6 includes a location of cell 6's antenna unit, the limitation added by claim 9 is satisfied. EX-1003, ¶241.



3. Claim 11

Since the third geographic footprint of Ericsson's cell 1 includes a location of cell 1's antenna unit, the limitation added by claim 11 is satisfied. EX-1003, ¶242.



E. Ground 5: Ericsson alone or in combination with Schwartz renders claims 7, 8, 9, 11, 15, 17, 18, 20 and 21 obvious

1. Claim 7

Section VII.D.1 above explains that Ericsson discloses all the limitations of Elements 7B, 7C, and 7D.

If the preamble (Element 7A) of claim 7 is construed to require a distributed antenna system, then Ericsson's does not show or describe the use of a DAS or a host unit (e.g., as required by claims 8, 15) to distribute radio resources from a remote location (e.g., BS hotel) to each cell. In deploying Ericsson's system in densely populated areas, it would have been obvious to modify Ericsson to include a DAS host unit to distribute radio resources from a remote base station hotel to each cell's respective antenna unit. EX-1003, ¶¶246-250, 259.

Motivation to modify Ericsson. It would have been obvious to modify Ericsson's system for deployments in densely populated areas by housing the base stations at a remote location and employing a DAS that includes a host and transport links for distributing radio resources to Ericsson's cells (e.g., to each respective antenna unit in Ericsson's cells 1, 5, and 6). EX-1003, ¶247.

Particularly in densely populated areas, a POSA would have known and understood that, for cost and efficiency reasons as well as lack of access to property at the cell site, (a) it was common to house base station equipment at a location (commonly known as a base station hotel as noted in the background of the '358 patent, 1:21) remote from the cell sites, and (b) a DAS host unit would have been commonly employed ("*typically*" according to the '358 patent, 1:17-20) at the base station hotel to facilitate the transport of the base station's RF signals long distances over DAS links to the remote antenna sites. This background knowledge is reinforced by the '358 patent. EX-1001, 1:14-26; EX-1003, ¶248.

That a POSA would have known it was common in densely populated areas to house the base station equipment at a site remote from the cells and employ a DAS host and links to transport the RF signal to the cell sites is also reinforced by the background DAS prior art. EX-1009, 1:60-65 ("The BTS hotel concept is especially valuable in metropolitan areas where fiber is abundant but equipment space comes at a premium. In these types of areas it is getting increasingly more

difficult to deploy new cell sites due to a variety of factors including regulatory and space constraint issues.”); EX-1014 ¶¶0005; EX-1008 6:24-41, Fig. 2; EX-1003, ¶249.

For a deployment of an Ericsson system in which the base station had to be located a long distance from the remote antenna units, the well-known benefit of including a DAS host unit and links (i.e., to facilitate the transport of the base station’s RF signals over long distances to the remote antenna sites) would have motivated a POSA to combine Ericsson with a DAS, including a DAS host and appropriate links for more efficiently and reliably transporting the signals long distances to the cell sites (and respective antenna units) of Ericsson’s system. EX-1003, ¶250.

Alternatively, it would have been obvious in view of Schwartz to combine Ericsson with a DAS. EX-1003, ¶¶251-259.

Motivation based on Schwartz. Based on Schwartz (and reinforced by the background in the ‘358 patent) a POSA would have known that that distributed antenna systems “**typically**” included “one or more host units” (EX-1001, 1:17-18) that together with the DAS links would provide the “means for distribution of the base stations downlink and uplink signals among multiple remote antenna units.” EX-1001, 1:20-24. EX-1003, ¶252.

Schwartz teaches the benefits of employing “a centralized base-station site containing a plurality of base-station units” (i.e., a base station hotel as described in the background) and a “means [router 22, a host unit] for transmitting the traffic channel resources between the centralized base station site and the remote cells....” EX-1008, 3:22-27, Fig. 2, 1:16-67 (describing the inefficiencies associated with locating a base station at the center of each cell and benefits to using a centralized base station site located remote from the cells sites); EX-1003, ¶253.

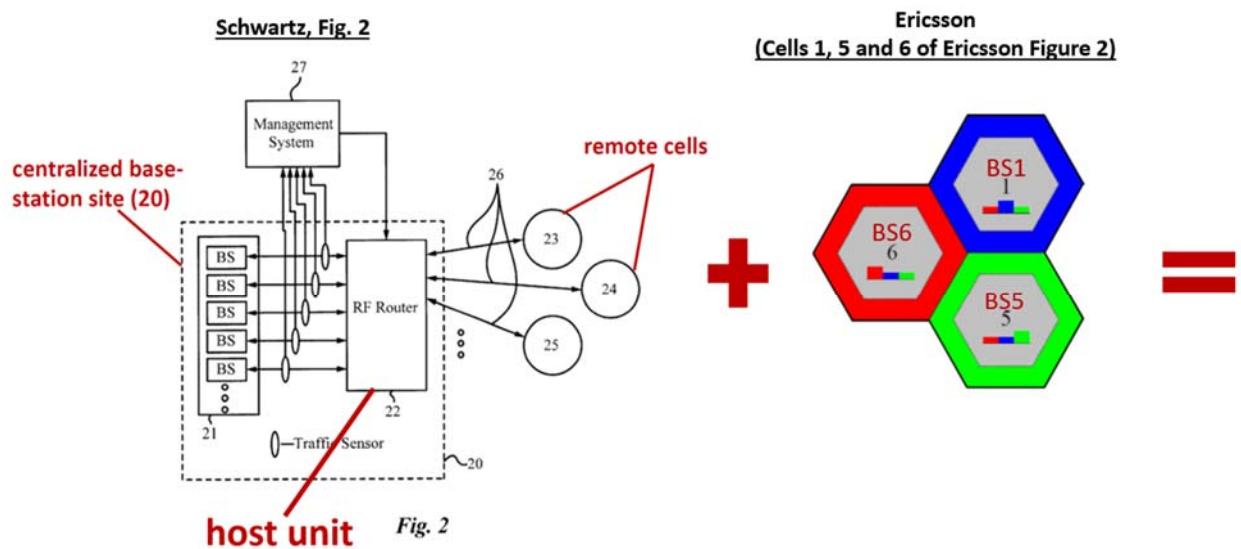
Based on Schwartz, a POSA would have understood that, for cost and efficiency reasons as well as lack of access to cell site property, in deploying cellular communication systems such as Ericsson’s system: (a) the base station equipment often must be located remote from the cell sites and (b) for such deployments, a DAS host unit (e.g., router 22 of Schwartz Fig. 2) as taught by Schwartz would facilitate more efficient transport of radio resources to Ericsson’s cells. EX-1003, ¶254.

Based on Schwartz, for those deployments of Ericsson’s system in which the base station had to be located a long distance from cell sites, the well-known benefit of including a DAS host unit and links (i.e., to facilitate the transport of the base station’s RF signals over long distances to the remote antenna sites) would have motivated a POSA to combine Ericsson with a DAS, including a DAS host and appropriate links for more efficiently and reliably transporting the signals long

distances to the cell sites (and respective antenna units) of Ericsson's system. EX-1003, ¶255.

For such deployments, Schwartz's teaches to use a host unit (e.g. "RF router 22") as an interface between one or more base stations (i.e., a Base Station Hotel) to facilitate the transport of the base station signals over the DAS links to the remote antenna units. EX-1008, Fig. 2, 6:24-41. EX-1003, ¶256.

This combination is shown below. Further, one of skill would be motivated to use a host unit as taught by Schwartz's router 22 that is not integral with one base station so that the host unit could serve and manage signals from multiple base stations, not just one base station, which produces significant cost savings (only one host required, not multiple, i.e., one within each base station). EX-1003, ¶257.



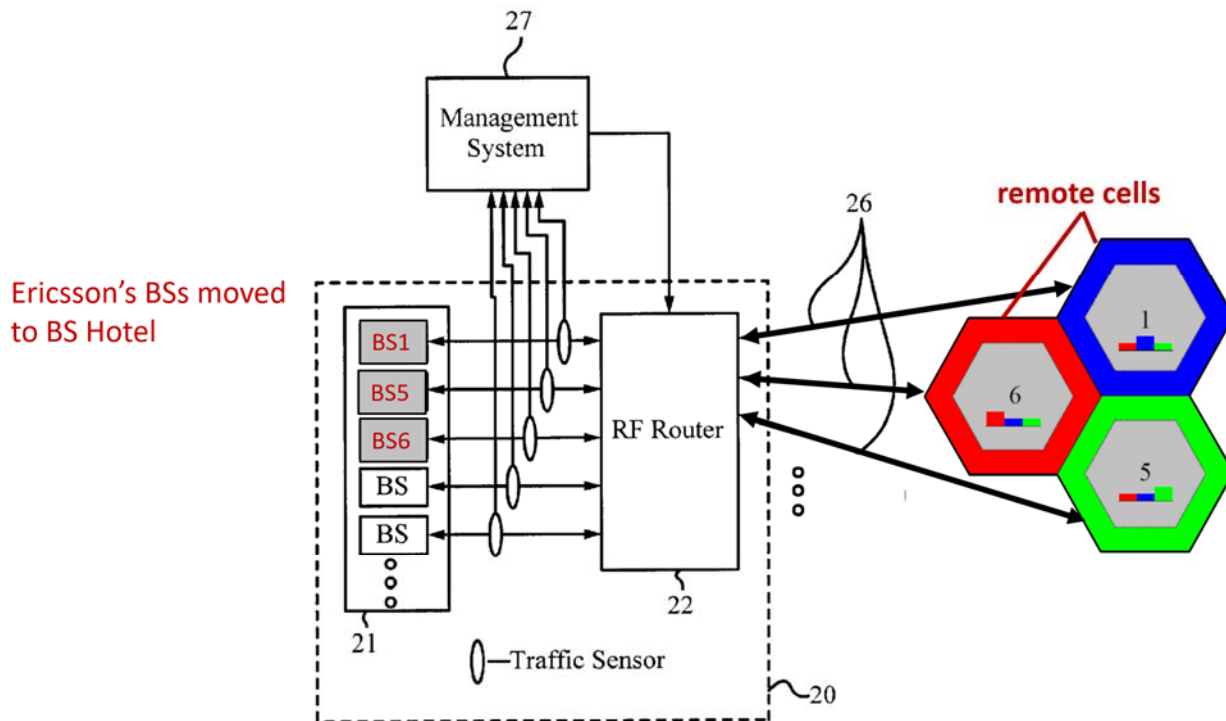


Fig. 2

EX-1003, ¶258.

A POSA would have a reasonable expectation that such a combination would be successful. That DAS host units and corresponding transport links have been so long used in the art of DAS (Schwartz filed in 2000 more than a decade before the '358 patent) would lead a POSA to have a reasonable expectation of success, a fact that is confirmed by the '358 patent itself which recognizes that DAS host units are "typical" in DAS deployments and commonly employed at base station hotel. EX-1001, 1:14-26; EX-1003, ¶259.

2. Claim 8

As discussed for Element 7A of claim 7 (assuming the preamble of claim 7 requires a DAS), Ericsson does not show or describe the use of a DAS or a DAS host to distribute radio resources from a remote location to the cell sites. Based on the same logic and reason discussed above for Element 7A, it would have been obvious based on Ericsson alone or in combination with Schwartz to modify Ericsson's system for deployments in densely populated areas by housing the base stations at a remote location and employing a DAS that includes a DAS host and transport links for distributing radio resources to the distributed antenna units of Ericsson's cell sites. EX-1003, ¶¶277-290.

3. Claims 9 and 11

For the reasons discussed in Sections VII.D.2 and VII.D.3, Ericsson discloses the limitations of claims 9 and 11. *See also* EX-1003, ¶¶291-292.

4. Claim 15

The claimed communication system of Claim 15 is similar to the claimed method of distributing communications frequencies of claim 7. Both require “a first communications unit” and “a second communications unit.” Claim 15 further requires “a host unit” that is coupled to the first and second communications units. Ericsson does not show or describe the host unit of claim 15.

Element 15A: Ericsson discloses this element because it discloses a cellular communication system (E-UTRA) that distributes communications frequencies in

a way that implements a frequency reuse technique for “reducing the interference experienced by these users....” EX-1003, ¶¶296-297; EX-1007, 2, Section 3.

Element 15B: For the same reasons discussed above with respect to claim 7 and 8 above, it would have been obvious based on Ericsson alone or in combination with Schwartz to provide a common host unit that is coupled to the first communication unit of Ericsson’s cell 6 and to the second communications unit of Ericsson’s cell 6. EX-1003, ¶¶194-208, 298-313. The discussion claim Element 7A and claim 8 above is included here for claim 15 by reference.

Elements 15C and 15D: The other limitations of claim 15 are disclosed by Ericsson for the same reasons that Ericsson discloses all the limitations of claim 7. EX-1003, ¶¶314-327 (Elements 15C and 15D). As shown in Ericsson and discussed above, the system will produce at least two different footprints in each cell, one larger than the other, each footprint associated with a different range where some of the frequencies are reused in the middle footprint of each cell. Dr. Acampora maps the limitations of Elements 15C/15D to Ericsson’s system EX-1003, ¶¶314, 321.

5. Claim 17

Ericsson discloses claim 17 because Ericsson’s antenna unit of cell 6 (above) transmits the red band at a power level that is higher than the power level used to transmit the blue and green bands. This results in the antenna unit having a larger

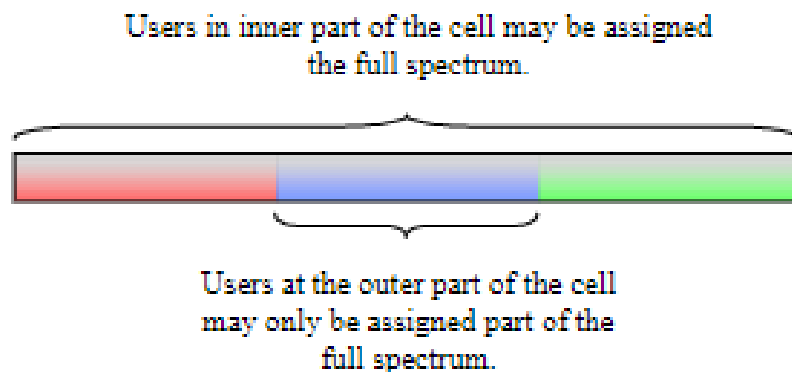
radio coverage (geographical footprint) for the red band. EX-1003, ¶328. EX-1007, 2 (Section 3).

6. Claim 18

Ericsson discloses claim 18's limitations because cell 1's antenna unit (above) transmits the blue band at a power level that is higher than the power level used to transmit the green band. This results in the antenna unit having a larger radio coverage (geographical footprint) for the blue band. EX-1003, ¶329; EX-1007, 2 (Section 3).

7. Claim 20

If the recited bands are construed to be referring to claim 15's first and second frequency ranges, then this limitation is disclosed by Ericsson. Ericsson discloses claim 20's limitations because, looking at the bands transmitted and received by cell 6's antenna unit, the first frequency band (blue) and the second frequency band (red) are contiguous frequency bands. EX-1003, ¶330.



EX-1007, 2, Fig. 2.

8. Claim 21

Ericsson discloses claim 21's limitations because the first frequency band/range (blue and green), the second frequency band/range (red), and the third frequency band/range (blue) include distinct frequencies, i.e., green, red and blue respectively. EX-1003, ¶331.

F. Ground 6: Ericsson in combination with Stratford renders claims 7, 8, 9, 11, 15, 17, 18, 20 and 21 obvious

1. Claim 7

Section VII.D.1 explains that Ericsson discloses all the limitations of Elements 7B, 7C, and 7D. *See also* EX-1003, ¶¶356-371.

If the preamble (Element 7A) of claim 7 is construed to be limited to a distributed antenna system, then Ericsson's does not show or describe the use of a DAS or a host unit (as required by claims 8, 15) to distribute radio resources from a remote location such as a base station hotel to each cell's respective antenna unit. It would have been obvious to modify Ericsson to include a DAS as taught by Stratford. EX-1003, ¶¶341-355.

Motivation based on Stratford. Based on Stratford, a POSA would have understood that, for cost and efficiency reasons as well as lack of access to cell site property, in deploying cellular communication systems such as Ericsson's system: (a) the base station equipment often must be located remote from the cell sites and

and (b) for such deployments, a DAS host unit (e.g., “Digital Hub 310” in Fig. 3) as taught by Stratford would facilitate more efficient transport of radio resources to Ericsson’s cells. EX-1009, 1:26-65; EX-1003, ¶¶342-343.

Stratford teaches that the DAS host (e.g., digital hub) can be employed at a remote base station hotel to support digital links distributing base station signals to remote cell sites. EX-1009, 3:9-15, 6:29-35, Figs. 3, 6.

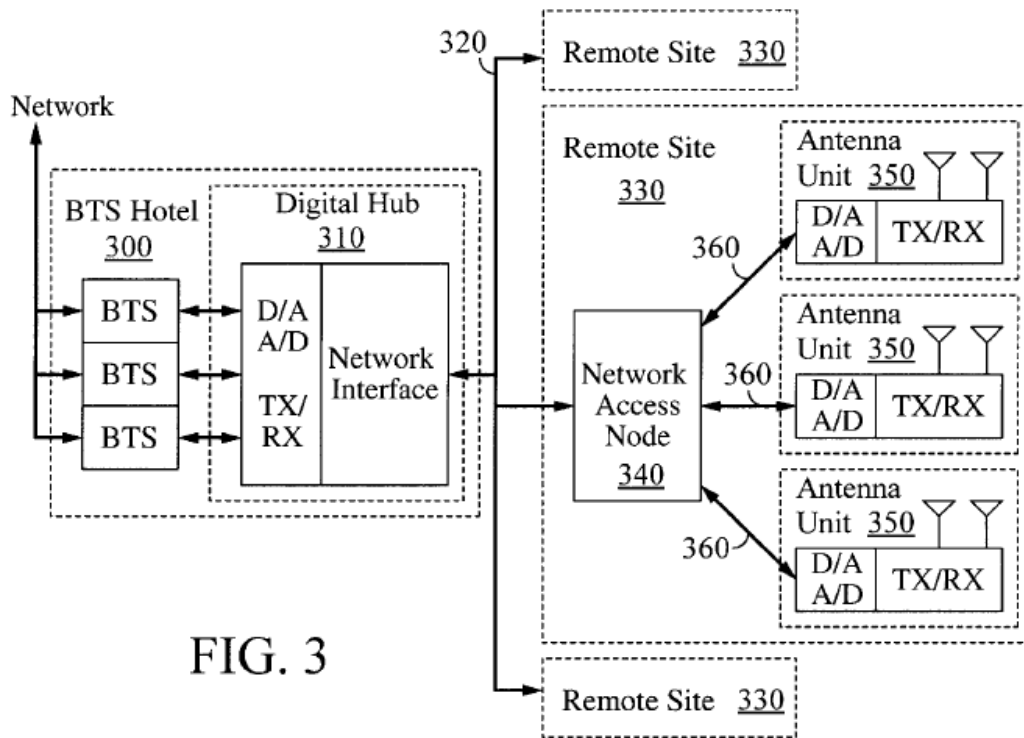


FIG. 3

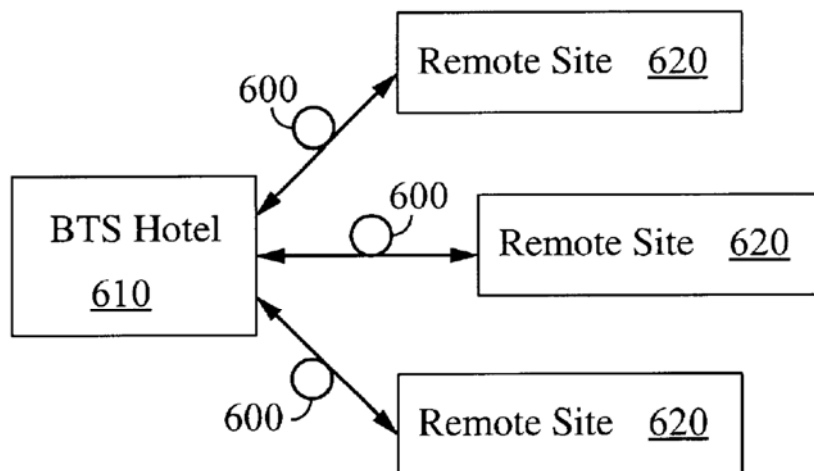


FIG. 6

EX-1009, Figs. 3, 6.

Stratford explains the purpose of including a digital hub at the base station hotel.

The digital hub acts as the interface between the base stations and the digital network. Its main purpose is to convert downlink analog RF signals into a digital format that is compatible with the network, and to extract uplink digital signals from the network and convert them back to analog RF signals.

EX-1009, 13:10-15.

Based on Stratford, for those deployments of Ericsson's system in which the base station had to be located a long distance from cell sites (i.e., metropolitan areas as discussed in Stratford), the well-known benefit of including a DAS host unit and links to facilitate the transport of the base station's RF signals over long

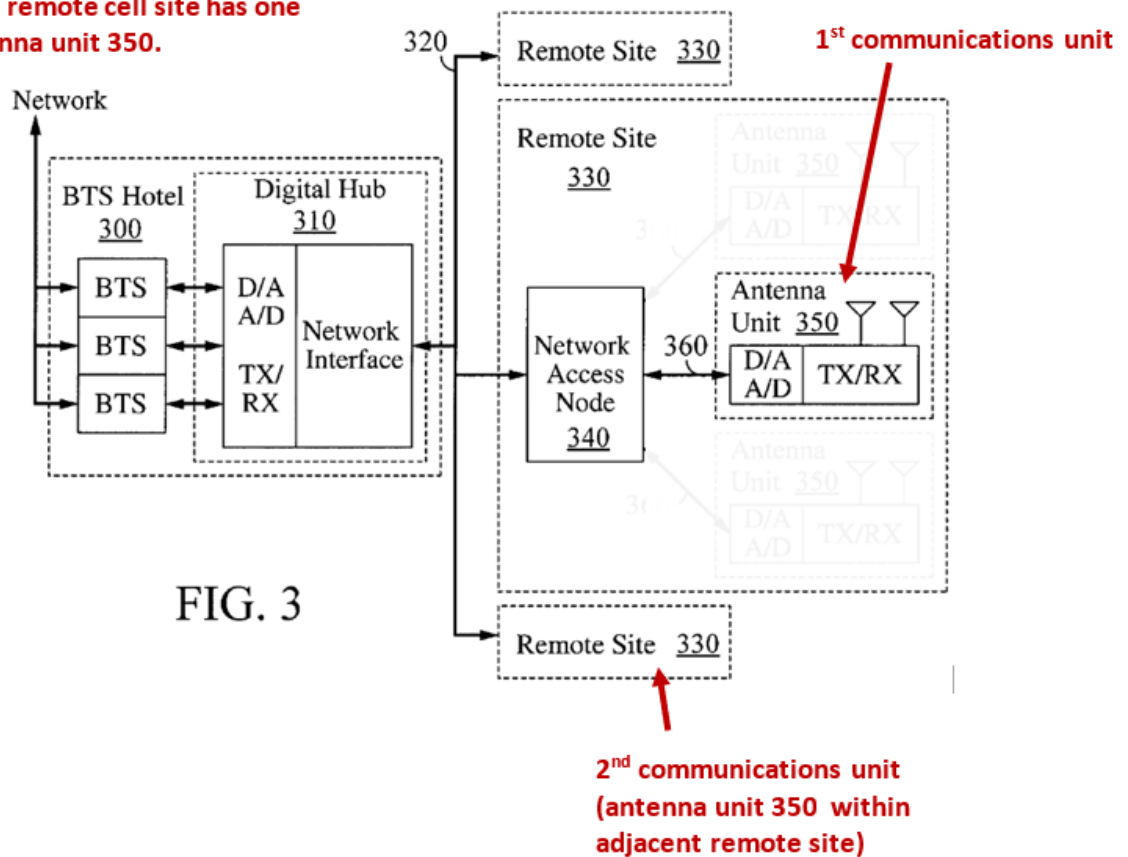
distances to the remote antenna cites would have motivated a POSA to combine Ericsson with a DAS, including a DAS host (such as Stratford's digital hub) and appropriate links for more efficiently and reliably transporting the signals long distances to the cell sites (and respective antenna units) of Ericsson's system. EX-1003, ¶345.

In describing the preferred embodiment, Stratford indicates that each remote site 330 has “one or more sector antenna units 350” EX-1009, 8:50-51.

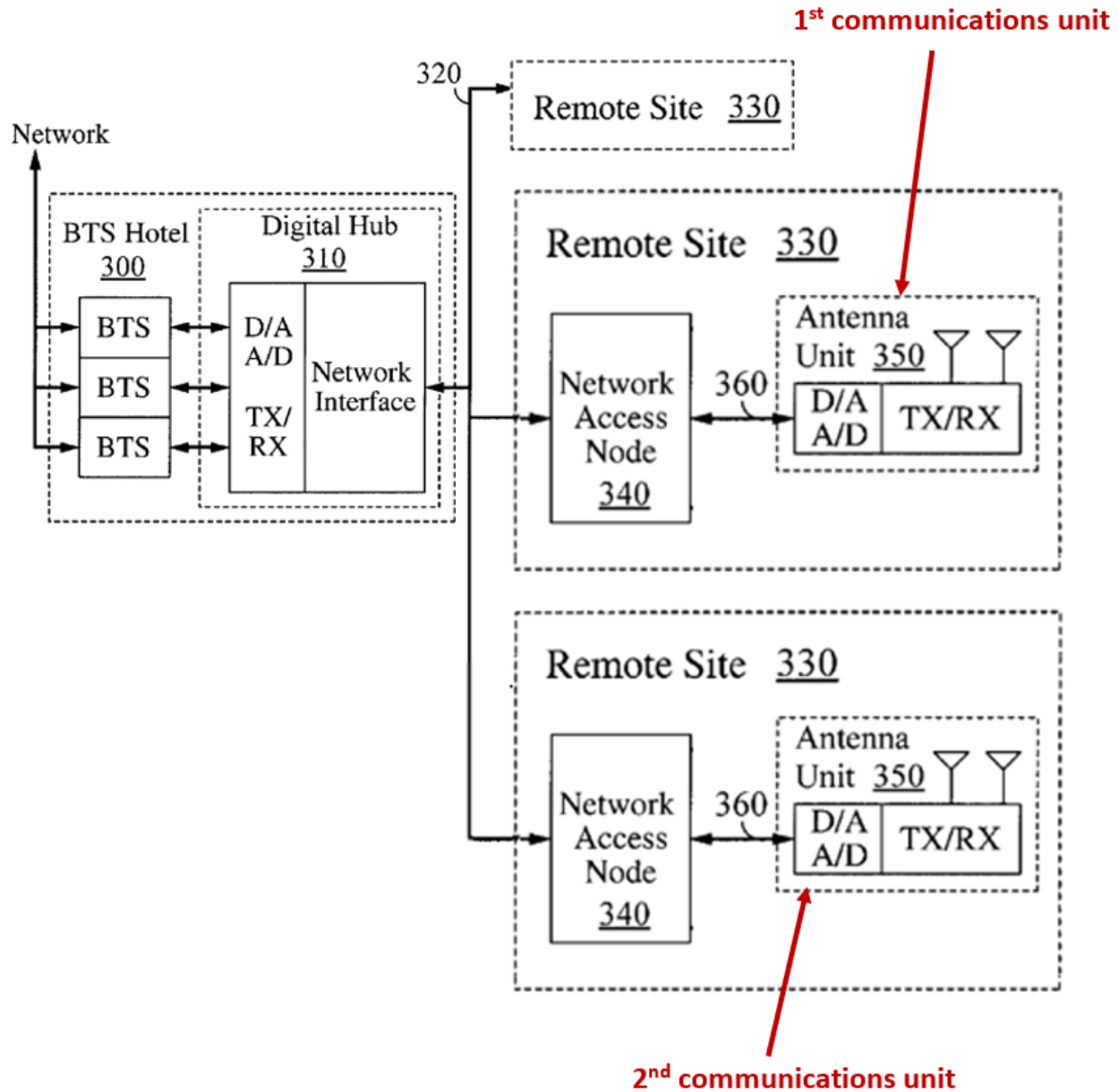
The antenna unit 350 within a first remote cell site is a first communication unit of claim 7. The antenna unit 350 within a second remote cell site is a second communication unit according to claim 7. Together they are an example of “providing a set of communications units” according to claim 7. EX-1003, ¶349.

Stratford Figure 3 is annotated below to identify the communications units (annotated to show only one antenna unit at middle remote site 330). EX-1003, ¶350; EX-1009, 8:45-53 (“one or more...antenna units 350”).

Annotated Figure 3 where
each remote cell site has one
antenna unit 350.



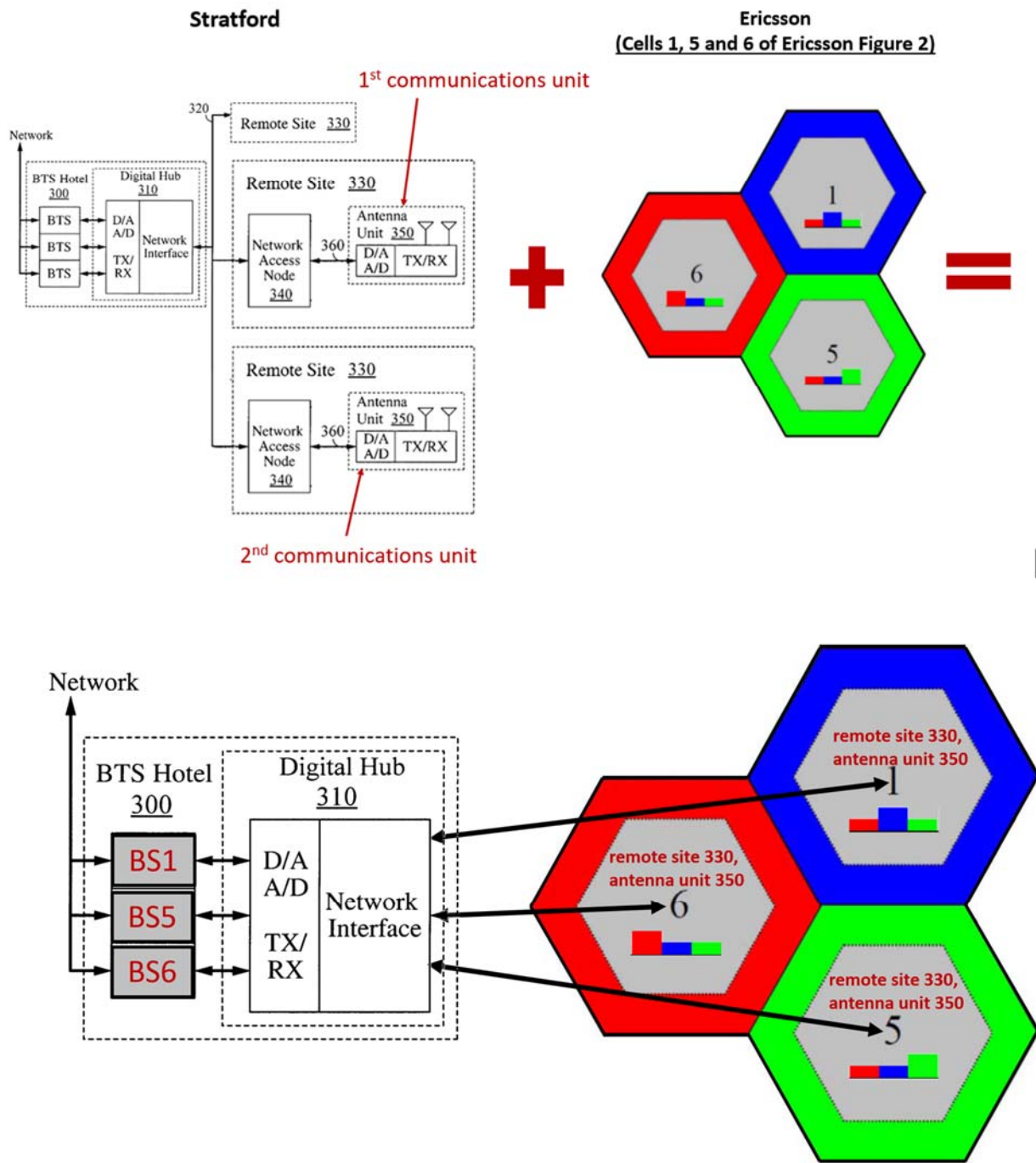
The same set of communications units can be illustrated by simply repeating the details given for the first remote site inside the second remote site as illustrated below. EX-1003, ¶351.



Together the first/second antenna units constitute a set of communications units according to claim Element 7B. EX-1003, ¶352.

The combination is illustrated below. EX-1003, ¶353-354. Further, one of skill would be motivated to use a host unit or hub as taught by Stratford that is not integral with one base station so that the host unit could serve and manage signals

from multiple base stations, not just one base station, which produces significant cost savings (only one host required, not multiple, i.e., one within each base station). *Id.*



Id.

Reasonable expectation of success. That a POSA would have a reasonable expectation that such a combination would be successful is reinforced by Stratford, stating that the “BTS hotel concept is especially valuable in metropolitan areas where fiber is abundant but equipment space comes at a premium.” EX-1003, ¶355; EX-1009, 1:60-63. That DAS host units and corresponding transport links have been so long used in the art of DAS (Stratford filed in 2002 and Schwartz filed in 2000) would also lead a POSA to have a reasonable expectation of success, a fact that is confirmed by the ‘358 patent itself which recognizes that DAS host units are “typical” in DAS deployments and commonly employed at base station hotel. EX-1001, 1:14-26; EX-1003, ¶355.

2. Claim 8

As discussed for Element 7A of claim 7 (assuming the preamble of claim 7 requires a DAS), Ericsson does not show or describe the use of a DAS or a DAS host to distribute radio resources from a remote location to the cell sites. Based on the same logic and reason discussed above for Element 7, it would have been obvious bases on Ericsson alone or in combination with Stratford to modify Ericsson's system for deployments in densely populated areas by housing the base stations at a remote location and employing a DAS that includes a DAS host and

transport links for distributing radio resources to the distributed antenna units of Ericsson's cell sites. EX-1003, ¶¶372-387.

3. Claims 9 and 11

For the reasons discussed in Sections VII.D.2 and VII.D.3, Ericsson discloses the limitations of claims 9 and 11. *See also* EX-1003, ¶¶388-389.

4. Claim 15

For the reasons discussed in Sections VII.E.4, Ericsson discloses Elements 15A, 15C and 15D. *See also*, EX-1003, ¶¶393, 412-425.

As discussed for Element 7A (assuming “distributing communications frequencies” requires a DAS) Ericsson does not show or describe the use of host unit to distribute radio resources from a remote location such as a base station hotel to cell's respective antenna units. For the reasons discussed in Section VII.E.4 (*see also* EX-1003, ¶¶395-411), based on Ericsson alone or in combination with Stratford claim 15 obvious. It would have been obvious to modify Ericsson's system for deployments in densely populated areas by housing the base stations at a remote location and employing a DAS that includes a DAS host and transport links for distributing radio resources to the antenna units of Ericsson's cell sites (e.g., for Ericsson's system above, cell 1's antenna unit, cell 5's antenna unit, and cell 6's antenna unit). EX-1003, ¶¶397-411.

6. Claims 17, 18, 20 and 21.

For the reasons discussed in Sections VII.E.5-8, Ericsson discloses the limitations of claims 17, 18, 20 and 21. EX-1003, ¶¶426-429.

G. Ground 7: Stratford in combination with Ericsson renders claims 7, 8, 9, 11, 15, 17, 18, 20 and 21 obvious

Stratford (EX-1009) discloses a distributed antenna system for distributing wireless cellular communications signals between a base station hotel and multiple remote cell sites. EX-1003, ¶¶430-432; EX-1009, Abstract, Fig. 3, 1:26-65, 2:37-44, 3:9-20, 6:29-51. Ericsson (EX-1007) taught that using fractional frequency reuse in adjacent cells of a cellular system improves the performance for cell edge users while also obtaining the spectral efficiency improvements of frequency reuse. EX-1003, ¶¶431; EX-1007, 2, Fig. 2.

It would have been obvious to improve Stratford's system by using fractional frequency reuse as taught by Ericsson to increase spectral efficiency through frequency reuse while mitigating inter cell interference, rendering all of the challenged claims obvious. EX-1003, ¶432, ¶¶430-482.

1. Claim 7

a. Element 7A

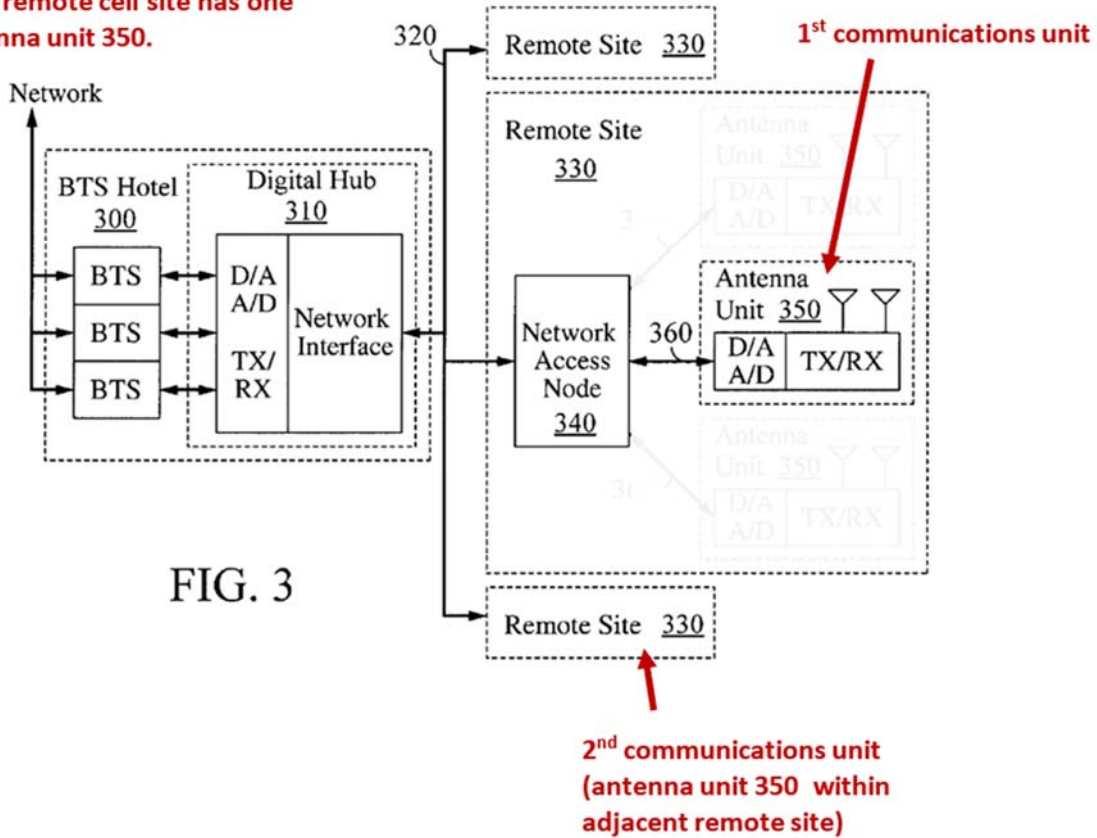
Stratford discloses a method of distributing communications frequencies. *See, e.g.*, EX-1009, Title, Abstract (“A method for transporting wireless communication signals...”), Fig. 3, 2:50-54 (“digitized carrier signals...are

distributed within the remote site...”), 3:9-47; 4:22-27; 4:40-44 (“After being distributed to the appropriate antenna radio units, the digital signals are converted to analog RF signals and broadcast...”); 6:29-51; EX-1003, ¶433. Therefore, Stratford discloses Element 7A.

b. Element 7B

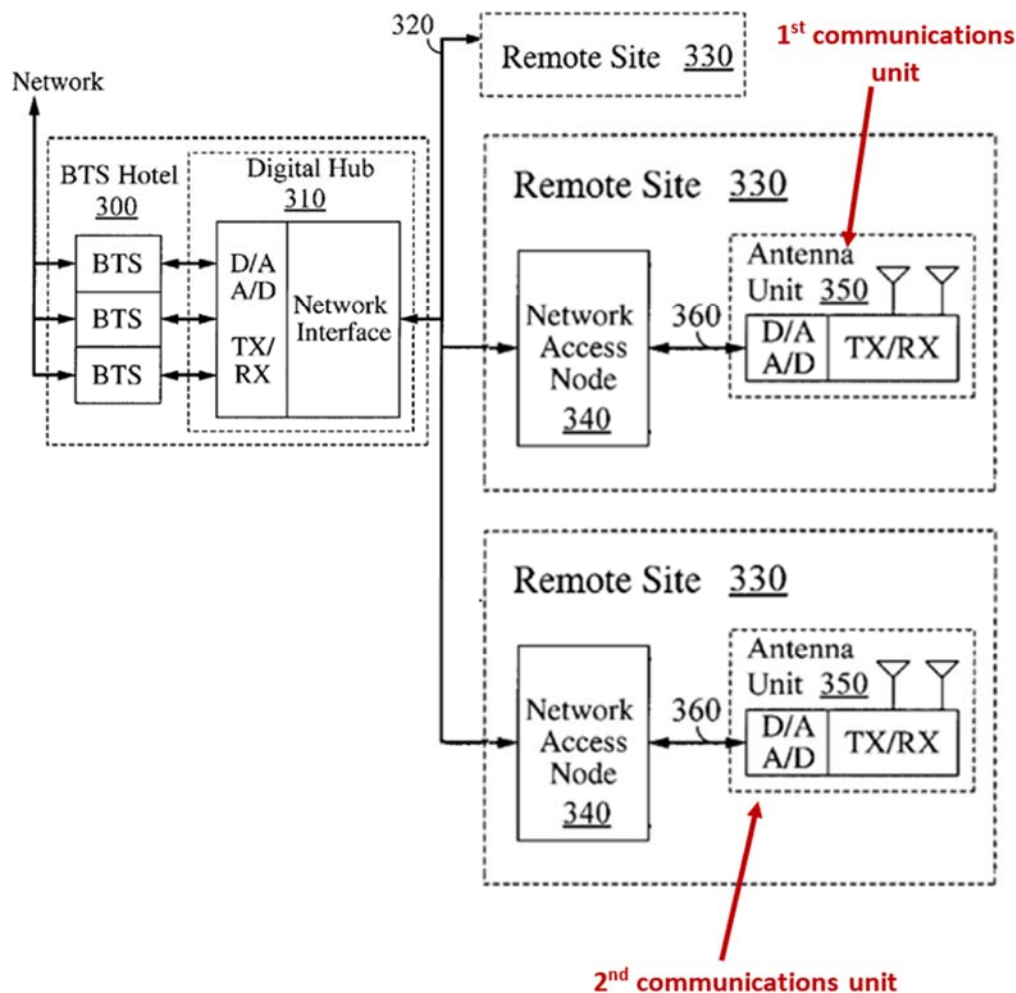
In Stratford, each of multiple remote cell sites 330 includes “one or more” antenna units 350 which are illustrated in Figure 3. EX-1009, 8:45-53; EX-1003, ¶¶434-435. The antenna units wirelessly communicate with wireless subscribers (such as cell phones) within their respective coverage areas. EX-1009, 6:41-44. The antenna unit 350 within a first remote cell site is a first communication unit of claim 7. EX-1003, ¶434. The antenna unit 350 within a second remote cell site is a second communication unit according to claim 7. *Id.* Together they are an example of “providing a set of communications units” according to claim 7. *Id.*

Annotated Figure 3 where
each remote cell site has one
antenna unit 350.



EX-1003, ¶435.

The same set of communications units can be illustrated by simply repeating the details given for the first remote site inside the second remote site as illustrated below. EX-1003, ¶¶436-437.



c. Element 7C

Stratford teaches that the antenna units 350 (communications units) transmit and receive RF analog signals to and from wireless subscribers. EX-1009, 6:41-44; EX-1003, ¶438. Stratford teaches that multiple different carrier signals (“first and second sets of frequencies”) even from different base stations can be transmitted to a particular antenna unit at a remote cellular site and wirelessly transmitted by the antenna unit to subscribers. See, e.g., EX-1009, 3:21-47; 6:52-7:4, 4:22-44, 6:29-44; EX-1003, ¶438. Stratford’s first narrowband carrier or

carrier signal transmitted/received by the first antenna unit is an example of a first set of frequencies of claim 7C. EX-1003, ¶¶438-439; EX-1009, 3:48-60; 4:45-63, 6:44-50. Stratford's second narrowband carrier or carrier signal (when multiple carrier signals are delivered to the same remote cell site as taught by Stratford) is an example of a second set of frequencies of claim 7C. EX-1003, ¶¶438-439.

A POSA would understand that each narrowband carrier or carrier signal (set of frequencies) will inherently be associated with a coverage area or geographic footprint depending on the amplification used for transmitting that carrier signal at the remote antenna units. EX-1003, ¶440. A POSA would understand that the geographic footprint or coverage area for a first carrier signal transmitted or received by the first antenna unit will be larger if the power of the amplifier is increased. *Id.*

Stratford discloses that each carrier signal can be associated with a different power level. *See, e.g.*, EX-1009, 7:18-23, 7:45-67; EX-1003, ¶441. However the specific recited relationship between the geographic footprints would not necessarily be inherent in Stratford's system.

Ericsson (EX-1007), however, taught that employing fractional frequency reuse by transmitting/receiving different frequencies at different power levels, improves the performance for cell edge users while also obtaining the spectral

efficiency improvements of frequency reuse. EX-1003, ¶442; EX-1007, 2, Figure 2.

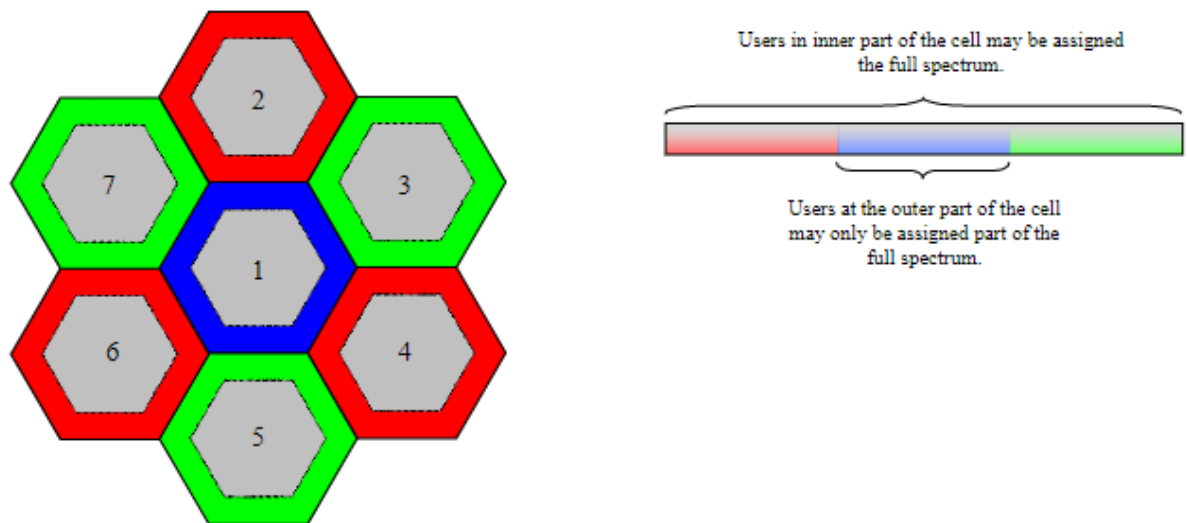


Figure 2: Example illustrating fractional reuse for cell-edge users (a continuous spectrum for the fractional reuse is assumed for illustrative purposes, distributed approaches could equally well be used).

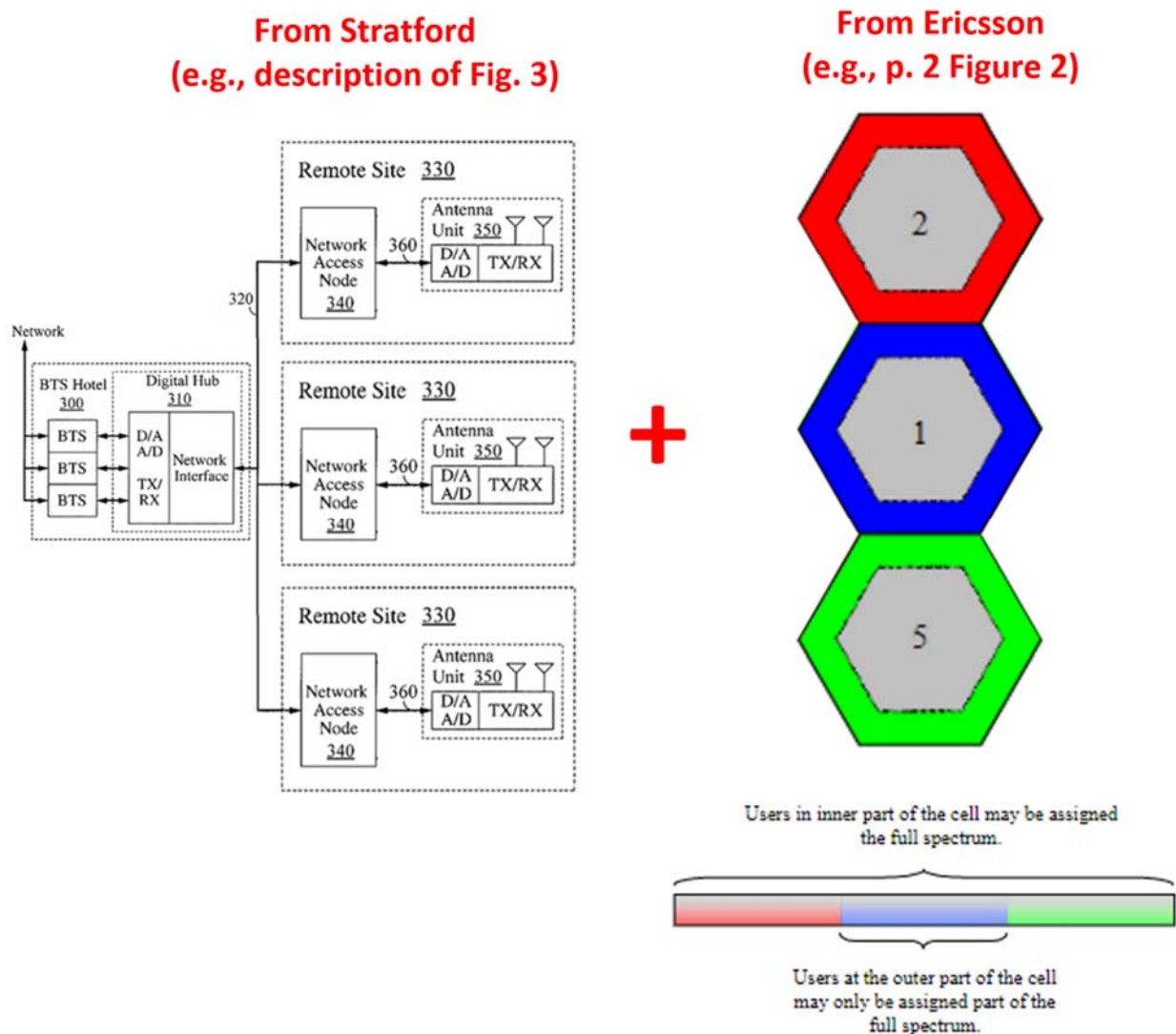
... With fractional reuse, only a part of the total resources is used for transmission to/from cell-edge users, thereby reducing the interference experienced by these users (at the cost of a reduced bandwidth). ... Figure 2 illustrates the principle of fractional frequency reuse. In the figure, only cell 1 is allowed to transmit with **full power** using the “blue” part of the spectrum while cells 2-7 only are allowed to transmit in the blue part of the spectrum **using a reduced power**. This will reduce the downlink interference...

EX-1007, 2.

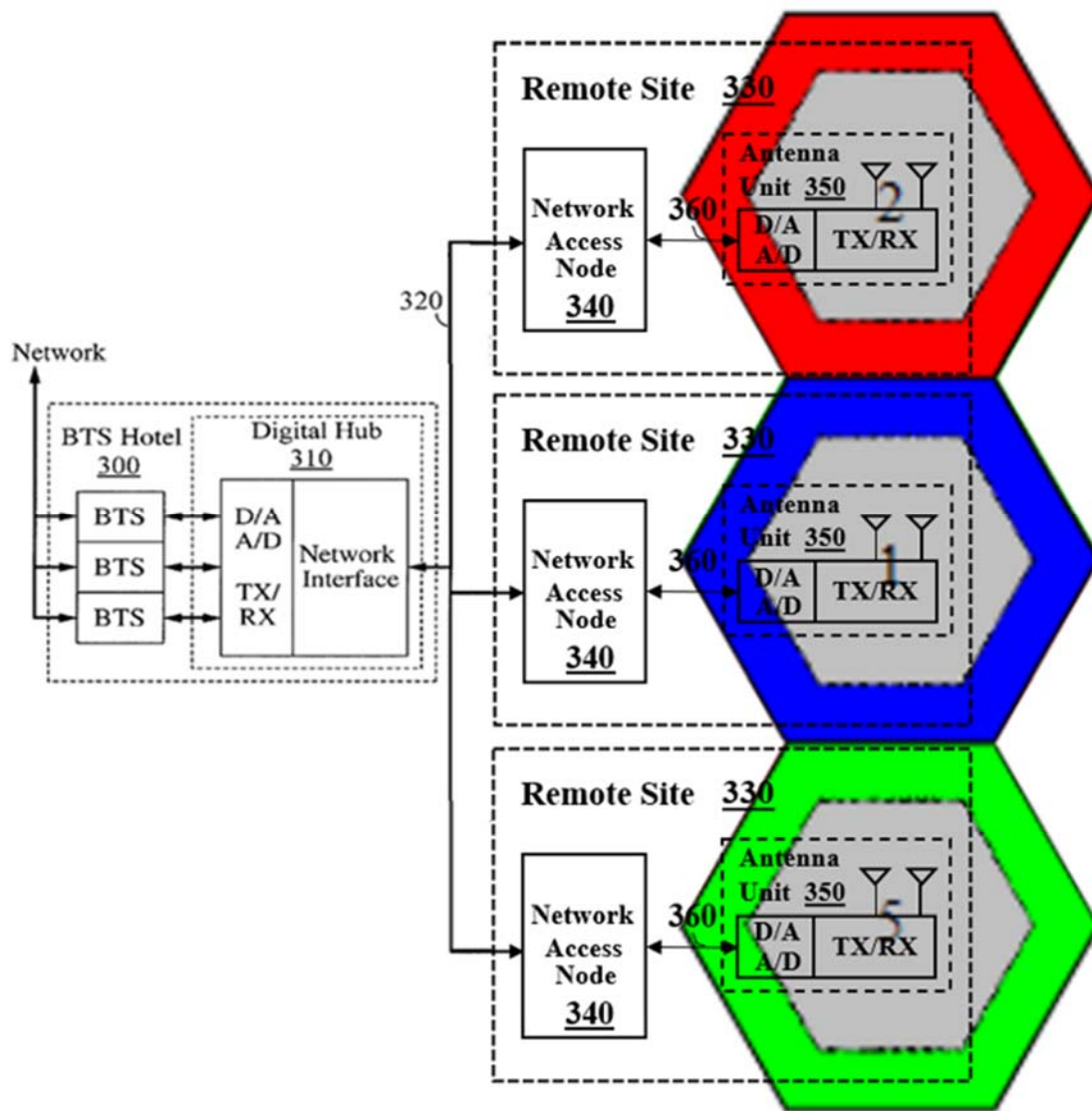
It would have been obvious to use fractional frequency reuse as taught by Ericsson in Stratford’s cellular communication system to increase spectral

efficiency through frequency reuse in the inner areas of each cell while mitigating inter cell interference at the cell edges. EX-1003, ¶443-451.

Applying Ericsson to Stratford's system would have been straight-forward for a POSA. EX-1003, ¶444-445. As shown in the figure below, Stratford already disclosed a distributed antenna system that fed multiple carrier signals to each of multiple remote adjacent cell sites. A POSA would apply Ericsson to Stratford as shown in the illustrations below:



Combination of Stratford and Ericsson:



EX-1003, ¶444-445.

As illustrated above, each remote cell site 330 in Stratford would correspond to one of the cells taught by Ericsson. EX-1003, ¶445. Using Ericsson's frequency reuse technique in Stratford would result in using, for example, the red portion of the frequency spectrum in the inner portions (grey areas) of two each of

Stratford's remote cell sites by using "reduced power" for those transmissions as taught by Ericsson. *Id.* Reusing at least a portion of the frequency spectrum increases the bandwidth capacity available in each cell. *Id.* The edge region of each remote cell would use only a part of the frequency spectrum (only the red, blue, or green portion of the spectrum depending on the cell) but at normal or full power as taught by Ericsson. *Id.* This reduces inter cell interference between cells for users in the edge regions. *Id.*

Motivations to Combine: A POSA would be motivated to combine Ericsson's fractional frequency reuse technique with Stratford's system for multiple reasons. EX-1003, ¶¶446-448. Ericsson teaches a technique that is useful for cellular wireless systems. EX-1007, 1-2 ("Inter-cell Interference Handling"). Stratford discloses a cellular wireless system. EX-1009, Abstract, 1:15-43 ("a cellular communications system includes multiple remote sites, each providing wireless service to a geographic service area, or cell."), Fig. 3, Fig. 6; EX-1003, ¶446.

A POSA would have been motivated to use frequency reuse in Stratford to increase the bandwidth capacity in each cell (by reusing some bandwidth in the inner portion of each cell), and would have been motivated to use Ericsson's specific fractional frequency reuse technique in order to minimize potential inter cell interference caused by that frequency reuse. EX-1003, ¶447.

Using Ericsson's frequency reuse technique in Stratford's cellular system would be an example of combining prior art elements according to known methods to yield predictable results and use of known technique to improve similar systems in the same way. EX-1003, ¶448. The benefits of using frequency reuse techniques were known, e.g., increasing bandwidth or spectral efficiency in a cellular system (reusing frequencies in adjacent cells) and mitigating inter cell interference in the edge regions of adjacent cells. *See, e.g.*, EX-1003, ¶448; EX-1005, 399 ("to maximize the attainable area spectral efficiency..."). The application of Ericsson's known method to Stratford's cells would yield the same predictable results: partial frequency reuse with reduced cell edge interference. EX-1003, ¶448.

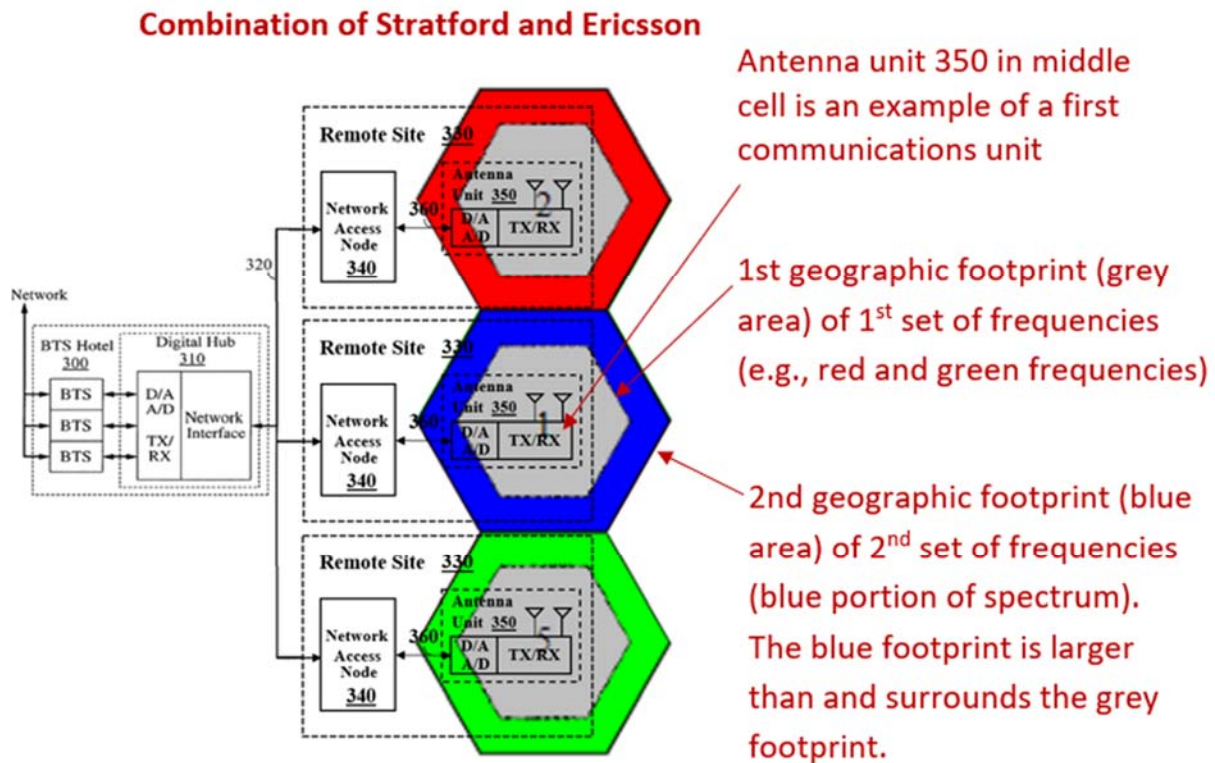
A POSA would have a reasonable expectation of success because the technique can be employed using simple modifications or duplication of components already present in Stratford's system. EX-1003, ¶449. The technique is accomplished using different power amplification/gain on different portions of the spectrum. Stratford's system already includes power amplifiers (EX-1009, 4:41-48), and one of ordinary skill in the art would have a reasonable expectation of success of including separate power amplifiers for separate portions of the spectrum (separate carrier signals) so that different power/gain levels can be

applied to different portions of the spectrum as taught by Ericsson. EX-1003, ¶449.

In addition, Stratford already disclosed the need to manage and accommodate different carrier signals having different transmit and receive power levels. EX-1009, 7:15-38 (“different power levels of the various carriers”); EX-1003, ¶450. And similarly, Stratford already discloses the use of auxiliary channels such as the “power control sub-channel” to send power control information from the digital hub to the remote cell sites for each carrier signal. EX-1009, 7:45-67.

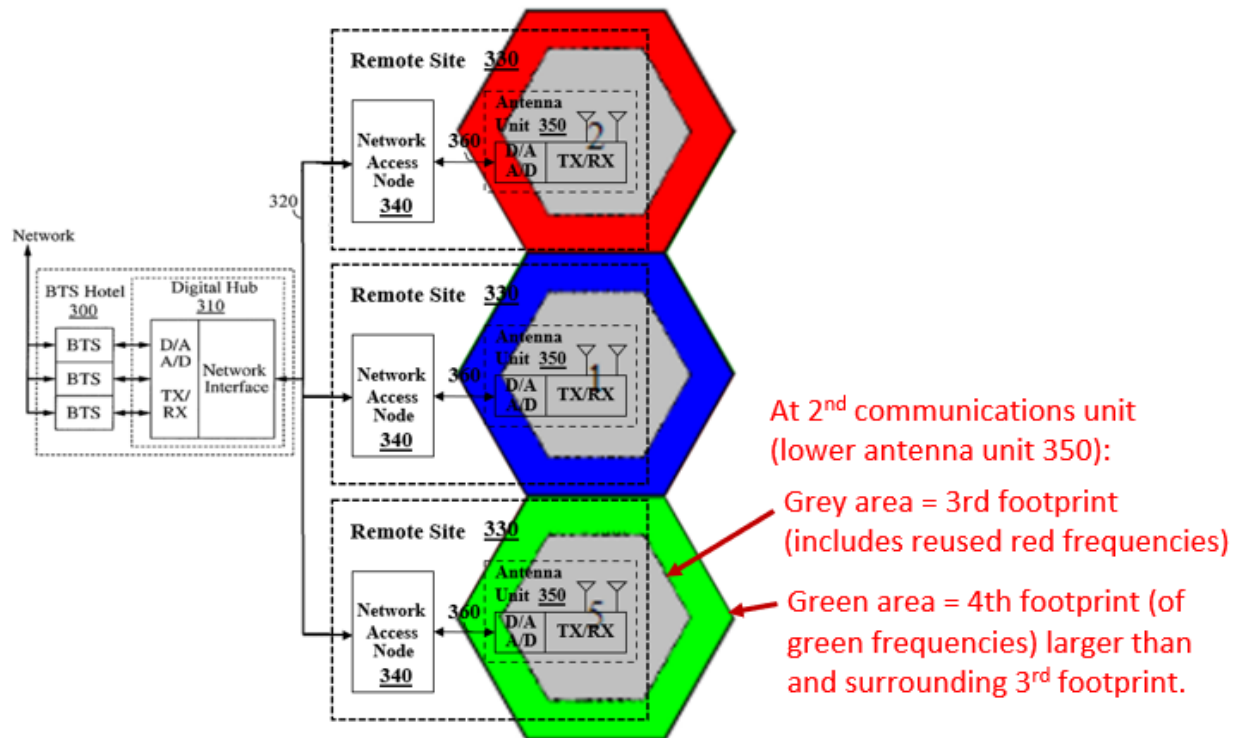
The obvious combination of Stratford’s system with Ericsson’s frequency reuse technique would include claim Element 7C. EX-1003, ¶451. The remote antenna unit in a first cell would transmit a first carrier signal (a first set of frequencies characterized by a first band, e.g., the red band) at reduced power to define a smaller geographical footprint as taught by Ericsson (shown as the grey inner coverage area). *Id.* In the middle remote cell site shown below, for example, the frequencies and band associated with the red portions of the RF spectrum (first set of frequencies characterized by a first band) are only transmitted at reduced power and will have a geographical footprint that extends only to the edge of the grey area in the middle of the cell. *Id.* The same remote antenna unit would also transmit a second carrier signal (second set of frequencies characterized by a

second, different band shown in blue) at full power to the cell-edge region and, therefore, define a second geographical footprint larger than and surrounding the first geographical footprint as shown in Ericsson (for example, the coverage area extending from the center out to the edge of the blue colored geographical footprint). *Id.*



d. Element 7D

The combination of Stratford and Ericsson also discloses claim Element 7D for the same reasons discussed above with respect to Element 7C except that the frequencies and footprints associated with the antenna unit of a second remote site of Stratford is used to satisfy the claim element as shown below. EX-1003, ¶452.



2. Claim 8

The combination of Stratford and Ericsson also renders obvious claim 8.

The antenna units 350 of Stratford are a plurality of remote communications units in communication with a host unit. EX-1003, ¶453. The antenna unit 350 at each remote cell site 330 are examples of remote communications units that are in communication with the digital hub (via cabling and NANs 340). The hub is a host unit. EX-1009, Fig. 3, 6:34-38; EX-1003, ¶453.

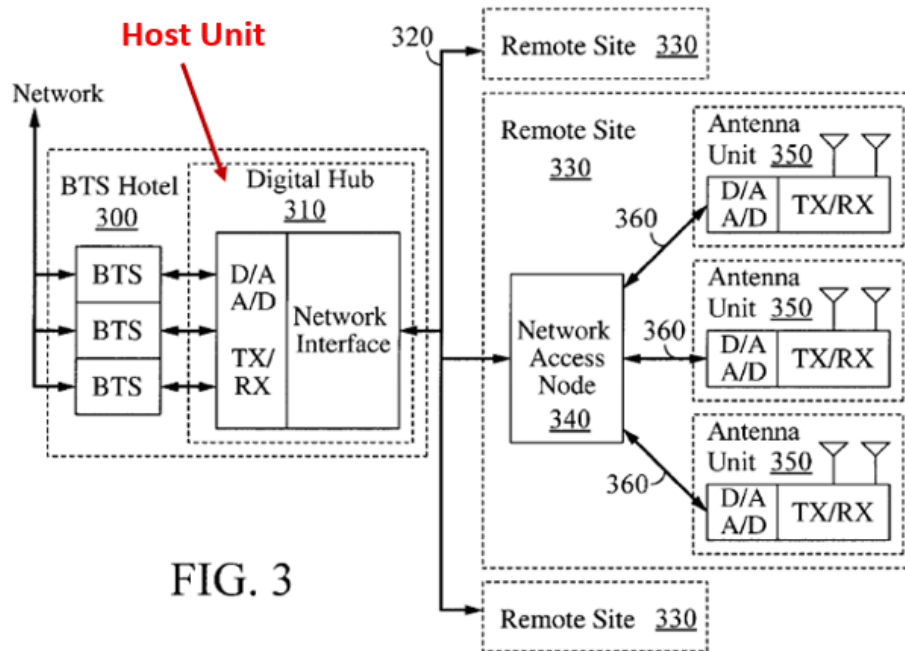
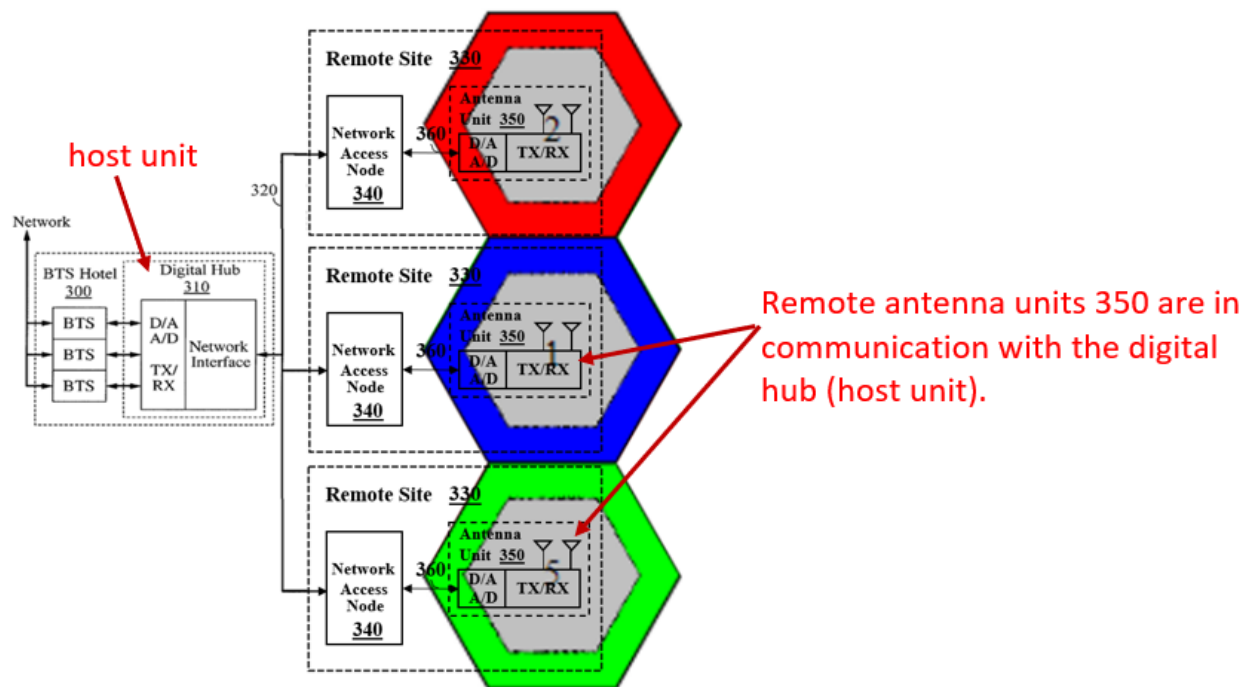


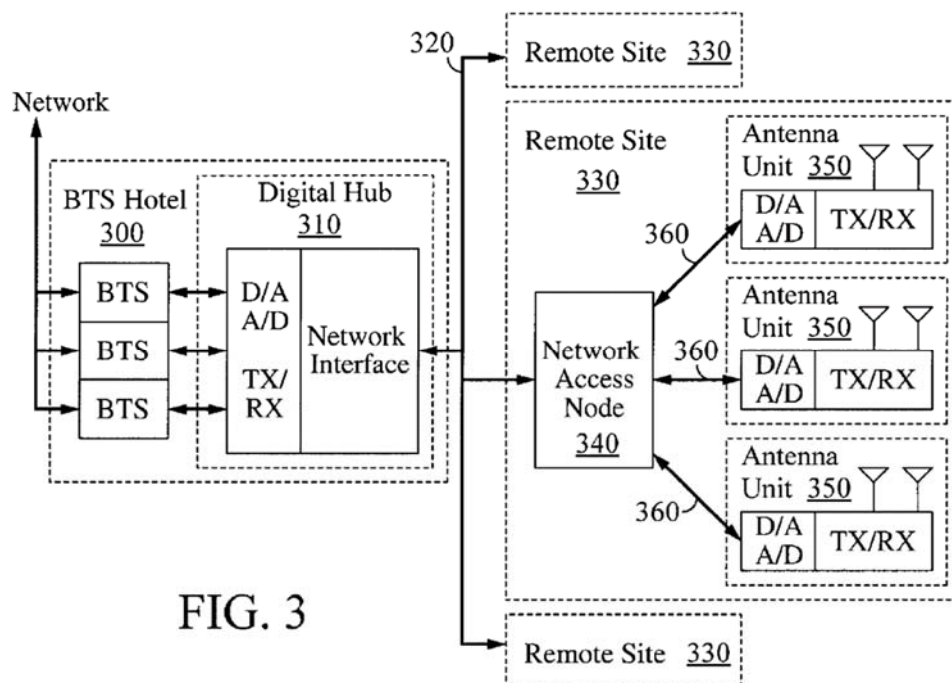
FIG. 3



Stratford's digital hub 310 is a host unit. EX-1003, ¶454. It receives and manages signals from base stations at the base station hotel 300. The hub digitizes and formats the base station signals for transmission to the remote antenna units via the network links and access nodes 340. EX-1009, 6:38-50; EX-1003, ¶454. It performs the reciprocal functions in the upstream direction. Id.

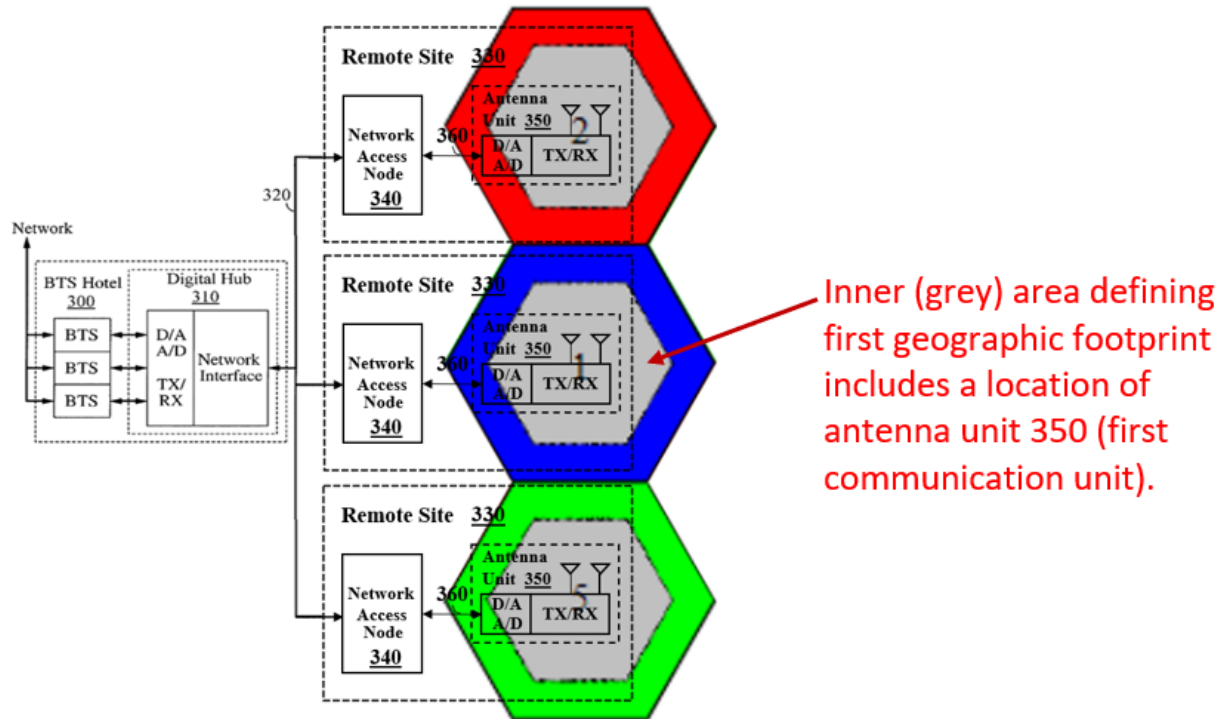
3. Claim 9

The combination of Stratford and Ericsson also renders obvious claim 9. Claim 9 is disclosed by Stratford (and inherently by Ericsson). EX-1003, ¶455. Stratford's remote antenna units 350 are located within the remote cellular site (see, e.g., EX-1009, Fig. 3) and within the geographic footprint of the grey inner area associated with the first carrier signals (first set of frequencies) in the combination of Stratford with Ericsson. EX-1003, ¶¶456-457.



EX-1009, Fig. 3.

Combination of Stratford with Ericsson

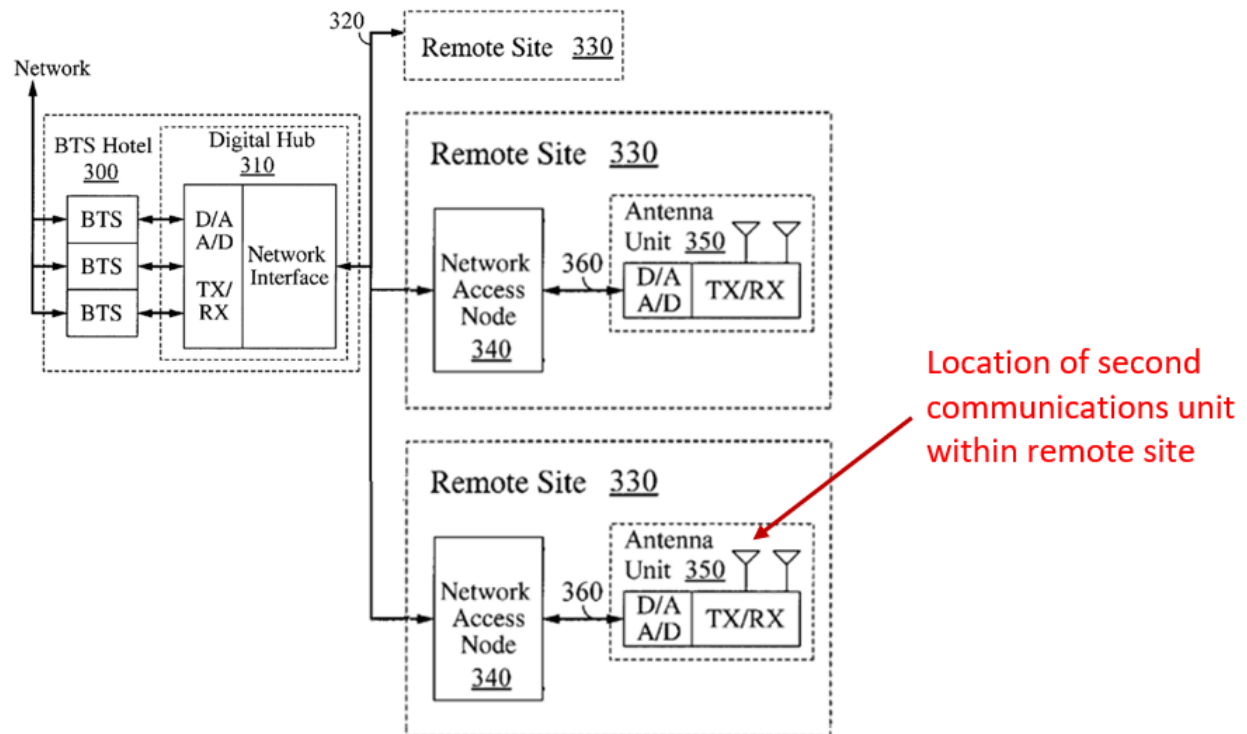


EX-1003, ¶456.

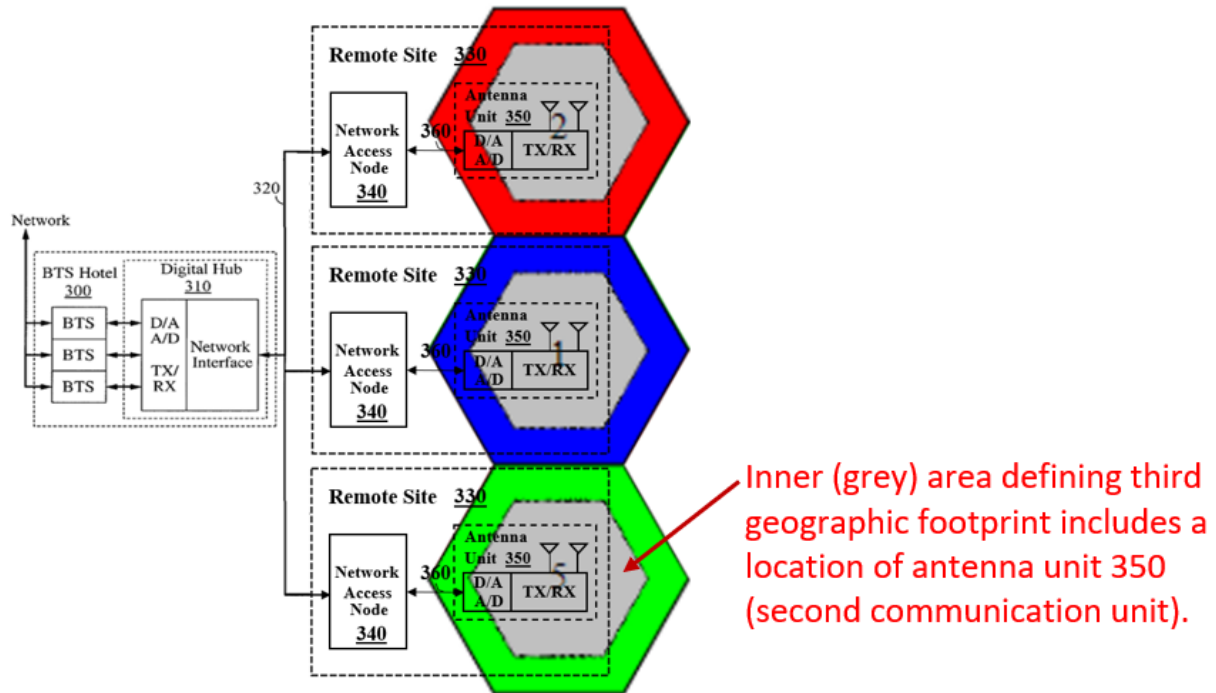
4. Claim 11

The combination of Stratford and Ericsson also renders obvious claim 11.

Claim 11 is disclosed by Stratford (and inherently by Ericsson). EX-1003, ¶¶458-460. In the combination of Stratford with Ericsson, Stratford's second remote antenna unit 350 is located within the second remote cellular site (see description of, e.g., Fig. 3) and within the geographic footprint of the grey inner area associated with the reused frequencies in Stratford's combination with Ericsson. EX-1003, ¶¶459-460.



Combination of Stratford with Ericsson



5. Claim 15

The same combination of Stratford and Ericsson discussed above with respect to claim 7 and 8 also renders obvious claim 15 for the same reasons as claim 7 and 8 are obvious. EX-1003, ¶461. The discussion of claims 7 and 8 from above are incorporated here.

a. Element 15A

Stratford discloses a communications system. EX-1009, Title, 1:15-16; 3:9-20; EX-1003, ¶462. Figure 3 of Stratford, for example, discloses a communications system, including base stations, a digital hub, digital fiber

communications links, network access nodes and antenna units for providing wireless cellular communications coverage. See EX-1009, Fig. 3, 6:29-51.

b. Element 15B

Stratford's digital hub 310 is a host unit. EX-1003, ¶¶463-464. It receives and manages signals from base stations at the base station hotel 300 and digitizes, formats and distributes those signals to appropriate remote cell sites using optical fiber communication links leading to distributed antenna units via network access nodes, and it performs the reciprocal functions in the upstream direction. See, e.g., EX-1009, 6:38-50; 6:51-7:38, Fig. 3, 6:34-38, 3:48-60, 4:45-63, 6:44-50; EX-1003, ¶463.

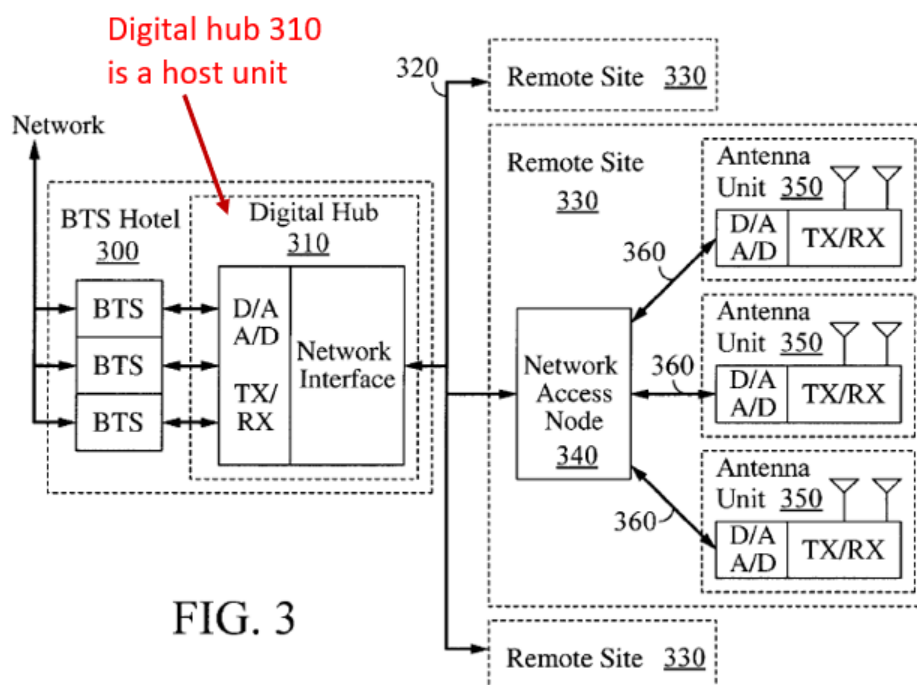
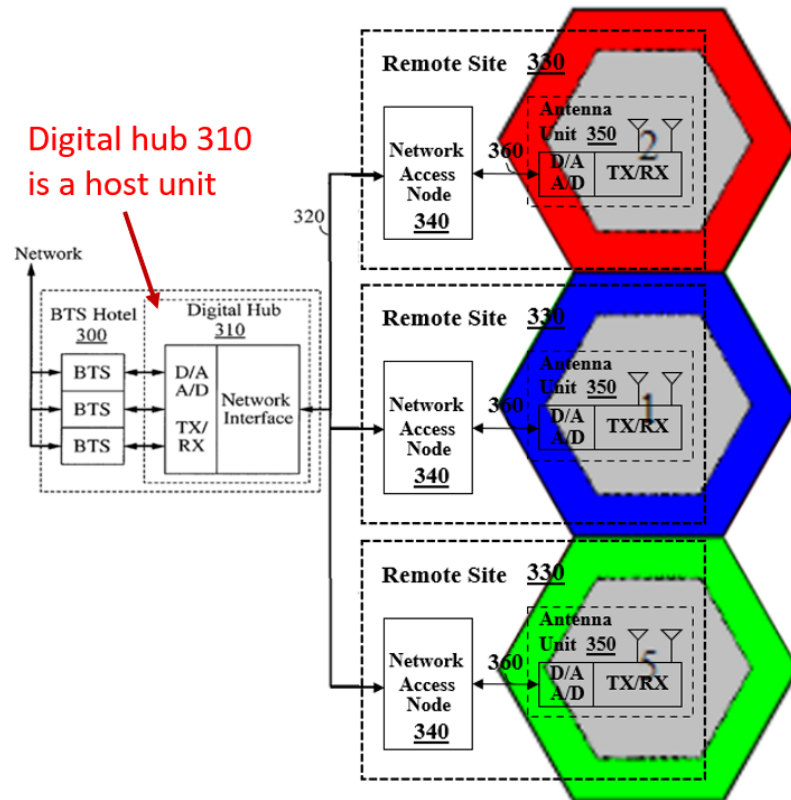


FIG. 3

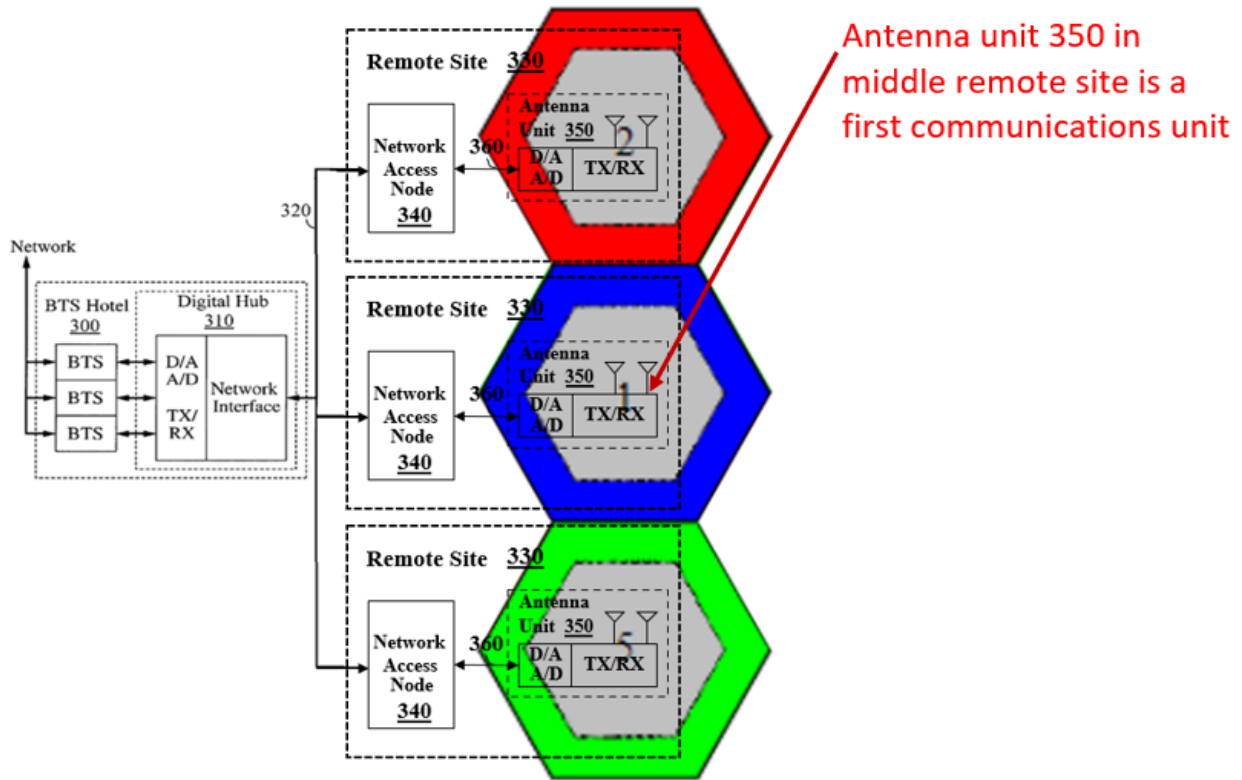
The combination of Stratford and Ericsson discussed above for claim 7 includes a host unit in communication with multiple antenna units (via network access nodes) as shown below. EX-1003, ¶464.



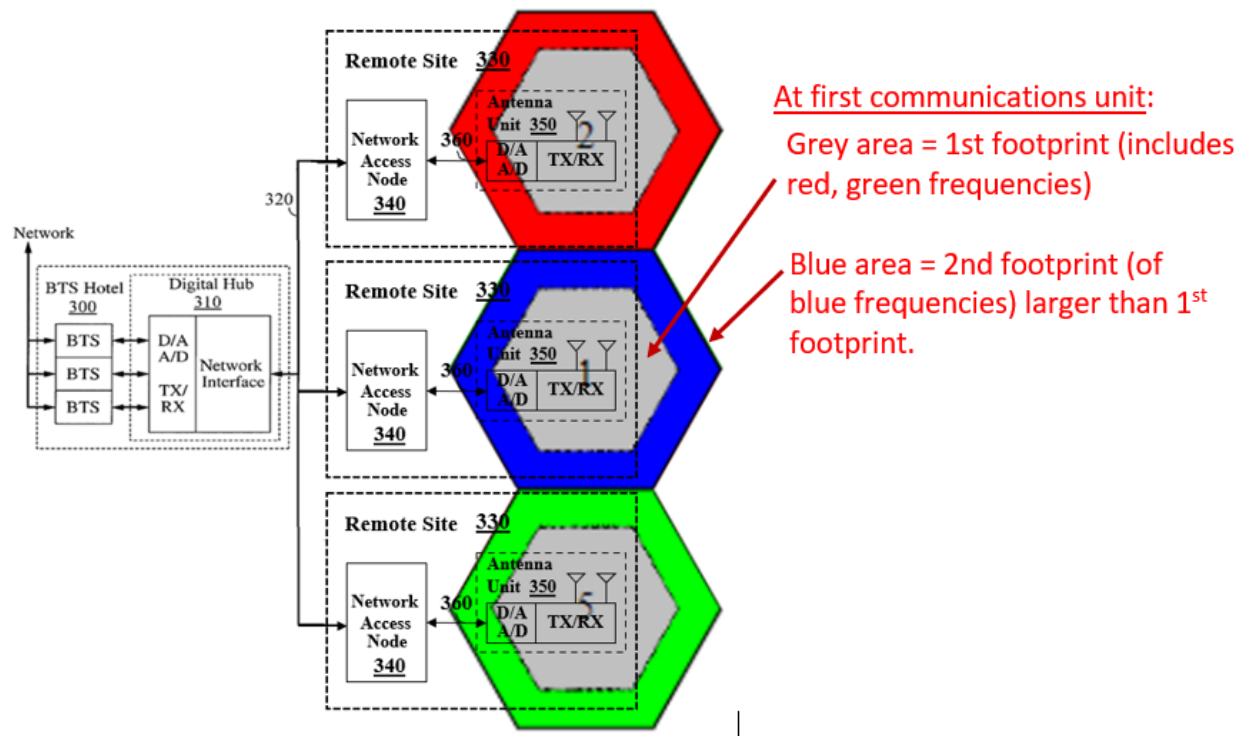
c. Element 15C

Element 15C is satisfied in the combination of Stratford and Ericsson for the same reasons as Element 7C is disclosed by the combination. EX-1003, ¶465. Stratford's antenna unit at one of its remote cell sites is a first communications unit. *Id.* When combined with Ericsson for the reasons discussed above regarding claim 7, the antenna unit 350 (first communications unit) is coupled to the digital

hub (“host unit”) via optical fiber and the network access node. EX-1009, Fig. 3; EX-1003, ¶466.



When combined with Ericsson for the reasons discussed above regarding claim 7, the antenna unit (first communications unit) is operable to transmit and receive communications using both (a) a first set of frequencies in a first frequency range in a region associated with a first geographic footprint (e.g. red and green frequencies), and (b) a second set of frequencies in a second frequency range and associated with a second geographical footprint (blue frequencies), as shown below. EX-1003, ¶467.



Users in inner part of the cell may be assigned the full spectrum.



Users at the outer part of the cell may only be assigned part of the full spectrum.

EX-1007, 2, Fig. 2.

As shown above, for the middle remote cell site, the geographical footprint or coverage area of the blue set of frequencies is larger than the geographical footprint of the red (and green) set of frequencies shown in grey area. EX-1003,

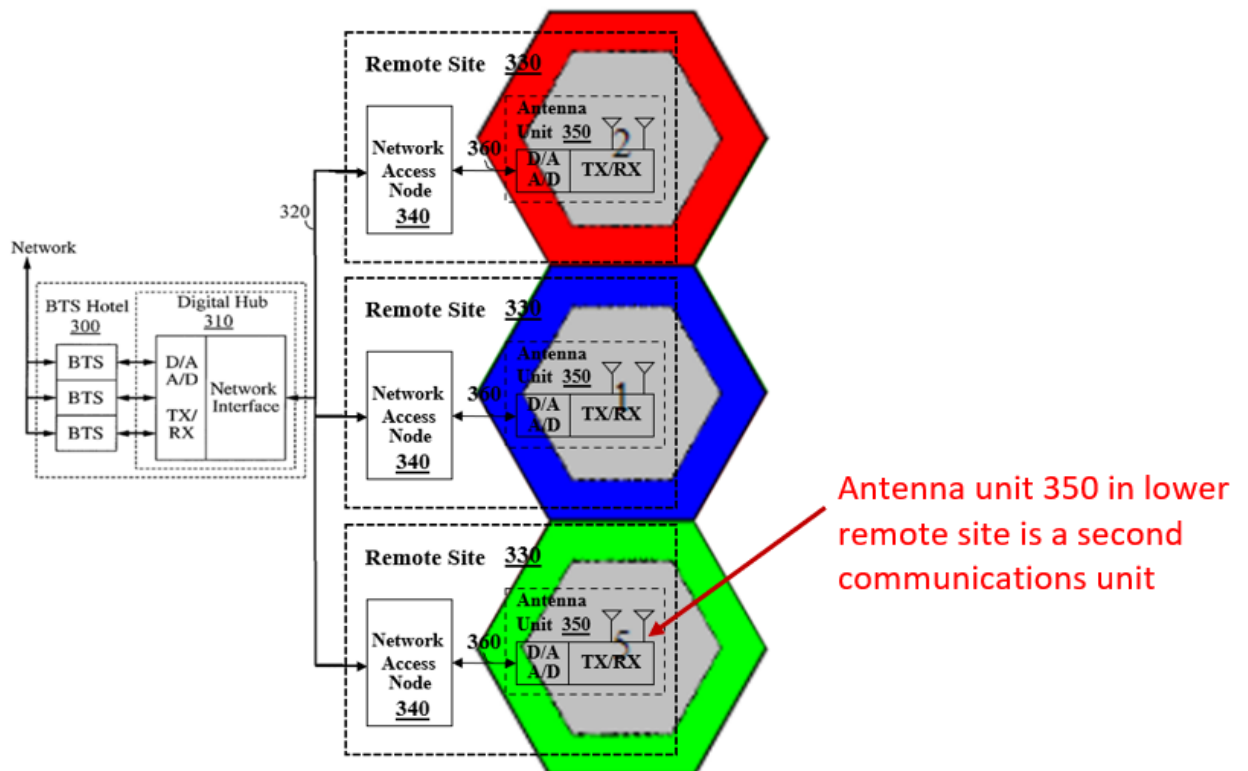
¶468. Ericsson teaches that this is achieved by using reduced power for the red (and green) frequencies. EX-1003, ¶468; EX-1007, 2.

c. Element 15D

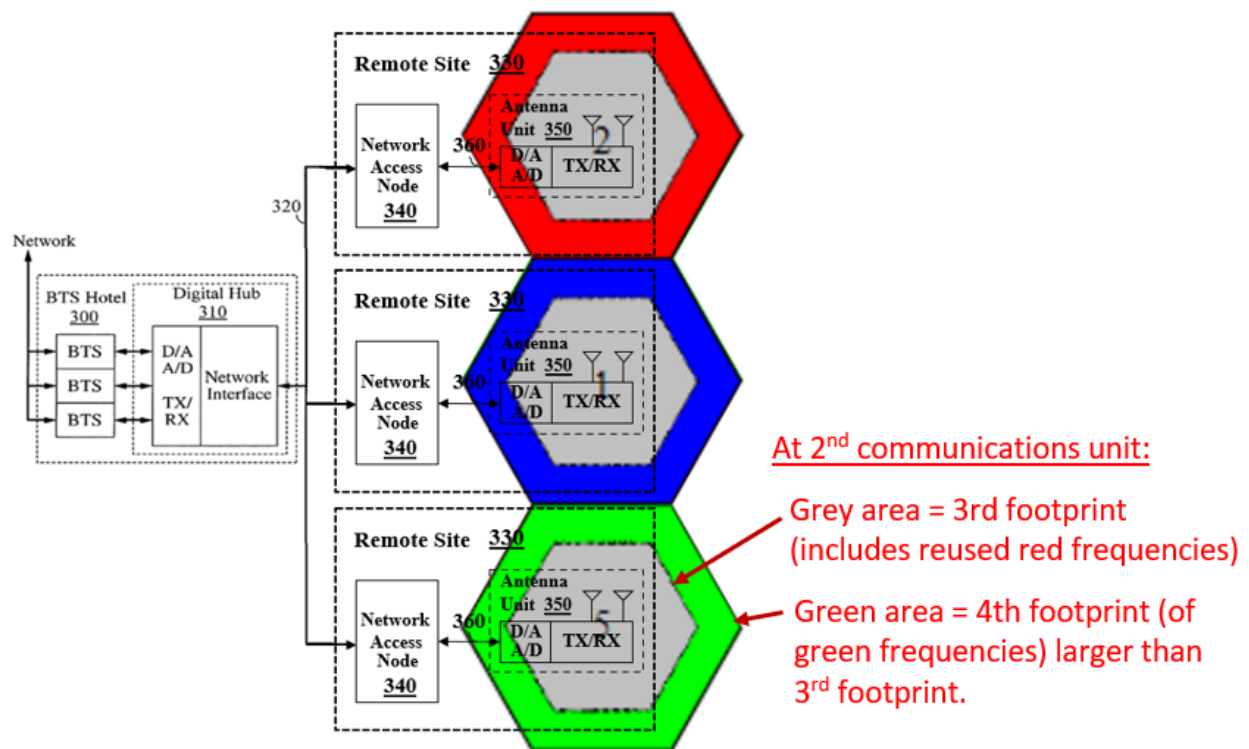
Element 15D is satisfied in the combination of Stratford and Ericsson for the same reasons as Element 7D is satisfied. EX-1003, ¶469. A second of Stratford's antenna units 350 at an adjacent remote cell site is a second communications unit.

Id.

When combined with Ericsson for the reasons discussed above regarding claim 7, the antenna unit (second communications unit) is coupled to the digital hub ("host unit") via optical fiber and the network access node. EX-1003, ¶470; EX-1009, Fig. 3.



In the combination, the antenna unit at the second remote cell site (second communications unit) is operable to transmit and receive communications using one or more of the first set of frequencies in a region associated with a third geographic footprint as shown below. EX-1003, ¶471. For example, it uses the red portion of the frequency spectrum at reduced power having a third geographical footprint (shown as the inner grey area) in the lower cell site. *Id.*



Users in inner part of the cell may be assigned the full spectrum.



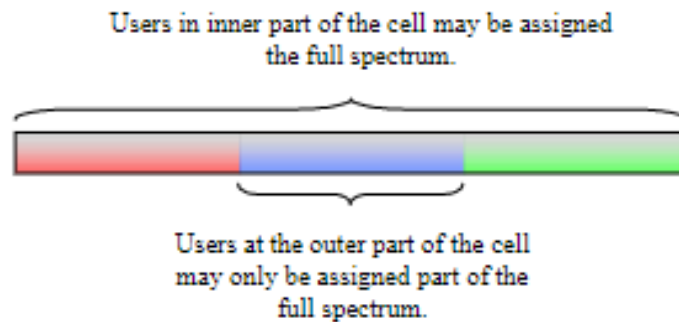
Users at the outer part of the cell may only be assigned part of the full spectrum.

EX-1007, 2, Fig. 2.

As shown above, for the lower remote cell site, the geographical footprint or coverage area of the green set of frequencies is larger than the footprint of the red and blue set of frequencies shown in grey area. EX-1003, ¶¶472-473.

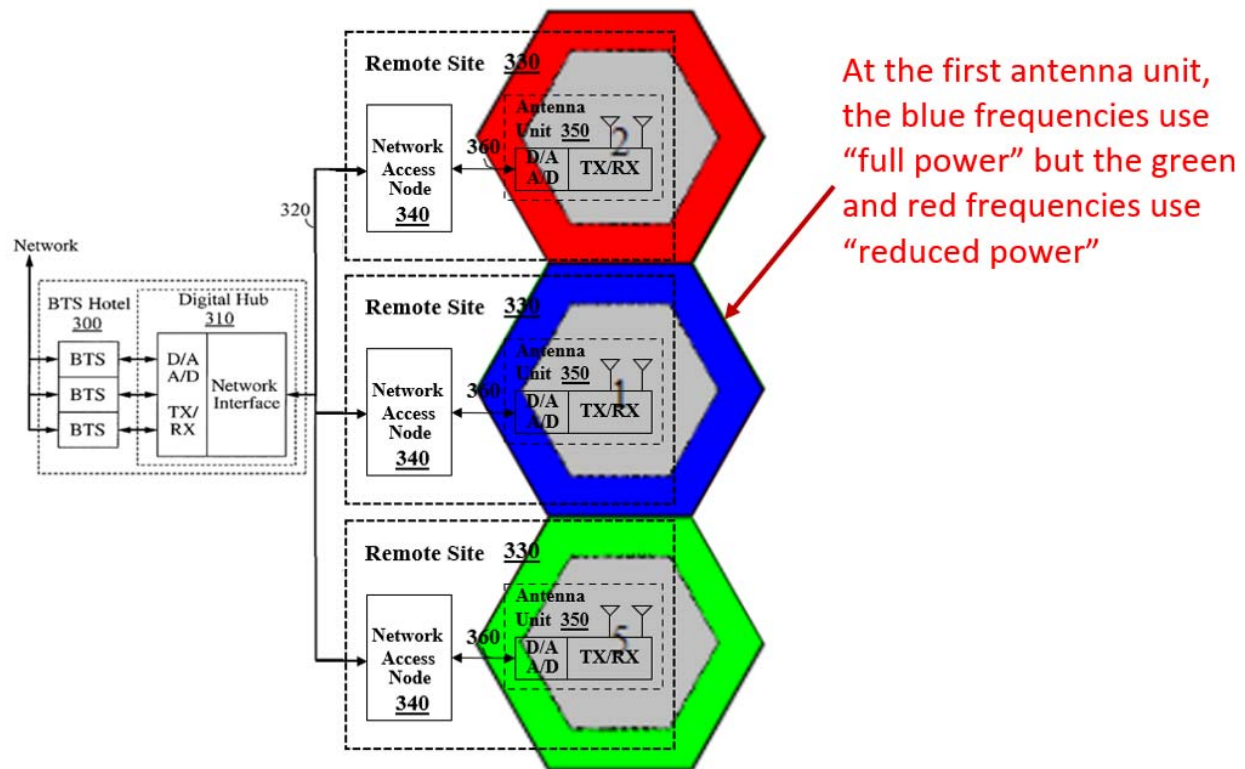
6. Claim 17

The combination of Stratford and Ericsson also renders obvious claim 17. EX-1003, ¶¶474-476. Ericsson discloses using different power levels to achieve the different geographic footprints. EX-1007, 2 (“full power...reduced power”).



EX-1007 p. 2, Fig. 2.

This teaching is illustrated in the figure below:



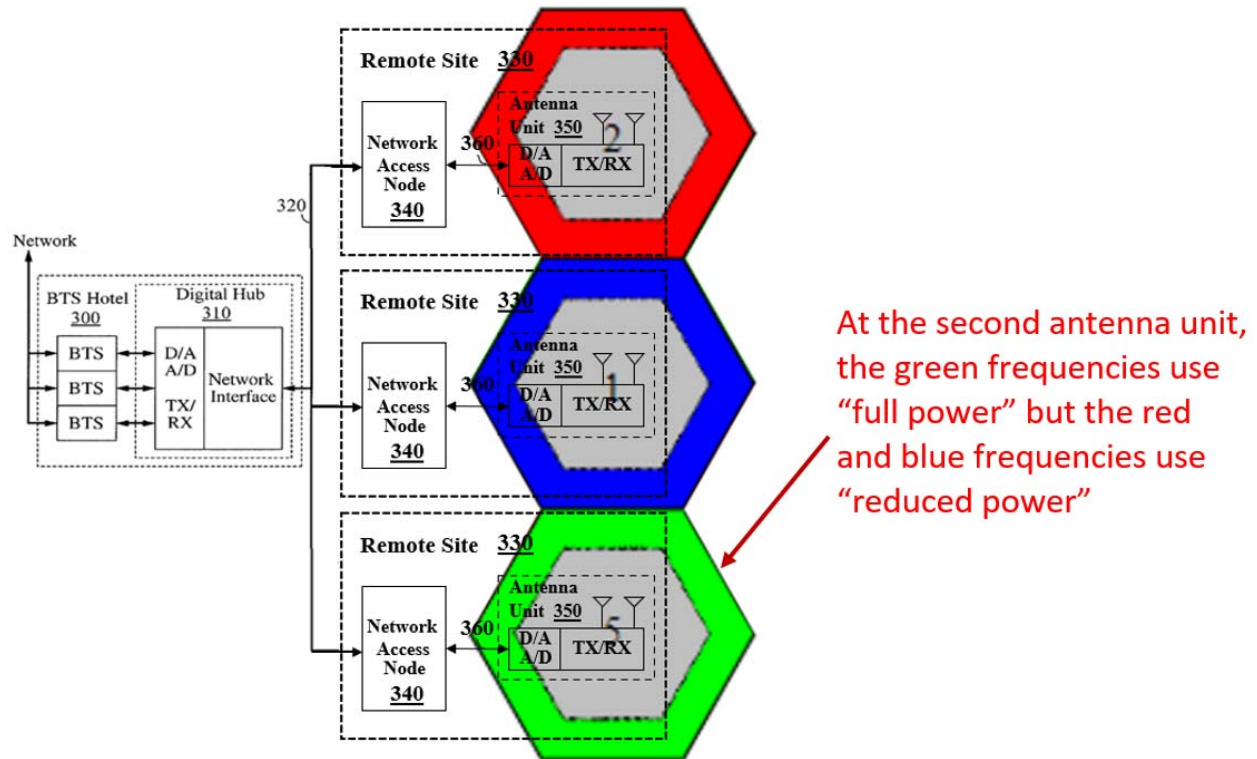
Ex-1003, ¶475.

It is understood from the figures that the teaching of Ericsson, e.g., with respect to the “blue” spectrum in the middle cell will also apply to the green spectrum in the neighboring cell. At the middle cell site, the blue frequencies are the second set of frequencies that convey communications using a greater power level than the power level used to convey communications in the red and green set of frequencies. EX-1003, ¶¶475-476.

7. Claim 18

Ericsson discloses using different power levels to achieve the different geographic footprints, e.g., in the passage quoted above describing Figure 2. EX-1003, ¶¶477-479; EX-1007, 2 (“full power...reduced power”). It is understood

from the figures that the teaching of Ericsson, e.g., with respect to the “blue” spectrum at “full power” in the middle cell will also apply to the green spectrum in the neighboring cell. This teaching is illustrated in the figure below:

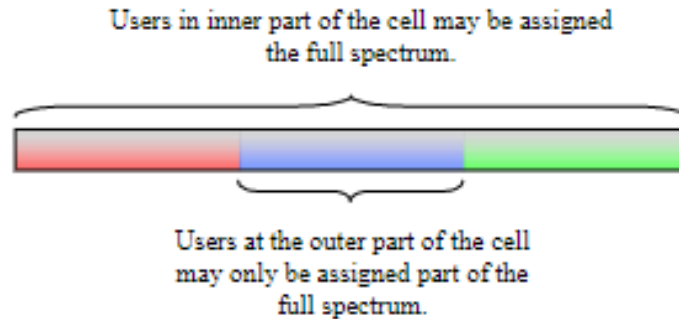


EX-1003, ¶478.

At the bottom cell site, the green frequencies are the third set of frequencies that convey communications using a greater power level (i.e., the “second power level”) than the power level used to convey communications in the red and blue set of frequencies (i.e., the “first power level”). EX-1003, ¶¶478-479.

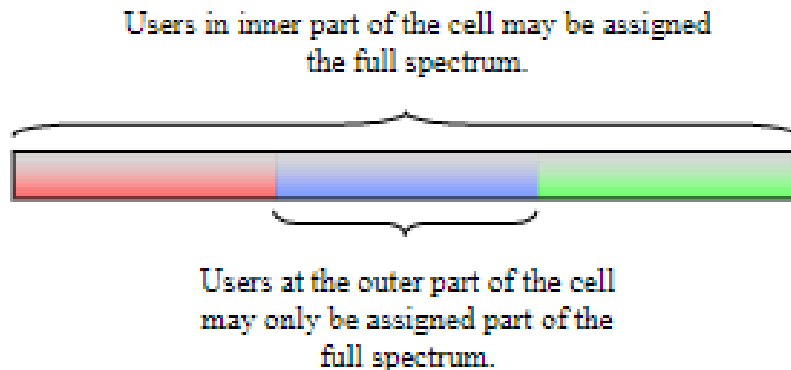
8. Claim 20

The first and second frequency bands (e.g., both the red and green portions of spectrum are contiguous frequency bands with the blue band). EX-1003, ¶481; EX-1007, 2, Figure 2.



9. Claim 21

As shown in the figure of Ericsson each frequency range includes distinct frequencies. For example, the red frequency range (first set of frequencies with a first footprint), the blue frequency range (second set of frequencies with a second footprint) and the green frequency range (third set of frequencies) include distinct frequencies. EX-1003, ¶482.



EX-1007, 2, Fig. 2.

CONCLUSION

There is at least a reasonable likelihood claims 7-9, 11, 15, 17-18, and 20-21 are invalid.

Respectfully submitted,

Dated: January 12, 2023

By: /Philip P. Caspers/

Philip P. Caspers, Reg. No. 33,227

Samuel A. Hamer, Reg. No. 46,754

Capella Tower, Suite 4200

225 South Sixth Street

Minneapolis, MN 55402

shamer@carlsoncaspers.com

Phone: 612.436.9615

Fax: 612.436.9605

Claims Listing Appendix
U.S. Patent No. 9,197,358
Challenged Claims

Designation	Claim 7
Element 7A	7. A method of distributing communications frequencies, the method providing:
Element 7B	providing a set of communications units;
Element 7C	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
Element 7D	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.
Claim 8	8. The method of claim 7 wherein the set of communications units includes a plurality of remote units in communication with a host unit.

Claim 9	9. The method of claim 7 wherein the first geographic footprint includes a location of the first communications unit.
Claim 11	11. The method of claim 7 wherein the third geographical footprint includes a location of the second communications unit.

Designation	Claim 15
Element 15A	15. A communications system comprising:
Element 15B	a host unit;
Element 15C	a first communications unit coupled to the host unit and operable to transmit and receive communications using a first set of frequencies in a first frequency range and associated with a first geographical footprint and a second set of frequencies in a second frequency range and associated with a second geographical footprint larger than the first geographical footprint; and
Element 15D	a second communications unit coupled to the host unit and operable to transmit and receive communications using one or more of the first set of frequencies in a region associated with a third geographical footprint and a third set of frequencies in a third frequency range and associated with a fourth geographical footprint larger than the third geographical footprint.
Claim 17	17. The communications system of claim 15 wherein the communications using the first set of frequencies in the first frequency range are associated with a first power level and the communications using the second set of frequencies in the second

	frequency range are associated with a second power level greater than the first power level.
Claim 18	18. The communications system of claim 15 wherein the communications using one or more of the first set of frequencies in the region associated with a third geographical footprint are associated with a first power level and the communications using the third set of frequencies in the third frequency range are associated with a second power level greater than the first power level.
Claim 20	20. The communications system of claim 15 wherein the first frequency band and the second frequency band are contiguous frequency bands.
Claim 21	21. The communications system of claim 15 wherein the first frequency range, the second frequency range, and the third frequency range include distinct frequencies.

Exhibit List Appendix

Exhibit No.	Exhibit Description
1001	U.S. Patent No. 9,197,358
1002	Prosecution History of U.S. Patent No. 9,197,358
1003	Declaration of Dr. Anthony Acampora
1004	<i>Curriculum Vitae</i> of Dr. Anthony Acampora
1005	Xinyi Xu et al., “Imperfect Digital-Fiber-Optic-Link-Based Cooperative Distributed Antennas with Fractional Frequency Reuse in Multicell Multiuser Network,” IEEE TRANSACTIONS ON VEHICULAR TECHNOLOGY, VOL. 60, NO. 9, pp. 4439-49, November 2011 (“Xu”)
1006	Huawei, “Further Analysis of Soft Frequency Reuse Scheme” 3GPP TSG-RAN WG1 #42, R1-050841, London, UK (August 29 – September 2, 2005) (“Huawei”)
1007	Ericsson, “Inter-cell Interference Handling for E-UTRA” 3GPP TSG-RAN WG1 #42, R1-050764, London, UK (August 29 – September 2, 2005) (“Ericsson”)
1008	U.S. Patent No. 6,353,600 to Schwartz et al. (“Schwartz”)
1009	U.S. Patent No. 6,785,558 to Stratford et al. (“Stratford”)
1010	U.S. Patent Application Publication No. 2012/0039254 to Stapleton et al. (“Stapleton”)
1011	U.S. Patent Application Publication No. 2006/0094470 to Wake et al. (“Wake”)
1012	U.S. Patent Application Publication No. 2010/0128676 to Wu (“Wu”)
1013	U.S. Patent Application Publication No. 2005/0157675 to Feder et al. (“Feder”)
1014	U.S. Patent Application Publication No. 2009/0180426 to Sabat et al. (“Sabat”)
1015	[Intentionally Blank]
1016	Provisional Application No. 61/649,143, filed on May 18, 2012 (“Provisional Application”)
1017	Utility Patent Application No. 13/894,309, filed on May 14, 2013 (later granted as the ‘358 patent) (“Utility Application”)

1018	Red-line comparing the Provisional Application (EX-1016) to the Utility Application (EX-1017)
1019	Masaaki Fujii, “User Scheduling for Distributed-Antenna Zero-Forcing Beamforming Downlink Multiuser MIMO-OFDM Systems,” IEICE Transactions on Communications, Vol. E93-B, No. 9, pp. 2370-2380 (September 2010) (“Fujii”)
1020	Patent Owner’s Infringement Contentions asserting the ‘358 patent against Corning’s SpiderCloud E-RAN System submitted in litigation between Patent Owner and Corning, <i>Dali Wireless, Inc. v. Corning Optical Communications, LLC</i> , No. 3:20-cv-06469-EMC (N.D. Cal.)
1021	Patent Owner’s Infringement Contentions asserting the ‘358 patent against CommScope’s OneCell product submitted in litigation between Patent Owner and CommScope, <i>Dali Wireless, Inc. v. AT&T Corp., et al.</i> , No. 2:22-cv-00012-RWS-RSP (E.D. Tex.).
1022	Declaration of Sylvia Hall-Ellis, Ph.D.
1023	Petition for <i>Inter Partes</i> Review of U.S. Patent No. 9,197,358, <i>Corning Optical Communications LLC v. Dali Wireless, Inc.</i> , IPR2021-00492, Paper 2 (PTAB Feb. 22, 2021)
1024	Patent Owner’s Preliminary Response, <i>Corning Optical Communications LLC v. Dali Wireless, Inc.</i> , IPR2021-00492, Paper 6 (PTAB Jun. 9, 2021)
1025	PTAB Decision Denying Institution of <i>Inter Partes</i> Review, <i>Corning Optical Communications LLC v. Dali Wireless, Inc.</i> , IPR2021-00492, Paper 8 (PTAB Sep. 7, 2021)
1026	Claim Construction Order in litigation between Patent Owner and Corning asserting the ‘358 patent, <i>Dali Wireless, Inc. v. Corning Optical Communications LLC</i> , No. 3:20-cv-06469-EMC (N.D. Cal. Jul. 19, 2021)
1027	Pengfei Ren et al., “A Novel Inter-Cell Interference Coordination Scheme for Relay Enhanced Cellular Networks,” 2011 IEEE VEHICULAR TECHNOLOGY CONFERENCE (VTC), San Francisco, California, US (September 5 – 8, 2011) (“Ren”)
1028	Final Written Decision of <i>CommScope Technologies LLC v. Dali Wireless Inc.</i> , IPR2018-00571, Paper 53 (PTAB August 12, 2019) (“‘473 patent IPR”)
1029	Docket History, <i>Dali Wireless, Inc. v. T-Mobile US, Inc. et al.</i> , No. 2:22-cv-414-RSW-RSP (E.D. Tex.)
1030	Federal Court Management Statistics – Profiles (June 30, 2022)

1031	Docket Control Order, <i>Dali Wireless, Inc. v. AT&T Corp., et al.</i> , No. 2:22-cv-00012-RWS-RSP (E.D. Tex. Dec. 23, 2022), ECF 90
1032	Defendants' Opposed Motion to Sever, <i>Dali Wireless, Inc. v. AT&T Corp., et al.</i> , No. 2:22-cv-00012-RWS-RSP (E.D. Tex. Sep. 30, 2022), ECF 77
1033	Plaintiff's Response to Motion to Sever, <i>Dali Wireless, Inc. v. AT&T Corp., et al.</i> , No. 2:22-cv-00012-RWS-RSP (E.D. Tex. Oct. 17, 2022), ECF 80
1034	Defendant's Reply to Motion to Sever, <i>Dali Wireless, Inc. v. AT&T Corp., et al.</i> , No. 2:22-cv-00012-RWS-RSP (E.D. Tex. Oct. 24, 2022), ECF 81
1035	Plaintiff's Sur-reply to Motion to Sever, <i>Dali Wireless, Inc. v. AT&T Corp., et al.</i> , No. 2:22-cv-00012-RWS-RSP (E.D. Tex. Oct. 31, 2022), ECF 82
1036	Stipulation Regarding Narrowing of Issues, <i>Dali Wireless, Inc. v. AT&T Corp., et al.</i> , No. 2:22-cv-00012-RWS-RSP (E.D. Tex. Oct. 14, 2022), ECF 79

CERTIFICATION UNDER 37 CFR § 42.24(d)

Under the provisions of 37 CFR § 42.24(d), the undersigned hereby certifies that the word count for the foregoing Petition for *Inter Partes* Review totals 12,726 words per Microsoft Word word count tool, which complies with requirement of 14,000 words allowed under 37 CFR § 42.24(a)(i).

Dated: January 12, 2023

By: /Philip P. Caspers/
Philip P. Caspers, Reg. No. 33,227
Samuel A. Hamer, Reg. No. 46,754
Capella Tower, Suite 4200
225 South Sixth Street
Minneapolis, MN 55402
shamer@carlsoncaspers.com
Phone: 612.436.9615
Fax: 612.436.9605

CERTIFICATE OF SERVICE

Pursuant to 37 CFR §§ 42.6(e)(4)(i) *et seq.* and 42.105(b), the undersigned certifies that on July 20, 2022 a complete and entire copy of this PETITION FOR INTER PARTES REVIEW OF UNITED STATES PATENT NO. 9,197,358 PURSUANT TO 35 U.S.C. §§ 311–319, 37 C.F.R. § 42 and all supporting exhibits were provided by Federal Express, to the Patent Owner by serving the correspondence address of record as follows:

Dali Wireless, Inc.
C/o Sheridan Ross PC
Sabrina Stavish
Robert Brunelli
1560 Broadway
Suite 1200
Denver, CO 80202
Phone: (303) 863-2972

Dated: January 12, 2023

By: /Philip P. Caspers/
Philip P. Caspers, Reg. No. 33,227
Samuel A. Hamer, Reg. No. 46,754
Capella Tower, Suite 4200
225 South Sixth Street
Minneapolis, MN 55402
shamer@carlsoncaspers.com
Phone: 612.436.9615
Fax: 612.436.9605